

CRU CORRESPONDENCE

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603. 1136298918.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Fwd: new climate model runs
Date: Tue Jan 3 09:35:18 2006

Date: Sun, 1 Jan 2006 21:28:08 -0700
To: joos <joos@climate.unibe.ch>, rahmstorf@ozean-klima.de
From: Jonathan Overpeck <jto@u.arizona.edu>
Subject: new climate model runs
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>,
Keith Briffa <k.briffa@uea.ac.uk>
X-UEA-Spam-Score: 0.0
X-UEA-Spam-Level: /
X-UEA-Spam-Flag: NO

Happy New Year Stefan and Fortunat - just wanted to check in to see where things stand with the EMIC runs you were going to do for the revised Fig 6.10 - that is, with the new Lean solar forcing, and (where the published runs don't already exist) with the old Lean solar forcing. Again, the purpose of all this is to assess what difference the new solar forcing makes. Eystein and I are hoping that you've figured out the best experimental framework - e.g., what other forcing series to use. It would be great if you used the same volcanic and trace gas series, if that is possible. I'm cc'ing this to Keith in the hope that he can help us make sure we're making the right decisions. Also, since Keith is going to be making the new figure comparing the range of obs climate over the last 1000 years to the range of simulated climate over the last 1000 years (i.e., like the fig we showed in our second/Thursday plenary talk), it would be worth thinking if there is any way to scale the solar forcing over the entire last 1000 years to Judith's new reduced-amplitude solar forcing. I'm not sure this is straightforward or not, but if it was possible, we'd have your new runs for inclusion in the new obs vs. simulated climate fig too - this would be helpful. In any case, the purpose of this email is just to see where we stand, and help keep things moving.

Thanks, Peck

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References

1. <http://www.geo.arizona.edu/>
2. <http://www.ispe.arizona.edu/>
3. <http://www.cru.uea.ac.uk/cru/people/briffa/>

604. 1136308095.txt

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: new climate model runs
Date: Tue, 3 Jan 2006 12:08:15 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, StefanRahmstorf Keith Briffa
<k.briffa@uea.ac.uk>, Anders Levermann <Anders.Levermann@pik-potsdam.de>

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Hi Fortunat et al - glad you have the forcing and can get it out to Anders/Stefan et al. Please do so with recommendations (perhaps building on mine, but suggest what you think is best) for experimental setup - what complete set of forcings should be used, etc.

Please note that we'd like (can we get from both of your groups??) simulated climate to present in two forms: 1) with natural (Lean solar plus volc) plus anthropogenic forcing and 2) with natural only also. It would be good if the results from your runs (Swiss and German) were directly comparable with each other.

Also, please note that I'm waiting for everyone to return to the TSU and let us know the official schedule for the next couple months. There is a finite chance that we'll need your runs, and the figures (which Keith and Tim Osborn will be drafting) well BEFORE the end of January. The reason for this is that this material will be used in the next draft of the TS/SPM (and will need iteration), and we are also likely to be under pressure to have all our figures out for broader WG1 review in January. So, we hope you can speed things up to be run sooner in Jan. OK?

I tried to attach the Christchurch Chap 6 plenary talk, but my phone line is not allowing it today. Will send soon. The figure that is being considered (wanted, might be the better word) for the TS is the one on the upper right of page 7 of the pdf I will send.

Please keep me, Eystein, and Keith in the loop as things develop. It
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>--

>e-mail: joos@climate.unibe.ch;

>

>Until November 23

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605. 1136413942.txt

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From: Jonathan Overpeck <jto@u.arizona.edu>

To: Fortunat Joos <joos@climate.unibe.ch>

Subject: Re: [Fwd: Re: [Wg1-ar4-ch06] Follow-up from Christchurch]

Date: Wed, 4 Jan 2006 17:32:22 -0700

Cc: Stefan Rahmstorf <rahmstorf@ozean-klima.de>, Eystein Jansen

<Eystein.Jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>,

Anders.Levermann@pik-potsdam.de, Gian-Kasper Plattner <plattner@climate.unibe.ch>,

Thomas Stocker <stocker@climate.unibe.ch>

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Hi Fortunat and friends - I suggest that we
(Fortunat, can you do this?) ask Thomas Stocker
since he has lots of experience w/ IPCC and knows
what we're trying to do too. Is this ok?

If it's ok (and I'm guessing that it might not be
ok to use an unpublished extended solar series,
as Fortunat suggest - but it would be more
comparable to other results in the same figure
(our old 6.10)), I think scaling to Bard would be
better since this is what has been done more in

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the other simulations published and in the old
Fig. 6.10 - am I correct?

If we can't scale Judith's new recon back to
1000, then we'll just have some simulated series
back to 1610.

Again, thanks Fortunat for figuring it all out.

best, peck

>Hi Peck,

>
>Thanks for your thoughts. We will try to have a complete forcing series next
>week.

>
>Stefan and Anders are you happy with time series of radiative forcings in w/m2
>for a) solar - b) volcanic - c) CO2 -d) sum of non-CO2? Is it correct that you
>do not need concentrations and burdens for individual gases and anthropogenic
>and natural (volcanic and others) aerosols?

>
>For extrapolation of the Lean series it might be possible to use the Bard et
>al., Tellus, Be-10 record as it has been used widely. Another option would be
>to use 14C-derived solar modulation (Muscheler et al). This is more
>sophisticated, but solar modulation has up-to-date not been used in climate
>models. In any case, extrapolation of the Lean
>serie might be challenged in the
>IPCC context as we are leaving the area of published results.

>
>Regards,

>
>Fortunat

>
>
>Quoting Jonathan Overpeck <jto@u.arizona.edu>:

>
>> Hi Fortunat, Stefan and gang - Have you given any
>> thought to scaling the new solar forcing
>> estimates from Lean (sent w/ this email - thanks)
>> in some way (e.g., to 14C/10Be) so that the new
>> simulations could cover the last 1000 years,
>> rather than the last 400? This would be nice
>> given that we'll plot the new runs in a fig with
>> the existing/published runs (old fig 6.10). Might
>> take a little more work for someone, but could
>> you, for example, take an old solar series used
>> in a recent simulation shown in the old Fig 6.10,
>> and calculate the amplitude reduction implied by
>> the new Lean data over the last 400 years, and
>> then apply that same reduction (assuming it's
>> relatively constant - I'm being lazy here and not
>> ready up) to the old solar forcing back to 1000
>> AD?

>>
>> Might be a stupid idea, so it's ok to say so.
>> Please let me know what you think - again, it
>> would be good if both groups could use the same
>> forcing.

>>
>> Thanks again, peck

>>
>> >Dear all,
>> >

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>> >Here the data I got from Judith Lean. Please
>> >note that Judith Lean provided the data for the
>> >IPCC context. We should inform Judit of the
>> >results as requested by her and as a matter of
>> >courtesy.
>> >
>> >Considering the other forcings, we will use
>> >updated historical forcing as used for chapter
>> >10 scenario calculation based on the
>> >formulations and the assessment provided in
>> >chapter 2. We are currently in the process of
>> >compiling these series.
>> >
>> >With best regards,
>> >
>> >Fortunat
>> >--
>> >
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>> > Physics Institute, University of Bern
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>> > Internet: http://www.climate.unibe.ch/~joos/
>> >
>> >
>> >Delivered-To: joos@climate.unibe.ch
>> >Return-Path: <jlean@ssd5.nrl.navy.mil>
>> >Received: from mailhub03.unibe.ch (mailhub03.unibe.ch [::ffff:130.92.9.70])
>> > (TLS: TLSv1/SSLv3,256bits,AES256-SHA)
>> > by phkup10 with esmtp; Fri, 23 Dec 2005 22:17:45 +0100
>> > id 0003FA0D.43AC697A.000077F8
>> > >Received: from localhost (scanhub02-eth0.unibe.ch [130.92.254.66])
>> > > by mailhub03.unibe.ch (Postfix) with ESMTMP id 304BD249D8
>> > > for <joos@climate.unibe.ch>; Fri, 23 Dec 2005 22:21:27 +0100 (CET)
>> > >Received: from mailhub03.unibe.ch ([130.92.9.70])
>> > > by localhost (scanhub02.unibe.ch [130.92.254.66]) (amavisd-new, port
>> > > 10024)
>> > > with LMTP id 10205-12-31 for <joos@climate.unibe.ch>;
>> > > Fri, 23 Dec 2005 22:21:26 +0100 (CET)
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>> > > by mailhub03.unibe.ch (Postfix) with ESMTMP id 27C4F24CC8
>> > > for <joos@climate.unibe.ch>; Fri, 23 Dec 2005 22:21:07 +0100 (CET)
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>> > > > (ccssun1.nrl.navy.mil [132.250.113.66])
>> > > > by mail2.nrl.navy.mil (8.13.4/8.13.4) with ESMTMP id jBNLL2mG029848
>> > > > for <joos@climate.unibe.ch>; Fri, 23 Dec 2005 16:21:02 -0500 (EST)
>> > > >Received: from [132.250.166.98] (sdpc28.nrl.navy.mil [132.250.166.98])
>> > > > by ccssun1.nrl.navy.mil (8.13.1/8.13.1) with ESMTMP id jBNLKulM003512
>> > > > for <joos@climate.unibe.ch>; Fri, 23 Dec 2005 16:20:56 -0500 (EST)
>> > > >Message-ID: <43AC6A37.5040905@ssd5.nrl.navy.mil>
>> > > >Date: Fri, 23 Dec 2005 16:20:55 -0500
>> > > >From: Judith Lean <jlean@ssd5.nrl.navy.mil>
>> > > >User-Agent: Mozilla Thunderbird 1.0.7 (windows/20050923)
>> > > >X-Accept-Language: en-us, en
>> > > >Mime-Version: 1.0
>> > > >Content-Type: multipart/mixed; boundary="=_phkup10-25635-1136296413-0001-3"
>> > > >To: Fortunat Joos <joos@climate.unibe.ch>
>> > > >Subject: Re: [Wg1-ar4-ch06] Follow-up from Christchurch
>> > > >References:
>> > > >><a06210219bfca1bb02c99@[10.100.1.158]>
>> > > >><43A7680A.9090404@ozean-klima.de>
>> > > >><a06210208bfcd374f0e53@[192.168.1.5]>
>> > > >><43A89A68.6060702@ozean-klima.de>
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>> <a06210211bfcf46657cfb@[192.168.1.5]>
>> <43AA0D0D.3080809@ozean-klima.de>
>> <43AA58B3.4010206@climate.unibe.ch>
>> >In-Reply-To: <43AA58B3.4010206@climate.unibe.ch>
>> >X-Scanned-By: MIMEDefang 2.52
>> >X-Virus-checked: by University of Berne
>> >
>> >Dear Fortunat,
>> >
>> >Attached is a file of the new lower estimates of
>> >annual TSI since 1610, as well as references
>> >that describe how the irradiance was
>> >reconstructed. For comparison, I've also
>> >attached the earlier (GRL, 2000) reconstruction
>> >which has larger long-term variability.
>> >
>> >I can also send you monthly mean values since
>> >1880 if you would prefer those. As well, instead
>> >of the total irradiance, I can send you files of
>> >actual spectra - depending on what you want to
>> >use as input to your model I can make the
>> >spectra on a specified wavelength grid, if this
>> >would help.
>> >
>> >Let me know if you need more than just the
>> >annual TSI. As well, I'd be interested to hear
>> >about your results! (which I guess I'll be able
>> >to read in IPCC).
>> >
>> >Best wishes,
>> >Judith
>> >.
>> >Fortunat Joos wrote:
>> >
>> >>Dear Judith,
>> >>
>> >>Please allow me to contact you with regard to
>> >>your solar forcing reconstructions.
>> >>
>> >>IPCC WGI chapter 6 is planning to run a couple
>> >>of intermediate complexity models (Climber and
>> >>BernCC) with your new low solar forcing records
>> >>for comparing the impact of low and high solar
>> >>on NH temperature. Would you mind to provide us
>> >>with your most recent, published forcing
>> >>estimates as shown in chapter 2. An ascii (or
>> >>excel table) would be fine. Could you provide a
>> >>central value as well as uncertainty estimates.
>> >>The material should be fully consistent with
>> >>chapter 2 for cross-reference.
>> >>
>> >>Thank you for all your help,
>> >>
>> >>Fortunat Joos
>> >>
>> >>Stefan Rahmstorf wrote:
>> >>
>> >>>Hi Peck,
>> >>>
>> >>>Eva is ready to start CLIMBER-2 with the same
>> >>>forcings as in her paper, except for swapping
>> >>>the solar series (she has used different solar
>> >>>series in her paper anyway). That would show

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>> >>>the impact of just swapping to a new solar
>> >>>reconstruction. But she can easily run with a
>> >>>full identical set of forcings as Fortunat -
>> >>>the bottom line is, whatever forcing you
>> >>>supply we can run, as long as it is given in
>> >>>some radiative forcing units (we do not have a
>> >>>model that could compute radiative forcing
> >>>from aerosol concentrations).

>> >>>

>> >>>Cheers, Stefan

>> >>>

>> >>>Jonathan Overpeck wrote:

>> >>>

>> >>>>Hi Stefan - thanks. I'm not sure if we can
>> >>>>more that fast, but if David can get the new
>> >>>>solar forcing, then perhaps you could then
>> >>>>run w/ the other forcings the same as the
>> >>>>Bauer runs? I'll cc to Fortunat too, since he
>> >>>>has offered to carry out the same runs w/ the
>> >>>>Bern model - he might have the new/latest
>> >>>>Lean solar series too (I think back to 1600
>> >>>>only). It would be good to have both CLIMBER
>> >>>>(two versions) and BernCC runs with the same
>> >>>>(or very similar) forcing, so perhaps you two
> >>>>can coordinate in European time. Keep Eystein
>> >>>>and me posted - David too, in case Fortunat
>> >>>>already has the new solar series. Thanks, Peck
>> >>>>

>> >>>>>Hi Jonathan, I got a positive response for
>> >>>>>doing those runs with both models - but it
>> >>>>>would be good to get the forcing time series
>> >>>>>we should use within a day, to start at
>> >>>>>least the slow model before the christmas
>> >>>>>holidays.

>> >>>>>

>> >>>>>Stefan

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>> >Mon Apr 2 15:18:18 2001
>> >ref: Evolution of the Sun's spectral irradiance since the Maunder Minimum,
>> >Judith Lean, GRL, 27, 2425-2428, 2000
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>>	>	1725.5	1365.6846	1364.1024
>>	>	1726.5	1365.8490	1364.2875
>>	>	1727.5	1365.8512	1364.3013
>>	>	1728.5	1366.0459	1364.4821
>>	>	1729.5	1365.7633	1364.2246
>>	>	1730.5	1366.0845	1364.5144
>>	>	1731.5	1365.5946	1364.0631
>>	>	1732.5	1365.7211	1364.1947
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>>	>	1735.5	1365.7233	1364.2986
>>	>	1736.5	1365.9362	1364.5007
>>	>	1737.5	1365.7633	1364.3536
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>>	>	1739.5	1365.9636	1364.5409
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>>	>	1741.5	1366.0001	1364.5580
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>>	>	1745.5	1365.5946	1364.1941
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>>	>	1753.5	1365.7626	1364.5011
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>>	>	1756.5	1365.6459	1364.5505
>>	>	1757.5	1365.7689	1364.6743
>>	>	1758.5	1365.8806	1364.7921
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>>	>	1762.5	1365.9193	1364.9268
>>	>	1763.5	1365.8350	1364.8948
>>	>	1764.5	1365.8090	1364.8768
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>>	>	1769.5	1366.2869	1365.2963
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>>	>	1775.5	1365.6339	1364.9504
>	>	1776.5	1365.6937	1364.9908
>>	>	1777.5	1365.8638	1365.1300
>>	>	1778.5	1366.1007	1365.3407
>>	>	1779.5	1366.1625	1365.3878
>>	>	1780.5	1365.9812	1365.2184
>>	>	1781.5	1366.0944	1365.3258
>>	>	1782.5	1365.8258	1365.0697

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>>	>	1783.5	1365.7429	1364.9484
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>>	>	1804.5	1365.7465	1364.1881
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>>	>	1813.5	1365.6586	1364.0035
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>>	>	1820.5	1365.6698	1364.0815
>>	>	1821.5	1365.6249	1364.1232
>>	>	1822.5	1365.6157	1364.2358
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>>	>	1824.5	1365.6305	1364.3669
>>	>	1825.5	1365.6958	1364.4620
>>	>	1826.5	1365.7957	1364.5746
>>	>	1827.5	1365.9066	1364.6865
>>	>	1828.5	1365.9952	1364.7704
>>	>	1829.5	1366.0107	1364.7952
>>	>	1830.5	1366.0465	1364.8501
>>	>	1831.5	1365.8701	1364.7161
>>	>	1832.5	1365.7542	1364.6519
>>	>	1833.5	1365.6403	1364.6066
>>	>	1834.5	1365.6635	1364.6750
>>	>	1835.5	1365.9200	1364.9484
>>	>	1836.5	1366.2988	1365.3376
>>	>	1837.5	1366.3635	1365.4343
>>	>	1838.5	1366.1387	1365.2535
>>	>	1839.5	1366.0521	1365.1826
>>	>	1840.5	1365.9341	1365.0696
>>	>	1841.5	1365.7816	1364.9200
>>	>	1842.5	1365.7267	1364.8647
>>	>	1843.5	1365.6522	1364.8060
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>>	>	1846.5	1365.9025	1365.0797
>>	>	1847.5	1366.0023	1365.1847
>>	>	1848.5	1366.1976	1365.3846
>	>	1849.5	1366.1829	1365.3910
>>	>	1850.5	1365.9812	1365.1982
>>	>	1851.5	1366.0029	1365.1567
>>	>	1852.5	1365.9446	1365.0192
>>	>	1853.5	1365.8448	1364.8820
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>>	>	1855.5	1365.6262	1364.7249
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>>	>	1858.5	1365.9066	1365.0951
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>>	>	1862.5	1365.9496	1365.0697
>>	>	1863.5	1365.8821	1364.9423
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>>	>	1865.5	1365.7534	1364.7239
>>	>	1866.5	1365.6909	1364.6573
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>>	>	1869.5	1366.0325	1365.0073
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>>	>	1871.5	1366.2054	1365.2012
>>	>	1872.5	1366.1576	1365.1577
>>	>	1873.5	1365.9580	1364.9529
>>	>	1874.5	1365.8406	1364.7947
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>>	>	1878.5	1365.6135	1364.5669
>>	>	1879.5	1365.6255	1364.6174
>>	>	1880.5	1365.7689	1364.7728
>>	>	1881.5	1365.9124	1364.9196
>>	>	1882.5	1365.9313	1364.9546
>>	>	1883.5	1365.9791	1364.9996
>>	>	1884.5	1365.8812	1364.9010
>>	>	1885.5	1365.7909	1364.7394
>>	>	1886.5	1365.6487	1364.5116
>>	>	1887.5	1365.6234	1364.4189
>>	>	1888.5	1365.5962	1364.3615
>>	>	1889.5	1365.5652	1364.3398
>>	>	1890.5	1365.5912	1364.3982
>>	>	1891.5	1365.8303	1364.6823
>>	>	1892.5	1365.9163	1364.8152
>>	>	1893.5	1366.0458	1364.9875
>>	>	1894.5	1366.1332	1365.1044
>>	>	1895.5	1366.0166	1364.9883
>>	>	1896.5	1365.8434	1364.7870
>>	>	1897.5	1365.7094	1364.6105
>>	>	1898.5	1365.6982	1364.5564
>>	>	1899.5	1365.6534	1364.4856
>>	>	1900.5	1365.6216	1364.4579
>>	>	1901.5	1365.5294	1364.4176
>>	>	1902.5	1365.5165	1364.4843
>>	>	1903.5	1365.7083	1364.7440
>>	>	1904.5	1365.9651	1365.0502
>>	>	1905.5	1365.7684	1364.8820
>>	>	1906.5	1365.9651	1365.0778
>>	>	1907.5	1365.8604	1364.9320
>>	>	1908.5	1365.9426	1364.9508

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>>	>	1909.5	1365.8459	1364.8024
>>	>	1910.5	1365.7173	1364.6566
>>	>	1911.5	1365.6285	1364.5870
>>	>	1912.5	1365.5706	1364.5724
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>>	>	1914.5	1365.6302	1364.7195
>>	>	1915.5	1365.9285	1365.0414
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>>	>	1917.5	1366.2821	1365.4149
>>	>	1918.5	1366.2454	1365.3726
>>	>	1919.5	1366.0179	1365.1373
>>	>	1920.5	1365.8523	1364.9840
>>	>	1921.5	1365.7351	1364.9114
>>	>	1922.5	1365.6019	1364.8347
>>	>	1923.5	1365.6211	1364.9006
>>	>	1924.5	1365.6436	1364.9569
>>	>	1925.5	1365.8406	1365.1799
>>	>	1926.5	1365.9348	1365.2997
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>>	>	1928.5	1365.9885	1365.3811
>>	>	1929.5	1365.9429	1365.3519
>>	>	1930.5	1365.9159	1365.3588
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>>	>	1941.5	1365.9130	1365.6616
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>>	>	1944.5	1365.6224	1365.5911
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>>	>	1947.5	1366.2190	1366.2172
>>	>	1948.5	1366.3475	1366.3531
>>	>	1949.5	1366.2528	1366.2626
>>	>	1950.5	1366.0098	1366.0220
>>	>	1951.5	1365.7721	1365.7882
>	>	1952.5	1365.7653	1365.7739
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>>	>	1958.5	1366.6246	1366.6552
>>	>	1959.5	1366.3717	1366.4130
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>>	>	1961.5	1365.9230	1365.9115
>>	>	1962.5	1365.7656	1365.7020
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>>	>	1970.5	1366.2036	1366.3480
>>	>	1971.5	1365.9354	1366.0192

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>>	>	1972.5	1366.0519
>>	>	1973.5	1365.8131
>>	>	1974.5	1365.7448
>>	>	1975.5	1365.5466
>>	>	1976.5	1365.6458
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>>	>	1981.5	1366.6829
>>	>	1982.5	1366.2808
>>	>	1983.5	1366.1989
>>	>	1984.5	1365.8088
>>	>	1985.5	1365.6382
>>	>	1986.5	1365.6345
>>	>	1987.5	1365.7865
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>>	>	1989.5	1366.6445
>>	>	1990.5	1366.5499
>>	>	1991.5	1366.4423
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>>	>	1993.5	1366.0251
>>	>	1994.5	1365.7937
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>>	>	1996.5	1365.6086
>>	>	1997.5	1365.7365
>>	>	1998.5	1366.0986
>>	>	1999.5	1366.3817
>>	>	2000.5	1366.6620

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From: Tom Wigley <wigley@ucar.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: Nature: Review of manuscript 2005-12-14395
Date: Tue, 10 Jan 2006 13:45:26 -0700

<x-flowed>
Keith,

Thanx for this. Interesting. However, I do not think your response is very good. Further, there are grammatical and text errors, and (shocking!!) you have spelled Mckitrick wrong. This is a sure way to piss them off.

They claim that three cores do not cross-date for TRW. They also say (without results) that the same applies to MXD (these results may be in their Supp. Mat. -- I presume you checked this).

So, all you need say is ...

- (1) TRW was not the only data used for cross-dating.
- (2) When MXD is used there are clear t-value peaks, contrary to their claim. You can show your Fig. 4 to prove this.
- (3) The 3-core-composite cross-dates with other (well-dated) chronologies (Yamal and Polurula), confirming the MXD-based dating. You can show your Fig. 5 to prove this.

You could say all this in very few words -- not many more than I have used above. As it is, your verbosity will leave any reader lost.

There are some problems still. I note that 1032 is not cold in Yamal. Seems odd. Is it cold in *all* of the three chronologies at issue?

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Or did a reindeer crap next to one of the trees?

Also, there seems to be a one-year offset in the 1020s in your Fig. 6.

I hope this is useful. I really think you have to do (and can do) a better job in combatting the two Ms. If this stuff gets into Nature, you still have a chance to improve it. Personally, I think it would be good for it to appear since, with an improved response, you can make MM look like ignorant idiots.

Tom.

=====
Keith Briffa wrote:

> Dear Emma
> I am very sorry for the delay in returning this response to the
> submitted Brief Communication By McIntyre and McKitric . I have been
> extremely busy and to substantiate my written remarks it was necessary
> to dig out the original data and produce a number of Figures
> illustrating the true nature of the cross-dating of the data . I have
> (or at least my Research Associate Tom) has now done this and I am
> finally in a position to write the response. This is contained in the
> WORD file attached to this message . The Figures are attached in a
> separate file. I am happy for you to send the attached written
> response to McIntyre and McKitric , but I would prefer if you would
> NOT send the Figures , at least until these are posted on the Climatic
> (hopefully sometime tomorrow). I am accepting your offer of sending
> this response directly to you rather than sending it through the
> Nature system . Sorry that it is a little long.
> If you decide to publish their communication (which I consider very
> unlikely , given its entirely fallacious content) I would expect
> Nature to publish this response and find room to publish my Figures
> (even if only as Supplementary material). Thank you again for your
> patience.
> yours sincerely
> Keith

>> At 10:30 06/01/2006, you wrote:
>> >Content-Type: multipart/alternative;
>> boundary="=_-----=_113654340816203"
>> >MIME-Version: 1.0
>> >X-Mailer: MIME::Lite 3.01 (F2.6; B2.12; Q2.03)
>> >Date: Fri, 6 Jan 2006 10:30:08 UT
>> >Message-Id: <113654340854@www11>
>> >Content-Transfer-Encoding: 7bit
>> >
>> >Dear Professor Briffa
>> >
>> >I am writing to you on behalf of Rosalind Cotter, with regard to
>> >your Reply to the Communications Arising manuscript by Dr Irwing and
>> >co-authors entitled "A gender difference in intelligence?". Should
>> >you now have had the chance to consider the paper, we would be
>> >grateful if you could send us your comments as soon as possible.
>> >
>> >We would respectfully remind you that if we do not hear from you
>> >within the next few days, we shall proceed with the reviewing

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>> >process without a Reply from you (in accordance with our guide to
>> authors).
>>
>> >
>> >Alternatively, if it would be more convenient, please send your
>> >reply directly to me by return email. However, please highlight
>> >those comments that are confidential and which should be passed on
>> >to the authors.
>> >
>> >Thank you in advance for your assistance in this matter.
>> >
>> >Yours sincerely
>> >
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> Fax: +44-1603-507784
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607. 1137184681.txt

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mail.2006

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Valerie.Masson@cea.fr,Eystein.Jansen@geo.uib.no, "Eric w wolff" <EWWO@bas.ac.uk>
Subject: Urgent request for reference letter
Date: Fri Jan 13 15:38:01 2006

Dear Valerie, Eystein and Eric,
We (that is Phil and myself - and of course also Bo) are hoping that you can help us greatly with an application Bo Vinther is submitting to the EU for a Marie Curie Intra-European Fellowship (EIF) , specifically to spend time with Phil and I at CRU working on the dating and interpretation of seasonally-resolved ice core data and tree-ring data.
We are allowed to submit up to 3 reviews or testimonials (though these must be submitted directly through the we would be really grateful if each of you would agree to provide one of these. Unfortunately, if you can make the time to help, these must in submitted by next Thursday.
Please accept our apologies for the lateness of this request - but you can probably understand that , as usual things have had to be cut fine.
The first stage of evaluation is based only on the quality of the applicant (70%) and the quality of the proposed research plan (30%). If the proposal gets through to the second evaluation stage , then other factors such as the quality of the hosts and host institution become relevant .
At this stage we would ask that you read the attached Science Plan and details of the Quality of the Candidate, and write an assessment based primarily on these. We will send precise details of how to submit them early next week. You probably also know just how strong the competition is these days for such awards , so reviews have to be particularly glowing, but it is only because Phil and I are so keen to work with Bo that we are taking the liberty of asking for your support. I am sure you know , and certainly valerie has indicated to me, how impressive Bo's work is. I am sure he is the sort of person for whom these awards are meant, as he is someone who will be doing important work to advance the field one day.
I am attaching (virtually final) drafts of the relevant sections , which are all that you need to be able to write these testimonials. We will send the full applications when they are complete. It would also help if you stressed your own distinguished qualifications , that make you so well qualified to offer this review. Please let me know whether you are able to do this for us.
Thank you lots
Keith and Phil

--
Professor Keith Briffa,
Climatic Research Unit

University of East Anglia
Norwich, NR4 7TJ, U.K.

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Fax: +44-1603-507784
[1]http://www.cru.uea.ac.uk/cru/people/briffa/

References

- 1. <http://www.cru.uea.ac.uk/cru/people/briffa/>

608. 1137686657.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: Millennium simulations
Date: Thu, 19 Jan 2006 11:04:17 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>

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Thanks Fortunat. I got the sense from Susan that she'd love to see good old raw ice core data, but I think it makes more sense for Tim and Keith to use what you've sent. It is based on multiple ice cores, and it provides some consistence with our modeling figs.

Tim and Keith - how are you doing? Let me know if you want to discuss figs you're working on beyond what I suggested in my December emails. I appreciate your dealing with the heavy load!

best, peck

>Hi all,

>
>Here the Crowley data from 1001 to 1998. The data were multiplied by >0.7 to factor in an albedo of 30% (see header of file for more >clarification). The data in the forcing file send yesterday have >been extended artificially to year 850 (mirroring the data from 1000 >to 1150) and shift in time by 0.5 to bring all forcing data to >mid-year.

>
>With best wishes,

>
>Fortunat

>
>Jonathan Overpeck wrote:
>>Hi Fortunat - thanks for pulling all the new EMIC simulation >>forcing together, and fast. Keith and Tim want (have been asked, >>might be the best way to say it...) to put together a figure that >>depicts volcanic forcing. Since you're using Cowley's recon, that >>might be the best for them too. Can you send Tim (cc me and Keith >>too) the data series for 1000 to present?

>>
>>Thanks, Peck

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> Climate and Environmental Physics,
> Physics Institute, University of Bern
> Sidlerstr. 5, CH-3012 Bern

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mail.2006
> Phone: ++41(0)31 631 44 61 Fax: ++41(0)31 631 87 42
> Internet: http://www.climate.unibe.ch/~joos/
>
>
>#
># Hi All,
>#
># some of you have requested the forcing time series used in last years
># Science paper. I referred you to a NOAA website. But I now realize there
># may be incomplete information in the explanations, in the sense that the
># solar and tropospheric aerosol forcing was listed as net radiative forcing
># after accounting for the 30% albedo of the earths atmosphere. some 1D ebm
># do not explicitly consider the albedo term, but virtually all other models
># so.
>#
># In order to ensure that everyone is on the same page with respect to
># evaluating the forcing terms I use I am sending each of you an ftp address
># where you can download estimates of volcano, solar, greenhouse gas, and
># tropospheric (1000-1998) using total forcing prior to accounting for the
># planetary albedo.
>#
># The ftp address is:
>#
># anonymous FTP to stommel.tamu.edu
># cd incoming/FORCING
># get forc-total-4.12.01.txt
>#
># a few other comments -
>#
># all units are in w/m**2
>#
># hl in volc time series refers to the fact that eruptions of unknown origin
># have been assigned a high latitude (hl) origin. There are "tails" to most
># of the large eruptions that were determined based on the estimated
># e-folding time of the aerosols as being about 1 year
>#
># sol.Be10 refers to the Beryllium 10 measurements of Bard et al but scaled
># by me to the Lean et al changes over the last 400 years. After further
># reflection I think the Be10 may be the most reliable of the solar indices.
>#
># GHG refers to greenhouse gases
>#
># Aer refers to tropospheric aerosols
>#
># sorry about any confusion the prior data may have caused, regards, Tom
>#
># Thomas J. Crowley
># Dept. of Oceanography
># Texas A&M University
># College Station, TX 77843-3146
># 979-845-0795
># 979-847-8879 (fax)
># 979-845-6331 (alternate fax)
>#
>#####
># HERE converted from original file: forc-total-4.12.01.txt
># WITH Planetary Albedo factored in: volc and sol-be10 multiplied by 0.7
>#####
>#Year Vol.hl.cct Sol.Be10/Lean.splice
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>	1819.00	0.0000	-0.0420
>	1820.00	0.0000	-0.0490
>	1821.00	0.0000	-0.0490
>	1822.00	0.0000	-0.0420
>	1823.00	0.0000	-0.0420

>	1824.00	0.0000	-0.0280
>	1825.00	0.0000	-0.0070
>	1826.00	0.0000	0.0140
>	1827.00	0.0000	0.0420
>	1828.00	0.0000	0.0630
>	1829.00	0.0000	0.0770
>	1830.00	-0.8400	0.0980
>	1831.00	-3.4020	0.0840
>	1832.00	-1.2600	0.0770
>	1833.00	0.0000	0.0770
>	1834.00	0.0000	0.0910
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>	1836.00	-0.7700	0.2030
>	1837.00	0.0000	0.2170
>	1838.00	0.0000	0.1960
>	1839.00	0.0000	0.1820
>	1840.00	-0.7000	0.1680
>	1841.00	-0.2800	0.1470
>	1842.00	0.0000	0.1330
>	1843.00	-1.0500	0.1190
>	1844.00	-0.4200	0.1190
>	1845.00	0.0000	0.1260
>	1846.00	0.0000	0.1330
>	1847.00	0.0000	0.1470
>	1848.00	0.0000	0.1750
>	1849.00	0.0000	0.1680
>	1850.00	0.0000	0.1330
>	1851.00	0.0000	0.1330
>	1852.00	0.0000	0.1260
>	1853.00	0.0000	0.1050
>	1854.00	-0.5600	0.0840
>	1855.00	0.0000	0.0700
>	1856.00	0.0000	0.0700
>	1857.00	0.0000	0.0910
>	1858.00	0.0000	0.1190
>	1859.00	0.0000	0.1610
>	1860.00	0.0000	0.1680
>	1861.00	0.0000	0.1540
>	1862.00	0.0000	0.1330
>	1863.00	0.0000	0.1260
>	1864.00	0.0000	0.1190
>	1865.00	0.0000	0.0980
>	1866.00	0.0000	0.0910
>	1867.00	0.0000	0.0840
>	1868.00	0.0000	0.1050
>	1869.00	0.0000	0.1400
>	1870.00	0.0000	0.1820
>	1871.00	0.0000	0.1680
>	1872.00	0.0000	0.1610
>	1873.00	0.0000	0.1260
>	1874.00	0.0000	0.0980
>	1875.00	0.0000	0.0700
>	1876.00	0.0000	0.0630
>	1877.00	0.0000	0.0560
>	1878.00	0.0000	0.0420
>	1879.00	0.0000	0.0420
>	1880.00	0.0000	0.0560
>	1881.00	0.0000	0.0840
>	1882.00	0.0000	0.0700
>	1883.00	-2.5900	0.0490
>	1884.00	-0.9800	0.0630
>	1885.00	0.0000	0.0560
>	1886.00	0.0000	0.0420

>	1887.00	0.0000	0.0350
>	1888.00	0.0000	0.0350
>	1889.00	0.0000	0.0350
>	1890.00	0.0000	0.0420
>	1891.00	0.0000	0.0770
>	1892.00	0.0000	0.1050
>	1893.00	0.0000	0.1050
>	1894.00	0.0000	0.1120
>	1895.00	0.0000	0.1120
>	1896.00	0.0000	0.0980
>	1897.00	0.0000	0.0700
>	1898.00	0.0000	0.0770
>	1899.00	0.0000	0.0630
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>	1901.00	0.0000	0.0420
>	1902.00	-2.5200	0.0350
>	1903.00	-0.9100	0.0560
>	1904.00	0.0000	0.0770
>	1905.00	0.0000	0.0490
>	1906.00	0.0000	0.0700
>	1907.00	-0.2590	0.0560
>	1908.00	0.0000	0.0630
>	1909.00	0.0000	0.0630
>	1910.00	0.0000	0.0490
>	1911.00	0.0000	0.0490
>	1912.00	-1.4560	0.0560
>	1913.00	-0.5600	0.0630
>	1914.00	-0.5600	0.0770
>	1915.00	0.0000	0.1260
>	1916.00	0.0000	0.1470
>	1917.00	0.0000	0.1820
>	1918.00	0.0000	0.1750
>	1919.00	0.0000	0.1470
>	1920.00	0.0000	0.1330
>	1921.00	0.0000	0.1190
>	1922.00	0.0000	0.1050
>	1923.00	0.0000	0.1050
>	1924.00	-0.9170	0.1050
>	1925.00	-0.3500	0.1120
>	1926.00	0.0000	0.1190
>	1927.00	0.0000	0.1400
>	1928.00	0.0000	0.1260
>	1929.00	0.0000	0.1120
>	1930.00	0.0000	0.1190
>	1931.00	0.0000	0.1190
>	1932.00	0.0000	0.1120
>	1933.00	0.0000	0.1120
>	1934.00	0.0000	0.1330
>	1935.00	0.0000	0.1610
>	1936.00	0.0000	0.2170
>	1937.00	0.0000	0.2170
>	1938.00	0.0000	0.2170
>	1939.00	0.0000	0.2170
>	1940.00	0.0000	0.2310
>	1941.00	0.0000	0.2240
>	1942.00	0.0000	0.2100
>	1943.00	0.0000	0.1960
>	1944.00	0.0000	0.2030
>	1945.00	0.0000	0.2310
>	1946.00	0.0000	0.2380
>	1947.00	0.0000	0.2940
>	1948.00	0.0000	0.3220
>	1949.00	0.0000	0.3080

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> 1950.00	0.0000	0.2870
> 1951.00	0.0000	0.2660
> 1952.00	0.0000	0.2520
> 1953.00	0.0000	0.2450
> 1954.00	0.0000	0.2380
> 1955.00	0.0000	0.2730
> 1956.00	-0.2870	0.3500
> 1957.00	0.0000	0.3920
> 1958.00	0.0000	0.3780
> 1959.00	0.0000	0.3360
> 1960.00	0.0000	0.3430
> 1961.00	-0.2800	0.3010
> 1962.00	-0.1960	0.2730
> 1963.00	-0.4480	0.2590
> 1964.00	-0.8330	0.2310
> 1965.00	-0.7070	0.2240
> 1966.00	-0.4620	0.2450
> 1967.00	-0.3080	0.2590
> 1968.00	-0.5950	0.2660
> 1969.00	-0.7420	0.2660
> 1970.00	-0.3570	0.2450
> 1971.00	-0.1400	0.2170
> 1972.00	-0.0770	0.2310
> 1973.00	-0.1610	0.2100
> 1974.00	-0.2660	0.2100
> 1975.00	-0.6300	0.1960
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> 1977.00	-0.1050	0.2310
> 1978.00	-0.1540	0.3220
> 1979.00	-0.1890	0.4060
> 1980.00	-0.1120	0.4130
> 1981.00	-0.1120	0.3850
> 1982.00	-1.6870	0.3360
> 1983.00	-2.1420	0.3220
> 1984.00	-0.8260	0.2800
> 1985.00	-0.2730	0.2590
> 1986.00	-0.3080	0.2590
> 1987.00	-0.2310	0.2870
> 1988.00	-0.1400	0.3710
> 1989.00	-0.1120	0.4200
> 1990.00	-0.1120	0.4200
> 1991.00	-1.1200	0.3920
> 1992.00	-2.6110	0.3570
> 1993.00	-0.9730	0.3150
> 1994.00	-0.3920	0.2730
> 1995.00	-0.1820	0.2730
> 1996.00	-0.1260	0.2590
> 1997.00	-0.0980	0.2730
> 1998.00	-0.0490	0.3220

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>
Subject: Re: Fwd: RE: Wahl-Ammann paper on MBH-MM issues
Date: Mon, 23 Jan 2006 13:47:30 -0700
Cc: "Wahl, Eugene R" <wahl@alfred.edu>, Keith Briffa <k.briffa@uea.ac.uk>

Hi all - I'm betting that "provisional acceptance" is not good enough for inclusion in the Second Order draft, but based on what Gene has said, he should have formal acceptance soon
- we really need that. Can you give us a read on when you'll have it Gene? Best make this a top priority, or we'll have to leave your important work out of the chapter. Many thanks!!
Peck

Hi Peck, I assume a provisional acceptance is OK by IPCC rules? The timing of these matters are being followed closely by McIntyre (see: <http://www.climateaudit.org/?p=503>) and we cannot afford to be caught doing anything that is not within the regulations. Thus need to consult with Martin and Susan on this (see also last mail from Melinda).

Cheers,
Eystein

Thanks Gene - it is worth all the effort, and please keep us (especially Keith) posted on the updates.

best, peck

X-Sieve: CMU Sieve 2.2
Subject: RE: Wahl-Ammann paper on MBH-MM issues
Date: Thu, 19 Jan 2006 21:17:03 -0500

Thread-Topic: Wahl-Ammann paper on MBH-MM issues
Thread-Index: AcWBF2jTf69xJLFkThuHZzU6qK8tMx+kOAJUB28NG2A=

From: "Wahl, Eugene R" <wahl@alfred.edu>
To: "Jonathan Overpeck" <jto@u.arizona.edu>

Hello Jonathan and Keith:

I'm not sure that I ever sent you the updated Wahl-Ammann paper that was the basis for Steve's provisional acceptance. Here it is. As is, it contains a long
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appendix (# 1)

on issues with interannual statistics of merit for validation, which was not in the version I had sent you earlier in the year. All the main results and conclusions are the same.

Caspar and I are also now responding to Steve's final requests, based on independent re-review. This is primarily to address publishing Pearson's r^2 and CE calculations for verification, which Steve and the reviewer reason should be done to get the conversation off the topic of us choosing not to report these measures, and onto the science itself. We explain thoroughly in the appendix I mention above why we feel these (and other interannual-only) measures of merit are not of much use for verification in the MBH context, so that the fact we are reporting them is contextualized appropriately. IN FACT, we will be going farther than that and will be bringing this material currently in an appendix into the main text, based on the reasoning below (quoted from another message)

Caspar mentioned yesterday that he talked with Susan Solomon about this paper, and she did not see the appendix we had added concerning the issues about Pearson's r^2 etc. Based on this she therefore thought our text was weak in this area in relation to McIntyre's criticisms. Caspar thought, and I agree, that we need to bring this stuff OUT of the appendix and get it INTO the methods section, so that it won't be so easily missed!! We are working on this--which will include other material as well in the text proper.

Also, we are going ahead with an even further-expanded discussion on the issues with r^2 , which itself will probably become an appendix in the final text (it had been slated for publication as supplemental web-site material). This expanded discussion will go into additional reasoning (with graphics) concerning the basis for r^2 not being useful in this context. It will give a vector space analysis of the issues, and explicit visual demonstration of how these issues with r^2 play out in terms of false negative and false positive errors in validation.

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Let me know if I can be of any further help in all this. Apologies if this message seems long. I did my best to keep it short, but I'm a bit tired and it is hard to edit well in that state!

Peace, Gene

Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

1 Saxon Drive
Alfred NY, 14802

607.871.2604

From: Wahl, Eugene R
Sent: Tuesday, December 13, 2005 12:55 AM
To: Jonathan Overpeck
Cc: Keith Briffa; ammann@ucar.edu
Subject: RE: Wahl-Ammann paper on MBH-MM issues

Hello Jonathan:

1) I want you to know that we heard from Steve Schneider today that our paper with Climatic Change has been provisionally accepted for publication. The provisions Steve outlined are ones we fully accept and will implement (extra statistics of merit and remaking of graphics), so this paper can be viewed as accepted, I should think.

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Caspar and I are getting right on it. We wanted you to know this ASAP.

2) The Ammann-Wahl GRL comment on the MM GRL paper from early 2005 is being sent for final review along with a response by MM that GRL is soliciting. We had thought, based on info from James Famiglietti (editor), that this article had been accepted and the response from MM was just being sought. We did not realize that the entire package of comment and response would be put through a final review. We just heard about this last Friday. Sorry that we had that one mistaken.

Hope you are well. Best wishes on IPCC work.

Peace, Gene

Dr. Eugene R. Wahl

Asst. Professor of Environmental Studies

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607-871-2604

1 Saxon Drive

Alfred, NY 14802

Content-Type: application/msword;
name="Wahl_Ammann_3321_revised.doc"
Content-Description: Wahl_Ammann_3321_revised.doc
Content-Disposition: attachment;
filename="Wahl_Ammann_3321_revised.doc"

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Attachment converted: Nebbiolo:wahl_Ammann_3321_revised.doc (WDBN/«IC»)
(009EB84C)

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Eystein Jansen
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--

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From: Gian-Kasper Plattner <plattner@climate.unibe.ch>
To: Jonathan Overpeck <jto@u.arizona.edu>
Subject: Bern2.5CC IPCC-AR4 millennium simulations
Date: Fri, 27 Jan 2006 16:46:40 +0100
Reply-to: plattner@climate.unibe.ch
Cc: Fortunat Joos <joos@climate.unibe.ch>, Stefan Rahmstorf
<rahmstorf@ozean-klima.de>, Anders Levermann <levermann@pik-potsdam.de>, Eva Bauer
<eva.bauer@pik-potsdam.de>, Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa
<k.briffa@uea.ac.uk>, Christoph Raible <raible@climate.unibe.ch>

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Dear all,

Please find attached the Bern2.5CC model output for the IPCC-AR4 millenium simulations, all spanning the period from 1000 - 1998AD. Some plots including a preliminary comparison between CLIMBER-2 and Bern2.5CC results are additionally included (see infos below).

1. The following Bern2.5CC files are attached (with the simulation tag as specified in Fortunat's readme document):

simulation B1.1: Bern2.5CC_bard08_volcCrow_CO2_nonCO2_1000-1998_ar4.dat

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Simulation B1.2: Bern2.5CC_bard25_volcCrow_CO2_nonCO2_1000-1998_ar4.dat
Simulation B2 : Bern2.5CC_WLS-2005_volcCrow_CO2_nonCO2_1000-1998_ar4.dat
Simulation B3.1: Bern2.5CC_bard08_volcCrow_CO2_anthr0_1000-1998_ar4.dat
Simulation B3.2: Bern2.5CC_bard25_volcCrow_CO2_anthr0_1000-1998_ar4.dat
Simulation B3.3: Bern2.5CC_WLS-2005_volcCrow_CO2_anthr0_1000-1998_ar4.dat
Simulation B4 : Bern2.5CC_ctrl_1000-1998_ar4.dat

The variables stored are: year AD, globally averaged surface air temperature, and northern hemispheric and southern hemispheric surface air temperature. The most important information about model setup and references is included in the extended header in each file. Please note that the information on the forcing timeseries applied are specified in the filename only!

Please let me know if something is unclear or if you want additional informations about these simulations in particular or the Bern2.5CC model in general. I can also provide more output variables if desired (such as e.g. MOC, sea level, ...).

2. In addition, the following plots with CLIMBER-2 and Bern2.5CC results are attached:

Dgmairtnorm_millennium_Bern2.5CC-CLIMBER2_1000_1998_ipccar4.eps
Dgmairtnorm_millennium_Bern2.5CC-CLIMBER2_offset0.8_1000_1998_ipccar4.eps
Dgmairtnorm_millennium_Bern2.5CC_1000_1998_ipccar4.eps
Dgmairtnorm_millennium_CLIMBER2_1000_1998_ipccar4.eps

All these plots show the anomaly in global mean surface air temperature with respect to the value in year 1001AD from either CLIMBER-2, Bern2.5CC, or both. Let me know if you have questions or comments about the plots.

with best regards,

Gian-Kasper

--

Gian-Kasper Plattner

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91
IPCC AR4 Millenium Runs output (vary solar forcing)
+++++

Model: Bern2.5CC version with active C-cycle

Prescribed forcing timeseries as described in file

mail.2006

```

# readme_doRuns_IPCC_Chap6_millennium_21jan06.txt
# provided by F. Joos, University of Bern.
#
# Contact:
# -----
# Gian-Kasper Plattner
# Climate and Environmental Physics
# Physics Institute, University of Bern
# Sidlerstrasse 5, CH-3012 Bern, Switzerland
# plattner@climate.unibe.ch
# http://www.climate.unibe.ch/~plattner/
# tel: ++41 (0)31 631-44-67
# fax: ++41 (0)31 631-87-42
#
# Some model setup informations:
# -----
# All runs with horizontal/vertical diffusion
#
# Run with standard ocean parameters
#   as used in Plattner et al. 2001/2002
#   with kv (diffusivity) 4*10^-5 m2/s
#
# Climate sens. set to ~ 3.2 degrees C
# parameterized see Knutti et al. (Clim. Dyn. 2003)
#
# Model version is annual mean.
#
# No radiation code, CO2 radiative forcing calculated
# for as RF=5.35*ln(CO2/CO2_preind),
# Non-co2 radiative forcing prescribed according to
# Joos et al. GBC 2001 with updates for solar forcing
#
# More model description:
# -----
# Zonally averaged dynamical ocean with 3 basins and
# Southern Ocean, zonally averaged one layer energy
# and moisture balance atmosphere, thermodynamic
# sea ice (Stocker et al., J. Climate 1992).
#
# Carbon cycle components: Ocean/Atm/Terr.biosphere;
# Ocean carbon cycle is a description of the cycles
# of organic carbon and CaCO3 (Marchal et al., Tellus
# Tellus B), based on Redfield approach using PO4 as
# biolimiting nutrient.
#
# Land Biota: Lund-Jena-Postdam Dynamical Global
#   Vegetation Model (LPJ-DGVM)
# at GCM resolution (Gerber et al. 2003, Climate
# Dynamics; Sitch et al. 2003, Global Change Biology)
#
# LPJ forced by Cramer/Leemans annual mean
# climatology plus interannual climate variability
# from Hadley simulation (30-recycled climate) plus
# changes in the fields of surface temperature,
# precipitation, and cloudcover as simulated with the
# Impulse-EOF version of ECHAM-3/LSG in response to
# projected radiative forcing changes.
#
# Land use changes are not explicitly considered.
#
# Impact of climate change on terrestrial C-storage
# included
#

```

References:

```
# -----
# Carbon cycle Ocean: Marchal et al., Tellus 1998
# Carbon cycle Terr. Bio: Sitch et al., GCB 2003
# Gerber et al., Clim. Dyn. 2003
# Ccycle-climate feedbacks and global warming:
# Plattner et al., Tellus 2001
# Plattner et al., GCB 2002
# Non-CO2 forcing: Joos et al., GCB 2001
# Climate model: Stocker et al., J. Climate 1992
# Sea level: Knutti et al., J. Climate 2000
# Global warming Physics: Knutti et al., Nature 2002
# Knutti et al., Cl. Dyn. 2003
# and refs therein.
```

Output columns:

```
# -----
# Time (yr AD)
# Global mean air temperature (deg C)
# NH-averaged air temperature (deg C)
# SH-averaged air temperature (deg C)
0.100100E+04 0.159155E+02 0.165835E+02 0.152475E+02
0.100200E+04 0.159209E+02 0.165892E+02 0.152525E+02
0.100300E+04 0.159252E+02 0.165938E+02 0.152567E+02
0.100400E+04 0.158977E+02 0.165611E+02 0.152344E+02
0.100500E+04 0.158655E+02 0.165220E+02 0.152089E+02
0.100600E+04 0.158774E+02 0.165361E+02 0.152187E+02
0.100700E+04 0.158992E+02 0.165626E+02 0.152358E+02
0.100800E+04 0.159109E+02 0.165768E+02 0.152449E+02
0.100900E+04 0.159171E+02 0.165843E+02 0.152500E+02
0.101000E+04 0.159213E+02 0.165891E+02 0.152535E+02
0.101100E+04 0.159242E+02 0.165924E+02 0.152560E+02
0.101200E+04 0.159263E+02 0.165946E+02 0.152579E+02
0.101300E+04 0.159279E+02 0.165964E+02 0.152593E+02
0.101400E+04 0.159292E+02 0.165979E+02 0.152606E+02
0.101500E+04 0.158213E+02 0.164710E+02 0.151715E+02
0.101600E+04 0.157214E+02 0.163645E+02 0.150782E+02
0.101700E+04 0.157650E+02 0.164064E+02 0.151236E+02
0.101800E+04 0.158283E+02 0.164797E+02 0.151770E+02
0.101900E+04 0.158570E+02 0.165118E+02 0.152022E+02
0.102000E+04 0.158701E+02 0.165312E+02 0.152089E+02
0.102100E+04 0.158780E+02 0.165447E+02 0.152113E+02
0.102200E+04 0.158856E+02 0.165546E+02 0.152167E+02
0.102300E+04 0.158920E+02 0.165619E+02 0.152220E+02
0.102400E+04 0.158971E+02 0.165676E+02 0.152267E+02
0.102500E+04 0.159014E+02 0.165720E+02 0.152307E+02
0.102600E+04 0.157770E+02 0.164254E+02 0.151285E+02
0.102700E+04 0.156600E+02 0.162963E+02 0.150237E+02
0.102800E+04 0.157085E+02 0.163461E+02 0.150709E+02
0.102900E+04 0.157839E+02 0.164324E+02 0.151353E+02
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0.125800E+04	0.159206E+02	0.166642E+02	0.151771E+02
0.125900E+04	0.154807E+02	0.161494E+02	0.148121E+02
0.126000E+04	0.152572E+02	0.160683E+02	0.144461E+02
0.126100E+04	0.154588E+02	0.163821E+02	0.145355E+02
0.126200E+04	0.156558E+02	0.165738E+02	0.147379E+02
0.126300E+04	0.157923E+02	0.166953E+02	0.148893E+02
0.126400E+04	0.158568E+02	0.167406E+02	0.149730E+02
0.126500E+04	0.158900E+02	0.167545E+02	0.150255E+02
0.126600E+04	0.159115E+02	0.167589E+02	0.150640E+02
0.126700E+04	0.159227E+02	0.167575E+02	0.150880E+02
0.126800E+04	0.159307E+02	0.167536E+02	0.151077E+02
0.126900E+04	0.159367E+02	0.167486E+02	0.151247E+02
0.127000E+04	0.159415E+02	0.167434E+02	0.151395E+02
0.127100E+04	0.159453E+02	0.167383E+02	0.151523E+02
0.127200E+04	0.159485E+02	0.167336E+02	0.151634E+02
0.127300E+04	0.159510E+02	0.167292E+02	0.151729E+02
0.127400E+04	0.159530E+02	0.167251E+02	0.151809E+02
0.127500E+04	0.158544E+02	0.166053E+02	0.151035E+02
0.127600E+04	0.157431E+02	0.164816E+02	0.150046E+02
0.127700E+04	0.157788E+02	0.165214E+02	0.150362E+02
0.127800E+04	0.158412E+02	0.165867E+02	0.150956E+02
0.127900E+04	0.158710E+02	0.166153E+02	0.151268E+02
0.128000E+04	0.158755E+02	0.166076E+02	0.151434E+02
0.128100E+04	0.158771E+02	0.165999E+02	0.151544E+02
0.128200E+04	0.158361E+02	0.165112E+02	0.151610E+02
0.128300E+04	0.158180E+02	0.164730E+02	0.151631E+02
0.128400E+04	0.158099E+02	0.164557E+02	0.151641E+02
0.128500E+04	0.156680E+02	0.162921E+02	0.150440E+02
0.128600E+04	0.155212E+02	0.161200E+02	0.149223E+02
0.128700E+04	0.156037E+02	0.162401E+02	0.149673E+02
0.128800E+04	0.158194E+02	0.163373E+02	0.153015E+02
0.128900E+04	0.158806E+02	0.163862E+02	0.153750E+02
0.129000E+04	0.159281E+02	0.164155E+02	0.154407E+02
0.129100E+04	0.159485E+02	0.164389E+02	0.154580E+02
0.129200E+04	0.159630E+02	0.164605E+02	0.154654E+02
0.129300E+04	0.159730E+02	0.164790E+02	0.154671E+02
0.129400E+04	0.159836E+02	0.164952E+02	0.154720E+02

0.129500E+04	0.158516E+02	0.163463E+02	0.153569E+02
0.129600E+04	0.157273E+02	0.162135E+02	0.152410E+02
0.129700E+04	0.157762E+02	0.162788E+02	0.152737E+02
0.129800E+04	0.158534E+02	0.163750E+02	0.153318E+02
0.129900E+04	0.158826E+02	0.164088E+02	0.153563E+02
0.130000E+04	0.159022E+02	0.164376E+02	0.153668E+02
0.130100E+04	0.159166E+02	0.164602E+02	0.153729E+02
0.130200E+04	0.159277E+02	0.164786E+02	0.153768E+02
0.130300E+04	0.159365E+02	0.164937E+02	0.153794E+02
0.130400E+04	0.159437E+02	0.165063E+02	0.153812E+02
0.130500E+04	0.159498E+02	0.165171E+02	0.153825E+02
0.130600E+04	0.159550E+02	0.165265E+02	0.153835E+02
0.130700E+04	0.159595E+02	0.165348E+02	0.153843E+02
0.130800E+04	0.159634E+02	0.165420E+02	0.153849E+02
0.130900E+04	0.159669E+02	0.165483E+02	0.153854E+02
0.131000E+04	0.159925E+02	0.165984E+02	0.153867E+02
0.131100E+04	0.159960E+02	0.166017E+02	0.153903E+02
0.131200E+04	0.159968E+02	0.166020E+02	0.153916E+02
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0.131400E+04	0.159816E+02	0.166054E+02	0.153578E+02
0.131500E+04	0.159730E+02	0.166070E+02	0.153391E+02
0.131600E+04	0.159365E+02	0.166080E+02	0.152649E+02
0.131700E+04	0.158919E+02	0.166079E+02	0.151758E+02
0.131800E+04	0.158676E+02	0.166061E+02	0.151291E+02
0.131900E+04	0.158506E+02	0.166035E+02	0.150976E+02
0.132000E+04	0.158387E+02	0.166006E+02	0.150767E+02
0.132100E+04	0.158288E+02	0.165975E+02	0.150601E+02
0.132200E+04	0.158235E+02	0.165944E+02	0.150526E+02
0.132300E+04	0.158210E+02	0.165916E+02	0.150504E+02
0.132400E+04	0.158207E+02	0.165893E+02	0.150520E+02
0.132500E+04	0.158220E+02	0.165876E+02	0.150563E+02
0.132600E+04	0.158244E+02	0.165863E+02	0.150624E+02
0.132700E+04	0.158276E+02	0.165856E+02	0.150696E+02
0.132800E+04	0.158312E+02	0.165849E+02	0.150774E+02
0.132900E+04	0.157124E+02	0.164412E+02	0.149837E+02
0.133000E+04	0.156000E+02	0.163193E+02	0.148807E+02
0.133100E+04	0.156443E+02	0.163665E+02	0.149222E+02
0.133200E+04	0.157169E+02	0.164435E+02	0.149904E+02
0.133300E+04	0.157558E+02	0.164836E+02	0.150280E+02
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0.133500E+04	0.157970E+02	0.165239E+02	0.150701E+02
0.133600E+04	0.158117E+02	0.165374E+02	0.150860E+02
0.133700E+04	0.158245E+02	0.165490E+02	0.151000E+02
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0.133900E+04	0.158458E+02	0.165679E+02	0.151236E+02
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0.134100E+04	0.158623E+02	0.165823E+02	0.151422E+02
0.134200E+04	0.158690E+02	0.165880E+02	0.151499E+02
0.134300E+04	0.158749E+02	0.165931E+02	0.151568E+02
0.134400E+04	0.158803E+02	0.165976E+02	0.151630E+02
0.134500E+04	0.157810E+02	0.164796E+02	0.150824E+02
0.134600E+04	0.156860E+02	0.163782E+02	0.149939E+02
0.134700E+04	0.157263E+02	0.164183E+02	0.150343E+02
0.134800E+04	0.157903E+02	0.164873E+02	0.150932E+02
0.134900E+04	0.158240E+02	0.165247E+02	0.151232E+02
0.135000E+04	0.158390E+02	0.165469E+02	0.151311E+02
0.135100E+04	0.158509E+02	0.165625E+02	0.151392E+02
0.135200E+04	0.158613E+02	0.165743E+02	0.151483E+02
0.135300E+04	0.158701E+02	0.165835E+02	0.151567E+02
0.135400E+04	0.158775E+02	0.165910E+02	0.151640E+02
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0.135600E+04	0.158893E+02	0.166023E+02	0.151763E+02
0.135700E+04	0.158942E+02	0.166068E+02	0.151815E+02

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0.135900E+04	0.159026E+02	0.166145E+02	0.151906E+02
0.136000E+04	0.159062E+02	0.166178E+02	0.151946E+02
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0.136200E+04	0.159126E+02	0.166236E+02	0.152016E+02
0.136300E+04	0.159155E+02	0.166262E+02	0.152047E+02
0.136400E+04	0.159181E+02	0.166286E+02	0.152076E+02
0.136500E+04	0.159206E+02	0.166308E+02	0.152104E+02
0.136600E+04	0.159229E+02	0.166328E+02	0.152130E+02
0.136700E+04	0.159251E+02	0.166348E+02	0.152155E+02
0.136800E+04	0.159272E+02	0.166366E+02	0.152178E+02
0.136900E+04	0.159292E+02	0.166383E+02	0.152201E+02
0.137000E+04	0.159311E+02	0.166400E+02	0.152223E+02
0.137100E+04	0.159330E+02	0.166415E+02	0.152244E+02
0.137200E+04	0.159347E+02	0.166430E+02	0.152265E+02
0.137300E+04	0.159364E+02	0.166444E+02	0.152285E+02
0.137400E+04	0.159380E+02	0.166457E+02	0.152303E+02
0.137500E+04	0.158966E+02	0.165967E+02	0.151964E+02
0.137600E+04	0.158502E+02	0.165415E+02	0.151589E+02
0.137700E+04	0.158650E+02	0.165592E+02	0.151707E+02
0.137800E+04	0.158934E+02	0.165937E+02	0.151931E+02
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0.138100E+04	0.159231E+02	0.166279E+02	0.152182E+02
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0.138400E+04	0.159339E+02	0.166382E+02	0.152295E+02
0.138500E+04	0.159361E+02	0.166400E+02	0.152322E+02
0.138600E+04	0.159378E+02	0.166412E+02	0.152344E+02
0.138700E+04	0.158964E+02	0.165921E+02	0.152007E+02
0.138800E+04	0.158500E+02	0.165366E+02	0.151633E+02
0.138900E+04	0.158645E+02	0.165539E+02	0.151751E+02
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0.139200E+04	0.159154E+02	0.166145E+02	0.152164E+02
0.139300E+04	0.159206E+02	0.166199E+02	0.152213E+02
0.139400E+04	0.159242E+02	0.166233E+02	0.152250E+02
0.139500E+04	0.159268E+02	0.166256E+02	0.152280E+02
0.139600E+04	0.159285E+02	0.166268E+02	0.152302E+02
0.139700E+04	0.159293E+02	0.166270E+02	0.152317E+02
0.139800E+04	0.159296E+02	0.166266E+02	0.152327E+02
0.139900E+04	0.159295E+02	0.166257E+02	0.152332E+02
0.140000E+04	0.159290E+02	0.166246E+02	0.152335E+02
0.140100E+04	0.159285E+02	0.166234E+02	0.152336E+02
0.140200E+04	0.159281E+02	0.166224E+02	0.152338E+02
0.140300E+04	0.159278E+02	0.166215E+02	0.152341E+02
0.140400E+04	0.159274E+02	0.166206E+02	0.152342E+02
0.140500E+04	0.159270E+02	0.166197E+02	0.152344E+02
0.140600E+04	0.159266E+02	0.166188E+02	0.152345E+02
0.140700E+04	0.159262E+02	0.166178E+02	0.152345E+02
0.140800E+04	0.158868E+02	0.165715E+02	0.152022E+02
0.140900E+04	0.158420E+02	0.165183E+02	0.151656E+02
0.141000E+04	0.158664E+02	0.165566E+02	0.151763E+02
0.141100E+04	0.158905E+02	0.165843E+02	0.151967E+02
0.141200E+04	0.159030E+02	0.165986E+02	0.152075E+02
0.141300E+04	0.159094E+02	0.166055E+02	0.152134E+02
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0.141600E+04	0.159174E+02	0.166124E+02	0.152223E+02
0.141700E+04	0.159178E+02	0.166121E+02	0.152234E+02
0.141800E+04	0.159176E+02	0.166111E+02	0.152240E+02
0.141900E+04	0.159169E+02	0.166096E+02	0.152241E+02
0.142000E+04	0.159159E+02	0.166079E+02	0.152239E+02

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0.142200E+04	0.159140E+02	0.166047E+02	0.152234E+02
0.142300E+04	0.159132E+02	0.166033E+02	0.152231E+02
0.142400E+04	0.159124E+02	0.166020E+02	0.152228E+02
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0.142600E+04	0.159108E+02	0.165994E+02	0.152222E+02
0.142700E+04	0.159100E+02	0.165981E+02	0.152218E+02
0.142800E+04	0.159089E+02	0.165966E+02	0.152212E+02
0.142900E+04	0.159073E+02	0.165945E+02	0.152201E+02
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0.143900E+04	0.158682E+02	0.165500E+02	0.151863E+02
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0.144300E+04	0.158674E+02	0.165489E+02	0.151860E+02
0.144400E+04	0.158671E+02	0.165484E+02	0.151859E+02
0.144500E+04	0.158668E+02	0.165480E+02	0.151857E+02
0.144600E+04	0.158666E+02	0.165475E+02	0.151856E+02
0.144700E+04	0.158663E+02	0.165471E+02	0.151855E+02
0.144800E+04	0.158660E+02	0.165467E+02	0.151853E+02
0.144900E+04	0.158657E+02	0.165463E+02	0.151852E+02
0.145000E+04	0.158655E+02	0.165459E+02	0.151850E+02
0.145100E+04	0.158652E+02	0.165456E+02	0.151849E+02
0.145200E+04	0.158649E+02	0.165451E+02	0.151847E+02
0.145300E+04	0.156986E+02	0.163494E+02	0.150478E+02
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0.145500E+04	0.157223E+02	0.162074E+02	0.152372E+02
0.145600E+04	0.158517E+02	0.163244E+02	0.153790E+02
0.145700E+04	0.159077E+02	0.163858E+02	0.154296E+02
0.145800E+04	0.159363E+02	0.164214E+02	0.154512E+02
0.145900E+04	0.157969E+02	0.162550E+02	0.153387E+02
0.146000E+04	0.155383E+02	0.159649E+02	0.151117E+02
0.146100E+04	0.154816E+02	0.159199E+02	0.150434E+02
0.146200E+04	0.156008E+02	0.160635E+02	0.151380E+02
0.146300E+04	0.157161E+02	0.161978E+02	0.152344E+02
0.146400E+04	0.157779E+02	0.162756E+02	0.152803E+02
0.146500E+04	0.158130E+02	0.163221E+02	0.153038E+02
0.146600E+04	0.157942E+02	0.163031E+02	0.152853E+02
0.146700E+04	0.157648E+02	0.162694E+02	0.152601E+02
0.146800E+04	0.157932E+02	0.163077E+02	0.152787E+02
0.146900E+04	0.158317E+02	0.163593E+02	0.153042E+02
0.147000E+04	0.158545E+02	0.163903E+02	0.153187E+02
0.147100E+04	0.158691E+02	0.164102E+02	0.153280E+02
0.147200E+04	0.158802E+02	0.164253E+02	0.153350E+02
0.147300E+04	0.159115E+02	0.164797E+02	0.153434E+02
0.147400E+04	0.159169E+02	0.164839E+02	0.153498E+02
0.147500E+04	0.159220E+02	0.164894E+02	0.153546E+02
0.147600E+04	0.159266E+02	0.164947E+02	0.153586E+02
0.147700E+04	0.159309E+02	0.164996E+02	0.153622E+02
0.147800E+04	0.159350E+02	0.165043E+02	0.153657E+02
0.147900E+04	0.159388E+02	0.165085E+02	0.153690E+02
0.148000E+04	0.159372E+02	0.165125E+02	0.153620E+02
0.148100E+04	0.158914E+02	0.164707E+02	0.153122E+02
0.148200E+04	0.158569E+02	0.164401E+02	0.152738E+02
0.148300E+04	0.158195E+02	0.164051E+02	0.152338E+02

0.148400E+04	0.158050E+02	0.164048E+02	0.152052E+02
0.148500E+04	0.158148E+02	0.164485E+02	0.151811E+02
0.148600E+04	0.157900E+02	0.164782E+02	0.151018E+02
0.148700E+04	0.157779E+02	0.164903E+02	0.150655E+02
0.148800E+04	0.157811E+02	0.164964E+02	0.150659E+02
0.148900E+04	0.157809E+02	0.164998E+02	0.150620E+02
0.149000E+04	0.157796E+02	0.165015E+02	0.150577E+02
0.149100E+04	0.157791E+02	0.165020E+02	0.150562E+02
0.149200E+04	0.157799E+02	0.165020E+02	0.150578E+02
0.149300E+04	0.157818E+02	0.165018E+02	0.150619E+02
0.149400E+04	0.157847E+02	0.165016E+02	0.150678E+02
0.149500E+04	0.157421E+02	0.164482E+02	0.150361E+02
0.149600E+04	0.156978E+02	0.163923E+02	0.150032E+02
0.149700E+04	0.157180E+02	0.164116E+02	0.150243E+02
0.149800E+04	0.157474E+02	0.164401E+02	0.150546E+02
0.149900E+04	0.157617E+02	0.164504E+02	0.150730E+02
0.150000E+04	0.157724E+02	0.164588E+02	0.150861E+02
0.150100E+04	0.157814E+02	0.164655E+02	0.150973E+02
0.150200E+04	0.157892E+02	0.164712E+02	0.151072E+02
0.150300E+04	0.157961E+02	0.164760E+02	0.151162E+02
0.150400E+04	0.157634E+02	0.164350E+02	0.150919E+02
0.150500E+04	0.157249E+02	0.163868E+02	0.150630E+02
0.150600E+04	0.157419E+02	0.164051E+02	0.150788E+02
0.150700E+04	0.157725E+02	0.164402E+02	0.151047E+02
0.150800E+04	0.157905E+02	0.164605E+02	0.151205E+02
0.150900E+04	0.158017E+02	0.164724E+02	0.151309E+02
0.151000E+04	0.158103E+02	0.164812E+02	0.151393E+02
0.151100E+04	0.158174E+02	0.164884E+02	0.151463E+02
0.151200E+04	0.158233E+02	0.164944E+02	0.151523E+02
0.151300E+04	0.158283E+02	0.164993E+02	0.151573E+02
0.151400E+04	0.158325E+02	0.165034E+02	0.151616E+02
0.151500E+04	0.158360E+02	0.165068E+02	0.151652E+02
0.151600E+04	0.158391E+02	0.165099E+02	0.151684E+02
0.151700E+04	0.158418E+02	0.165126E+02	0.151711E+02
0.151800E+04	0.158442E+02	0.165151E+02	0.151734E+02
0.151900E+04	0.158464E+02	0.165174E+02	0.151754E+02
0.152000E+04	0.158485E+02	0.165197E+02	0.151773E+02
0.152100E+04	0.158505E+02	0.165220E+02	0.151790E+02
0.152200E+04	0.158523E+02	0.165241E+02	0.151805E+02
0.152300E+04	0.158541E+02	0.165262E+02	0.151819E+02
0.152400E+04	0.158556E+02	0.165280E+02	0.151832E+02
0.152500E+04	0.158570E+02	0.165298E+02	0.151843E+02
0.152600E+04	0.158584E+02	0.165314E+02	0.151853E+02
0.152700E+04	0.157598E+02	0.164234E+02	0.150961E+02
0.152800E+04	0.156533E+02	0.162994E+02	0.150073E+02
0.152900E+04	0.156942E+02	0.163413E+02	0.150471E+02
0.153000E+04	0.157584E+02	0.164157E+02	0.151010E+02
0.153100E+04	0.157864E+02	0.164467E+02	0.151262E+02
0.153200E+04	0.157988E+02	0.164660E+02	0.151317E+02
0.153300E+04	0.158070E+02	0.164795E+02	0.151346E+02
0.153400E+04	0.158147E+02	0.164895E+02	0.151400E+02
0.153500E+04	0.158212E+02	0.164971E+02	0.151452E+02
0.153600E+04	0.158266E+02	0.165033E+02	0.151499E+02
0.153700E+04	0.158312E+02	0.165085E+02	0.151540E+02
0.153800E+04	0.158351E+02	0.165127E+02	0.151575E+02
0.153900E+04	0.158383E+02	0.165161E+02	0.151606E+02
0.154000E+04	0.158410E+02	0.165189E+02	0.151632E+02
0.154100E+04	0.158435E+02	0.165214E+02	0.151656E+02
0.154200E+04	0.158457E+02	0.165237E+02	0.151677E+02
0.154300E+04	0.158477E+02	0.165258E+02	0.151696E+02
0.154400E+04	0.158495E+02	0.165277E+02	0.151714E+02
0.154500E+04	0.158512E+02	0.165294E+02	0.151730E+02
0.154600E+04	0.158527E+02	0.165310E+02	0.151744E+02

0.154700E+04	0.158541E+02	0.165324E+02	0.151757E+02
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0.154900E+04	0.158564E+02	0.165349E+02	0.151780E+02
0.155000E+04	0.158574E+02	0.165359E+02	0.151790E+02
0.155100E+04	0.158583E+02	0.165368E+02	0.151798E+02
0.155200E+04	0.158591E+02	0.165375E+02	0.151806E+02
0.155300E+04	0.158597E+02	0.165381E+02	0.151813E+02
0.155400E+04	0.158603E+02	0.165387E+02	0.151819E+02
0.155500E+04	0.158608E+02	0.165391E+02	0.151825E+02
0.155600E+04	0.158612E+02	0.165395E+02	0.151830E+02
0.155700E+04	0.158616E+02	0.165398E+02	0.151834E+02
0.155800E+04	0.158620E+02	0.165401E+02	0.151839E+02
0.155900E+04	0.158623E+02	0.165402E+02	0.151843E+02
0.156000E+04	0.158626E+02	0.165405E+02	0.151848E+02
0.156100E+04	0.158631E+02	0.165409E+02	0.151853E+02
0.156200E+04	0.158636E+02	0.165413E+02	0.151860E+02
0.156300E+04	0.158642E+02	0.165418E+02	0.151866E+02
0.156400E+04	0.157724E+02	0.164418E+02	0.151029E+02
0.156500E+04	0.156692E+02	0.163206E+02	0.150179E+02
0.156600E+04	0.157063E+02	0.163577E+02	0.150550E+02
0.156700E+04	0.157687E+02	0.164302E+02	0.151072E+02
0.156800E+04	0.157953E+02	0.164588E+02	0.151319E+02
0.156900E+04	0.158074E+02	0.164769E+02	0.151379E+02
0.157000E+04	0.157880E+02	0.164580E+02	0.151180E+02
0.157100E+04	0.157674E+02	0.164338E+02	0.151011E+02
0.157200E+04	0.157842E+02	0.164534E+02	0.151150E+02
0.157300E+04	0.158059E+02	0.164792E+02	0.151326E+02
0.157400E+04	0.158187E+02	0.164940E+02	0.151434E+02
0.157500E+04	0.158270E+02	0.165031E+02	0.151509E+02
0.157600E+04	0.158334E+02	0.165097E+02	0.151570E+02
0.157700E+04	0.158386E+02	0.165150E+02	0.151622E+02
0.157800E+04	0.158433E+02	0.165196E+02	0.151670E+02
0.157900E+04	0.158475E+02	0.165236E+02	0.151713E+02
0.158000E+04	0.158512E+02	0.165272E+02	0.151753E+02
0.158100E+04	0.158547E+02	0.165305E+02	0.151789E+02
0.158200E+04	0.158579E+02	0.165334E+02	0.151823E+02
0.158300E+04	0.158609E+02	0.165362E+02	0.151855E+02
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0.158500E+04	0.158663E+02	0.165412E+02	0.151913E+02
0.158600E+04	0.158686E+02	0.165433E+02	0.151938E+02
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0.158800E+04	0.154744E+02	0.160886E+02	0.148602E+02
0.158900E+04	0.156158E+02	0.161042E+02	0.151275E+02
0.159000E+04	0.157461E+02	0.162183E+02	0.152740E+02
0.159100E+04	0.158410E+02	0.163176E+02	0.153645E+02
0.159200E+04	0.158870E+02	0.163685E+02	0.154054E+02
0.159300E+04	0.159142E+02	0.164041E+02	0.154242E+02
0.159400E+04	0.159325E+02	0.164313E+02	0.154336E+02
0.159500E+04	0.159455E+02	0.164532E+02	0.154379E+02
0.159600E+04	0.159551E+02	0.164710E+02	0.154392E+02
0.159700E+04	0.159644E+02	0.164859E+02	0.154430E+02
0.159800E+04	0.159701E+02	0.164982E+02	0.154419E+02
0.159900E+04	0.159745E+02	0.165086E+02	0.154403E+02
0.160000E+04	0.160005E+02	0.165604E+02	0.154407E+02
0.160100E+04	0.158122E+02	0.163475E+02	0.152769E+02
0.160200E+04	0.155901E+02	0.160843E+02	0.150960E+02
0.160300E+04	0.156584E+02	0.161822E+02	0.151345E+02
0.160400E+04	0.157541E+02	0.162916E+02	0.152167E+02
0.160500E+04	0.158219E+02	0.163701E+02	0.152738E+02
0.160600E+04	0.158609E+02	0.164181E+02	0.153037E+02
0.160700E+04	0.158846E+02	0.164478E+02	0.153213E+02
0.160800E+04	0.159013E+02	0.164688E+02	0.153337E+02
0.160900E+04	0.159137E+02	0.164844E+02	0.153430E+02

0.161000E+04	0.159238E+02	0.164969E+02	0.153507E+02
0.161100E+04	0.159318E+02	0.165068E+02	0.153569E+02
0.161200E+04	0.159390E+02	0.165186E+02	0.153594E+02
0.161300E+04	0.158339E+02	0.164063E+02	0.152615E+02
0.161400E+04	0.157340E+02	0.163069E+02	0.151611E+02
0.161500E+04	0.157652E+02	0.163531E+02	0.151773E+02
0.161600E+04	0.157956E+02	0.164189E+02	0.151722E+02
0.161700E+04	0.157667E+02	0.164460E+02	0.150875E+02
0.161800E+04	0.157532E+02	0.164578E+02	0.150485E+02
0.161900E+04	0.157451E+02	0.164659E+02	0.150243E+02
0.162000E+04	0.157411E+02	0.164719E+02	0.150103E+02
0.162100E+04	0.157380E+02	0.164753E+02	0.150008E+02
0.162200E+04	0.156322E+02	0.163359E+02	0.149285E+02
0.162300E+04	0.155198E+02	0.162136E+02	0.148260E+02
0.162400E+04	0.155648E+02	0.162614E+02	0.148681E+02
0.162500E+04	0.156398E+02	0.163442E+02	0.149354E+02
0.162600E+04	0.156795E+02	0.163859E+02	0.149732E+02
0.162700E+04	0.157020E+02	0.164082E+02	0.149957E+02
0.162800E+04	0.157181E+02	0.164227E+02	0.150135E+02
0.162900E+04	0.157311E+02	0.164333E+02	0.150289E+02
0.163000E+04	0.157403E+02	0.164394E+02	0.150413E+02
0.163100E+04	0.157475E+02	0.164431E+02	0.150518E+02
0.163200E+04	0.157543E+02	0.164467E+02	0.150619E+02
0.163300E+04	0.157616E+02	0.164512E+02	0.150719E+02
0.163400E+04	0.157685E+02	0.164556E+02	0.150813E+02
0.163500E+04	0.157740E+02	0.164587E+02	0.150892E+02
0.163600E+04	0.157788E+02	0.164614E+02	0.150962E+02
0.163700E+04	0.157831E+02	0.164638E+02	0.151025E+02
0.163800E+04	0.157918E+02	0.164716E+02	0.151120E+02
0.163900E+04	0.158041E+02	0.164840E+02	0.151243E+02
0.164000E+04	0.158098E+02	0.164888E+02	0.151308E+02
0.164100E+04	0.156118E+02	0.162614E+02	0.149622E+02
0.164200E+04	0.153879E+02	0.160021E+02	0.147737E+02
0.164300E+04	0.154603E+02	0.160982E+02	0.148224E+02
0.164400E+04	0.156929E+02	0.162056E+02	0.151802E+02
0.164500E+04	0.157847E+02	0.162687E+02	0.153006E+02
0.164600E+04	0.158189E+02	0.163024E+02	0.153354E+02
0.164700E+04	0.158534E+02	0.163439E+02	0.153628E+02
0.164800E+04	0.158805E+02	0.163807E+02	0.153803E+02
0.164900E+04	0.158974E+02	0.164068E+02	0.153879E+02
0.165000E+04	0.159084E+02	0.164265E+02	0.153903E+02
0.165100E+04	0.159161E+02	0.164422E+02	0.153899E+02
0.165200E+04	0.159217E+02	0.164552E+02	0.153881E+02
0.165300E+04	0.159279E+02	0.164660E+02	0.153898E+02
0.165400E+04	0.159304E+02	0.164744E+02	0.153863E+02
0.165500E+04	0.159319E+02	0.164811E+02	0.153827E+02
0.165600E+04	0.159327E+02	0.164865E+02	0.153790E+02
0.165700E+04	0.159331E+02	0.164909E+02	0.153754E+02
0.165800E+04	0.159331E+02	0.164944E+02	0.153718E+02
0.165900E+04	0.159327E+02	0.164971E+02	0.153683E+02
0.166000E+04	0.159323E+02	0.164995E+02	0.153652E+02
0.166100E+04	0.159318E+02	0.165014E+02	0.153622E+02
0.166200E+04	0.159311E+02	0.165028E+02	0.153594E+02
0.166300E+04	0.159302E+02	0.165038E+02	0.153566E+02
0.166400E+04	0.159293E+02	0.165046E+02	0.153541E+02
0.166500E+04	0.159285E+02	0.165052E+02	0.153517E+02
0.166600E+04	0.159276E+02	0.165056E+02	0.153495E+02
0.166700E+04	0.158344E+02	0.163951E+02	0.152737E+02
0.166800E+04	0.157492E+02	0.163029E+02	0.151955E+02
0.166900E+04	0.157781E+02	0.163374E+02	0.152187E+02
0.167000E+04	0.158318E+02	0.164032E+02	0.152604E+02
0.167100E+04	0.158537E+02	0.164279E+02	0.152796E+02
0.167200E+04	0.158664E+02	0.164438E+02	0.152889E+02

0.167300E+04	0.158750E+02	0.164551E+02	0.152949E+02
0.167400E+04	0.157526E+02	0.163090E+02	0.151962E+02
0.167500E+04	0.156341E+02	0.161792E+02	0.150889E+02
0.167600E+04	0.156827E+02	0.162345E+02	0.151310E+02
0.167700E+04	0.157585E+02	0.163240E+02	0.151930E+02
0.167800E+04	0.157964E+02	0.163696E+02	0.152232E+02
0.167900E+04	0.158178E+02	0.163960E+02	0.152395E+02
0.168000E+04	0.158326E+02	0.164144E+02	0.152509E+02
0.168100E+04	0.157374E+02	0.163006E+02	0.151742E+02
0.168200E+04	0.156461E+02	0.161991E+02	0.150931E+02
0.168300E+04	0.156884E+02	0.162485E+02	0.151283E+02
0.168400E+04	0.157531E+02	0.163242E+02	0.151820E+02
0.168500E+04	0.157872E+02	0.163648E+02	0.152095E+02
0.168600E+04	0.158072E+02	0.163891E+02	0.152252E+02
0.168700E+04	0.158181E+02	0.164063E+02	0.152299E+02
0.168800E+04	0.158173E+02	0.164190E+02	0.152155E+02
0.168900E+04	0.157868E+02	0.163945E+02	0.151790E+02
0.169000E+04	0.157641E+02	0.163768E+02	0.151515E+02
0.169100E+04	0.157200E+02	0.164022E+02	0.150378E+02
0.169200E+04	0.157075E+02	0.164202E+02	0.149947E+02
0.169300E+04	0.156965E+02	0.164278E+02	0.149651E+02
0.169400E+04	0.156887E+02	0.164316E+02	0.149458E+02
0.169500E+04	0.155731E+02	0.162939E+02	0.148524E+02
0.169600E+04	0.154275E+02	0.161307E+02	0.147242E+02
0.169700E+04	0.154729E+02	0.161823E+02	0.147636E+02
0.169800E+04	0.155553E+02	0.162755E+02	0.148352E+02
0.169900E+04	0.155967E+02	0.163202E+02	0.148733E+02
0.170000E+04	0.156214E+02	0.163459E+02	0.148968E+02
0.170100E+04	0.156400E+02	0.163638E+02	0.149161E+02
0.170200E+04	0.156552E+02	0.163771E+02	0.149332E+02
0.170300E+04	0.156684E+02	0.163878E+02	0.149489E+02
0.170400E+04	0.156802E+02	0.163968E+02	0.149636E+02
0.170500E+04	0.156909E+02	0.164047E+02	0.149772E+02
0.170600E+04	0.157005E+02	0.164113E+02	0.149897E+02
0.170700E+04	0.157091E+02	0.164172E+02	0.150011E+02
0.170800E+04	0.157169E+02	0.164224E+02	0.150115E+02
0.170900E+04	0.157239E+02	0.164268E+02	0.150209E+02
0.171000E+04	0.157302E+02	0.164310E+02	0.150294E+02
0.171100E+04	0.157362E+02	0.164351E+02	0.150373E+02
0.171200E+04	0.157419E+02	0.164391E+02	0.150447E+02
0.171300E+04	0.157472E+02	0.164429E+02	0.150514E+02
0.171400E+04	0.157522E+02	0.164468E+02	0.150577E+02
0.171500E+04	0.157573E+02	0.164508E+02	0.150637E+02
0.171600E+04	0.157624E+02	0.164552E+02	0.150696E+02
0.171700E+04	0.157679E+02	0.164602E+02	0.150755E+02
0.171800E+04	0.157726E+02	0.164645E+02	0.150807E+02
0.171900E+04	0.157778E+02	0.164695E+02	0.150861E+02
0.172000E+04	0.157834E+02	0.164751E+02	0.150917E+02
0.172100E+04	0.157875E+02	0.164790E+02	0.150960E+02
0.172200E+04	0.157904E+02	0.164816E+02	0.150992E+02
0.172300E+04	0.157922E+02	0.164831E+02	0.151014E+02
0.172400E+04	0.157947E+02	0.164854E+02	0.151041E+02
0.172500E+04	0.157980E+02	0.164887E+02	0.151073E+02
0.172600E+04	0.158025E+02	0.164935E+02	0.151114E+02
0.172700E+04	0.158079E+02	0.164995E+02	0.151162E+02
0.172800E+04	0.158140E+02	0.165064E+02	0.151217E+02
0.172900E+04	0.156973E+02	0.163766E+02	0.150180E+02
0.173000E+04	0.156142E+02	0.162820E+02	0.149463E+02
0.173100E+04	0.156949E+02	0.163697E+02	0.150201E+02
0.173200E+04	0.157397E+02	0.164162E+02	0.150632E+02
0.173300E+04	0.157571E+02	0.164387E+02	0.150755E+02
0.173400E+04	0.157614E+02	0.164530E+02	0.150697E+02
0.173500E+04	0.157679E+02	0.164650E+02	0.150708E+02

0.173600E+04	0.157772E+02	0.164781E+02	0.150763E+02
0.173700E+04	0.157852E+02	0.164885E+02	0.150818E+02
0.173800E+04	0.157893E+02	0.164938E+02	0.150848E+02
0.173900E+04	0.157441E+02	0.164411E+02	0.150472E+02
0.174000E+04	0.157109E+02	0.164014E+02	0.150203E+02
0.174100E+04	0.157445E+02	0.164414E+02	0.150475E+02
0.174200E+04	0.157701E+02	0.164725E+02	0.150677E+02
0.174300E+04	0.157796E+02	0.164836E+02	0.150755E+02
0.174400E+04	0.157848E+02	0.164894E+02	0.150802E+02
0.174500E+04	0.157889E+02	0.164937E+02	0.150841E+02
0.174600E+04	0.157926E+02	0.164975E+02	0.150877E+02
0.174700E+04	0.157961E+02	0.165011E+02	0.150911E+02
0.174800E+04	0.158034E+02	0.165091E+02	0.150977E+02
0.174900E+04	0.158135E+02	0.165204E+02	0.151066E+02
0.175000E+04	0.158207E+02	0.165282E+02	0.151131E+02
0.175100E+04	0.158239E+02	0.165313E+02	0.151164E+02
0.175200E+04	0.158247E+02	0.165316E+02	0.151178E+02
0.175300E+04	0.158257E+02	0.165321E+02	0.151192E+02
0.175400E+04	0.158261E+02	0.165320E+02	0.151202E+02
0.175500E+04	0.158260E+02	0.165314E+02	0.151205E+02
0.175600E+04	0.158265E+02	0.165316E+02	0.151215E+02
0.175700E+04	0.158289E+02	0.165339E+02	0.151239E+02
0.175800E+04	0.158332E+02	0.165386E+02	0.151279E+02
0.175900E+04	0.158383E+02	0.165441E+02	0.151325E+02
0.176000E+04	0.158424E+02	0.165484E+02	0.151364E+02
0.176100E+04	0.158468E+02	0.165530E+02	0.151406E+02
0.176200E+04	0.158506E+02	0.165569E+02	0.151443E+02
0.176300E+04	0.158516E+02	0.165575E+02	0.151458E+02
0.176400E+04	0.158518E+02	0.165571E+02	0.151465E+02
0.176500E+04	0.158509E+02	0.165554E+02	0.151463E+02
0.176600E+04	0.158489E+02	0.165526E+02	0.151452E+02
0.176700E+04	0.158496E+02	0.165530E+02	0.151462E+02
0.176800E+04	0.158551E+02	0.165590E+02	0.151512E+02
0.176900E+04	0.158634E+02	0.165682E+02	0.151585E+02
0.177000E+04	0.158709E+02	0.165766E+02	0.151653E+02
0.177100E+04	0.158751E+02	0.165809E+02	0.151694E+02
0.177200E+04	0.158766E+02	0.165819E+02	0.151713E+02
0.177300E+04	0.158752E+02	0.165796E+02	0.151709E+02
0.177400E+04	0.158724E+02	0.165756E+02	0.151692E+02
0.177500E+04	0.158693E+02	0.165714E+02	0.151672E+02
0.177600E+04	0.158669E+02	0.165681E+02	0.151656E+02
0.177700E+04	0.158677E+02	0.165687E+02	0.151667E+02
0.177800E+04	0.158724E+02	0.165738E+02	0.151709E+02
0.177900E+04	0.158785E+02	0.165807E+02	0.151764E+02
0.178000E+04	0.158816E+02	0.165838E+02	0.151794E+02
0.178100E+04	0.158830E+02	0.165849E+02	0.151811E+02
0.178200E+04	0.158829E+02	0.165842E+02	0.151816E+02
0.178300E+04	0.157636E+02	0.164499E+02	0.150773E+02
0.178400E+04	0.156658E+02	0.163405E+02	0.149910E+02
0.178500E+04	0.157445E+02	0.164247E+02	0.150644E+02
0.178600E+04	0.157928E+02	0.164771E+02	0.151084E+02
0.178700E+04	0.158182E+02	0.165069E+02	0.151295E+02
0.178800E+04	0.158312E+02	0.165278E+02	0.151346E+02
0.178900E+04	0.157948E+02	0.164865E+02	0.151030E+02
0.179000E+04	0.157519E+02	0.164358E+02	0.150681E+02
0.179100E+04	0.157715E+02	0.164588E+02	0.150843E+02
0.179200E+04	0.158025E+02	0.164957E+02	0.151093E+02
0.179300E+04	0.158196E+02	0.165156E+02	0.151236E+02
0.179400E+04	0.158288E+02	0.165256E+02	0.151320E+02
0.179500E+04	0.158336E+02	0.165302E+02	0.151369E+02
0.179600E+04	0.158362E+02	0.165323E+02	0.151400E+02
0.179700E+04	0.158380E+02	0.165335E+02	0.151425E+02
0.179800E+04	0.158392E+02	0.165340E+02	0.151444E+02

0.179900E+04	0.158405E+02	0.165347E+02	0.151462E+02
0.180000E+04	0.158423E+02	0.165361E+02	0.151484E+02
0.180100E+04	0.158470E+02	0.165409E+02	0.151530E+02
0.180200E+04	0.158521E+02	0.165463E+02	0.151578E+02
0.180300E+04	0.158532E+02	0.165470E+02	0.151594E+02
0.180400E+04	0.158529E+02	0.165459E+02	0.151598E+02
0.180500E+04	0.158533E+02	0.165458E+02	0.151607E+02
0.180600E+04	0.158532E+02	0.165452E+02	0.151611E+02
0.180700E+04	0.158517E+02	0.165430E+02	0.151604E+02
0.180800E+04	0.158500E+02	0.165405E+02	0.151594E+02
0.180900E+04	0.156519E+02	0.163164E+02	0.149873E+02
0.181000E+04	0.154280E+02	0.160537E+02	0.148024E+02
0.181100E+04	0.156399E+02	0.161472E+02	0.151326E+02
0.181200E+04	0.157679E+02	0.162559E+02	0.152799E+02
0.181300E+04	0.158479E+02	0.163399E+02	0.153558E+02
0.181400E+04	0.158826E+02	0.163737E+02	0.153914E+02
0.181500E+04	0.156966E+02	0.161616E+02	0.152316E+02
0.181600E+04	0.154872E+02	0.159275E+02	0.150469E+02
0.181700E+04	0.155465E+02	0.160009E+02	0.150920E+02
0.181800E+04	0.156674E+02	0.161506E+02	0.151841E+02
0.181900E+04	0.157479E+02	0.162478E+02	0.152480E+02
0.182000E+04	0.157966E+02	0.163125E+02	0.152807E+02
0.182100E+04	0.158258E+02	0.163527E+02	0.152989E+02
0.182200E+04	0.158467E+02	0.163822E+02	0.153111E+02
0.182300E+04	0.158627E+02	0.164052E+02	0.153202E+02
0.182400E+04	0.158755E+02	0.164236E+02	0.153273E+02
0.182500E+04	0.158865E+02	0.164394E+02	0.153335E+02
0.182600E+04	0.158967E+02	0.164537E+02	0.153396E+02
0.182700E+04	0.159288E+02	0.165105E+02	0.153471E+02
0.182800E+04	0.159366E+02	0.165175E+02	0.153556E+02
0.182900E+04	0.159429E+02	0.165243E+02	0.153615E+02
0.183000E+04	0.159029E+02	0.164761E+02	0.153297E+02
0.183100E+04	0.157047E+02	0.162489E+02	0.151605E+02
0.183200E+04	0.155328E+02	0.160448E+02	0.150207E+02
0.183300E+04	0.156347E+02	0.161797E+02	0.150896E+02
0.183400E+04	0.157406E+02	0.162986E+02	0.151826E+02
0.183500E+04	0.156834E+02	0.162272E+02	0.151396E+02
0.183600E+04	0.156094E+02	0.161435E+02	0.150753E+02
0.183700E+04	0.156759E+02	0.162219E+02	0.151299E+02
0.183800E+04	0.157538E+02	0.163093E+02	0.151983E+02
0.183900E+04	0.157944E+02	0.163556E+02	0.152332E+02
0.184000E+04	0.157790E+02	0.163355E+02	0.152225E+02
0.184100E+04	0.157509E+02	0.162995E+02	0.152022E+02
0.184200E+04	0.157738E+02	0.163266E+02	0.152209E+02
0.184300E+04	0.157718E+02	0.163414E+02	0.152023E+02
0.184400E+04	0.157430E+02	0.163138E+02	0.151721E+02
0.184500E+04	0.157721E+02	0.163440E+02	0.152002E+02
0.184600E+04	0.158152E+02	0.163961E+02	0.152343E+02
0.184700E+04	0.158279E+02	0.164210E+02	0.152349E+02
0.184800E+04	0.158034E+02	0.164430E+02	0.151638E+02
0.184900E+04	0.157776E+02	0.164604E+02	0.150948E+02
0.185000E+04	0.157634E+02	0.164694E+02	0.150575E+02
0.185100E+04	0.157519E+02	0.164728E+02	0.150310E+02
0.185200E+04	0.157438E+02	0.164741E+02	0.150135E+02
0.185300E+04	0.157375E+02	0.164730E+02	0.150021E+02
0.185400E+04	0.156986E+02	0.164328E+02	0.149644E+02
0.185500E+04	0.156712E+02	0.164014E+02	0.149410E+02
0.185600E+04	0.156871E+02	0.164191E+02	0.149551E+02
0.185700E+04	0.157018E+02	0.164343E+02	0.149692E+02
0.185800E+04	0.157132E+02	0.164443E+02	0.149820E+02
0.185900E+04	0.157263E+02	0.164556E+02	0.149970E+02
0.186000E+04	0.157399E+02	0.164670E+02	0.150128E+02
0.186100E+04	0.157505E+02	0.164746E+02	0.150263E+02

0.186200E+04	0.157570E+02	0.164775E+02	0.150365E+02
0.186300E+04	0.157612E+02	0.164779E+02	0.150445E+02
0.186400E+04	0.157649E+02	0.164779E+02	0.150518E+02
0.186500E+04	0.157679E+02	0.164776E+02	0.150581E+02
0.186600E+04	0.157702E+02	0.164769E+02	0.150636E+02
0.186700E+04	0.157723E+02	0.164762E+02	0.150684E+02
0.186800E+04	0.157763E+02	0.164782E+02	0.150745E+02
0.186900E+04	0.157844E+02	0.164853E+02	0.150835E+02
0.187000E+04	0.157959E+02	0.164966E+02	0.150951E+02
0.187100E+04	0.158066E+02	0.165073E+02	0.151059E+02
0.187200E+04	0.158138E+02	0.165140E+02	0.151136E+02
0.187300E+04	0.158175E+02	0.165167E+02	0.151183E+02
0.187400E+04	0.158181E+02	0.165161E+02	0.151202E+02
0.187500E+04	0.158172E+02	0.165139E+02	0.151206E+02
0.187600E+04	0.158160E+02	0.165116E+02	0.151204E+02
0.187700E+04	0.158157E+02	0.165106E+02	0.151209E+02
0.187800E+04	0.158163E+02	0.165108E+02	0.151218E+02
0.187900E+04	0.158174E+02	0.165118E+02	0.151230E+02
0.188000E+04	0.158205E+02	0.165152E+02	0.151257E+02
0.188100E+04	0.158262E+02	0.165218E+02	0.151305E+02
0.188200E+04	0.158323E+02	0.165290E+02	0.151357E+02
0.188300E+04	0.157052E+02	0.163900E+02	0.150204E+02
0.188400E+04	0.155552E+02	0.162176E+02	0.148927E+02
0.188500E+04	0.156085E+02	0.162716E+02	0.149454E+02
0.188600E+04	0.156927E+02	0.163696E+02	0.150159E+02
0.188700E+04	0.157312E+02	0.164129E+02	0.150494E+02
0.188800E+04	0.157496E+02	0.164376E+02	0.150615E+02
0.188900E+04	0.157602E+02	0.164547E+02	0.150657E+02
0.189000E+04	0.157706E+02	0.164679E+02	0.150734E+02
0.189100E+04	0.157826E+02	0.164819E+02	0.150833E+02
0.189200E+04	0.157959E+02	0.164973E+02	0.150946E+02
0.189300E+04	0.158088E+02	0.165119E+02	0.151057E+02
0.189400E+04	0.158210E+02	0.165257E+02	0.151164E+02
0.189500E+04	0.158304E+02	0.165361E+02	0.151248E+02
0.189600E+04	0.158351E+02	0.165409E+02	0.151292E+02
0.189700E+04	0.158362E+02	0.165417E+02	0.151308E+02
0.189800E+04	0.158366E+02	0.165416E+02	0.151316E+02
0.189900E+04	0.158373E+02	0.165421E+02	0.151325E+02
0.190000E+04	0.158379E+02	0.165425E+02	0.151333E+02
0.190100E+04	0.158379E+02	0.165424E+02	0.151335E+02
0.190200E+04	0.157089E+02	0.164009E+02	0.150169E+02
0.190300E+04	0.155666E+02	0.162342E+02	0.148989E+02
0.190400E+04	0.156233E+02	0.162943E+02	0.149522E+02
0.190500E+04	0.157090E+02	0.163933E+02	0.150246E+02
0.190600E+04	0.157524E+02	0.164431E+02	0.150618E+02
0.190700E+04	0.157604E+02	0.164561E+02	0.150647E+02
0.190800E+04	0.157641E+02	0.164641E+02	0.150641E+02
0.190900E+04	0.157846E+02	0.164886E+02	0.150805E+02
0.191000E+04	0.157986E+02	0.165048E+02	0.150923E+02
0.191100E+04	0.158060E+02	0.165127E+02	0.150993E+02
0.191200E+04	0.157299E+02	0.164230E+02	0.150368E+02
0.191300E+04	0.156573E+02	0.163470E+02	0.149677E+02
0.191400E+04	0.156577E+02	0.163447E+02	0.149707E+02
0.191500E+04	0.156980E+02	0.163862E+02	0.150098E+02
0.191600E+04	0.157493E+02	0.164422E+02	0.150565E+02
0.191700E+04	0.157825E+02	0.164811E+02	0.150839E+02
0.191800E+04	0.158015E+02	0.165074E+02	0.150956E+02
0.191900E+04	0.158147E+02	0.165230E+02	0.151064E+02
0.192000E+04	0.158217E+02	0.165301E+02	0.151132E+02
0.192100E+04	0.158256E+02	0.165334E+02	0.151179E+02
0.192200E+04	0.158278E+02	0.165345E+02	0.151210E+02
0.192300E+04	0.158298E+02	0.165355E+02	0.151240E+02
0.192400E+04	0.157817E+02	0.164783E+02	0.150852E+02

0.192500E+04	0.157295E+02	0.164157E+02	0.150433E+02
0.192600E+04	0.157652E+02	0.164664E+02	0.150641E+02
0.192700E+04	0.158039E+02	0.165099E+02	0.150979E+02
0.192800E+04	0.158210E+02	0.165249E+02	0.151171E+02
0.192900E+04	0.158315E+02	0.165354E+02	0.151276E+02
0.193000E+04	0.158391E+02	0.165430E+02	0.151352E+02
0.193100E+04	0.158441E+02	0.165476E+02	0.151406E+02
0.193200E+04	0.158462E+02	0.165489E+02	0.151435E+02
0.193300E+04	0.158463E+02	0.165479E+02	0.151446E+02
0.193400E+04	0.158470E+02	0.165478E+02	0.151462E+02
0.193500E+04	0.158515E+02	0.165522E+02	0.151508E+02
0.193600E+04	0.158611E+02	0.165627E+02	0.151596E+02
0.193700E+04	0.158713E+02	0.165738E+02	0.151687E+02
0.193800E+04	0.158771E+02	0.165798E+02	0.151744E+02
0.193900E+04	0.158805E+02	0.165829E+02	0.151782E+02
0.194000E+04	0.158829E+02	0.165847E+02	0.151810E+02
0.194100E+04	0.158838E+02	0.165850E+02	0.151826E+02
0.194200E+04	0.158832E+02	0.165835E+02	0.151829E+02
0.194300E+04	0.158808E+02	0.165800E+02	0.151816E+02
0.194400E+04	0.158785E+02	0.165766E+02	0.151803E+02
0.194500E+04	0.158803E+02	0.165782E+02	0.151823E+02
0.194600E+04	0.158856E+02	0.165840E+02	0.151871E+02
0.194700E+04	0.158926E+02	0.165918E+02	0.151934E+02
0.194800E+04	0.159012E+02	0.166013E+02	0.152010E+02
0.194900E+04	0.159076E+02	0.166083E+02	0.152070E+02
0.195000E+04	0.159090E+02	0.166092E+02	0.152088E+02
0.195100E+04	0.159057E+02	0.166046E+02	0.152068E+02
0.195200E+04	0.159016E+02	0.165992E+02	0.152041E+02
0.195300E+04	0.158983E+02	0.165947E+02	0.152018E+02
0.195400E+04	0.158953E+02	0.165910E+02	0.151997E+02
0.195500E+04	0.158951E+02	0.165904E+02	0.151999E+02
0.195600E+04	0.158857E+02	0.165791E+02	0.151922E+02
0.195700E+04	0.158874E+02	0.165809E+02	0.151940E+02
0.195800E+04	0.159090E+02	0.166061E+02	0.152120E+02
0.195900E+04	0.159212E+02	0.166203E+02	0.152222E+02
0.196000E+04	0.159246E+02	0.166236E+02	0.152256E+02
0.196100E+04	0.159074E+02	0.166029E+02	0.152119E+02
0.196200E+04	0.158797E+02	0.165698E+02	0.151895E+02
0.196300E+04	0.158506E+02	0.165356E+02	0.151656E+02
0.196400E+04	0.158127E+02	0.164970E+02	0.151284E+02
0.196500E+04	0.157605E+02	0.164380E+02	0.150830E+02
0.196600E+04	0.157488E+02	0.164254E+02	0.150721E+02
0.196700E+04	0.157656E+02	0.164461E+02	0.150852E+02
0.196800E+04	0.157688E+02	0.164506E+02	0.150869E+02
0.196900E+04	0.157444E+02	0.164232E+02	0.150657E+02
0.197000E+04	0.157400E+02	0.164187E+02	0.150613E+02
0.197100E+04	0.157682E+02	0.164519E+02	0.150845E+02
0.197200E+04	0.157945E+02	0.164808E+02	0.151082E+02
0.197300E+04	0.158068E+02	0.164936E+02	0.151200E+02
0.197400E+04	0.158017E+02	0.164869E+02	0.151165E+02
0.197500E+04	0.157696E+02	0.164485E+02	0.150908E+02
0.197600E+04	0.157467E+02	0.164213E+02	0.150720E+02
0.197700E+04	0.157658E+02	0.164439E+02	0.150877E+02
0.197800E+04	0.157938E+02	0.164771E+02	0.151104E+02
0.197900E+04	0.158134E+02	0.165001E+02	0.151267E+02
0.198000E+04	0.158318E+02	0.165211E+02	0.151425E+02
0.198100E+04	0.158499E+02	0.165415E+02	0.151582E+02
0.198200E+04	0.157715E+02	0.164493E+02	0.150938E+02
0.198300E+04	0.156124E+02	0.162730E+02	0.149517E+02
0.198400E+04	0.155485E+02	0.161923E+02	0.149046E+02
0.198500E+04	0.156109E+02	0.162601E+02	0.149617E+02
0.198600E+04	0.158011E+02	0.163328E+02	0.152694E+02
0.198700E+04	0.158724E+02	0.163760E+02	0.153688E+02

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0.198800E+04	0.159084E+02	0.164078E+02	0.154090E+02
0.198900E+04	0.159455E+02	0.164509E+02	0.154401E+02
0.199000E+04	0.159758E+02	0.164907E+02	0.154609E+02
0.199100E+04	0.159382E+02	0.164510E+02	0.154255E+02
0.199200E+04	0.157860E+02	0.162794E+02	0.152926E+02
0.199300E+04	0.156819E+02	0.161604E+02	0.152034E+02
0.199400E+04	0.157312E+02	0.162260E+02	0.152365E+02
0.199500E+04	0.157990E+02	0.163122E+02	0.152857E+02
0.199600E+04	0.158415E+02	0.163674E+02	0.153155E+02
0.199700E+04	0.158711E+02	0.164086E+02	0.153337E+02
0.199800E+04	0.158986E+02	0.164463E+02	0.153509E+02

```

#          91
# IPCC AR4 Millenium Runs output (vary solar forcing)
# ++++++
#
# Model: Bern2.5CC version with active C-cycle
# -----
# Prescribed forcing timeseries as described in file
# readme_doRuns_IPCC_Chap6_millennium_21jan06.txt
# provided by F. Joos, University of Bern.
#
# Contact:
# -----
# Gian-Kasper Plattner
# Climate and Environmental Physics
# Physics Institute, University of Bern
# Sidlerstrasse 5, CH-3012 Bern, Switzerland
# plattner@climate.unibe.ch
# http://www.climate.unibe.ch/~plattner/
# tel: ++41 (0)31 631-44-67
# fax: ++41 (0)31 631-87-42
#
# Some model setup informations:
# -----
# All runs with horizontal/vertical diffusion
#
# Run with standard ocean parameters
#   as used in Plattner et al. 2001/2002
#   with Kv (diffusivity) 4*10^-5 m2/s
#
# Climate sens. set to ~ 3.2 degrees C
# parameterized see Knutti et al. (Clim. Dyn. 2003)
#
# Model version is annual mean.
#
# No radiation code, CO2 radiative forcing calculated
# for as RF=5.35*ln(CO2/CO2_preind),
# Non-co2 radiative forcing prescribed according to
# Joos et al. GBC 2001 with updates for solar forcing
#
# More model description:
# -----
# Zonally averaged dynamical ocean with 3 basins and
# Southern Ocean, zonally averaged one layer energy
# and moisture balance atmosphere, thermodynamic
# sea ice (Stocker et al., J. Climate 1992).
#
# Carbon cycle components: Ocean/Atm/Terr.biosphere;
# Ocean carbon cycle is a description of the cycles
# of organic carbon and CaCO3 (Marchal et al., Tellus
# Tellus B), based on Redfield approach using PO4 as
# biolimiting nutrient.

```

```

#
# Land Biota: Lund-Jena-Postdam Dynamical Global
# Vegetation Model (LPJ-DGVM)
# at GCM resolution (Gerber et al. 2003, Climate
# Dynamics; Sitch et al. 2003, Global Change Biology)
#
# LPJ forced by Cramer/Leemans annual mean
# climatology plus interannual climate variability
# from Hadley simulation (30-recycled climate) plus
# changes in the fields of surface temperature,
# precipitation, and cloudcover as simulated with the
# Impulse-EOF version of ECHAM-3/LSG in response to
# projected radiative forcing changes.
#
# Land use changes are not explicitly considered.
#
# Impact of climate change on terrestrial C-storage
# included
#
# References:
# -----
# Carbon cycle Ocean: Marchal et al., Tellus 1998
# Carbon cycle Terr. Bio: Sitch et al., GCB 2003
# Gerber et al., Clim. Dyn. 2003
# Ccycle-climate feedbacks and global warming:
# Plattner et al., Tellus 2001
# Plattner et al., GCB 2002
# Non-CO2 forcing: Joos et al., GCB 2001
# Climate model: Stocker et al., J. Climate 1992
# Sea level: Knutti et al., J. Climate 2000
# Global warming Physics: Knutti et al., Nature 2002
# Knutti et al., Cl. Dyn. 2003
# and refs therein.
#
# Output columns:
# -----
# Time (yr AD)
# Global mean air temperature (deg C)
# NH-averaged air temperature (deg C)
# SH-averaged air temperature (deg C)
0.100100E+04 0.159155E+02 0.165835E+02 0.152475E+02
0.100200E+04 0.159209E+02 0.165892E+02 0.152525E+02
0.100300E+04 0.159252E+02 0.165938E+02 0.152567E+02
0.100400E+04 0.158977E+02 0.165611E+02 0.152344E+02
0.100500E+04 0.158655E+02 0.165220E+02 0.152089E+02
0.100600E+04 0.158774E+02 0.165361E+02 0.152187E+02
0.100700E+04 0.158992E+02 0.165626E+02 0.152358E+02
0.100800E+04 0.159109E+02 0.165768E+02 0.152449E+02
0.100900E+04 0.159171E+02 0.165843E+02 0.152500E+02
0.101000E+04 0.159213E+02 0.165891E+02 0.152535E+02
0.101100E+04 0.159242E+02 0.165924E+02 0.152560E+02
0.101200E+04 0.159263E+02 0.165946E+02 0.152579E+02
0.101300E+04 0.159279E+02 0.165964E+02 0.152593E+02
0.101400E+04 0.159292E+02 0.165979E+02 0.152606E+02
0.101500E+04 0.158213E+02 0.164710E+02 0.151715E+02
0.101600E+04 0.157214E+02 0.163645E+02 0.150782E+02
0.101700E+04 0.157650E+02 0.164064E+02 0.151236E+02
0.101800E+04 0.158283E+02 0.164797E+02 0.151770E+02
0.101900E+04 0.158570E+02 0.165118E+02 0.152022E+02
0.102000E+04 0.158701E+02 0.165312E+02 0.152089E+02
0.102100E+04 0.158780E+02 0.165447E+02 0.152113E+02
0.102200E+04 0.158856E+02 0.165546E+02 0.152167E+02
0.102300E+04 0.158920E+02 0.165619E+02 0.152220E+02

```

0.102400E+04	0.158971E+02	0.165676E+02	0.152267E+02
0.102500E+04	0.159014E+02	0.165720E+02	0.152307E+02
0.102600E+04	0.157770E+02	0.164254E+02	0.151285E+02
0.102700E+04	0.156600E+02	0.162963E+02	0.150237E+02
0.102800E+04	0.157085E+02	0.163461E+02	0.150709E+02
0.102900E+04	0.157839E+02	0.164324E+02	0.151353E+02
0.103000E+04	0.158211E+02	0.164751E+02	0.151670E+02
0.103100E+04	0.158403E+02	0.164997E+02	0.151808E+02
0.103200E+04	0.158500E+02	0.165164E+02	0.151835E+02
0.103300E+04	0.158594E+02	0.165285E+02	0.151903E+02
0.103400E+04	0.158673E+02	0.165375E+02	0.151971E+02
0.103500E+04	0.158737E+02	0.165443E+02	0.152032E+02
0.103600E+04	0.158791E+02	0.165496E+02	0.152085E+02
0.103700E+04	0.158835E+02	0.165539E+02	0.152131E+02
0.103800E+04	0.158873E+02	0.165574E+02	0.152171E+02
0.103900E+04	0.158904E+02	0.165603E+02	0.152206E+02
0.104000E+04	0.158931E+02	0.165627E+02	0.152235E+02
0.104100E+04	0.158954E+02	0.165646E+02	0.152261E+02
0.104200E+04	0.158973E+02	0.165663E+02	0.152284E+02
0.104300E+04	0.158990E+02	0.165676E+02	0.152303E+02
0.104400E+04	0.159004E+02	0.165687E+02	0.152320E+02
0.104500E+04	0.159016E+02	0.165697E+02	0.152335E+02
0.104600E+04	0.159027E+02	0.165706E+02	0.152348E+02
0.104700E+04	0.159038E+02	0.165715E+02	0.152361E+02
0.104800E+04	0.159047E+02	0.165722E+02	0.152372E+02
0.104900E+04	0.159055E+02	0.165729E+02	0.152382E+02
0.105000E+04	0.159063E+02	0.165735E+02	0.152392E+02
0.105100E+04	0.159070E+02	0.165740E+02	0.152400E+02
0.105200E+04	0.159077E+02	0.165745E+02	0.152409E+02
0.105300E+04	0.159083E+02	0.165750E+02	0.152416E+02
0.105400E+04	0.159089E+02	0.165754E+02	0.152423E+02
0.105500E+04	0.159095E+02	0.165759E+02	0.152431E+02
0.105600E+04	0.159101E+02	0.165764E+02	0.152438E+02
0.105700E+04	0.159107E+02	0.165769E+02	0.152445E+02
0.105800E+04	0.157526E+02	0.163976E+02	0.151075E+02
0.105900E+04	0.155681E+02	0.161824E+02	0.149539E+02
0.106000E+04	0.157024E+02	0.162482E+02	0.151566E+02
0.106100E+04	0.158714E+02	0.163711E+02	0.153716E+02
0.106200E+04	0.159064E+02	0.163799E+02	0.154328E+02
0.106300E+04	0.158912E+02	0.163588E+02	0.154235E+02
0.106400E+04	0.159282E+02	0.164062E+02	0.154501E+02
0.106500E+04	0.159701E+02	0.164636E+02	0.154766E+02
0.106600E+04	0.159940E+02	0.164998E+02	0.154882E+02
0.106700E+04	0.160082E+02	0.165240E+02	0.154924E+02
0.106800E+04	0.160205E+02	0.165424E+02	0.154986E+02
0.106900E+04	0.160272E+02	0.165572E+02	0.154971E+02
0.107000E+04	0.160326E+02	0.165692E+02	0.154960E+02
0.107100E+04	0.160368E+02	0.165792E+02	0.154944E+02
0.107200E+04	0.160401E+02	0.165874E+02	0.154927E+02
0.107300E+04	0.160427E+02	0.165944E+02	0.154910E+02
0.107400E+04	0.160449E+02	0.166004E+02	0.154894E+02
0.107500E+04	0.160467E+02	0.166055E+02	0.154880E+02
0.107600E+04	0.160483E+02	0.166098E+02	0.154867E+02
0.107700E+04	0.160495E+02	0.166134E+02	0.154855E+02
0.107800E+04	0.160504E+02	0.166164E+02	0.154844E+02
0.107900E+04	0.160513E+02	0.166191E+02	0.154835E+02
0.108000E+04	0.160218E+02	0.165851E+02	0.154584E+02
0.108100E+04	0.159894E+02	0.165469E+02	0.154319E+02
0.108200E+04	0.160000E+02	0.165607E+02	0.154393E+02
0.108300E+04	0.160202E+02	0.165871E+02	0.154533E+02
0.108400E+04	0.160222E+02	0.166017E+02	0.154427E+02
0.108500E+04	0.160174E+02	0.166096E+02	0.154252E+02
0.108600E+04	0.160121E+02	0.166147E+02	0.154095E+02

0.108700E+04	0.159660E+02	0.166182E+02	0.153138E+02
0.108800E+04	0.159316E+02	0.166197E+02	0.152435E+02
0.108900E+04	0.159111E+02	0.166198E+02	0.152025E+02
0.109000E+04	0.158969E+02	0.166188E+02	0.151750E+02
0.109100E+04	0.158874E+02	0.166175E+02	0.151574E+02
0.109200E+04	0.158810E+02	0.166159E+02	0.151460E+02
0.109300E+04	0.158765E+02	0.166143E+02	0.151387E+02
0.109400E+04	0.158754E+02	0.166129E+02	0.151380E+02
0.109500E+04	0.158763E+02	0.166119E+02	0.151407E+02
0.109600E+04	0.158786E+02	0.166114E+02	0.151459E+02
0.109700E+04	0.158099E+02	0.165273E+02	0.150926E+02
0.109800E+04	0.157483E+02	0.164610E+02	0.150355E+02
0.109900E+04	0.157746E+02	0.164875E+02	0.150618E+02
0.110000E+04	0.158230E+02	0.165395E+02	0.151065E+02
0.110100E+04	0.158454E+02	0.165578E+02	0.151331E+02
0.110200E+04	0.158613E+02	0.165715E+02	0.151512E+02
0.110300E+04	0.158743E+02	0.165824E+02	0.151662E+02
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0.110500E+04	0.158948E+02	0.165988E+02	0.151909E+02
0.110600E+04	0.159034E+02	0.166054E+02	0.152014E+02
0.110700E+04	0.159111E+02	0.166114E+02	0.152108E+02
0.110800E+04	0.159182E+02	0.166169E+02	0.152195E+02
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0.111900E+04	0.159765E+02	0.166703E+02	0.152828E+02
0.112000E+04	0.159799E+02	0.166737E+02	0.152861E+02
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0.112400E+04	0.159916E+02	0.166862E+02	0.152970E+02
0.112500E+04	0.159942E+02	0.166891E+02	0.152993E+02
0.112600E+04	0.159967E+02	0.166919E+02	0.153015E+02
0.112700E+04	0.159991E+02	0.166946E+02	0.153036E+02
0.112800E+04	0.160014E+02	0.166972E+02	0.153055E+02
0.112900E+04	0.160036E+02	0.166997E+02	0.153074E+02
0.113000E+04	0.160057E+02	0.167022E+02	0.153092E+02
0.113100E+04	0.160078E+02	0.167046E+02	0.153109E+02
0.113200E+04	0.160097E+02	0.167069E+02	0.153126E+02
0.113300E+04	0.160118E+02	0.167093E+02	0.153142E+02
0.113400E+04	0.160140E+02	0.167119E+02	0.153160E+02
0.113500E+04	0.160161E+02	0.167144E+02	0.153178E+02
0.113600E+04	0.160182E+02	0.167169E+02	0.153195E+02
0.113700E+04	0.160202E+02	0.167192E+02	0.153212E+02
0.113800E+04	0.160222E+02	0.167215E+02	0.153228E+02
0.113900E+04	0.160240E+02	0.167236E+02	0.153244E+02
0.114000E+04	0.160256E+02	0.167255E+02	0.153258E+02
0.114100E+04	0.160271E+02	0.167272E+02	0.153270E+02
0.114200E+04	0.160285E+02	0.167288E+02	0.153282E+02
0.114300E+04	0.160298E+02	0.167303E+02	0.153294E+02
0.114400E+04	0.160311E+02	0.167317E+02	0.153304E+02
0.114500E+04	0.160322E+02	0.167330E+02	0.153315E+02
0.114600E+04	0.160333E+02	0.167342E+02	0.153325E+02
0.114700E+04	0.160343E+02	0.167353E+02	0.153333E+02
0.114800E+04	0.160351E+02	0.167361E+02	0.153341E+02
0.114900E+04	0.160358E+02	0.167368E+02	0.153347E+02

0.115000E+04	0.160363E+02	0.167373E+02	0.153353E+02
0.115100E+04	0.160368E+02	0.167377E+02	0.153358E+02
0.115200E+04	0.160372E+02	0.167381E+02	0.153363E+02
0.115300E+04	0.160375E+02	0.167383E+02	0.153366E+02
0.115400E+04	0.160377E+02	0.167385E+02	0.153370E+02
0.115500E+04	0.160379E+02	0.167386E+02	0.153373E+02
0.115600E+04	0.160380E+02	0.167385E+02	0.153375E+02
0.115700E+04	0.160379E+02	0.167382E+02	0.153376E+02
0.115800E+04	0.160376E+02	0.167377E+02	0.153375E+02
0.115900E+04	0.160372E+02	0.167371E+02	0.153373E+02
0.116000E+04	0.160367E+02	0.167363E+02	0.153371E+02
0.116100E+04	0.160362E+02	0.167355E+02	0.153368E+02
0.116200E+04	0.160358E+02	0.167349E+02	0.153367E+02
0.116300E+04	0.160357E+02	0.167346E+02	0.153368E+02
0.116400E+04	0.160358E+02	0.167345E+02	0.153370E+02
0.116500E+04	0.160359E+02	0.167345E+02	0.153374E+02
0.116600E+04	0.159930E+02	0.166837E+02	0.153022E+02
0.116700E+04	0.159464E+02	0.166292E+02	0.152636E+02
0.116800E+04	0.159600E+02	0.166457E+02	0.152742E+02
0.116900E+04	0.159866E+02	0.166781E+02	0.152951E+02
0.117000E+04	0.160004E+02	0.166949E+02	0.153060E+02
0.117100E+04	0.160074E+02	0.167030E+02	0.153119E+02
0.117200E+04	0.160119E+02	0.167079E+02	0.153159E+02
0.117300E+04	0.160150E+02	0.167111E+02	0.153189E+02
0.117400E+04	0.160172E+02	0.167132E+02	0.153212E+02
0.117500E+04	0.157641E+02	0.164281E+02	0.151002E+02
0.117600E+04	0.156187E+02	0.161368E+02	0.151005E+02
0.117700E+04	0.157262E+02	0.162059E+02	0.152466E+02
0.117800E+04	0.158665E+02	0.163478E+02	0.153853E+02
0.117900E+04	0.159583E+02	0.164437E+02	0.154728E+02
0.118000E+04	0.160115E+02	0.165076E+02	0.155154E+02
0.118100E+04	0.160423E+02	0.165479E+02	0.155367E+02
0.118200E+04	0.160629E+02	0.165776E+02	0.155483E+02
0.118300E+04	0.160774E+02	0.166006E+02	0.155543E+02
0.118400E+04	0.160901E+02	0.166188E+02	0.155613E+02
0.118500E+04	0.160976E+02	0.166333E+02	0.155619E+02
0.118600E+04	0.161031E+02	0.166448E+02	0.155615E+02
0.118700E+04	0.161071E+02	0.166539E+02	0.155602E+02
0.118800E+04	0.161099E+02	0.166612E+02	0.155586E+02
0.118900E+04	0.161334E+02	0.167069E+02	0.155598E+02
0.119000E+04	0.161327E+02	0.167065E+02	0.155588E+02
0.119100E+04	0.161322E+02	0.167074E+02	0.155571E+02
0.119200E+04	0.161319E+02	0.167084E+02	0.155553E+02
0.119300E+04	0.161240E+02	0.167094E+02	0.155386E+02
0.119400E+04	0.160214E+02	0.166002E+02	0.154426E+02
0.119500E+04	0.159266E+02	0.165069E+02	0.153463E+02
0.119600E+04	0.159470E+02	0.165403E+02	0.153538E+02
0.119700E+04	0.159938E+02	0.166044E+02	0.153832E+02
0.119800E+04	0.159733E+02	0.166301E+02	0.153165E+02
0.119900E+04	0.159482E+02	0.166444E+02	0.152520E+02
0.120000E+04	0.159354E+02	0.166526E+02	0.152182E+02
0.120100E+04	0.159268E+02	0.166569E+02	0.151968E+02
0.120200E+04	0.159216E+02	0.166589E+02	0.151843E+02
0.120300E+04	0.159191E+02	0.166595E+02	0.151786E+02
0.120400E+04	0.159166E+02	0.166591E+02	0.151741E+02
0.120500E+04	0.158664E+02	0.165991E+02	0.151337E+02
0.120600E+04	0.158113E+02	0.165312E+02	0.150915E+02
0.120700E+04	0.158427E+02	0.165735E+02	0.151118E+02
0.120800E+04	0.158776E+02	0.166097E+02	0.151455E+02
0.120900E+04	0.158981E+02	0.166288E+02	0.151674E+02
0.121000E+04	0.159110E+02	0.166387E+02	0.151834E+02
0.121100E+04	0.159211E+02	0.166451E+02	0.151971E+02
0.121200E+04	0.159295E+02	0.166497E+02	0.152093E+02

0.121300E+04	0.159368E+02	0.166532E+02	0.152203E+02
0.121400E+04	0.159412E+02	0.166523E+02	0.152302E+02
0.121500E+04	0.159417E+02	0.166451E+02	0.152383E+02
0.121600E+04	0.159454E+02	0.166451E+02	0.152458E+02
0.121700E+04	0.159497E+02	0.166466E+02	0.152527E+02
0.121800E+04	0.159538E+02	0.166485E+02	0.152591E+02
0.121900E+04	0.159578E+02	0.166506E+02	0.152649E+02
0.122000E+04	0.159615E+02	0.166528E+02	0.152702E+02
0.122100E+04	0.159650E+02	0.166550E+02	0.152751E+02
0.122200E+04	0.159684E+02	0.166573E+02	0.152794E+02
0.122300E+04	0.159715E+02	0.166595E+02	0.152834E+02
0.122400E+04	0.159744E+02	0.166618E+02	0.152871E+02
0.122500E+04	0.159772E+02	0.166640E+02	0.152904E+02
0.122600E+04	0.159798E+02	0.166662E+02	0.152934E+02
0.122700E+04	0.159512E+02	0.166321E+02	0.152703E+02
0.122800E+04	0.159185E+02	0.165928E+02	0.152442E+02
0.122900E+04	0.157488E+02	0.164060E+02	0.150916E+02
0.123000E+04	0.155640E+02	0.161868E+02	0.149411E+02
0.123100E+04	0.157756E+02	0.162876E+02	0.152636E+02
0.123200E+04	0.159056E+02	0.163980E+02	0.154133E+02
0.123300E+04	0.159822E+02	0.164718E+02	0.154927E+02
0.123400E+04	0.160216E+02	0.165128E+02	0.155304E+02
0.123500E+04	0.160469E+02	0.165448E+02	0.155489E+02
0.123600E+04	0.160638E+02	0.165696E+02	0.155579E+02
0.123700E+04	0.160753E+02	0.165892E+02	0.155615E+02
0.123800E+04	0.160834E+02	0.166051E+02	0.155618E+02
0.123900E+04	0.160918E+02	0.166181E+02	0.155654E+02
0.124000E+04	0.160957E+02	0.166290E+02	0.155623E+02
0.124100E+04	0.160987E+02	0.166380E+02	0.155594E+02
0.124200E+04	0.161230E+02	0.166886E+02	0.155574E+02
0.124300E+04	0.161230E+02	0.166895E+02	0.155566E+02
0.124400E+04	0.161223E+02	0.166907E+02	0.155539E+02
0.124500E+04	0.161217E+02	0.166926E+02	0.155509E+02
0.124600E+04	0.161211E+02	0.166942E+02	0.155479E+02
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0.124800E+04	0.161119E+02	0.166962E+02	0.155277E+02
0.124900E+04	0.161002E+02	0.166964E+02	0.155039E+02
0.125000E+04	0.160896E+02	0.166961E+02	0.154831E+02
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0.125200E+04	0.160221E+02	0.166938E+02	0.153503E+02
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0.125500E+04	0.159499E+02	0.166818E+02	0.152181E+02
0.125600E+04	0.159376E+02	0.166759E+02	0.151992E+02
0.125700E+04	0.159286E+02	0.166699E+02	0.151873E+02
0.125800E+04	0.159206E+02	0.166642E+02	0.151771E+02
0.125900E+04	0.154807E+02	0.161494E+02	0.148121E+02
0.126000E+04	0.152572E+02	0.160683E+02	0.144461E+02
0.126100E+04	0.154588E+02	0.163821E+02	0.145355E+02
0.126200E+04	0.156558E+02	0.165738E+02	0.147379E+02
0.126300E+04	0.157923E+02	0.166953E+02	0.148893E+02
0.126400E+04	0.158568E+02	0.167406E+02	0.149730E+02
0.126500E+04	0.158900E+02	0.167545E+02	0.150255E+02
0.126600E+04	0.159115E+02	0.167589E+02	0.150640E+02
0.126700E+04	0.159227E+02	0.167575E+02	0.150880E+02
0.126800E+04	0.159307E+02	0.167536E+02	0.151077E+02
0.126900E+04	0.159367E+02	0.167486E+02	0.151247E+02
0.127000E+04	0.159415E+02	0.167434E+02	0.151395E+02
0.127100E+04	0.159453E+02	0.167383E+02	0.151523E+02
0.127200E+04	0.159485E+02	0.167336E+02	0.151634E+02
0.127300E+04	0.159510E+02	0.167292E+02	0.151729E+02
0.127400E+04	0.159530E+02	0.167251E+02	0.151809E+02
0.127500E+04	0.158544E+02	0.166053E+02	0.151035E+02

0.127600E+04	0.157431E+02	0.164816E+02	0.150046E+02
0.127700E+04	0.157788E+02	0.165214E+02	0.150362E+02
0.127800E+04	0.158412E+02	0.165867E+02	0.150956E+02
0.127900E+04	0.158710E+02	0.166153E+02	0.151268E+02
0.128000E+04	0.158755E+02	0.166076E+02	0.151434E+02
0.128100E+04	0.158771E+02	0.165999E+02	0.151544E+02
0.128200E+04	0.158361E+02	0.165112E+02	0.151610E+02
0.128300E+04	0.158180E+02	0.164730E+02	0.151631E+02
0.128400E+04	0.158099E+02	0.164557E+02	0.151641E+02
0.128500E+04	0.156680E+02	0.162921E+02	0.150440E+02
0.128600E+04	0.155212E+02	0.161200E+02	0.149223E+02
0.128700E+04	0.156037E+02	0.162401E+02	0.149673E+02
0.128800E+04	0.158194E+02	0.163373E+02	0.153015E+02
0.128900E+04	0.158806E+02	0.163862E+02	0.153750E+02
0.129000E+04	0.159281E+02	0.164155E+02	0.154407E+02
0.129100E+04	0.159485E+02	0.164389E+02	0.154580E+02
0.129200E+04	0.159630E+02	0.164605E+02	0.154654E+02
0.129300E+04	0.159730E+02	0.164790E+02	0.154671E+02
0.129400E+04	0.159836E+02	0.164952E+02	0.154720E+02
0.129500E+04	0.158516E+02	0.163463E+02	0.153569E+02
0.129600E+04	0.157273E+02	0.162135E+02	0.152410E+02
0.129700E+04	0.157762E+02	0.162788E+02	0.152737E+02
0.129800E+04	0.158534E+02	0.163750E+02	0.153318E+02
0.129900E+04	0.158826E+02	0.164088E+02	0.153563E+02
0.130000E+04	0.159022E+02	0.164376E+02	0.153668E+02
0.130100E+04	0.159166E+02	0.164602E+02	0.153729E+02
0.130200E+04	0.159277E+02	0.164786E+02	0.153768E+02
0.130300E+04	0.159365E+02	0.164937E+02	0.153794E+02
0.130400E+04	0.159437E+02	0.165063E+02	0.153812E+02
0.130500E+04	0.159498E+02	0.165171E+02	0.153825E+02
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0.130700E+04	0.159595E+02	0.165348E+02	0.153843E+02
0.130800E+04	0.159634E+02	0.165420E+02	0.153849E+02
0.130900E+04	0.159669E+02	0.165483E+02	0.153854E+02
0.131000E+04	0.159925E+02	0.165984E+02	0.153867E+02
0.131100E+04	0.159960E+02	0.166017E+02	0.153903E+02
0.131200E+04	0.159968E+02	0.166020E+02	0.153916E+02
0.131300E+04	0.159915E+02	0.166036E+02	0.153793E+02
0.131400E+04	0.159816E+02	0.166054E+02	0.153578E+02
0.131500E+04	0.159730E+02	0.166070E+02	0.153391E+02
0.131600E+04	0.159365E+02	0.166080E+02	0.152649E+02
0.131700E+04	0.158919E+02	0.166079E+02	0.151758E+02
0.131800E+04	0.158676E+02	0.166061E+02	0.151291E+02
0.131900E+04	0.158506E+02	0.166035E+02	0.150976E+02
0.132000E+04	0.158387E+02	0.166006E+02	0.150767E+02
0.132100E+04	0.158288E+02	0.165975E+02	0.150601E+02
0.132200E+04	0.158235E+02	0.165944E+02	0.150526E+02
0.132300E+04	0.158210E+02	0.165916E+02	0.150504E+02
0.132400E+04	0.158207E+02	0.165893E+02	0.150520E+02
0.132500E+04	0.158220E+02	0.165876E+02	0.150563E+02
0.132600E+04	0.158244E+02	0.165863E+02	0.150624E+02
0.132700E+04	0.158276E+02	0.165856E+02	0.150696E+02
0.132800E+04	0.158312E+02	0.165849E+02	0.150774E+02
0.132900E+04	0.157124E+02	0.164412E+02	0.149837E+02
0.133000E+04	0.156000E+02	0.163193E+02	0.148807E+02
0.133100E+04	0.156443E+02	0.163665E+02	0.149222E+02
0.133200E+04	0.157169E+02	0.164435E+02	0.149904E+02
0.133300E+04	0.157558E+02	0.164836E+02	0.150280E+02
0.133400E+04	0.157793E+02	0.165071E+02	0.150516E+02
0.133500E+04	0.157970E+02	0.165239E+02	0.150701E+02
0.133600E+04	0.158117E+02	0.165374E+02	0.150860E+02
0.133700E+04	0.158245E+02	0.165490E+02	0.151000E+02
0.133800E+04	0.158357E+02	0.165590E+02	0.151124E+02

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0.134000E+04	0.158546E+02	0.165757E+02	0.151335E+02
0.134100E+04	0.158623E+02	0.165823E+02	0.151422E+02
0.134200E+04	0.158690E+02	0.165880E+02	0.151499E+02
0.134300E+04	0.158749E+02	0.165931E+02	0.151568E+02
0.134400E+04	0.158803E+02	0.165976E+02	0.151630E+02
0.134500E+04	0.157810E+02	0.164796E+02	0.150824E+02
0.134600E+04	0.156860E+02	0.163782E+02	0.149939E+02
0.134700E+04	0.157263E+02	0.164183E+02	0.150343E+02
0.134800E+04	0.157903E+02	0.164873E+02	0.150932E+02
0.134900E+04	0.158240E+02	0.165247E+02	0.151232E+02
0.135000E+04	0.158390E+02	0.165469E+02	0.151311E+02
0.135100E+04	0.158509E+02	0.165625E+02	0.151392E+02
0.135200E+04	0.158613E+02	0.165743E+02	0.151483E+02
0.135300E+04	0.158701E+02	0.165835E+02	0.151567E+02
0.135400E+04	0.158775E+02	0.165910E+02	0.151640E+02
0.135500E+04	0.158838E+02	0.165971E+02	0.151705E+02
0.135600E+04	0.158893E+02	0.166023E+02	0.151763E+02
0.135700E+04	0.158942E+02	0.166068E+02	0.151815E+02
0.135800E+04	0.158986E+02	0.166109E+02	0.151863E+02
0.135900E+04	0.159026E+02	0.166145E+02	0.151906E+02
0.136000E+04	0.159062E+02	0.166178E+02	0.151946E+02
0.136100E+04	0.159095E+02	0.166209E+02	0.151982E+02
0.136200E+04	0.159126E+02	0.166236E+02	0.152016E+02
0.136300E+04	0.159155E+02	0.166262E+02	0.152047E+02
0.136400E+04	0.159181E+02	0.166286E+02	0.152076E+02
0.136500E+04	0.159206E+02	0.166308E+02	0.152104E+02
0.136600E+04	0.159229E+02	0.166328E+02	0.152130E+02
0.136700E+04	0.159251E+02	0.166348E+02	0.152155E+02
0.136800E+04	0.159272E+02	0.166366E+02	0.152178E+02
0.136900E+04	0.159292E+02	0.166383E+02	0.152201E+02
0.137000E+04	0.159311E+02	0.166400E+02	0.152223E+02
0.137100E+04	0.159330E+02	0.166415E+02	0.152244E+02
0.137200E+04	0.159347E+02	0.166430E+02	0.152265E+02
0.137300E+04	0.159364E+02	0.166444E+02	0.152285E+02
0.137400E+04	0.159380E+02	0.166457E+02	0.152303E+02
0.137500E+04	0.158966E+02	0.165967E+02	0.151964E+02
0.137600E+04	0.158502E+02	0.165415E+02	0.151589E+02
0.137700E+04	0.158650E+02	0.165592E+02	0.151707E+02
0.137800E+04	0.158934E+02	0.165937E+02	0.151931E+02
0.137900E+04	0.159088E+02	0.166121E+02	0.152055E+02
0.138000E+04	0.159172E+02	0.166217E+02	0.152128E+02
0.138100E+04	0.159231E+02	0.166279E+02	0.152182E+02
0.138200E+04	0.159275E+02	0.166324E+02	0.152227E+02
0.138300E+04	0.159311E+02	0.166357E+02	0.152264E+02
0.138400E+04	0.159339E+02	0.166382E+02	0.152295E+02
0.138500E+04	0.159361E+02	0.166400E+02	0.152322E+02
0.138600E+04	0.159378E+02	0.166412E+02	0.152344E+02
0.138700E+04	0.158964E+02	0.165921E+02	0.152007E+02
0.138800E+04	0.158500E+02	0.165366E+02	0.151633E+02
0.138900E+04	0.158645E+02	0.165539E+02	0.151751E+02
0.139000E+04	0.158926E+02	0.165878E+02	0.151973E+02
0.139100E+04	0.159075E+02	0.166056E+02	0.152094E+02
0.139200E+04	0.159154E+02	0.166145E+02	0.152164E+02
0.139300E+04	0.159206E+02	0.166199E+02	0.152213E+02
0.139400E+04	0.159242E+02	0.166233E+02	0.152250E+02
0.139500E+04	0.159268E+02	0.166256E+02	0.152280E+02
0.139600E+04	0.159285E+02	0.166268E+02	0.152302E+02
0.139700E+04	0.159293E+02	0.166270E+02	0.152317E+02
0.139800E+04	0.159296E+02	0.166266E+02	0.152327E+02
0.139900E+04	0.159295E+02	0.166257E+02	0.152332E+02
0.140000E+04	0.159290E+02	0.166246E+02	0.152335E+02
0.140100E+04	0.159285E+02	0.166234E+02	0.152336E+02

0.140200E+04	0.159281E+02	0.166224E+02	0.152338E+02
0.140300E+04	0.159278E+02	0.166215E+02	0.152341E+02
0.140400E+04	0.159274E+02	0.166206E+02	0.152342E+02
0.140500E+04	0.159270E+02	0.166197E+02	0.152344E+02
0.140600E+04	0.159266E+02	0.166188E+02	0.152345E+02
0.140700E+04	0.159262E+02	0.166178E+02	0.152345E+02
0.140800E+04	0.158868E+02	0.165715E+02	0.152022E+02
0.140900E+04	0.158420E+02	0.165183E+02	0.151656E+02
0.141000E+04	0.158664E+02	0.165566E+02	0.151763E+02
0.141100E+04	0.158905E+02	0.165843E+02	0.151967E+02
0.141200E+04	0.159030E+02	0.165986E+02	0.152075E+02
0.141300E+04	0.159094E+02	0.166055E+02	0.152134E+02
0.141400E+04	0.159135E+02	0.166096E+02	0.152175E+02
0.141500E+04	0.159161E+02	0.166118E+02	0.152204E+02
0.141600E+04	0.159174E+02	0.166124E+02	0.152223E+02
0.141700E+04	0.159178E+02	0.166121E+02	0.152234E+02
0.141800E+04	0.159176E+02	0.166111E+02	0.152240E+02
0.141900E+04	0.159169E+02	0.166096E+02	0.152241E+02
0.142000E+04	0.159159E+02	0.166079E+02	0.152239E+02
0.142100E+04	0.159149E+02	0.166062E+02	0.152236E+02
0.142200E+04	0.159140E+02	0.166047E+02	0.152234E+02
0.142300E+04	0.159132E+02	0.166033E+02	0.152231E+02
0.142400E+04	0.159124E+02	0.166020E+02	0.152228E+02
0.142500E+04	0.159116E+02	0.166007E+02	0.152225E+02
0.142600E+04	0.159108E+02	0.165994E+02	0.152222E+02
0.142700E+04	0.159100E+02	0.165981E+02	0.152218E+02
0.142800E+04	0.159089E+02	0.165966E+02	0.152212E+02
0.142900E+04	0.159073E+02	0.165945E+02	0.152201E+02
0.143000E+04	0.159054E+02	0.165921E+02	0.152188E+02
0.143100E+04	0.159033E+02	0.165894E+02	0.152172E+02
0.143200E+04	0.159011E+02	0.165867E+02	0.152155E+02
0.143300E+04	0.158987E+02	0.165838E+02	0.152137E+02
0.143400E+04	0.158695E+02	0.165499E+02	0.151891E+02
0.143500E+04	0.158398E+02	0.165154E+02	0.151643E+02
0.143600E+04	0.158475E+02	0.165247E+02	0.151703E+02
0.143700E+04	0.158607E+02	0.165407E+02	0.151806E+02
0.143800E+04	0.158662E+02	0.165476E+02	0.151849E+02
0.143900E+04	0.158682E+02	0.165500E+02	0.151863E+02
0.144000E+04	0.158687E+02	0.165506E+02	0.151867E+02
0.144100E+04	0.158684E+02	0.165502E+02	0.151865E+02
0.144200E+04	0.158678E+02	0.165494E+02	0.151862E+02
0.144300E+04	0.158674E+02	0.165489E+02	0.151860E+02
0.144400E+04	0.158671E+02	0.165484E+02	0.151859E+02
0.144500E+04	0.158668E+02	0.165480E+02	0.151857E+02
0.144600E+04	0.158666E+02	0.165475E+02	0.151856E+02
0.144700E+04	0.158663E+02	0.165471E+02	0.151855E+02
0.144800E+04	0.158660E+02	0.165467E+02	0.151853E+02
0.144900E+04	0.158657E+02	0.165463E+02	0.151852E+02
0.145000E+04	0.158655E+02	0.165459E+02	0.151850E+02
0.145100E+04	0.158652E+02	0.165456E+02	0.151849E+02
0.145200E+04	0.158649E+02	0.165451E+02	0.151847E+02
0.145300E+04	0.156986E+02	0.163494E+02	0.150478E+02
0.145400E+04	0.155209E+02	0.161407E+02	0.149010E+02
0.145500E+04	0.157223E+02	0.162074E+02	0.152372E+02
0.145600E+04	0.158517E+02	0.163244E+02	0.153790E+02
0.145700E+04	0.159077E+02	0.163858E+02	0.154296E+02
0.145800E+04	0.159363E+02	0.164214E+02	0.154512E+02
0.145900E+04	0.157969E+02	0.162550E+02	0.153387E+02
0.146000E+04	0.155383E+02	0.159649E+02	0.151117E+02
0.146100E+04	0.154816E+02	0.159199E+02	0.150434E+02
0.146200E+04	0.156008E+02	0.160635E+02	0.151380E+02
0.146300E+04	0.157161E+02	0.161978E+02	0.152344E+02
0.146400E+04	0.157779E+02	0.162756E+02	0.152803E+02

0.146500E+04	0.158130E+02	0.163221E+02	0.153038E+02
0.146600E+04	0.157942E+02	0.163031E+02	0.152853E+02
0.146700E+04	0.157648E+02	0.162694E+02	0.152601E+02
0.146800E+04	0.157932E+02	0.163077E+02	0.152787E+02
0.146900E+04	0.158317E+02	0.163593E+02	0.153042E+02
0.147000E+04	0.158545E+02	0.163903E+02	0.153187E+02
0.147100E+04	0.158691E+02	0.164102E+02	0.153280E+02
0.147200E+04	0.158802E+02	0.164253E+02	0.153350E+02
0.147300E+04	0.159115E+02	0.164797E+02	0.153434E+02
0.147400E+04	0.159169E+02	0.164839E+02	0.153498E+02
0.147500E+04	0.159220E+02	0.164894E+02	0.153546E+02
0.147600E+04	0.159266E+02	0.164947E+02	0.153586E+02
0.147700E+04	0.159309E+02	0.164996E+02	0.153622E+02
0.147800E+04	0.159350E+02	0.165043E+02	0.153657E+02
0.147900E+04	0.159388E+02	0.165085E+02	0.153690E+02
0.148000E+04	0.159372E+02	0.165125E+02	0.153620E+02
0.148100E+04	0.158914E+02	0.164707E+02	0.153122E+02
0.148200E+04	0.158569E+02	0.164401E+02	0.152738E+02
0.148300E+04	0.158195E+02	0.164051E+02	0.152338E+02
0.148400E+04	0.158050E+02	0.164048E+02	0.152052E+02
0.148500E+04	0.158148E+02	0.164485E+02	0.151811E+02
0.148600E+04	0.157900E+02	0.164782E+02	0.151018E+02
0.148700E+04	0.157779E+02	0.164903E+02	0.150655E+02
0.148800E+04	0.157811E+02	0.164964E+02	0.150659E+02
0.148900E+04	0.157809E+02	0.164998E+02	0.150620E+02
0.149000E+04	0.157796E+02	0.165015E+02	0.150577E+02
0.149100E+04	0.157791E+02	0.165020E+02	0.150562E+02
0.149200E+04	0.157799E+02	0.165020E+02	0.150578E+02
0.149300E+04	0.157818E+02	0.165018E+02	0.150619E+02
0.149400E+04	0.157847E+02	0.165016E+02	0.150678E+02
0.149500E+04	0.157421E+02	0.164482E+02	0.150361E+02
0.149600E+04	0.156978E+02	0.163923E+02	0.150032E+02
0.149700E+04	0.157180E+02	0.164116E+02	0.150243E+02
0.149800E+04	0.157474E+02	0.164401E+02	0.150546E+02
0.149900E+04	0.157617E+02	0.164504E+02	0.150730E+02
0.150000E+04	0.157724E+02	0.164588E+02	0.150861E+02
0.150100E+04	0.157814E+02	0.164655E+02	0.150973E+02
0.150200E+04	0.157892E+02	0.164712E+02	0.151072E+02
0.150300E+04	0.157961E+02	0.164760E+02	0.151162E+02
0.150400E+04	0.157634E+02	0.164350E+02	0.150919E+02
0.150500E+04	0.157249E+02	0.163868E+02	0.150630E+02
0.150600E+04	0.157419E+02	0.164051E+02	0.150788E+02
0.150700E+04	0.157725E+02	0.164402E+02	0.151047E+02
0.150800E+04	0.157905E+02	0.164605E+02	0.151205E+02
0.150900E+04	0.158017E+02	0.164724E+02	0.151309E+02
0.151000E+04	0.158103E+02	0.164812E+02	0.151393E+02
0.151100E+04	0.158174E+02	0.164884E+02	0.151463E+02
0.151200E+04	0.158233E+02	0.164944E+02	0.151523E+02
0.151300E+04	0.158283E+02	0.164993E+02	0.151573E+02
0.151400E+04	0.158325E+02	0.165034E+02	0.151616E+02
0.151500E+04	0.158360E+02	0.165068E+02	0.151652E+02
0.151600E+04	0.158391E+02	0.165099E+02	0.151684E+02
0.151700E+04	0.158418E+02	0.165126E+02	0.151711E+02
0.151800E+04	0.158442E+02	0.165151E+02	0.151734E+02
0.151900E+04	0.158464E+02	0.165174E+02	0.151754E+02
0.152000E+04	0.158485E+02	0.165197E+02	0.151773E+02
0.152100E+04	0.158505E+02	0.165220E+02	0.151790E+02
0.152200E+04	0.158523E+02	0.165241E+02	0.151805E+02
0.152300E+04	0.158541E+02	0.165262E+02	0.151819E+02
0.152400E+04	0.158556E+02	0.165280E+02	0.151832E+02
0.152500E+04	0.158570E+02	0.165298E+02	0.151843E+02
0.152600E+04	0.158584E+02	0.165314E+02	0.151853E+02
0.152700E+04	0.157598E+02	0.164234E+02	0.150961E+02

0.152800E+04	0.156533E+02	0.162994E+02	0.150073E+02
0.152900E+04	0.156942E+02	0.163413E+02	0.150471E+02
0.153000E+04	0.157584E+02	0.164157E+02	0.151010E+02
0.153100E+04	0.157864E+02	0.164467E+02	0.151262E+02
0.153200E+04	0.157988E+02	0.164660E+02	0.151317E+02
0.153300E+04	0.158070E+02	0.164795E+02	0.151346E+02
0.153400E+04	0.158147E+02	0.164895E+02	0.151400E+02
0.153500E+04	0.158212E+02	0.164971E+02	0.151452E+02
0.153600E+04	0.158266E+02	0.165033E+02	0.151499E+02
0.153700E+04	0.158312E+02	0.165085E+02	0.151540E+02
0.153800E+04	0.158351E+02	0.165127E+02	0.151575E+02
0.153900E+04	0.158383E+02	0.165161E+02	0.151606E+02
0.154000E+04	0.158410E+02	0.165189E+02	0.151632E+02
0.154100E+04	0.158435E+02	0.165214E+02	0.151656E+02
0.154200E+04	0.158457E+02	0.165237E+02	0.151677E+02
0.154300E+04	0.158477E+02	0.165258E+02	0.151696E+02
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0.154500E+04	0.158512E+02	0.165294E+02	0.151730E+02
0.154600E+04	0.158527E+02	0.165310E+02	0.151744E+02
0.154700E+04	0.158541E+02	0.165324E+02	0.151757E+02
0.154800E+04	0.158553E+02	0.165337E+02	0.151769E+02
0.154900E+04	0.158564E+02	0.165349E+02	0.151780E+02
0.155000E+04	0.158574E+02	0.165359E+02	0.151790E+02
0.155100E+04	0.158583E+02	0.165368E+02	0.151798E+02
0.155200E+04	0.158591E+02	0.165375E+02	0.151806E+02
0.155300E+04	0.158597E+02	0.165381E+02	0.151813E+02
0.155400E+04	0.158603E+02	0.165387E+02	0.151819E+02
0.155500E+04	0.158608E+02	0.165391E+02	0.151825E+02
0.155600E+04	0.158612E+02	0.165395E+02	0.151830E+02
0.155700E+04	0.158616E+02	0.165398E+02	0.151834E+02
0.155800E+04	0.158620E+02	0.165401E+02	0.151839E+02
0.155900E+04	0.158623E+02	0.165402E+02	0.151843E+02
0.156000E+04	0.158626E+02	0.165405E+02	0.151848E+02
0.156100E+04	0.158631E+02	0.165409E+02	0.151853E+02
0.156200E+04	0.158636E+02	0.165413E+02	0.151860E+02
0.156300E+04	0.158642E+02	0.165418E+02	0.151866E+02
0.156400E+04	0.157724E+02	0.164418E+02	0.151029E+02
0.156500E+04	0.156692E+02	0.163206E+02	0.150179E+02
0.156600E+04	0.157063E+02	0.163577E+02	0.150550E+02
0.156700E+04	0.157687E+02	0.164302E+02	0.151072E+02
0.156800E+04	0.157953E+02	0.164588E+02	0.151319E+02
0.156900E+04	0.158074E+02	0.164769E+02	0.151379E+02
0.157000E+04	0.157880E+02	0.164580E+02	0.151180E+02
0.157100E+04	0.157674E+02	0.164338E+02	0.151011E+02
0.157200E+04	0.157842E+02	0.164534E+02	0.151150E+02
0.157300E+04	0.158059E+02	0.164792E+02	0.151326E+02
0.157400E+04	0.158187E+02	0.164940E+02	0.151434E+02
0.157500E+04	0.158270E+02	0.165031E+02	0.151509E+02
0.157600E+04	0.158334E+02	0.165097E+02	0.151570E+02
0.157700E+04	0.158386E+02	0.165150E+02	0.151622E+02
0.157800E+04	0.158433E+02	0.165196E+02	0.151670E+02
0.157900E+04	0.158475E+02	0.165236E+02	0.151713E+02
0.158000E+04	0.158512E+02	0.165272E+02	0.151753E+02
0.158100E+04	0.158547E+02	0.165305E+02	0.151789E+02
0.158200E+04	0.158579E+02	0.165334E+02	0.151823E+02
0.158300E+04	0.158609E+02	0.165362E+02	0.151855E+02
0.158400E+04	0.158637E+02	0.165389E+02	0.151885E+02
0.158500E+04	0.158663E+02	0.165412E+02	0.151913E+02
0.158600E+04	0.158686E+02	0.165433E+02	0.151938E+02
0.158700E+04	0.157132E+02	0.163666E+02	0.150598E+02
0.158800E+04	0.154744E+02	0.160886E+02	0.148602E+02
0.158900E+04	0.156158E+02	0.161042E+02	0.151275E+02
0.159000E+04	0.157461E+02	0.162183E+02	0.152740E+02

0.159100E+04	0.158410E+02	0.163176E+02	0.153645E+02
0.159200E+04	0.158870E+02	0.163685E+02	0.154054E+02
0.159300E+04	0.159142E+02	0.164041E+02	0.154242E+02
0.159400E+04	0.159325E+02	0.164313E+02	0.154336E+02
0.159500E+04	0.159455E+02	0.164532E+02	0.154379E+02
0.159600E+04	0.159551E+02	0.164710E+02	0.154392E+02
0.159700E+04	0.159644E+02	0.164859E+02	0.154430E+02
0.159800E+04	0.159701E+02	0.164982E+02	0.154419E+02
0.159900E+04	0.159745E+02	0.165086E+02	0.154403E+02
0.160000E+04	0.160005E+02	0.165604E+02	0.154407E+02
0.160100E+04	0.158122E+02	0.163475E+02	0.152769E+02
0.160200E+04	0.155901E+02	0.160843E+02	0.150960E+02
0.160300E+04	0.156584E+02	0.161822E+02	0.151345E+02
0.160400E+04	0.157541E+02	0.162916E+02	0.152167E+02
0.160500E+04	0.158219E+02	0.163701E+02	0.152738E+02
0.160600E+04	0.158609E+02	0.164181E+02	0.153037E+02
0.160700E+04	0.158846E+02	0.164478E+02	0.153213E+02
0.160800E+04	0.159013E+02	0.164688E+02	0.153337E+02
0.160900E+04	0.159137E+02	0.164844E+02	0.153430E+02
0.161000E+04	0.159238E+02	0.164969E+02	0.153507E+02
0.161100E+04	0.159318E+02	0.165068E+02	0.153569E+02
0.161200E+04	0.159390E+02	0.165186E+02	0.153594E+02
0.161300E+04	0.158339E+02	0.164063E+02	0.152615E+02
0.161400E+04	0.157340E+02	0.163069E+02	0.151611E+02
0.161500E+04	0.157652E+02	0.163531E+02	0.151773E+02
0.161600E+04	0.157956E+02	0.164189E+02	0.151722E+02
0.161700E+04	0.157667E+02	0.164460E+02	0.150875E+02
0.161800E+04	0.157532E+02	0.164578E+02	0.150485E+02
0.161900E+04	0.157451E+02	0.164659E+02	0.150243E+02
0.162000E+04	0.157411E+02	0.164719E+02	0.150103E+02
0.162100E+04	0.157380E+02	0.164753E+02	0.150008E+02
0.162200E+04	0.156322E+02	0.163359E+02	0.149285E+02
0.162300E+04	0.155198E+02	0.162136E+02	0.148260E+02
0.162400E+04	0.155648E+02	0.162614E+02	0.148681E+02
0.162500E+04	0.156398E+02	0.163442E+02	0.149354E+02
0.162600E+04	0.156795E+02	0.163859E+02	0.149732E+02
0.162700E+04	0.157020E+02	0.164082E+02	0.149957E+02
0.162800E+04	0.157181E+02	0.164227E+02	0.150135E+02
0.162900E+04	0.157311E+02	0.164333E+02	0.150289E+02
0.163000E+04	0.157403E+02	0.164394E+02	0.150413E+02
0.163100E+04	0.157475E+02	0.164431E+02	0.150518E+02
0.163200E+04	0.157543E+02	0.164467E+02	0.150619E+02
0.163300E+04	0.157616E+02	0.164512E+02	0.150719E+02
0.163400E+04	0.157685E+02	0.164556E+02	0.150813E+02
0.163500E+04	0.157740E+02	0.164587E+02	0.150892E+02
0.163600E+04	0.157788E+02	0.164614E+02	0.150962E+02
0.163700E+04	0.157831E+02	0.164638E+02	0.151025E+02
0.163800E+04	0.157918E+02	0.164716E+02	0.151120E+02
0.163900E+04	0.158041E+02	0.164840E+02	0.151243E+02
0.164000E+04	0.158098E+02	0.164888E+02	0.151308E+02
0.164100E+04	0.156118E+02	0.162614E+02	0.149622E+02
0.164200E+04	0.153879E+02	0.160021E+02	0.147737E+02
0.164300E+04	0.154603E+02	0.160982E+02	0.148224E+02
0.164400E+04	0.156929E+02	0.162056E+02	0.151802E+02
0.164500E+04	0.157847E+02	0.162687E+02	0.153006E+02
0.164600E+04	0.158189E+02	0.163024E+02	0.153354E+02
0.164700E+04	0.158534E+02	0.163439E+02	0.153628E+02
0.164800E+04	0.158805E+02	0.163807E+02	0.153803E+02
0.164900E+04	0.158974E+02	0.164068E+02	0.153879E+02
0.165000E+04	0.159084E+02	0.164265E+02	0.153903E+02
0.165100E+04	0.159161E+02	0.164422E+02	0.153899E+02
0.165200E+04	0.159217E+02	0.164552E+02	0.153881E+02
0.165300E+04	0.159279E+02	0.164660E+02	0.153898E+02

0.165400E+04	0.159304E+02	0.164744E+02	0.153863E+02
0.165500E+04	0.159319E+02	0.164811E+02	0.153827E+02
0.165600E+04	0.159327E+02	0.164865E+02	0.153790E+02
0.165700E+04	0.159331E+02	0.164909E+02	0.153754E+02
0.165800E+04	0.159331E+02	0.164944E+02	0.153718E+02
0.165900E+04	0.159327E+02	0.164971E+02	0.153683E+02
0.166000E+04	0.159323E+02	0.164995E+02	0.153652E+02
0.166100E+04	0.159318E+02	0.165014E+02	0.153622E+02
0.166200E+04	0.159311E+02	0.165028E+02	0.153594E+02
0.166300E+04	0.159302E+02	0.165038E+02	0.153566E+02
0.166400E+04	0.159293E+02	0.165046E+02	0.153541E+02
0.166500E+04	0.159285E+02	0.165052E+02	0.153517E+02
0.166600E+04	0.159276E+02	0.165056E+02	0.153495E+02
0.166700E+04	0.158344E+02	0.163951E+02	0.152737E+02
0.166800E+04	0.157492E+02	0.163029E+02	0.151955E+02
0.166900E+04	0.157781E+02	0.163374E+02	0.152187E+02
0.167000E+04	0.158318E+02	0.164032E+02	0.152604E+02
0.167100E+04	0.158537E+02	0.164279E+02	0.152796E+02
0.167200E+04	0.158664E+02	0.164438E+02	0.152889E+02
0.167300E+04	0.158750E+02	0.164551E+02	0.152949E+02
0.167400E+04	0.157526E+02	0.163090E+02	0.151962E+02
0.167500E+04	0.156341E+02	0.161792E+02	0.150889E+02
0.167600E+04	0.156827E+02	0.162345E+02	0.151310E+02
0.167700E+04	0.157585E+02	0.163240E+02	0.151930E+02
0.167800E+04	0.157964E+02	0.163696E+02	0.152232E+02
0.167900E+04	0.158178E+02	0.163960E+02	0.152395E+02
0.168000E+04	0.158326E+02	0.164144E+02	0.152509E+02
0.168100E+04	0.157374E+02	0.163006E+02	0.151742E+02
0.168200E+04	0.156461E+02	0.161991E+02	0.150931E+02
0.168300E+04	0.156884E+02	0.162485E+02	0.151283E+02
0.168400E+04	0.157531E+02	0.163242E+02	0.151820E+02
0.168500E+04	0.157872E+02	0.163648E+02	0.152095E+02
0.168600E+04	0.158072E+02	0.163891E+02	0.152252E+02
0.168700E+04	0.158181E+02	0.164063E+02	0.152299E+02
0.168800E+04	0.158173E+02	0.164190E+02	0.152155E+02
0.168900E+04	0.157868E+02	0.163945E+02	0.151790E+02
0.169000E+04	0.157641E+02	0.163768E+02	0.151515E+02
0.169100E+04	0.157200E+02	0.164022E+02	0.150378E+02
0.169200E+04	0.157075E+02	0.164202E+02	0.149947E+02
0.169300E+04	0.156965E+02	0.164278E+02	0.149651E+02
0.169400E+04	0.156887E+02	0.164316E+02	0.149458E+02
0.169500E+04	0.155731E+02	0.162939E+02	0.148524E+02
0.169600E+04	0.154275E+02	0.161307E+02	0.147242E+02
0.169700E+04	0.154729E+02	0.161823E+02	0.147636E+02
0.169800E+04	0.155553E+02	0.162755E+02	0.148352E+02
0.169900E+04	0.155967E+02	0.163202E+02	0.148733E+02
0.170000E+04	0.156214E+02	0.163459E+02	0.148968E+02
0.170100E+04	0.156400E+02	0.163638E+02	0.149161E+02
0.170200E+04	0.156552E+02	0.163771E+02	0.149332E+02
0.170300E+04	0.156684E+02	0.163878E+02	0.149489E+02
0.170400E+04	0.156802E+02	0.163968E+02	0.149636E+02
0.170500E+04	0.156909E+02	0.164047E+02	0.149772E+02
0.170600E+04	0.157005E+02	0.164113E+02	0.149897E+02
0.170700E+04	0.157091E+02	0.164172E+02	0.150011E+02
0.170800E+04	0.157169E+02	0.164224E+02	0.150115E+02
0.170900E+04	0.157239E+02	0.164268E+02	0.150209E+02
0.171000E+04	0.157302E+02	0.164310E+02	0.150294E+02
0.171100E+04	0.157362E+02	0.164351E+02	0.150373E+02
0.171200E+04	0.157419E+02	0.164391E+02	0.150447E+02
0.171300E+04	0.157472E+02	0.164429E+02	0.150514E+02
0.171400E+04	0.157522E+02	0.164468E+02	0.150577E+02
0.171500E+04	0.157573E+02	0.164508E+02	0.150637E+02
0.171600E+04	0.157624E+02	0.164552E+02	0.150696E+02

0.171700E+04	0.157679E+02	0.164602E+02	0.150755E+02
0.171800E+04	0.157726E+02	0.164645E+02	0.150807E+02
0.171900E+04	0.157778E+02	0.164695E+02	0.150861E+02
0.172000E+04	0.157834E+02	0.164751E+02	0.150917E+02
0.172100E+04	0.157875E+02	0.164790E+02	0.150960E+02
0.172200E+04	0.157904E+02	0.164816E+02	0.150992E+02
0.172300E+04	0.157922E+02	0.164831E+02	0.151014E+02
0.172400E+04	0.157947E+02	0.164854E+02	0.151041E+02
0.172500E+04	0.157980E+02	0.164887E+02	0.151073E+02
0.172600E+04	0.158025E+02	0.164935E+02	0.151114E+02
0.172700E+04	0.158079E+02	0.164995E+02	0.151162E+02
0.172800E+04	0.158140E+02	0.165064E+02	0.151217E+02
0.172900E+04	0.156973E+02	0.163766E+02	0.150180E+02
0.173000E+04	0.156142E+02	0.162820E+02	0.149463E+02
0.173100E+04	0.156949E+02	0.163697E+02	0.150201E+02
0.173200E+04	0.157397E+02	0.164162E+02	0.150632E+02
0.173300E+04	0.157571E+02	0.164387E+02	0.150755E+02
0.173400E+04	0.157614E+02	0.164530E+02	0.150697E+02
0.173500E+04	0.157679E+02	0.164650E+02	0.150708E+02
0.173600E+04	0.157772E+02	0.164781E+02	0.150763E+02
0.173700E+04	0.157852E+02	0.164885E+02	0.150818E+02
0.173800E+04	0.157893E+02	0.164938E+02	0.150848E+02
0.173900E+04	0.157441E+02	0.164411E+02	0.150472E+02
0.174000E+04	0.157109E+02	0.164014E+02	0.150203E+02
0.174100E+04	0.157445E+02	0.164414E+02	0.150475E+02
0.174200E+04	0.157701E+02	0.164725E+02	0.150677E+02
0.174300E+04	0.157796E+02	0.164836E+02	0.150755E+02
0.174400E+04	0.157848E+02	0.164894E+02	0.150802E+02
0.174500E+04	0.157889E+02	0.164937E+02	0.150841E+02
0.174600E+04	0.157926E+02	0.164975E+02	0.150877E+02
0.174700E+04	0.157961E+02	0.165011E+02	0.150911E+02
0.174800E+04	0.158034E+02	0.165091E+02	0.150977E+02
0.174900E+04	0.158135E+02	0.165204E+02	0.151066E+02
0.175000E+04	0.158207E+02	0.165282E+02	0.151131E+02
0.175100E+04	0.158239E+02	0.165313E+02	0.151164E+02
0.175200E+04	0.158247E+02	0.165316E+02	0.151178E+02
0.175300E+04	0.158257E+02	0.165321E+02	0.151192E+02
0.175400E+04	0.158261E+02	0.165320E+02	0.151202E+02
0.175500E+04	0.158260E+02	0.165314E+02	0.151205E+02
0.175600E+04	0.158265E+02	0.165316E+02	0.151215E+02
0.175700E+04	0.158289E+02	0.165339E+02	0.151239E+02
0.175800E+04	0.158332E+02	0.165386E+02	0.151279E+02
0.175900E+04	0.158383E+02	0.165441E+02	0.151325E+02
0.176000E+04	0.158424E+02	0.165484E+02	0.151364E+02
0.176100E+04	0.158468E+02	0.165530E+02	0.151406E+02
0.176200E+04	0.158506E+02	0.165569E+02	0.151443E+02
0.176300E+04	0.158516E+02	0.165575E+02	0.151458E+02
0.176400E+04	0.158518E+02	0.165571E+02	0.151465E+02
0.176500E+04	0.158508E+02	0.165554E+02	0.151463E+02
0.176600E+04	0.158489E+02	0.165526E+02	0.151451E+02
0.176700E+04	0.158497E+02	0.165531E+02	0.151463E+02
0.176800E+04	0.158555E+02	0.165594E+02	0.151515E+02
0.176900E+04	0.158640E+02	0.165690E+02	0.151590E+02
0.177000E+04	0.158719E+02	0.165777E+02	0.151661E+02
0.177100E+04	0.158765E+02	0.165825E+02	0.151706E+02
0.177200E+04	0.158784E+02	0.165839E+02	0.151728E+02
0.177300E+04	0.158775E+02	0.165822E+02	0.151728E+02
0.177400E+04	0.158751E+02	0.165786E+02	0.151715E+02
0.177500E+04	0.158724E+02	0.165749E+02	0.151699E+02
0.177600E+04	0.158705E+02	0.165722E+02	0.151688E+02
0.177700E+04	0.158718E+02	0.165733E+02	0.151703E+02
0.177800E+04	0.158770E+02	0.165791E+02	0.151750E+02
0.177900E+04	0.158837E+02	0.165865E+02	0.151810E+02

0.178000E+04	0.158873E+02	0.165902E+02	0.151844E+02
0.178100E+04	0.158893E+02	0.165920E+02	0.151867E+02
0.178200E+04	0.158898E+02	0.165920E+02	0.151877E+02
0.178300E+04	0.157674E+02	0.164578E+02	0.150771E+02
0.178400E+04	0.156736E+02	0.163494E+02	0.149979E+02
0.178500E+04	0.157525E+02	0.164338E+02	0.150712E+02
0.178600E+04	0.158018E+02	0.164870E+02	0.151165E+02
0.178700E+04	0.158276E+02	0.165178E+02	0.151374E+02
0.178800E+04	0.158417E+02	0.165396E+02	0.151437E+02
0.178900E+04	0.158061E+02	0.164991E+02	0.151131E+02
0.179000E+04	0.157640E+02	0.164491E+02	0.150790E+02
0.179100E+04	0.157842E+02	0.164727E+02	0.150958E+02
0.179200E+04	0.158159E+02	0.165104E+02	0.151215E+02
0.179300E+04	0.158338E+02	0.165312E+02	0.151365E+02
0.179400E+04	0.158438E+02	0.165420E+02	0.151455E+02
0.179500E+04	0.158493E+02	0.165475E+02	0.151511E+02
0.179600E+04	0.158527E+02	0.165504E+02	0.151549E+02
0.179700E+04	0.158553E+02	0.165525E+02	0.151581E+02
0.179800E+04	0.158573E+02	0.165539E+02	0.151607E+02
0.179900E+04	0.158594E+02	0.165555E+02	0.151633E+02
0.180000E+04	0.158620E+02	0.165577E+02	0.151663E+02
0.180100E+04	0.158675E+02	0.165635E+02	0.151716E+02
0.180200E+04	0.158735E+02	0.165698E+02	0.151772E+02
0.180300E+04	0.158755E+02	0.165714E+02	0.151796E+02
0.180400E+04	0.158761E+02	0.165713E+02	0.151808E+02
0.180500E+04	0.158774E+02	0.165722E+02	0.151826E+02
0.180600E+04	0.158782E+02	0.165726E+02	0.151839E+02
0.180700E+04	0.158777E+02	0.165715E+02	0.151840E+02
0.180800E+04	0.158770E+02	0.165702E+02	0.151839E+02
0.180900E+04	0.156798E+02	0.163468E+02	0.150127E+02
0.181000E+04	0.154564E+02	0.160852E+02	0.148275E+02
0.181100E+04	0.156659E+02	0.161791E+02	0.151526E+02
0.181200E+04	0.157948E+02	0.162886E+02	0.153010E+02
0.181300E+04	0.158754E+02	0.163699E+02	0.153808E+02
0.181400E+04	0.159140E+02	0.164091E+02	0.154189E+02
0.181500E+04	0.157300E+02	0.161986E+02	0.152614E+02
0.181600E+04	0.155212E+02	0.159664E+02	0.150761E+02
0.181700E+04	0.155826E+02	0.160408E+02	0.151244E+02
0.181800E+04	0.157036E+02	0.161897E+02	0.152175E+02
0.181900E+04	0.157867E+02	0.162909E+02	0.152825E+02
0.182000E+04	0.158368E+02	0.163573E+02	0.153163E+02
0.182100E+04	0.158673E+02	0.163991E+02	0.153355E+02
0.182200E+04	0.158894E+02	0.164301E+02	0.153488E+02
0.182300E+04	0.159068E+02	0.164546E+02	0.153589E+02
0.182400E+04	0.159208E+02	0.164745E+02	0.153671E+02
0.182500E+04	0.159330E+02	0.164917E+02	0.153743E+02
0.182600E+04	0.159445E+02	0.165076E+02	0.153815E+02
0.182700E+04	0.159556E+02	0.165226E+02	0.153887E+02
0.182800E+04	0.159835E+02	0.165794E+02	0.153876E+02
0.182900E+04	0.159796E+02	0.165850E+02	0.153742E+02
0.183000E+04	0.159308E+02	0.165369E+02	0.153247E+02
0.183100E+04	0.157253E+02	0.163108E+02	0.151398E+02
0.183200E+04	0.155665E+02	0.161065E+02	0.150265E+02
0.183300E+04	0.156822E+02	0.162418E+02	0.151225E+02
0.183400E+04	0.157923E+02	0.163618E+02	0.152227E+02
0.183500E+04	0.157373E+02	0.162921E+02	0.151825E+02
0.183600E+04	0.156656E+02	0.162096E+02	0.151216E+02
0.183700E+04	0.157342E+02	0.162890E+02	0.151795E+02
0.183800E+04	0.158139E+02	0.163773E+02	0.152504E+02
0.183900E+04	0.158577E+02	0.164278E+02	0.152875E+02
0.184000E+04	0.158444E+02	0.164102E+02	0.152786E+02
0.184100E+04	0.158182E+02	0.163764E+02	0.152600E+02
0.184200E+04	0.158421E+02	0.164056E+02	0.152785E+02

0.184300E+04	0.158322E+02	0.164176E+02	0.152469E+02
0.184400E+04	0.157952E+02	0.163962E+02	0.151943E+02
0.184500E+04	0.158073E+02	0.164286E+02	0.151861E+02
0.184600E+04	0.157933E+02	0.164781E+02	0.151086E+02
0.184700E+04	0.157942E+02	0.165049E+02	0.150835E+02
0.184800E+04	0.157977E+02	0.165265E+02	0.150689E+02
0.184900E+04	0.158031E+02	0.165438E+02	0.150625E+02
0.185000E+04	0.158053E+02	0.165537E+02	0.150568E+02
0.185100E+04	0.158066E+02	0.165582E+02	0.150550E+02
0.185200E+04	0.158093E+02	0.165609E+02	0.150577E+02
0.185300E+04	0.158118E+02	0.165612E+02	0.150624E+02
0.185400E+04	0.157823E+02	0.165229E+02	0.150417E+02
0.185500E+04	0.157610E+02	0.164933E+02	0.150287E+02
0.185600E+04	0.157816E+02	0.165128E+02	0.150503E+02
0.185700E+04	0.157998E+02	0.165298E+02	0.150697E+02
0.185800E+04	0.158138E+02	0.165416E+02	0.150861E+02
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0.186000E+04	0.158439E+02	0.165673E+02	0.151205E+02
0.186100E+04	0.158556E+02	0.165764E+02	0.151347E+02
0.186200E+04	0.158631E+02	0.165810E+02	0.151452E+02
0.186300E+04	0.158682E+02	0.165830E+02	0.151534E+02
0.186400E+04	0.158725E+02	0.165845E+02	0.151606E+02
0.186500E+04	0.158762E+02	0.165856E+02	0.151667E+02
0.186600E+04	0.158791E+02	0.165863E+02	0.151719E+02
0.186700E+04	0.158818E+02	0.165871E+02	0.151765E+02
0.186800E+04	0.158864E+02	0.165905E+02	0.151823E+02
0.186900E+04	0.158952E+02	0.165990E+02	0.151913E+02
0.187000E+04	0.159074E+02	0.166118E+02	0.152030E+02
0.187100E+04	0.159188E+02	0.166238E+02	0.152138E+02
0.187200E+04	0.159268E+02	0.166319E+02	0.152217E+02
0.187300E+04	0.159311E+02	0.166358E+02	0.152265E+02
0.187400E+04	0.159325E+02	0.166363E+02	0.152286E+02
0.187500E+04	0.159323E+02	0.166353E+02	0.152293E+02
0.187600E+04	0.159319E+02	0.166342E+02	0.152296E+02
0.187700E+04	0.159327E+02	0.166346E+02	0.152307E+02
0.187800E+04	0.159343E+02	0.166363E+02	0.152323E+02
0.187900E+04	0.159366E+02	0.166388E+02	0.152344E+02
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0.188400E+04	0.156808E+02	0.163508E+02	0.150108E+02
0.188500E+04	0.157272E+02	0.164051E+02	0.150493E+02
0.188600E+04	0.158103E+02	0.165011E+02	0.151194E+02
0.188700E+04	0.158508E+02	0.165480E+02	0.151536E+02
0.188800E+04	0.158733E+02	0.165744E+02	0.151723E+02
0.188900E+04	0.158892E+02	0.165927E+02	0.151857E+02
0.189000E+04	0.159020E+02	0.166073E+02	0.151966E+02
0.189100E+04	0.159153E+02	0.166225E+02	0.152080E+02
0.189200E+04	0.159293E+02	0.166385E+02	0.152201E+02
0.189300E+04	0.159425E+02	0.166535E+02	0.152315E+02
0.189400E+04	0.159549E+02	0.166675E+02	0.152423E+02
0.189500E+04	0.159644E+02	0.166781E+02	0.152507E+02
0.189600E+04	0.159692E+02	0.166831E+02	0.152552E+02
0.189700E+04	0.159704E+02	0.166840E+02	0.152568E+02
0.189800E+04	0.159709E+02	0.166841E+02	0.152576E+02
0.189900E+04	0.159717E+02	0.166847E+02	0.152587E+02
0.190000E+04	0.159725E+02	0.166854E+02	0.152596E+02
0.190100E+04	0.159725E+02	0.166852E+02	0.152598E+02
0.190200E+04	0.158415E+02	0.165400E+02	0.151430E+02
0.190300E+04	0.156991E+02	0.163760E+02	0.150222E+02
0.190400E+04	0.157540E+02	0.164351E+02	0.150729E+02
0.190500E+04	0.158402E+02	0.165316E+02	0.151487E+02

0.190600E+04	0.158818E+02	0.165821E+02	0.151816E+02
0.190700E+04	0.158887E+02	0.165947E+02	0.151827E+02
0.190800E+04	0.158943E+02	0.166020E+02	0.151867E+02
0.190900E+04	0.159148E+02	0.166258E+02	0.152038E+02
0.191000E+04	0.159284E+02	0.166413E+02	0.152154E+02
0.191100E+04	0.159357E+02	0.166492E+02	0.152223E+02
0.191200E+04	0.158605E+02	0.165604E+02	0.151605E+02
0.191300E+04	0.157888E+02	0.164854E+02	0.150922E+02
0.191400E+04	0.157889E+02	0.164851E+02	0.150926E+02
0.191500E+04	0.158260E+02	0.165284E+02	0.151236E+02
0.191600E+04	0.158772E+02	0.165840E+02	0.151705E+02
0.191700E+04	0.159147E+02	0.166263E+02	0.152031E+02
0.191800E+04	0.159396E+02	0.166543E+02	0.152249E+02
0.191900E+04	0.159552E+02	0.166711E+02	0.152392E+02
0.192000E+04	0.159636E+02	0.166795E+02	0.152478E+02
0.192100E+04	0.159692E+02	0.166845E+02	0.152539E+02
0.192200E+04	0.159736E+02	0.166882E+02	0.152590E+02
0.192300E+04	0.159783E+02	0.166925E+02	0.152641E+02
0.192400E+04	0.159334E+02	0.166389E+02	0.152279E+02
0.192500E+04	0.158851E+02	0.165812E+02	0.151889E+02
0.192600E+04	0.159101E+02	0.166100E+02	0.152102E+02
0.192700E+04	0.159539E+02	0.166622E+02	0.152457E+02
0.192800E+04	0.159806E+02	0.166935E+02	0.152677E+02
0.192900E+04	0.159955E+02	0.167102E+02	0.152808E+02
0.193000E+04	0.160062E+02	0.167216E+02	0.152908E+02
0.193100E+04	0.160147E+02	0.167303E+02	0.152991E+02
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0.193400E+04	0.160333E+02	0.167484E+02	0.153182E+02
0.193500E+04	0.160439E+02	0.167597E+02	0.153281E+02
0.193600E+04	0.160580E+02	0.167751E+02	0.153410E+02
0.193700E+04	0.160697E+02	0.167876E+02	0.153517E+02
0.193800E+04	0.160751E+02	0.167927E+02	0.153574E+02
0.193900E+04	0.160770E+02	0.167937E+02	0.153602E+02
0.194000E+04	0.160769E+02	0.167924E+02	0.153614E+02
0.194100E+04	0.160769E+02	0.167913E+02	0.153624E+02
0.194200E+04	0.160785E+02	0.167923E+02	0.153647E+02
0.194300E+04	0.160805E+02	0.167938E+02	0.153672E+02
0.194400E+04	0.160837E+02	0.167967E+02	0.153706E+02
0.194500E+04	0.160920E+02	0.168057E+02	0.153782E+02
0.194600E+04	0.161022E+02	0.168170E+02	0.153874E+02
0.194700E+04	0.161108E+02	0.168263E+02	0.153953E+02
0.194800E+04	0.161189E+02	0.168349E+02	0.154029E+02
0.194900E+04	0.161238E+02	0.168398E+02	0.154078E+02
0.195000E+04	0.161229E+02	0.168378E+02	0.154080E+02
0.195100E+04	0.161180E+02	0.168311E+02	0.154048E+02
0.195200E+04	0.161140E+02	0.168257E+02	0.154023E+02
0.195300E+04	0.161118E+02	0.168225E+02	0.154010E+02
0.195400E+04	0.161107E+02	0.168208E+02	0.154007E+02
0.195500E+04	0.161130E+02	0.168231E+02	0.154030E+02
0.195600E+04	0.161058E+02	0.168143E+02	0.153973E+02
0.195700E+04	0.161086E+02	0.168173E+02	0.154000E+02
0.195800E+04	0.161306E+02	0.168428E+02	0.154185E+02
0.195900E+04	0.161432E+02	0.168573E+02	0.154291E+02
0.196000E+04	0.161478E+02	0.168621E+02	0.154336E+02
0.196100E+04	0.161340E+02	0.168452E+02	0.154228E+02
0.196200E+04	0.161102E+02	0.168165E+02	0.154038E+02
0.196300E+04	0.160845E+02	0.167860E+02	0.153829E+02
0.196400E+04	0.160362E+02	0.167254E+02	0.153470E+02
0.196500E+04	0.160004E+02	0.166951E+02	0.153057E+02
0.196600E+04	0.159936E+02	0.166874E+02	0.152999E+02
0.196700E+04	0.160167E+02	0.167148E+02	0.153186E+02
0.196800E+04	0.160272E+02	0.167277E+02	0.153266E+02

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0.196900E+04	0.160098E+02	0.167080E+02	0.153116E+02
0.197000E+04	0.160114E+02	0.167100E+02	0.153129E+02
0.197100E+04	0.160408E+02	0.167411E+02	0.153406E+02
0.197200E+04	0.160739E+02	0.167794E+02	0.153683E+02
0.197300E+04	0.160961E+02	0.168053E+02	0.153870E+02
0.197400E+04	0.161001E+02	0.168092E+02	0.153910E+02
0.197500E+04	0.160780E+02	0.167823E+02	0.153737E+02
0.197600E+04	0.160646E+02	0.167656E+02	0.153636E+02
0.197700E+04	0.160929E+02	0.167982E+02	0.153875E+02
0.197800E+04	0.161319E+02	0.168438E+02	0.154199E+02
0.197900E+04	0.161637E+02	0.168806E+02	0.154469E+02
0.198000E+04	0.161950E+02	0.169161E+02	0.154739E+02
0.198100E+04	0.162291E+02	0.169546E+02	0.155036E+02
0.198200E+04	0.161686E+02	0.168823E+02	0.154548E+02
0.198300E+04	0.160240E+02	0.167153E+02	0.153327E+02
0.198400E+04	0.159701E+02	0.166542E+02	0.152859E+02
0.198500E+04	0.160376E+02	0.167323E+02	0.153428E+02
0.198600E+04	0.161041E+02	0.168078E+02	0.154005E+02
0.198700E+04	0.161489E+02	0.168612E+02	0.154366E+02
0.198800E+04	0.161941E+02	0.169136E+02	0.154746E+02
0.198900E+04	0.162427E+02	0.169686E+02	0.155168E+02
0.199000E+04	0.162786E+02	0.170029E+02	0.155543E+02
0.199100E+04	0.162497E+02	0.169631E+02	0.155364E+02
0.199200E+04	0.160918E+02	0.167727E+02	0.154109E+02
0.199300E+04	0.160097E+02	0.166791E+02	0.153402E+02
0.199400E+04	0.160749E+02	0.167535E+02	0.153963E+02
0.199500E+04	0.161539E+02	0.168396E+02	0.154683E+02
0.199600E+04	0.162162E+02	0.169094E+02	0.155229E+02
0.199700E+04	0.162681E+02	0.169693E+02	0.155668E+02
0.199800E+04	0.163186E+02	0.170273E+02	0.156099E+02

```
#          91
# IPCC AR4 Millenium Runs output (vary solar forcing)
# ++++++
#
# Model: Bern2.5CC version with active C-cycle
# -----
# Prescribed forcing timeseries as described in file
# readme_doRuns_IPCC_Chap6_millennium_21jan06.txt
# provided by F. Joos, University of Bern.
#
# Contact:
# -----
# Gian-Kasper Plattner
# Climate and Environmental Physics
# Physics Institute, University of Bern
# Sidlerstrasse 5, CH-3012 Bern, Switzerland
# plattner@climate.unibe.ch
# http://www.climate.unibe.ch/~plattner/
# tel: ++41 (0)31 631-44-67
# fax: ++41 (0)31 631-87-42
#
# Some model setup informations:
# -----
# All runs with horizontal/vertical diffusion
#
# Run with standard ocean parameters
#   as used in Plattner et al. 2001/2002
#   with Kv (diffusivity) 4*10^-5 m2/s
#
# Climate sens. set to ~ 3.2 degrees C
# parameterized see Knutti et al. (Clim. Dyn. 2003)
#
```

```

# Model version is annual mean.
#
# No radiation code, CO2 radiative forcing calculated
# for as RF=5.35*ln(CO2/CO2_preind),
# Non-co2 radiative forcing prescribed according to
# Joos et al. GBC 2001 with updates for solar forcing
#
# More model description:
# -----
# Zonally averaged dynamical ocean with 3 basins and
# Southern Ocean, zonally averaged one layer energy
# and moisture balance atmosphere, thermodynamic
# sea ice (Stocker et al., J. Climate 1992).
#
# Carbon cycle components: Ocean/Atm/Terr.biosphere;
# Ocean carbon cycle is a description of the cycles
# of organic carbon and CaCO3 (Marchal et al., Tellus
# Tellus B), based on Redfield approach using PO4 as
# biolimiting nutrient.
#
# Land Biota: Lund-Jena-Postdam Dynamical Global
# Vegetation Model (LPJ-DGVM)
# at GCM resolution (Gerber et al. 2003, Climate
# Dynamics; Sitch et al. 2003, Global Change Biology)
#
# LPJ forced by Cramer/Leemans annual mean
# climatology plus interannual climate variability
# from Hadley simulation (30-recycled climate) plus
# changes in the fields of surface temperature,
# precipitation, and cloudcover as simulated with the
# Impulse-EOF version of ECHAM-3/LSG in response to
# projected radiative forcing changes.
#
# Land use changes are not explicitly considered.
#
# Impact of climate change on terrestrial C-storage
# included
#
# References:
# -----
# Carbon cycle Ocean: Marchal et al., Tellus 1998
# Carbon cycle Terr. Bio: Sitch et al., GCB 2003
# Gerber et al., Clim. Dyn. 2003
# Ccycle-climate feedbacks and global warming:
# Plattner et al., Tellus 2001
# Plattner et al., GBC 2002
# Non-CO2 forcing: Joos et al., GBC 2001
# Climate model: Stocker et al., J. Climate 1992
# Sea level: Knutti et al., J. Climate 2000
# Global warming Physics: Knutti et al., Nature 2002
# Knutti et al., Cl. Dyn. 2003
# and refs therein.
#
# Output columns:
# -----
# Time (yr AD)
# Global mean air temperature (deg C)
# NH-averaged air temperature (deg C)
# SH-averaged air temperature (deg C)
0.100100E+04 0.159155E+02 0.165835E+02 0.152475E+02
0.100200E+04 0.159209E+02 0.165892E+02 0.152525E+02
0.100300E+04 0.159252E+02 0.165938E+02 0.152567E+02
0.100400E+04 0.158977E+02 0.165611E+02 0.152344E+02

```

0.100500E+04	0.158655E+02	0.165220E+02	0.152089E+02
0.100600E+04	0.158774E+02	0.165361E+02	0.152187E+02
0.100700E+04	0.158992E+02	0.165626E+02	0.152358E+02
0.100800E+04	0.159109E+02	0.165768E+02	0.152449E+02
0.100900E+04	0.159171E+02	0.165843E+02	0.152500E+02
0.101000E+04	0.159213E+02	0.165891E+02	0.152535E+02
0.101100E+04	0.159242E+02	0.165924E+02	0.152560E+02
0.101200E+04	0.159263E+02	0.165946E+02	0.152579E+02
0.101300E+04	0.159279E+02	0.165964E+02	0.152593E+02
0.101400E+04	0.159292E+02	0.165979E+02	0.152606E+02
0.101500E+04	0.158213E+02	0.164710E+02	0.151715E+02
0.101600E+04	0.157214E+02	0.163645E+02	0.150782E+02
0.101700E+04	0.157650E+02	0.164064E+02	0.151236E+02
0.101800E+04	0.158283E+02	0.164797E+02	0.151770E+02
0.101900E+04	0.158570E+02	0.165118E+02	0.152022E+02
0.102000E+04	0.158701E+02	0.165312E+02	0.152089E+02
0.102100E+04	0.158780E+02	0.165447E+02	0.152113E+02
0.102200E+04	0.158856E+02	0.165546E+02	0.152167E+02
0.102300E+04	0.158920E+02	0.165619E+02	0.152220E+02
0.102400E+04	0.158971E+02	0.165676E+02	0.152267E+02
0.102500E+04	0.159014E+02	0.165720E+02	0.152307E+02
0.102600E+04	0.157770E+02	0.164254E+02	0.151285E+02
0.102700E+04	0.156600E+02	0.162963E+02	0.150237E+02
0.102800E+04	0.157085E+02	0.163461E+02	0.150709E+02
0.102900E+04	0.157839E+02	0.164324E+02	0.151353E+02
0.103000E+04	0.158211E+02	0.164751E+02	0.151670E+02
0.103100E+04	0.158403E+02	0.164997E+02	0.151808E+02
0.103200E+04	0.158500E+02	0.165164E+02	0.151835E+02
0.103300E+04	0.158594E+02	0.165285E+02	0.151903E+02
0.103400E+04	0.158673E+02	0.165375E+02	0.151971E+02
0.103500E+04	0.158737E+02	0.165443E+02	0.152032E+02
0.103600E+04	0.158791E+02	0.165496E+02	0.152085E+02
0.103700E+04	0.158835E+02	0.165539E+02	0.152131E+02
0.103800E+04	0.158873E+02	0.165574E+02	0.152171E+02
0.103900E+04	0.158904E+02	0.165603E+02	0.152206E+02
0.104000E+04	0.158931E+02	0.165627E+02	0.152235E+02
0.104100E+04	0.158954E+02	0.165646E+02	0.152261E+02
0.104200E+04	0.158973E+02	0.165663E+02	0.152284E+02
0.104300E+04	0.158990E+02	0.165676E+02	0.152303E+02
0.104400E+04	0.159004E+02	0.165687E+02	0.152320E+02
0.104500E+04	0.159016E+02	0.165697E+02	0.152335E+02
0.104600E+04	0.159027E+02	0.165706E+02	0.152348E+02
0.104700E+04	0.159038E+02	0.165715E+02	0.152361E+02
0.104800E+04	0.159047E+02	0.165722E+02	0.152372E+02
0.104900E+04	0.159055E+02	0.165729E+02	0.152382E+02
0.105000E+04	0.159063E+02	0.165735E+02	0.152392E+02
0.105100E+04	0.159070E+02	0.165740E+02	0.152400E+02
0.105200E+04	0.159077E+02	0.165745E+02	0.152409E+02
0.105300E+04	0.159083E+02	0.165750E+02	0.152416E+02
0.105400E+04	0.159089E+02	0.165754E+02	0.152423E+02
0.105500E+04	0.159095E+02	0.165759E+02	0.152431E+02
0.105600E+04	0.159101E+02	0.165764E+02	0.152438E+02
0.105700E+04	0.159107E+02	0.165769E+02	0.152445E+02
0.105800E+04	0.157526E+02	0.163976E+02	0.151075E+02
0.105900E+04	0.155681E+02	0.161824E+02	0.149539E+02
0.106000E+04	0.157024E+02	0.162482E+02	0.151566E+02
0.106100E+04	0.158714E+02	0.163711E+02	0.153716E+02
0.106200E+04	0.159064E+02	0.163799E+02	0.154328E+02
0.106300E+04	0.158912E+02	0.163588E+02	0.154235E+02
0.106400E+04	0.159282E+02	0.164062E+02	0.154501E+02
0.106500E+04	0.159701E+02	0.164636E+02	0.154766E+02
0.106600E+04	0.159940E+02	0.164998E+02	0.154882E+02
0.106700E+04	0.160082E+02	0.165240E+02	0.154924E+02

0.106800E+04	0.160205E+02	0.165424E+02	0.154986E+02
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0.107000E+04	0.160326E+02	0.165692E+02	0.154960E+02
0.107100E+04	0.160368E+02	0.165792E+02	0.154944E+02
0.107200E+04	0.160401E+02	0.165874E+02	0.154927E+02
0.107300E+04	0.160427E+02	0.165944E+02	0.154910E+02
0.107400E+04	0.160449E+02	0.166004E+02	0.154894E+02
0.107500E+04	0.160467E+02	0.166055E+02	0.154880E+02
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0.107800E+04	0.160504E+02	0.166164E+02	0.154844E+02
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0.108000E+04	0.160218E+02	0.165851E+02	0.154584E+02
0.108100E+04	0.159894E+02	0.165469E+02	0.154319E+02
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0.108300E+04	0.160202E+02	0.165871E+02	0.154533E+02
0.108400E+04	0.160222E+02	0.166017E+02	0.154427E+02
0.108500E+04	0.160174E+02	0.166096E+02	0.154252E+02
0.108600E+04	0.160121E+02	0.166147E+02	0.154095E+02
0.108700E+04	0.159660E+02	0.166182E+02	0.153138E+02
0.108800E+04	0.159316E+02	0.166197E+02	0.152435E+02
0.108900E+04	0.159111E+02	0.166198E+02	0.152025E+02
0.109000E+04	0.158969E+02	0.166188E+02	0.151750E+02
0.109100E+04	0.158874E+02	0.166175E+02	0.151574E+02
0.109200E+04	0.158810E+02	0.166159E+02	0.151460E+02
0.109300E+04	0.158765E+02	0.166143E+02	0.151387E+02
0.109400E+04	0.158754E+02	0.166129E+02	0.151380E+02
0.109500E+04	0.158763E+02	0.166119E+02	0.151407E+02
0.109600E+04	0.158786E+02	0.166114E+02	0.151459E+02
0.109700E+04	0.158099E+02	0.165273E+02	0.150926E+02
0.109800E+04	0.157483E+02	0.164610E+02	0.150355E+02
0.109900E+04	0.157746E+02	0.164875E+02	0.150618E+02
0.110000E+04	0.158230E+02	0.165395E+02	0.151065E+02
0.110100E+04	0.158454E+02	0.165578E+02	0.151331E+02
0.110200E+04	0.158613E+02	0.165715E+02	0.151512E+02
0.110300E+04	0.158743E+02	0.165824E+02	0.151662E+02
0.110400E+04	0.158852E+02	0.165912E+02	0.151792E+02
0.110500E+04	0.158948E+02	0.165988E+02	0.151909E+02
0.110600E+04	0.159034E+02	0.166054E+02	0.152014E+02
0.110700E+04	0.159111E+02	0.166114E+02	0.152108E+02
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0.111000E+04	0.159314E+02	0.166278E+02	0.152350E+02
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0.111700E+04	0.159691E+02	0.166628E+02	0.152753E+02
0.111800E+04	0.159729E+02	0.166667E+02	0.152792E+02
0.111900E+04	0.159765E+02	0.166703E+02	0.152828E+02
0.112000E+04	0.159799E+02	0.166737E+02	0.152861E+02
0.112100E+04	0.159831E+02	0.166770E+02	0.152891E+02
0.112200E+04	0.159861E+02	0.166802E+02	0.152919E+02
0.112300E+04	0.159889E+02	0.166833E+02	0.152946E+02
0.112400E+04	0.159916E+02	0.166862E+02	0.152970E+02
0.112500E+04	0.159942E+02	0.166891E+02	0.152993E+02
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0.112800E+04	0.160014E+02	0.166972E+02	0.153055E+02
0.112900E+04	0.160036E+02	0.166997E+02	0.153074E+02
0.113000E+04	0.160057E+02	0.167022E+02	0.153092E+02

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0.113300E+04	0.160118E+02	0.167093E+02	0.153142E+02
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0.113700E+04	0.160202E+02	0.167192E+02	0.153212E+02
0.113800E+04	0.160222E+02	0.167215E+02	0.153228E+02
0.113900E+04	0.160240E+02	0.167236E+02	0.153244E+02
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0.114100E+04	0.160271E+02	0.167272E+02	0.153270E+02
0.114200E+04	0.160285E+02	0.167288E+02	0.153282E+02
0.114300E+04	0.160298E+02	0.167303E+02	0.153294E+02
0.114400E+04	0.160311E+02	0.167317E+02	0.153304E+02
0.114500E+04	0.160322E+02	0.167330E+02	0.153315E+02
0.114600E+04	0.160333E+02	0.167342E+02	0.153325E+02
0.114700E+04	0.160343E+02	0.167353E+02	0.153333E+02
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0.115100E+04	0.160368E+02	0.167377E+02	0.153358E+02
0.115200E+04	0.160372E+02	0.167381E+02	0.153363E+02
0.115300E+04	0.160375E+02	0.167383E+02	0.153366E+02
0.115400E+04	0.160377E+02	0.167385E+02	0.153370E+02
0.115500E+04	0.160379E+02	0.167386E+02	0.153373E+02
0.115600E+04	0.160380E+02	0.167385E+02	0.153375E+02
0.115700E+04	0.160379E+02	0.167382E+02	0.153376E+02
0.115800E+04	0.160376E+02	0.167377E+02	0.153375E+02
0.115900E+04	0.160372E+02	0.167371E+02	0.153373E+02
0.116000E+04	0.160367E+02	0.167363E+02	0.153371E+02
0.116100E+04	0.160362E+02	0.167355E+02	0.153368E+02
0.116200E+04	0.160358E+02	0.167349E+02	0.153367E+02
0.116300E+04	0.160357E+02	0.167346E+02	0.153368E+02
0.116400E+04	0.160358E+02	0.167345E+02	0.153370E+02
0.116500E+04	0.160359E+02	0.167345E+02	0.153374E+02
0.116600E+04	0.159930E+02	0.166837E+02	0.153022E+02
0.116700E+04	0.159464E+02	0.166292E+02	0.152636E+02
0.116800E+04	0.159600E+02	0.166457E+02	0.152742E+02
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0.117000E+04	0.160004E+02	0.166949E+02	0.153060E+02
0.117100E+04	0.160074E+02	0.167030E+02	0.153119E+02
0.117200E+04	0.160119E+02	0.167079E+02	0.153159E+02
0.117300E+04	0.160150E+02	0.167111E+02	0.153189E+02
0.117400E+04	0.160172E+02	0.167132E+02	0.153212E+02
0.117500E+04	0.157641E+02	0.164281E+02	0.151002E+02
0.117600E+04	0.156187E+02	0.161368E+02	0.151005E+02
0.117700E+04	0.157262E+02	0.162059E+02	0.152466E+02
0.117800E+04	0.158665E+02	0.163478E+02	0.153853E+02
0.117900E+04	0.159583E+02	0.164437E+02	0.154728E+02
0.118000E+04	0.160115E+02	0.165076E+02	0.155154E+02
0.118100E+04	0.160423E+02	0.165479E+02	0.155367E+02
0.118200E+04	0.160629E+02	0.165776E+02	0.155483E+02
0.118300E+04	0.160774E+02	0.166006E+02	0.155543E+02
0.118400E+04	0.160901E+02	0.166188E+02	0.155613E+02
0.118500E+04	0.160976E+02	0.166333E+02	0.155619E+02
0.118600E+04	0.161031E+02	0.166448E+02	0.155615E+02
0.118700E+04	0.161071E+02	0.166539E+02	0.155602E+02
0.118800E+04	0.161099E+02	0.166612E+02	0.155586E+02
0.118900E+04	0.161334E+02	0.167069E+02	0.155598E+02
0.119000E+04	0.161327E+02	0.167065E+02	0.155588E+02
0.119100E+04	0.161322E+02	0.167074E+02	0.155571E+02
0.119200E+04	0.161319E+02	0.167084E+02	0.155553E+02
0.119300E+04	0.161240E+02	0.167094E+02	0.155386E+02

0.119400E+04	0.160214E+02	0.166002E+02	0.154426E+02
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0.119600E+04	0.159470E+02	0.165403E+02	0.153538E+02
0.119700E+04	0.159938E+02	0.166044E+02	0.153832E+02
0.119800E+04	0.159733E+02	0.166301E+02	0.153165E+02
0.119900E+04	0.159482E+02	0.166444E+02	0.152520E+02
0.120000E+04	0.159354E+02	0.166526E+02	0.152182E+02
0.120100E+04	0.159268E+02	0.166569E+02	0.151968E+02
0.120200E+04	0.159216E+02	0.166589E+02	0.151843E+02
0.120300E+04	0.159191E+02	0.166595E+02	0.151786E+02
0.120400E+04	0.159166E+02	0.166591E+02	0.151741E+02
0.120500E+04	0.158664E+02	0.165991E+02	0.151337E+02
0.120600E+04	0.158113E+02	0.165312E+02	0.150915E+02
0.120700E+04	0.158427E+02	0.165735E+02	0.151118E+02
0.120800E+04	0.158776E+02	0.166097E+02	0.151455E+02
0.120900E+04	0.158981E+02	0.166288E+02	0.151674E+02
0.121000E+04	0.159110E+02	0.166387E+02	0.151834E+02
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0.121200E+04	0.159295E+02	0.166497E+02	0.152093E+02
0.121300E+04	0.159368E+02	0.166532E+02	0.152203E+02
0.121400E+04	0.159412E+02	0.166523E+02	0.152302E+02
0.121500E+04	0.159417E+02	0.166451E+02	0.152383E+02
0.121600E+04	0.159454E+02	0.166451E+02	0.152458E+02
0.121700E+04	0.159497E+02	0.166466E+02	0.152527E+02
0.121800E+04	0.159538E+02	0.166485E+02	0.152591E+02
0.121900E+04	0.159578E+02	0.166506E+02	0.152649E+02
0.122000E+04	0.159615E+02	0.166528E+02	0.152702E+02
0.122100E+04	0.159650E+02	0.166550E+02	0.152751E+02
0.122200E+04	0.159684E+02	0.166573E+02	0.152794E+02
0.122300E+04	0.159715E+02	0.166595E+02	0.152834E+02
0.122400E+04	0.159744E+02	0.166618E+02	0.152871E+02
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0.122800E+04	0.159185E+02	0.165928E+02	0.152442E+02
0.122900E+04	0.157488E+02	0.164060E+02	0.150916E+02
0.123000E+04	0.155640E+02	0.161868E+02	0.149411E+02
0.123100E+04	0.157756E+02	0.162876E+02	0.152636E+02
0.123200E+04	0.159056E+02	0.163980E+02	0.154133E+02
0.123300E+04	0.159822E+02	0.164718E+02	0.154927E+02
0.123400E+04	0.160216E+02	0.165128E+02	0.155304E+02
0.123500E+04	0.160469E+02	0.165448E+02	0.155489E+02
0.123600E+04	0.160638E+02	0.165696E+02	0.155579E+02
0.123700E+04	0.160753E+02	0.165892E+02	0.155615E+02
0.123800E+04	0.160834E+02	0.166051E+02	0.155618E+02
0.123900E+04	0.160918E+02	0.166181E+02	0.155654E+02
0.124000E+04	0.160957E+02	0.166290E+02	0.155623E+02
0.124100E+04	0.160987E+02	0.166380E+02	0.155594E+02
0.124200E+04	0.161230E+02	0.166886E+02	0.155574E+02
0.124300E+04	0.161230E+02	0.166895E+02	0.155566E+02
0.124400E+04	0.161223E+02	0.166907E+02	0.155539E+02
0.124500E+04	0.161217E+02	0.166926E+02	0.155509E+02
0.124600E+04	0.161211E+02	0.166942E+02	0.155479E+02
0.124700E+04	0.161202E+02	0.166954E+02	0.155449E+02
0.124800E+04	0.161119E+02	0.166962E+02	0.155277E+02
0.124900E+04	0.161002E+02	0.166964E+02	0.155039E+02
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0.125100E+04	0.160803E+02	0.166953E+02	0.154653E+02
0.125200E+04	0.160221E+02	0.166938E+02	0.153503E+02
0.125300E+04	0.159889E+02	0.166911E+02	0.152866E+02
0.125400E+04	0.159666E+02	0.166870E+02	0.152462E+02
0.125500E+04	0.159499E+02	0.166818E+02	0.152181E+02
0.125600E+04	0.159376E+02	0.166759E+02	0.151992E+02

0.125700E+04	0.159286E+02	0.166699E+02	0.151873E+02
0.125800E+04	0.159206E+02	0.166642E+02	0.151771E+02
0.125900E+04	0.154807E+02	0.161494E+02	0.148121E+02
0.126000E+04	0.152572E+02	0.160683E+02	0.144461E+02
0.126100E+04	0.154588E+02	0.163821E+02	0.145355E+02
0.126200E+04	0.156558E+02	0.165738E+02	0.147379E+02
0.126300E+04	0.157923E+02	0.166953E+02	0.148893E+02
0.126400E+04	0.158568E+02	0.167406E+02	0.149730E+02
0.126500E+04	0.158900E+02	0.167545E+02	0.150255E+02
0.126600E+04	0.159115E+02	0.167589E+02	0.150640E+02
0.126700E+04	0.159227E+02	0.167575E+02	0.150880E+02
0.126800E+04	0.159307E+02	0.167536E+02	0.151077E+02
0.126900E+04	0.159367E+02	0.167486E+02	0.151247E+02
0.127000E+04	0.159415E+02	0.167434E+02	0.151395E+02
0.127100E+04	0.159453E+02	0.167383E+02	0.151523E+02
0.127200E+04	0.159485E+02	0.167336E+02	0.151634E+02
0.127300E+04	0.159510E+02	0.167292E+02	0.151729E+02
0.127400E+04	0.159530E+02	0.167251E+02	0.151809E+02
0.127500E+04	0.158544E+02	0.166053E+02	0.151035E+02
0.127600E+04	0.157431E+02	0.164816E+02	0.150046E+02
0.127700E+04	0.157788E+02	0.165214E+02	0.150362E+02
0.127800E+04	0.158412E+02	0.165867E+02	0.150956E+02
0.127900E+04	0.158710E+02	0.166153E+02	0.151268E+02
0.128000E+04	0.158755E+02	0.166076E+02	0.151434E+02
0.128100E+04	0.158771E+02	0.165999E+02	0.151544E+02
0.128200E+04	0.158361E+02	0.165112E+02	0.151610E+02
0.128300E+04	0.158180E+02	0.164730E+02	0.151631E+02
0.128400E+04	0.158099E+02	0.164557E+02	0.151641E+02
0.128500E+04	0.156680E+02	0.162921E+02	0.150440E+02
0.128600E+04	0.155212E+02	0.161200E+02	0.149223E+02
0.128700E+04	0.156037E+02	0.162401E+02	0.149673E+02
0.128800E+04	0.158194E+02	0.163373E+02	0.153015E+02
0.128900E+04	0.158806E+02	0.163862E+02	0.153750E+02
0.129000E+04	0.159281E+02	0.164155E+02	0.154407E+02
0.129100E+04	0.159485E+02	0.164389E+02	0.154580E+02
0.129200E+04	0.159630E+02	0.164605E+02	0.154654E+02
0.129300E+04	0.159730E+02	0.164790E+02	0.154671E+02
0.129400E+04	0.159836E+02	0.164952E+02	0.154720E+02
0.129500E+04	0.158516E+02	0.163463E+02	0.153569E+02
0.129600E+04	0.157273E+02	0.162135E+02	0.152410E+02
0.129700E+04	0.157762E+02	0.162788E+02	0.152737E+02
0.129800E+04	0.158534E+02	0.163750E+02	0.153318E+02
0.129900E+04	0.158826E+02	0.164088E+02	0.153563E+02
0.130000E+04	0.159022E+02	0.164376E+02	0.153668E+02
0.130100E+04	0.159166E+02	0.164602E+02	0.153729E+02
0.130200E+04	0.159277E+02	0.164786E+02	0.153768E+02
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0.130400E+04	0.159437E+02	0.165063E+02	0.153812E+02
0.130500E+04	0.159498E+02	0.165171E+02	0.153825E+02
0.130600E+04	0.159550E+02	0.165265E+02	0.153835E+02
0.130700E+04	0.159595E+02	0.165348E+02	0.153843E+02
0.130800E+04	0.159634E+02	0.165420E+02	0.153849E+02
0.130900E+04	0.159669E+02	0.165483E+02	0.153854E+02
0.131000E+04	0.159925E+02	0.165984E+02	0.153867E+02
0.131100E+04	0.159960E+02	0.166017E+02	0.153903E+02
0.131200E+04	0.159968E+02	0.166020E+02	0.153916E+02
0.131300E+04	0.159915E+02	0.166036E+02	0.153793E+02
0.131400E+04	0.159816E+02	0.166054E+02	0.153578E+02
0.131500E+04	0.159730E+02	0.166070E+02	0.153391E+02
0.131600E+04	0.159365E+02	0.166080E+02	0.152649E+02
0.131700E+04	0.158919E+02	0.166079E+02	0.151758E+02
0.131800E+04	0.158676E+02	0.166061E+02	0.151291E+02
0.131900E+04	0.158506E+02	0.166035E+02	0.150976E+02

0.132000E+04	0.158387E+02	0.166006E+02	0.150767E+02
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0.132400E+04	0.158207E+02	0.165893E+02	0.150520E+02
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0.132600E+04	0.158244E+02	0.165863E+02	0.150624E+02
0.132700E+04	0.158276E+02	0.165856E+02	0.150696E+02
0.132800E+04	0.158312E+02	0.165849E+02	0.150774E+02
0.132900E+04	0.157124E+02	0.164412E+02	0.149837E+02
0.133000E+04	0.156000E+02	0.163193E+02	0.148807E+02
0.133100E+04	0.156443E+02	0.163665E+02	0.149222E+02
0.133200E+04	0.157169E+02	0.164435E+02	0.149904E+02
0.133300E+04	0.157558E+02	0.164836E+02	0.150280E+02
0.133400E+04	0.157793E+02	0.165071E+02	0.150516E+02
0.133500E+04	0.157970E+02	0.165239E+02	0.150701E+02
0.133600E+04	0.158117E+02	0.165374E+02	0.150860E+02
0.133700E+04	0.158245E+02	0.165490E+02	0.151000E+02
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0.134000E+04	0.158546E+02	0.165757E+02	0.151335E+02
0.134100E+04	0.158623E+02	0.165823E+02	0.151422E+02
0.134200E+04	0.158690E+02	0.165880E+02	0.151499E+02
0.134300E+04	0.158749E+02	0.165931E+02	0.151568E+02
0.134400E+04	0.158803E+02	0.165976E+02	0.151630E+02
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0.134600E+04	0.156860E+02	0.163782E+02	0.149939E+02
0.134700E+04	0.157263E+02	0.164183E+02	0.150343E+02
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0.134900E+04	0.158240E+02	0.165247E+02	0.151232E+02
0.135000E+04	0.158390E+02	0.165469E+02	0.151311E+02
0.135100E+04	0.158509E+02	0.165625E+02	0.151392E+02
0.135200E+04	0.158613E+02	0.165743E+02	0.151483E+02
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0.135700E+04	0.158942E+02	0.166068E+02	0.151815E+02
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0.136300E+04	0.159155E+02	0.166262E+02	0.152047E+02
0.136400E+04	0.159181E+02	0.166286E+02	0.152076E+02
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0.136900E+04	0.159292E+02	0.166383E+02	0.152201E+02
0.137000E+04	0.159311E+02	0.166400E+02	0.152223E+02
0.137100E+04	0.159330E+02	0.166415E+02	0.152244E+02
0.137200E+04	0.159347E+02	0.166430E+02	0.152265E+02
0.137300E+04	0.159364E+02	0.166444E+02	0.152285E+02
0.137400E+04	0.159380E+02	0.166457E+02	0.152303E+02
0.137500E+04	0.158966E+02	0.165967E+02	0.151964E+02
0.137600E+04	0.158502E+02	0.165415E+02	0.151589E+02
0.137700E+04	0.158650E+02	0.165592E+02	0.151707E+02
0.137800E+04	0.158934E+02	0.165937E+02	0.151931E+02
0.137900E+04	0.159088E+02	0.166121E+02	0.152055E+02
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0.138500E+04	0.159361E+02	0.166400E+02	0.152322E+02
0.138600E+04	0.159378E+02	0.166412E+02	0.152344E+02
0.138700E+04	0.158964E+02	0.165921E+02	0.152007E+02
0.138800E+04	0.158500E+02	0.165366E+02	0.151633E+02
0.138900E+04	0.158645E+02	0.165539E+02	0.151751E+02
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0.139300E+04	0.159206E+02	0.166199E+02	0.152213E+02
0.139400E+04	0.159242E+02	0.166233E+02	0.152250E+02
0.139500E+04	0.159268E+02	0.166256E+02	0.152280E+02
0.139600E+04	0.159285E+02	0.166268E+02	0.152302E+02
0.139700E+04	0.159293E+02	0.166270E+02	0.152317E+02
0.139800E+04	0.159296E+02	0.166266E+02	0.152327E+02
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0.140000E+04	0.159290E+02	0.166246E+02	0.152335E+02
0.140100E+04	0.159285E+02	0.166234E+02	0.152336E+02
0.140200E+04	0.159281E+02	0.166224E+02	0.152338E+02
0.140300E+04	0.159278E+02	0.166215E+02	0.152341E+02
0.140400E+04	0.159274E+02	0.166206E+02	0.152342E+02
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0.140700E+04	0.159262E+02	0.166178E+02	0.152345E+02
0.140800E+04	0.158868E+02	0.165715E+02	0.152022E+02
0.140900E+04	0.158420E+02	0.165183E+02	0.151656E+02
0.141000E+04	0.158664E+02	0.165566E+02	0.151763E+02
0.141100E+04	0.158905E+02	0.165843E+02	0.151967E+02
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0.141700E+04	0.159178E+02	0.166121E+02	0.152234E+02
0.141800E+04	0.159176E+02	0.166111E+02	0.152240E+02
0.141900E+04	0.159169E+02	0.166096E+02	0.152241E+02
0.142000E+04	0.159159E+02	0.166079E+02	0.152239E+02
0.142100E+04	0.159149E+02	0.166062E+02	0.152236E+02
0.142200E+04	0.159140E+02	0.166047E+02	0.152234E+02
0.142300E+04	0.159132E+02	0.166033E+02	0.152231E+02
0.142400E+04	0.159124E+02	0.166020E+02	0.152228E+02
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0.142600E+04	0.159108E+02	0.165994E+02	0.152222E+02
0.142700E+04	0.159100E+02	0.165981E+02	0.152218E+02
0.142800E+04	0.159089E+02	0.165966E+02	0.152212E+02
0.142900E+04	0.159073E+02	0.165945E+02	0.152201E+02
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0.144500E+04	0.158668E+02	0.165480E+02	0.151857E+02

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0.144700E+04	0.158663E+02	0.165471E+02	0.151855E+02
0.144800E+04	0.158660E+02	0.165467E+02	0.151853E+02
0.144900E+04	0.158657E+02	0.165463E+02	0.151852E+02
0.145000E+04	0.158655E+02	0.165459E+02	0.151850E+02
0.145100E+04	0.158652E+02	0.165456E+02	0.151849E+02
0.145200E+04	0.158649E+02	0.165451E+02	0.151847E+02
0.145300E+04	0.156986E+02	0.163494E+02	0.150478E+02
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0.145500E+04	0.157223E+02	0.162074E+02	0.152372E+02
0.145600E+04	0.158517E+02	0.163244E+02	0.153790E+02
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0.146000E+04	0.155383E+02	0.159649E+02	0.151117E+02
0.146100E+04	0.154816E+02	0.159199E+02	0.150434E+02
0.146200E+04	0.156008E+02	0.160635E+02	0.151380E+02
0.146300E+04	0.157161E+02	0.161978E+02	0.152344E+02
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0.146700E+04	0.157648E+02	0.162694E+02	0.152601E+02
0.146800E+04	0.157932E+02	0.163077E+02	0.152787E+02
0.146900E+04	0.158317E+02	0.163593E+02	0.153042E+02
0.147000E+04	0.158545E+02	0.163903E+02	0.153187E+02
0.147100E+04	0.158691E+02	0.164102E+02	0.153280E+02
0.147200E+04	0.158802E+02	0.164253E+02	0.153350E+02
0.147300E+04	0.159115E+02	0.164797E+02	0.153434E+02
0.147400E+04	0.159169E+02	0.164839E+02	0.153498E+02
0.147500E+04	0.159220E+02	0.164894E+02	0.153546E+02
0.147600E+04	0.159266E+02	0.164947E+02	0.153586E+02
0.147700E+04	0.159309E+02	0.164996E+02	0.153622E+02
0.147800E+04	0.159350E+02	0.165043E+02	0.153657E+02
0.147900E+04	0.159388E+02	0.165085E+02	0.153690E+02
0.148000E+04	0.159372E+02	0.165125E+02	0.153620E+02
0.148100E+04	0.158914E+02	0.164707E+02	0.153122E+02
0.148200E+04	0.158569E+02	0.164401E+02	0.152738E+02
0.148300E+04	0.158195E+02	0.164051E+02	0.152338E+02
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0.148500E+04	0.158148E+02	0.164485E+02	0.151811E+02
0.148600E+04	0.157900E+02	0.164782E+02	0.151018E+02
0.148700E+04	0.157779E+02	0.164903E+02	0.150655E+02
0.148800E+04	0.157811E+02	0.164964E+02	0.150659E+02
0.148900E+04	0.157809E+02	0.164998E+02	0.150620E+02
0.149000E+04	0.157796E+02	0.165015E+02	0.150577E+02
0.149100E+04	0.157791E+02	0.165020E+02	0.150562E+02
0.149200E+04	0.157799E+02	0.165020E+02	0.150578E+02
0.149300E+04	0.157818E+02	0.165018E+02	0.150619E+02
0.149400E+04	0.157847E+02	0.165016E+02	0.150678E+02
0.149500E+04	0.157421E+02	0.164482E+02	0.150361E+02
0.149600E+04	0.156978E+02	0.163923E+02	0.150032E+02
0.149700E+04	0.157180E+02	0.164116E+02	0.150243E+02
0.149800E+04	0.157474E+02	0.164401E+02	0.150546E+02
0.149900E+04	0.157617E+02	0.164504E+02	0.150730E+02
0.150000E+04	0.157724E+02	0.164588E+02	0.150861E+02
0.150100E+04	0.157814E+02	0.164655E+02	0.150973E+02
0.150200E+04	0.157892E+02	0.164712E+02	0.151072E+02
0.150300E+04	0.157961E+02	0.164760E+02	0.151162E+02
0.150400E+04	0.157634E+02	0.164350E+02	0.150919E+02
0.150500E+04	0.157249E+02	0.163868E+02	0.150630E+02
0.150600E+04	0.157419E+02	0.164051E+02	0.150788E+02
0.150700E+04	0.157725E+02	0.164402E+02	0.151047E+02
0.150800E+04	0.157905E+02	0.164605E+02	0.151205E+02

0.150900E+04	0.158017E+02	0.164724E+02	0.151309E+02
0.151000E+04	0.158103E+02	0.164812E+02	0.151393E+02
0.151100E+04	0.158174E+02	0.164884E+02	0.151463E+02
0.151200E+04	0.158233E+02	0.164944E+02	0.151523E+02
0.151300E+04	0.158283E+02	0.164993E+02	0.151573E+02
0.151400E+04	0.158325E+02	0.165034E+02	0.151616E+02
0.151500E+04	0.158360E+02	0.165068E+02	0.151652E+02
0.151600E+04	0.158391E+02	0.165099E+02	0.151684E+02
0.151700E+04	0.158418E+02	0.165126E+02	0.151711E+02
0.151800E+04	0.158442E+02	0.165151E+02	0.151734E+02
0.151900E+04	0.158464E+02	0.165174E+02	0.151754E+02
0.152000E+04	0.158485E+02	0.165197E+02	0.151773E+02
0.152100E+04	0.158505E+02	0.165220E+02	0.151790E+02
0.152200E+04	0.158523E+02	0.165241E+02	0.151805E+02
0.152300E+04	0.158541E+02	0.165262E+02	0.151819E+02
0.152400E+04	0.158556E+02	0.165280E+02	0.151832E+02
0.152500E+04	0.158570E+02	0.165298E+02	0.151843E+02
0.152600E+04	0.158584E+02	0.165314E+02	0.151853E+02
0.152700E+04	0.157598E+02	0.164234E+02	0.150961E+02
0.152800E+04	0.156533E+02	0.162994E+02	0.150073E+02
0.152900E+04	0.156942E+02	0.163413E+02	0.150471E+02
0.153000E+04	0.157584E+02	0.164157E+02	0.151010E+02
0.153100E+04	0.157864E+02	0.164467E+02	0.151262E+02
0.153200E+04	0.157988E+02	0.164660E+02	0.151317E+02
0.153300E+04	0.158070E+02	0.164795E+02	0.151346E+02
0.153400E+04	0.158147E+02	0.164895E+02	0.151400E+02
0.153500E+04	0.158212E+02	0.164971E+02	0.151452E+02
0.153600E+04	0.158266E+02	0.165033E+02	0.151499E+02
0.153700E+04	0.158312E+02	0.165085E+02	0.151540E+02
0.153800E+04	0.158351E+02	0.165127E+02	0.151575E+02
0.153900E+04	0.158383E+02	0.165161E+02	0.151606E+02
0.154000E+04	0.158410E+02	0.165189E+02	0.151632E+02
0.154100E+04	0.158435E+02	0.165214E+02	0.151656E+02
0.154200E+04	0.158457E+02	0.165237E+02	0.151677E+02
0.154300E+04	0.158477E+02	0.165258E+02	0.151696E+02
0.154400E+04	0.158495E+02	0.165277E+02	0.151714E+02
0.154500E+04	0.158512E+02	0.165294E+02	0.151730E+02
0.154600E+04	0.158527E+02	0.165310E+02	0.151744E+02
0.154700E+04	0.158541E+02	0.165324E+02	0.151757E+02
0.154800E+04	0.158553E+02	0.165337E+02	0.151769E+02
0.154900E+04	0.158564E+02	0.165349E+02	0.151780E+02
0.155000E+04	0.158574E+02	0.165359E+02	0.151790E+02
0.155100E+04	0.158583E+02	0.165368E+02	0.151798E+02
0.155200E+04	0.158591E+02	0.165375E+02	0.151806E+02
0.155300E+04	0.158597E+02	0.165381E+02	0.151813E+02
0.155400E+04	0.158603E+02	0.165387E+02	0.151819E+02
0.155500E+04	0.158608E+02	0.165391E+02	0.151825E+02
0.155600E+04	0.158612E+02	0.165395E+02	0.151830E+02
0.155700E+04	0.158616E+02	0.165398E+02	0.151834E+02
0.155800E+04	0.158620E+02	0.165401E+02	0.151839E+02
0.155900E+04	0.158623E+02	0.165402E+02	0.151843E+02
0.156000E+04	0.158626E+02	0.165405E+02	0.151848E+02
0.156100E+04	0.158631E+02	0.165409E+02	0.151853E+02
0.156200E+04	0.158636E+02	0.165413E+02	0.151860E+02
0.156300E+04	0.158642E+02	0.165418E+02	0.151866E+02
0.156400E+04	0.157724E+02	0.164418E+02	0.151029E+02
0.156500E+04	0.156692E+02	0.163206E+02	0.150179E+02
0.156600E+04	0.157063E+02	0.163577E+02	0.150550E+02
0.156700E+04	0.157687E+02	0.164302E+02	0.151072E+02
0.156800E+04	0.157953E+02	0.164588E+02	0.151319E+02
0.156900E+04	0.158074E+02	0.164769E+02	0.151379E+02
0.157000E+04	0.157880E+02	0.164580E+02	0.151180E+02
0.157100E+04	0.157674E+02	0.164338E+02	0.151011E+02

0.157200E+04	0.157842E+02	0.164534E+02	0.151150E+02
0.157300E+04	0.158059E+02	0.164792E+02	0.151326E+02
0.157400E+04	0.158187E+02	0.164940E+02	0.151434E+02
0.157500E+04	0.158270E+02	0.165031E+02	0.151509E+02
0.157600E+04	0.158334E+02	0.165097E+02	0.151570E+02
0.157700E+04	0.158386E+02	0.165150E+02	0.151622E+02
0.157800E+04	0.158433E+02	0.165196E+02	0.151670E+02
0.157900E+04	0.158475E+02	0.165236E+02	0.151713E+02
0.158000E+04	0.158512E+02	0.165272E+02	0.151753E+02
0.158100E+04	0.158547E+02	0.165305E+02	0.151789E+02
0.158200E+04	0.158579E+02	0.165334E+02	0.151823E+02
0.158300E+04	0.158609E+02	0.165362E+02	0.151855E+02
0.158400E+04	0.158637E+02	0.165389E+02	0.151885E+02
0.158500E+04	0.158663E+02	0.165412E+02	0.151913E+02
0.158600E+04	0.158686E+02	0.165433E+02	0.151938E+02
0.158700E+04	0.157132E+02	0.163666E+02	0.150598E+02
0.158800E+04	0.154744E+02	0.160886E+02	0.148602E+02
0.158900E+04	0.156158E+02	0.161042E+02	0.151275E+02
0.159000E+04	0.157461E+02	0.162183E+02	0.152740E+02
0.159100E+04	0.158410E+02	0.163176E+02	0.153645E+02
0.159200E+04	0.158870E+02	0.163685E+02	0.154054E+02
0.159300E+04	0.159142E+02	0.164041E+02	0.154242E+02
0.159400E+04	0.159325E+02	0.164313E+02	0.154336E+02
0.159500E+04	0.159455E+02	0.164532E+02	0.154379E+02
0.159600E+04	0.159551E+02	0.164710E+02	0.154392E+02
0.159700E+04	0.159644E+02	0.164859E+02	0.154430E+02
0.159800E+04	0.159701E+02	0.164982E+02	0.154419E+02
0.159900E+04	0.159745E+02	0.165086E+02	0.154403E+02
0.160000E+04	0.160005E+02	0.165604E+02	0.154407E+02
0.160100E+04	0.158122E+02	0.163475E+02	0.152769E+02
0.160200E+04	0.155901E+02	0.160843E+02	0.150960E+02
0.160300E+04	0.156584E+02	0.161822E+02	0.151345E+02
0.160400E+04	0.157541E+02	0.162916E+02	0.152167E+02
0.160500E+04	0.158219E+02	0.163701E+02	0.152738E+02
0.160600E+04	0.158609E+02	0.164181E+02	0.153037E+02
0.160700E+04	0.158846E+02	0.164478E+02	0.153213E+02
0.160800E+04	0.159013E+02	0.164688E+02	0.153337E+02
0.160900E+04	0.159137E+02	0.164844E+02	0.153430E+02
0.161000E+04	0.159234E+02	0.164964E+02	0.153503E+02
0.161100E+04	0.159310E+02	0.165057E+02	0.153562E+02
0.161200E+04	0.159371E+02	0.165130E+02	0.153611E+02
0.161300E+04	0.158360E+02	0.163919E+02	0.152802E+02
0.161400E+04	0.157406E+02	0.162851E+02	0.151960E+02
0.161500E+04	0.157794E+02	0.163302E+02	0.152285E+02
0.161600E+04	0.158420E+02	0.164039E+02	0.152801E+02
0.161700E+04	0.158742E+02	0.164425E+02	0.153060E+02
0.161800E+04	0.158916E+02	0.164651E+02	0.153181E+02
0.161900E+04	0.158932E+02	0.164807E+02	0.153057E+02
0.162000E+04	0.158925E+02	0.164920E+02	0.152929E+02
0.162100E+04	0.158471E+02	0.165003E+02	0.151940E+02
0.162200E+04	0.156965E+02	0.163644E+02	0.150287E+02
0.162300E+04	0.155671E+02	0.162420E+02	0.148922E+02
0.162400E+04	0.156052E+02	0.162909E+02	0.149196E+02
0.162500E+04	0.156690E+02	0.163711E+02	0.149668E+02
0.162600E+04	0.156993E+02	0.164112E+02	0.149874E+02
0.162700E+04	0.157160E+02	0.164336E+02	0.149985E+02
0.162800E+04	0.157286E+02	0.164485E+02	0.150087E+02
0.162900E+04	0.157391E+02	0.164591E+02	0.150191E+02
0.163000E+04	0.157487E+02	0.164672E+02	0.150301E+02
0.163100E+04	0.157575E+02	0.164737E+02	0.150414E+02
0.163200E+04	0.157656E+02	0.164787E+02	0.150526E+02
0.163300E+04	0.157729E+02	0.164825E+02	0.150632E+02
0.163400E+04	0.157794E+02	0.164855E+02	0.150733E+02

0.163500E+04	0.157854E+02	0.164880E+02	0.150828E+02
0.163600E+04	0.157909E+02	0.164902E+02	0.150916E+02
0.163700E+04	0.157960E+02	0.164921E+02	0.150998E+02
0.163800E+04	0.158006E+02	0.164938E+02	0.151074E+02
0.163900E+04	0.158049E+02	0.164955E+02	0.151143E+02
0.164000E+04	0.158090E+02	0.164973E+02	0.151207E+02
0.164100E+04	0.156164E+02	0.162750E+02	0.149578E+02
0.164200E+04	0.153906E+02	0.160159E+02	0.147653E+02
0.164300E+04	0.154635E+02	0.161100E+02	0.148171E+02
0.164400E+04	0.155646E+02	0.162184E+02	0.149108E+02
0.164500E+04	0.156245E+02	0.162818E+02	0.149673E+02
0.164600E+04	0.156531E+02	0.163139E+02	0.149922E+02
0.164700E+04	0.156822E+02	0.163524E+02	0.150120E+02
0.164800E+04	0.157101E+02	0.163854E+02	0.150349E+02
0.164900E+04	0.157302E+02	0.164077E+02	0.150528E+02
0.165000E+04	0.157455E+02	0.164238E+02	0.150671E+02
0.165100E+04	0.157577E+02	0.164364E+02	0.150791E+02
0.165200E+04	0.157678E+02	0.164464E+02	0.150892E+02
0.165300E+04	0.157760E+02	0.164544E+02	0.150976E+02
0.165400E+04	0.157828E+02	0.164609E+02	0.151047E+02
0.165500E+04	0.157884E+02	0.164662E+02	0.151106E+02
0.165600E+04	0.157930E+02	0.164705E+02	0.151154E+02
0.165700E+04	0.157968E+02	0.164741E+02	0.151195E+02
0.165800E+04	0.157999E+02	0.164770E+02	0.151227E+02
0.165900E+04	0.158024E+02	0.164794E+02	0.151254E+02
0.166000E+04	0.158046E+02	0.164816E+02	0.151277E+02
0.166100E+04	0.158068E+02	0.164838E+02	0.151298E+02
0.166200E+04	0.158089E+02	0.164860E+02	0.151317E+02
0.166300E+04	0.158107E+02	0.164879E+02	0.151334E+02
0.166400E+04	0.158124E+02	0.164898E+02	0.151350E+02
0.166500E+04	0.158139E+02	0.164916E+02	0.151363E+02
0.166600E+04	0.158154E+02	0.164932E+02	0.151375E+02
0.166700E+04	0.157219E+02	0.163835E+02	0.150603E+02
0.166800E+04	0.156393E+02	0.162928E+02	0.149858E+02
0.166900E+04	0.156740E+02	0.163283E+02	0.150197E+02
0.167000E+04	0.157309E+02	0.163948E+02	0.150671E+02
0.167100E+04	0.157546E+02	0.164201E+02	0.150892E+02
0.167200E+04	0.157647E+02	0.164366E+02	0.150927E+02
0.167300E+04	0.157717E+02	0.164485E+02	0.150949E+02
0.167400E+04	0.156464E+02	0.163025E+02	0.149903E+02
0.167500E+04	0.155271E+02	0.161725E+02	0.148816E+02
0.167600E+04	0.155809E+02	0.162270E+02	0.149348E+02
0.167700E+04	0.156587E+02	0.163162E+02	0.150011E+02
0.167800E+04	0.156979E+02	0.163612E+02	0.150346E+02
0.167900E+04	0.157186E+02	0.163878E+02	0.150495E+02
0.168000E+04	0.157301E+02	0.164064E+02	0.150538E+02
0.168100E+04	0.156317E+02	0.162918E+02	0.149716E+02
0.168200E+04	0.155379E+02	0.161918E+02	0.148840E+02
0.168300E+04	0.155854E+02	0.162408E+02	0.149301E+02
0.168400E+04	0.156550E+02	0.163166E+02	0.149935E+02
0.168500E+04	0.156910E+02	0.163567E+02	0.150252E+02
0.168600E+04	0.157096E+02	0.163811E+02	0.150380E+02
0.168700E+04	0.157209E+02	0.163983E+02	0.150434E+02
0.168800E+04	0.157316E+02	0.164110E+02	0.150521E+02
0.168900E+04	0.157115E+02	0.163869E+02	0.150362E+02
0.169000E+04	0.156984E+02	0.163702E+02	0.150266E+02
0.169100E+04	0.157224E+02	0.163974E+02	0.150473E+02
0.169200E+04	0.157407E+02	0.164185E+02	0.150628E+02
0.169300E+04	0.157510E+02	0.164299E+02	0.150722E+02
0.169400E+04	0.157587E+02	0.164379E+02	0.150795E+02
0.169500E+04	0.156370E+02	0.163016E+02	0.149724E+02
0.169600E+04	0.155058E+02	0.161448E+02	0.148669E+02
0.169700E+04	0.155564E+02	0.161998E+02	0.149130E+02

0.169800E+04	0.157199E+02	0.162960E+02	0.151438E+02
0.169900E+04	0.158122E+02	0.163454E+02	0.152790E+02
0.170000E+04	0.158754E+02	0.163766E+02	0.153742E+02
0.170100E+04	0.158976E+02	0.164003E+02	0.153949E+02
0.170200E+04	0.159116E+02	0.164191E+02	0.154040E+02
0.170300E+04	0.159205E+02	0.164345E+02	0.154065E+02
0.170400E+04	0.159261E+02	0.164471E+02	0.154052E+02
0.170500E+04	0.159296E+02	0.164575E+02	0.154016E+02
0.170600E+04	0.159315E+02	0.164661E+02	0.153970E+02
0.170700E+04	0.159355E+02	0.164732E+02	0.153978E+02
0.170800E+04	0.159350E+02	0.164792E+02	0.153908E+02
0.170900E+04	0.159350E+02	0.164842E+02	0.153859E+02
0.171000E+04	0.159347E+02	0.164882E+02	0.153812E+02
0.171100E+04	0.159342E+02	0.164915E+02	0.153769E+02
0.171200E+04	0.159335E+02	0.164942E+02	0.153728E+02
0.171300E+04	0.159328E+02	0.164964E+02	0.153692E+02
0.171400E+04	0.159322E+02	0.164984E+02	0.153660E+02
0.171500E+04	0.159316E+02	0.165001E+02	0.153631E+02
0.171600E+04	0.159311E+02	0.165015E+02	0.153606E+02
0.171700E+04	0.159307E+02	0.165030E+02	0.153585E+02
0.171800E+04	0.159305E+02	0.165043E+02	0.153567E+02
0.171900E+04	0.159303E+02	0.165055E+02	0.153551E+02
0.172000E+04	0.159302E+02	0.165066E+02	0.153538E+02
0.172100E+04	0.159253E+02	0.165081E+02	0.153424E+02
0.172200E+04	0.159150E+02	0.165100E+02	0.153200E+02
0.172300E+04	0.159065E+02	0.165122E+02	0.153009E+02
0.172400E+04	0.158735E+02	0.165143E+02	0.152328E+02
0.172500E+04	0.158276E+02	0.165158E+02	0.151394E+02
0.172600E+04	0.158046E+02	0.165163E+02	0.150928E+02
0.172700E+04	0.157892E+02	0.165163E+02	0.150621E+02
0.172800E+04	0.157790E+02	0.165157E+02	0.150422E+02
0.172900E+04	0.156549E+02	0.163865E+02	0.149232E+02
0.173000E+04	0.155742E+02	0.162819E+02	0.148665E+02
0.173100E+04	0.156523E+02	0.163685E+02	0.149361E+02
0.173200E+04	0.156991E+02	0.164177E+02	0.149806E+02
0.173300E+04	0.157211E+02	0.164410E+02	0.150013E+02
0.173400E+04	0.157368E+02	0.164564E+02	0.150171E+02
0.173500E+04	0.157494E+02	0.164676E+02	0.150312E+02
0.173600E+04	0.157606E+02	0.164766E+02	0.150446E+02
0.173700E+04	0.157712E+02	0.164847E+02	0.150577E+02
0.173800E+04	0.157812E+02	0.164920E+02	0.150703E+02
0.173900E+04	0.157401E+02	0.164398E+02	0.150405E+02
0.174000E+04	0.157122E+02	0.164027E+02	0.150218E+02
0.174100E+04	0.157494E+02	0.164427E+02	0.150561E+02
0.174200E+04	0.157783E+02	0.164745E+02	0.150821E+02
0.174300E+04	0.157942E+02	0.164905E+02	0.150979E+02
0.174400E+04	0.158061E+02	0.165016E+02	0.151105E+02
0.174500E+04	0.158159E+02	0.165104E+02	0.151214E+02
0.174600E+04	0.158238E+02	0.165178E+02	0.151299E+02
0.174700E+04	0.158280E+02	0.165242E+02	0.151318E+02
0.174800E+04	0.158320E+02	0.165297E+02	0.151343E+02
0.174900E+04	0.158362E+02	0.165347E+02	0.151376E+02
0.175000E+04	0.158403E+02	0.165393E+02	0.151414E+02
0.175100E+04	0.158445E+02	0.165437E+02	0.151454E+02
0.175200E+04	0.158486E+02	0.165478E+02	0.151495E+02
0.175300E+04	0.158526E+02	0.165517E+02	0.151536E+02
0.175400E+04	0.158565E+02	0.165555E+02	0.151576E+02
0.175500E+04	0.158603E+02	0.165592E+02	0.151615E+02
0.175600E+04	0.158640E+02	0.165628E+02	0.151652E+02
0.175700E+04	0.158675E+02	0.165663E+02	0.151686E+02
0.175800E+04	0.158708E+02	0.165697E+02	0.151720E+02
0.175900E+04	0.158740E+02	0.165729E+02	0.151751E+02
0.176000E+04	0.158771E+02	0.165761E+02	0.151781E+02

0.176100E+04	0.158801E+02	0.165793E+02	0.151809E+02
0.176200E+04	0.158830E+02	0.165824E+02	0.151836E+02
0.176300E+04	0.158858E+02	0.165854E+02	0.151862E+02
0.176400E+04	0.158884E+02	0.165883E+02	0.151886E+02
0.176500E+04	0.158908E+02	0.165908E+02	0.151907E+02
0.176600E+04	0.158928E+02	0.165931E+02	0.151925E+02
0.176700E+04	0.158947E+02	0.165952E+02	0.151942E+02
0.176800E+04	0.158964E+02	0.165971E+02	0.151957E+02
0.176900E+04	0.158980E+02	0.165989E+02	0.151970E+02
0.177000E+04	0.158994E+02	0.166006E+02	0.151983E+02
0.177100E+04	0.159008E+02	0.166022E+02	0.151994E+02
0.177200E+04	0.159019E+02	0.166035E+02	0.152003E+02
0.177300E+04	0.159026E+02	0.166043E+02	0.152009E+02
0.177400E+04	0.159029E+02	0.166047E+02	0.152011E+02
0.177500E+04	0.159031E+02	0.166049E+02	0.152012E+02
0.177600E+04	0.159031E+02	0.166050E+02	0.152012E+02
0.177700E+04	0.159029E+02	0.166049E+02	0.152010E+02
0.177800E+04	0.159026E+02	0.166046E+02	0.152007E+02
0.177900E+04	0.159022E+02	0.166041E+02	0.152003E+02
0.178000E+04	0.159019E+02	0.166037E+02	0.152000E+02
0.178100E+04	0.159018E+02	0.166037E+02	0.151998E+02
0.178200E+04	0.159019E+02	0.166039E+02	0.151999E+02
0.178300E+04	0.157862E+02	0.164735E+02	0.150989E+02
0.178400E+04	0.156921E+02	0.163697E+02	0.150145E+02
0.178500E+04	0.157734E+02	0.164570E+02	0.150898E+02
0.178600E+04	0.158192E+02	0.165063E+02	0.151322E+02
0.178700E+04	0.158388E+02	0.165295E+02	0.151481E+02
0.178800E+04	0.158466E+02	0.165446E+02	0.151487E+02
0.178900E+04	0.158077E+02	0.165008E+02	0.151146E+02
0.179000E+04	0.157643E+02	0.164500E+02	0.150787E+02
0.179100E+04	0.157857E+02	0.164755E+02	0.150959E+02
0.179200E+04	0.158189E+02	0.165152E+02	0.151226E+02
0.179300E+04	0.158376E+02	0.165373E+02	0.151380E+02
0.179400E+04	0.158488E+02	0.165500E+02	0.151477E+02
0.179500E+04	0.158570E+02	0.165588E+02	0.151552E+02
0.179600E+04	0.158633E+02	0.165655E+02	0.151612E+02
0.179700E+04	0.158684E+02	0.165706E+02	0.151662E+02
0.179800E+04	0.158726E+02	0.165747E+02	0.151704E+02
0.179900E+04	0.158760E+02	0.165780E+02	0.151740E+02
0.180000E+04	0.158789E+02	0.165806E+02	0.151771E+02
0.180100E+04	0.158813E+02	0.165828E+02	0.151798E+02
0.180200E+04	0.158833E+02	0.165845E+02	0.151821E+02
0.180300E+04	0.158850E+02	0.165859E+02	0.151841E+02
0.180400E+04	0.158864E+02	0.165871E+02	0.151858E+02
0.180500E+04	0.158877E+02	0.165880E+02	0.151874E+02
0.180600E+04	0.158887E+02	0.165887E+02	0.151887E+02
0.180700E+04	0.158896E+02	0.165892E+02	0.151899E+02
0.180800E+04	0.158903E+02	0.165896E+02	0.151910E+02
0.180900E+04	0.156937E+02	0.163667E+02	0.150207E+02
0.181000E+04	0.154708E+02	0.161056E+02	0.148360E+02
0.181100E+04	0.156805E+02	0.161989E+02	0.151620E+02
0.181200E+04	0.158080E+02	0.163068E+02	0.153092E+02
0.181300E+04	0.158876E+02	0.163885E+02	0.153867E+02
0.181400E+04	0.159217E+02	0.164210E+02	0.154224E+02
0.181500E+04	0.157344E+02	0.162065E+02	0.152623E+02
0.181600E+04	0.155212E+02	0.159690E+02	0.150735E+02
0.181700E+04	0.155783E+02	0.160388E+02	0.151177E+02
0.181800E+04	0.156985E+02	0.161879E+02	0.152091E+02
0.181900E+04	0.157783E+02	0.162838E+02	0.152728E+02
0.182000E+04	0.158270E+02	0.163485E+02	0.153055E+02
0.182100E+04	0.158566E+02	0.163893E+02	0.153239E+02
0.182200E+04	0.158775E+02	0.164188E+02	0.153361E+02
0.182300E+04	0.158929E+02	0.164411E+02	0.153446E+02

0.182400E+04	0.159045E+02	0.164581E+02	0.153508E+02
0.182500E+04	0.159131E+02	0.164711E+02	0.153552E+02
0.182600E+04	0.159197E+02	0.164810E+02	0.153583E+02
0.182700E+04	0.159471E+02	0.165312E+02	0.153629E+02
0.182800E+04	0.159487E+02	0.165311E+02	0.153663E+02
0.182900E+04	0.159501E+02	0.165323E+02	0.153679E+02
0.183000E+04	0.159060E+02	0.164794E+02	0.153326E+02
0.183100E+04	0.157065E+02	0.162509E+02	0.151621E+02
0.183200E+04	0.155492E+02	0.160746E+02	0.150238E+02
0.183300E+04	0.156413E+02	0.161879E+02	0.150946E+02
0.183400E+04	0.157492E+02	0.163092E+02	0.151892E+02
0.183500E+04	0.156914E+02	0.162375E+02	0.151453E+02
0.183600E+04	0.156109E+02	0.161462E+02	0.150756E+02
0.183700E+04	0.156696E+02	0.162156E+02	0.151236E+02
0.183800E+04	0.157467E+02	0.163038E+02	0.151895E+02
0.183900E+04	0.157854E+02	0.163458E+02	0.152249E+02
0.184000E+04	0.157723E+02	0.163285E+02	0.152161E+02
0.184100E+04	0.157485E+02	0.162980E+02	0.151990E+02
0.184200E+04	0.157766E+02	0.163315E+02	0.152216E+02
0.184300E+04	0.157749E+02	0.163440E+02	0.152058E+02
0.184400E+04	0.157535E+02	0.163283E+02	0.151787E+02
0.184500E+04	0.157843E+02	0.163603E+02	0.152082E+02
0.184600E+04	0.158264E+02	0.164106E+02	0.152422E+02
0.184700E+04	0.158368E+02	0.164324E+02	0.152412E+02
0.184800E+04	0.158123E+02	0.164494E+02	0.151752E+02
0.184900E+04	0.157795E+02	0.164617E+02	0.150972E+02
0.185000E+04	0.157642E+02	0.164700E+02	0.150584E+02
0.185100E+04	0.157541E+02	0.164755E+02	0.150328E+02
0.185200E+04	0.157478E+02	0.164792E+02	0.150165E+02
0.185300E+04	0.157431E+02	0.164816E+02	0.150045E+02
0.185400E+04	0.157100E+02	0.164468E+02	0.149732E+02
0.185500E+04	0.156879E+02	0.164214E+02	0.149544E+02
0.185600E+04	0.157083E+02	0.164442E+02	0.149725E+02
0.185700E+04	0.157253E+02	0.164618E+02	0.149887E+02
0.185800E+04	0.157355E+02	0.164701E+02	0.150009E+02
0.185900E+04	0.157441E+02	0.164757E+02	0.150125E+02
0.186000E+04	0.157520E+02	0.164801E+02	0.150238E+02
0.186100E+04	0.157595E+02	0.164841E+02	0.150350E+02
0.186200E+04	0.157668E+02	0.164878E+02	0.150458E+02
0.186300E+04	0.157738E+02	0.164914E+02	0.150562E+02
0.186400E+04	0.157806E+02	0.164951E+02	0.150661E+02
0.186500E+04	0.157871E+02	0.164987E+02	0.150755E+02
0.186600E+04	0.157933E+02	0.165024E+02	0.150843E+02
0.186700E+04	0.157992E+02	0.165059E+02	0.150924E+02
0.186800E+04	0.158047E+02	0.165094E+02	0.150999E+02
0.186900E+04	0.158099E+02	0.165129E+02	0.151069E+02
0.187000E+04	0.158148E+02	0.165164E+02	0.151133E+02
0.187100E+04	0.158195E+02	0.165198E+02	0.151192E+02
0.187200E+04	0.158239E+02	0.165232E+02	0.151246E+02
0.187300E+04	0.158281E+02	0.165266E+02	0.151296E+02
0.187400E+04	0.158321E+02	0.165300E+02	0.151342E+02
0.187500E+04	0.158359E+02	0.165334E+02	0.151385E+02
0.187600E+04	0.158395E+02	0.165367E+02	0.151424E+02
0.187700E+04	0.158430E+02	0.165400E+02	0.151460E+02
0.187800E+04	0.158462E+02	0.165432E+02	0.151493E+02
0.187900E+04	0.158494E+02	0.165464E+02	0.151523E+02
0.188000E+04	0.158523E+02	0.165495E+02	0.151551E+02
0.188100E+04	0.158550E+02	0.165524E+02	0.151577E+02
0.188200E+04	0.158576E+02	0.165552E+02	0.151601E+02
0.188300E+04	0.157276E+02	0.164127E+02	0.150425E+02
0.188400E+04	0.155762E+02	0.162387E+02	0.149137E+02
0.188500E+04	0.156302E+02	0.162938E+02	0.149667E+02
0.188600E+04	0.157171E+02	0.163944E+02	0.150398E+02

0.188700E+04	0.157599E+02	0.164432E+02	0.150767E+02
0.188800E+04	0.157801E+02	0.164716E+02	0.150885E+02
0.188900E+04	0.157942E+02	0.164914E+02	0.150970E+02
0.189000E+04	0.158065E+02	0.165063E+02	0.151066E+02
0.189100E+04	0.158166E+02	0.165180E+02	0.151151E+02
0.189200E+04	0.158250E+02	0.165274E+02	0.151225E+02
0.189300E+04	0.158321E+02	0.165352E+02	0.151289E+02
0.189400E+04	0.158382E+02	0.165418E+02	0.151346E+02
0.189500E+04	0.158436E+02	0.165476E+02	0.151395E+02
0.189600E+04	0.158483E+02	0.165527E+02	0.151439E+02
0.189700E+04	0.158525E+02	0.165572E+02	0.151477E+02
0.189800E+04	0.158561E+02	0.165611E+02	0.151511E+02
0.189900E+04	0.158594E+02	0.165647E+02	0.151541E+02
0.190000E+04	0.158623E+02	0.165678E+02	0.151568E+02
0.190100E+04	0.158650E+02	0.165708E+02	0.151593E+02
0.190200E+04	0.157377E+02	0.164306E+02	0.150448E+02
0.190300E+04	0.155938E+02	0.162649E+02	0.149226E+02
0.190400E+04	0.156473E+02	0.163193E+02	0.149752E+02
0.190500E+04	0.157298E+02	0.164144E+02	0.150453E+02
0.190600E+04	0.157707E+02	0.164608E+02	0.150805E+02
0.190700E+04	0.157759E+02	0.164711E+02	0.150807E+02
0.190800E+04	0.157786E+02	0.164776E+02	0.150795E+02
0.190900E+04	0.157986E+02	0.165017E+02	0.150956E+02
0.191000E+04	0.158145E+02	0.165202E+02	0.151089E+02
0.191100E+04	0.158253E+02	0.165321E+02	0.151185E+02
0.191200E+04	0.157526E+02	0.164464E+02	0.150588E+02
0.191300E+04	0.156824E+02	0.163731E+02	0.149917E+02
0.191400E+04	0.156819E+02	0.163721E+02	0.149918E+02
0.191500E+04	0.157149E+02	0.164106E+02	0.150193E+02
0.191600E+04	0.157597E+02	0.164597E+02	0.150598E+02
0.191700E+04	0.157870E+02	0.164891E+02	0.150850E+02
0.191800E+04	0.158047E+02	0.165085E+02	0.151009E+02
0.191900E+04	0.158181E+02	0.165229E+02	0.151132E+02
0.192000E+04	0.158288E+02	0.165343E+02	0.151234E+02
0.192100E+04	0.158377E+02	0.165434E+02	0.151320E+02
0.192200E+04	0.158453E+02	0.165511E+02	0.151395E+02
0.192300E+04	0.158519E+02	0.165576E+02	0.151462E+02
0.192400E+04	0.158066E+02	0.165036E+02	0.151095E+02
0.192500E+04	0.157542E+02	0.164409E+02	0.150675E+02
0.192600E+04	0.157741E+02	0.164642E+02	0.150841E+02
0.192700E+04	0.158113E+02	0.165087E+02	0.151140E+02
0.192800E+04	0.158326E+02	0.165338E+02	0.151314E+02
0.192900E+04	0.158452E+02	0.165480E+02	0.151424E+02
0.193000E+04	0.158545E+02	0.165580E+02	0.151510E+02
0.193100E+04	0.158618E+02	0.165656E+02	0.151580E+02
0.193200E+04	0.158678E+02	0.165716E+02	0.151640E+02
0.193300E+04	0.158729E+02	0.165766E+02	0.151693E+02
0.193400E+04	0.158774E+02	0.165808E+02	0.151739E+02
0.193500E+04	0.158812E+02	0.165844E+02	0.151781E+02
0.193600E+04	0.158847E+02	0.165875E+02	0.151820E+02
0.193700E+04	0.158879E+02	0.165903E+02	0.151855E+02
0.193800E+04	0.158908E+02	0.165929E+02	0.151888E+02
0.193900E+04	0.158935E+02	0.165952E+02	0.151918E+02
0.194000E+04	0.158961E+02	0.165974E+02	0.151947E+02
0.194100E+04	0.158985E+02	0.165995E+02	0.151974E+02
0.194200E+04	0.159007E+02	0.166014E+02	0.152000E+02
0.194300E+04	0.159029E+02	0.166033E+02	0.152025E+02
0.194400E+04	0.159050E+02	0.166051E+02	0.152049E+02
0.194500E+04	0.159069E+02	0.166066E+02	0.152071E+02
0.194600E+04	0.159084E+02	0.166078E+02	0.152090E+02
0.194700E+04	0.159098E+02	0.166088E+02	0.152107E+02
0.194800E+04	0.159109E+02	0.166096E+02	0.152122E+02
0.194900E+04	0.159120E+02	0.166103E+02	0.152137E+02

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0.195000E+04	0.159129E+02	0.166109E+02	0.152150E+02
0.195100E+04	0.159139E+02	0.166116E+02	0.152162E+02
0.195200E+04	0.159148E+02	0.166122E+02	0.152174E+02
0.195300E+04	0.159157E+02	0.166128E+02	0.152186E+02
0.195400E+04	0.159166E+02	0.166135E+02	0.152197E+02
0.195500E+04	0.159174E+02	0.166141E+02	0.152208E+02
0.195600E+04	0.159023E+02	0.165960E+02	0.152086E+02
0.195700E+04	0.158914E+02	0.165829E+02	0.151999E+02
0.195800E+04	0.159014E+02	0.165945E+02	0.152083E+02
0.195900E+04	0.159089E+02	0.166034E+02	0.152144E+02
0.196000E+04	0.159125E+02	0.166074E+02	0.152176E+02
0.196100E+04	0.158994E+02	0.165919E+02	0.152070E+02
0.196200E+04	0.158791E+02	0.165678E+02	0.151904E+02
0.196300E+04	0.158569E+02	0.165418E+02	0.151720E+02
0.196400E+04	0.158226E+02	0.165066E+02	0.151385E+02
0.196500E+04	0.157740E+02	0.164525E+02	0.150955E+02
0.196600E+04	0.157622E+02	0.164396E+02	0.150848E+02
0.196700E+04	0.157755E+02	0.164560E+02	0.150951E+02
0.196800E+04	0.157741E+02	0.164552E+02	0.150931E+02
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0.197000E+04	0.157379E+02	0.164147E+02	0.150612E+02
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0.197800E+04	0.158060E+02	0.164895E+02	0.151225E+02
0.197900E+04	0.158140E+02	0.164987E+02	0.151293E+02
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0.198400E+04	0.155380E+02	0.161790E+02	0.148970E+02
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0.199300E+04	0.156643E+02	0.161434E+02	0.151852E+02
0.199400E+04	0.157223E+02	0.162167E+02	0.152280E+02
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0.199600E+04	0.158453E+02	0.163735E+02	0.153170E+02
0.199700E+04	0.158789E+02	0.164193E+02	0.153384E+02
0.199800E+04	0.159043E+02	0.164543E+02	0.153543E+02

```
#          91
# IPCC AR4 Millenium Runs output (vary solar forcing)
# ++++++
#
# Model: Bern2.5CC version with active C-cycle
# -----
# Prescribed forcing timeseries as described in file
# readme_doRuns_IPCC_Chap6_millennium_21jan06.txt
# provided by F. Joos, University of Bern.
#
# Contact:
# -----
# Gian-Kasper Plattner
```

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```
# Climate and Environmental Physics
# Physics Institute, University of Bern
# Sidlerstrasse 5, CH-3012 Bern, Switzerland
# plattner@climate.unibe.ch
# http://www.climate.unibe.ch/~plattner/
# tel: ++41 (0)31 631-44-67
# fax: ++41 (0)31 631-87-42
#
# Some model setup informations:
# -----
# All runs with horizontal/vertical diffusion
#
# Run with standard ocean parameters
#   as used in Plattner et al. 2001/2002
#   with kv (diffusivity) 4*10^-5 m2/s
#
# Climate sens. set to ~ 3.2 degrees C
# parameterized see Knutti et al. (Clim. Dyn. 2003)
#
# Model version is annual mean.
#
# No radiation code, CO2 radiative forcing calculated
# for as RF=5.35*ln(CO2/CO2_preind),
# Non-co2 radiative forcing prescribed according to
# Joos et al. GBC 2001 with updates for solar forcing
#
# More model description:
# -----
# Zonally averaged dynamical ocean with 3 basins and
# Southern Ocean, zonally averaged one layer energy
# and moisture balance atmosphere, thermodynamic
# sea ice (Stocker et al., J. Climate 1992).
#
# Carbon cycle components: Ocean/Atm/Terr.biosphere;
# Ocean carbon cycle is a description of the cycles
# of organic carbon and CaCO3 (Marchal et al., Tellus
# Tellus B), based on Redfield approach using PO4 as
# biolimiting nutrient.
#
# Land Biota: Lund-Jena-Postdam Dynamical Global
#   Vegetation Model (LPJ-DGVM)
# at GCM resolution (Gerber et al. 2003, Climate
# Dynamics; Sitch et al. 2003, Global Change Biology)
#
# LPJ forced by Cramer/Leemans annual mean
# climatology plus interannual climate variability
# from Hadley simulation (30-recycled climate) plus
# changes in the fields of surface temperature,
# precipitation, and cloudcover as simulated with the
# Impulse-EOF version of ECHAM-3/LSG in response to
# projected radiative forcing changes.
#
# Land use changes are not explicitly considered.
#
# Impact of climate change on terrestrial C-storage
# included
#
# References:
# -----
# Carbon cycle Ocean: Marchal et al., Tellus 1998
# Carbon cycle Terr. Bio: Sitch et al., GCB 2003
#   Gerber et al., Clim. Dyn. 2003
# Ccycle-climate feedbacks and global warming:
```

```

# Plattner et al., Tellus 2001
# Plattner et al., GBC 2002
# Non-CO2 forcing: Joos et al., GBC 2001
# Climate model: Stocker et al., J. Climate 1992
# Sea level: Knutti et al., J. Climate 2000
# Global warming Physics: Knutti et al., Nature 2002
# Knutti et al., Cl. Dyn. 2003
# and refs therein.
#
# Output columns:
# -----
# Time (yr AD)
# Global mean air temperature (deg C)
# NH-averaged air temperature (deg C)
# SH-averaged air temperature (deg C)
0.100100E+04 0.159155E+02 0.165835E+02 0.152475E+02
0.100200E+04 0.159209E+02 0.165892E+02 0.152525E+02
0.100300E+04 0.159252E+02 0.165938E+02 0.152567E+02
0.100400E+04 0.158977E+02 0.165611E+02 0.152344E+02
0.100500E+04 0.158655E+02 0.165220E+02 0.152089E+02
0.100600E+04 0.158774E+02 0.165361E+02 0.152187E+02
0.100700E+04 0.158992E+02 0.165626E+02 0.152358E+02
0.100800E+04 0.159109E+02 0.165768E+02 0.152449E+02
0.100900E+04 0.159171E+02 0.165843E+02 0.152500E+02
0.101000E+04 0.159213E+02 0.165891E+02 0.152535E+02
0.101100E+04 0.159242E+02 0.165924E+02 0.152560E+02
0.101200E+04 0.159263E+02 0.165946E+02 0.152579E+02
0.101300E+04 0.159279E+02 0.165964E+02 0.152593E+02
0.101400E+04 0.159292E+02 0.165979E+02 0.152606E+02
0.101500E+04 0.158213E+02 0.164710E+02 0.151715E+02
0.101600E+04 0.157214E+02 0.163645E+02 0.150782E+02
0.101700E+04 0.157650E+02 0.164064E+02 0.151236E+02
0.101800E+04 0.158283E+02 0.164797E+02 0.151770E+02
0.101900E+04 0.158570E+02 0.165118E+02 0.152022E+02
0.102000E+04 0.158701E+02 0.165312E+02 0.152089E+02
0.102100E+04 0.158780E+02 0.165447E+02 0.152113E+02
0.102200E+04 0.158856E+02 0.165546E+02 0.152167E+02
0.102300E+04 0.158920E+02 0.165619E+02 0.152220E+02
0.102400E+04 0.158971E+02 0.165676E+02 0.152267E+02
0.102500E+04 0.159014E+02 0.165720E+02 0.152307E+02
0.102600E+04 0.157770E+02 0.164254E+02 0.151285E+02
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0.103000E+04 0.158211E+02 0.164751E+02 0.151670E+02
0.103100E+04 0.158403E+02 0.164997E+02 0.151808E+02
0.103200E+04 0.158500E+02 0.165164E+02 0.151835E+02
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0.103600E+04 0.158791E+02 0.165496E+02 0.152085E+02
0.103700E+04 0.158835E+02 0.165539E+02 0.152131E+02
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0.104800E+04 0.159047E+02 0.165722E+02 0.152372E+02

```

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0.105000E+04	0.159063E+02	0.165735E+02	0.152392E+02
0.105100E+04	0.159070E+02	0.165740E+02	0.152400E+02
0.105200E+04	0.159077E+02	0.165745E+02	0.152409E+02
0.105300E+04	0.159083E+02	0.165750E+02	0.152416E+02
0.105400E+04	0.159089E+02	0.165754E+02	0.152423E+02
0.105500E+04	0.159095E+02	0.165759E+02	0.152431E+02
0.105600E+04	0.159101E+02	0.165764E+02	0.152438E+02
0.105700E+04	0.159107E+02	0.165769E+02	0.152445E+02
0.105800E+04	0.157526E+02	0.163976E+02	0.151075E+02
0.105900E+04	0.155681E+02	0.161824E+02	0.149539E+02
0.106000E+04	0.157024E+02	0.162482E+02	0.151566E+02
0.106100E+04	0.158714E+02	0.163711E+02	0.153716E+02
0.106200E+04	0.159064E+02	0.163799E+02	0.154328E+02
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0.106400E+04	0.159282E+02	0.164062E+02	0.154501E+02
0.106500E+04	0.159701E+02	0.164636E+02	0.154766E+02
0.106600E+04	0.159940E+02	0.164998E+02	0.154882E+02
0.106700E+04	0.160082E+02	0.165240E+02	0.154924E+02
0.106800E+04	0.160205E+02	0.165424E+02	0.154986E+02
0.106900E+04	0.160272E+02	0.165572E+02	0.154971E+02
0.107000E+04	0.160326E+02	0.165692E+02	0.154960E+02
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0.107300E+04	0.160427E+02	0.165944E+02	0.154910E+02
0.107400E+04	0.160449E+02	0.166004E+02	0.154894E+02
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0.113800E+04	0.160222E+02	0.167215E+02	0.153228E+02
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0.115100E+04	0.160368E+02	0.167377E+02	0.153358E+02
0.115200E+04	0.160372E+02	0.167381E+02	0.153363E+02
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0.115500E+04	0.160379E+02	0.167386E+02	0.153373E+02
0.115600E+04	0.160380E+02	0.167385E+02	0.153375E+02
0.115700E+04	0.160379E+02	0.167382E+02	0.153376E+02
0.115800E+04	0.160376E+02	0.167377E+02	0.153375E+02
0.115900E+04	0.160372E+02	0.167371E+02	0.153373E+02
0.116000E+04	0.160367E+02	0.167363E+02	0.153371E+02
0.116100E+04	0.160362E+02	0.167355E+02	0.153368E+02
0.116200E+04	0.160358E+02	0.167349E+02	0.153367E+02
0.116300E+04	0.160357E+02	0.167346E+02	0.153368E+02
0.116400E+04	0.160358E+02	0.167345E+02	0.153370E+02
0.116500E+04	0.160359E+02	0.167345E+02	0.153374E+02
0.116600E+04	0.159930E+02	0.166837E+02	0.153022E+02
0.116700E+04	0.159464E+02	0.166292E+02	0.152636E+02
0.116800E+04	0.159600E+02	0.166457E+02	0.152742E+02
0.116900E+04	0.159866E+02	0.166781E+02	0.152951E+02
0.117000E+04	0.160004E+02	0.166949E+02	0.153060E+02
0.117100E+04	0.160074E+02	0.167030E+02	0.153119E+02
0.117200E+04	0.160119E+02	0.167079E+02	0.153159E+02
0.117300E+04	0.160150E+02	0.167111E+02	0.153189E+02
0.117400E+04	0.160172E+02	0.167132E+02	0.153212E+02

0.117500E+04	0.157641E+02	0.164281E+02	0.151002E+02
0.117600E+04	0.156187E+02	0.161368E+02	0.151005E+02
0.117700E+04	0.157262E+02	0.162059E+02	0.152466E+02
0.117800E+04	0.158665E+02	0.163478E+02	0.153853E+02
0.117900E+04	0.159583E+02	0.164437E+02	0.154728E+02
0.118000E+04	0.160115E+02	0.165076E+02	0.155154E+02
0.118100E+04	0.160423E+02	0.165479E+02	0.155367E+02
0.118200E+04	0.160629E+02	0.165776E+02	0.155483E+02
0.118300E+04	0.160774E+02	0.166006E+02	0.155543E+02
0.118400E+04	0.160901E+02	0.166188E+02	0.155613E+02
0.118500E+04	0.160976E+02	0.166333E+02	0.155619E+02
0.118600E+04	0.161031E+02	0.166448E+02	0.155615E+02
0.118700E+04	0.161071E+02	0.166539E+02	0.155602E+02
0.118800E+04	0.161099E+02	0.166612E+02	0.155586E+02
0.118900E+04	0.161334E+02	0.167069E+02	0.155598E+02
0.119000E+04	0.161327E+02	0.167065E+02	0.155588E+02
0.119100E+04	0.161322E+02	0.167074E+02	0.155571E+02
0.119200E+04	0.161319E+02	0.167084E+02	0.155553E+02
0.119300E+04	0.161240E+02	0.167094E+02	0.155386E+02
0.119400E+04	0.160214E+02	0.166002E+02	0.154426E+02
0.119500E+04	0.159266E+02	0.165069E+02	0.153463E+02
0.119600E+04	0.159470E+02	0.165403E+02	0.153538E+02
0.119700E+04	0.159938E+02	0.166044E+02	0.153832E+02
0.119800E+04	0.159733E+02	0.166301E+02	0.153165E+02
0.119900E+04	0.159482E+02	0.166444E+02	0.152520E+02
0.120000E+04	0.159354E+02	0.166526E+02	0.152182E+02
0.120100E+04	0.159268E+02	0.166569E+02	0.151968E+02
0.120200E+04	0.159216E+02	0.166589E+02	0.151843E+02
0.120300E+04	0.159191E+02	0.166595E+02	0.151786E+02
0.120400E+04	0.159166E+02	0.166591E+02	0.151741E+02
0.120500E+04	0.158664E+02	0.165991E+02	0.151337E+02
0.120600E+04	0.158113E+02	0.165312E+02	0.150915E+02
0.120700E+04	0.158427E+02	0.165735E+02	0.151118E+02
0.120800E+04	0.158776E+02	0.166097E+02	0.151455E+02
0.120900E+04	0.158981E+02	0.166288E+02	0.151674E+02
0.121000E+04	0.159110E+02	0.166387E+02	0.151834E+02
0.121100E+04	0.159211E+02	0.166451E+02	0.151971E+02
0.121200E+04	0.159295E+02	0.166497E+02	0.152093E+02
0.121300E+04	0.159368E+02	0.166532E+02	0.152203E+02
0.121400E+04	0.159412E+02	0.166523E+02	0.152302E+02
0.121500E+04	0.159417E+02	0.166451E+02	0.152383E+02
0.121600E+04	0.159454E+02	0.166451E+02	0.152458E+02
0.121700E+04	0.159497E+02	0.166466E+02	0.152527E+02
0.121800E+04	0.159538E+02	0.166485E+02	0.152591E+02
0.121900E+04	0.159578E+02	0.166506E+02	0.152649E+02
0.122000E+04	0.159615E+02	0.166528E+02	0.152702E+02
0.122100E+04	0.159650E+02	0.166550E+02	0.152751E+02
0.122200E+04	0.159684E+02	0.166573E+02	0.152794E+02
0.122300E+04	0.159715E+02	0.166595E+02	0.152834E+02
0.122400E+04	0.159744E+02	0.166618E+02	0.152871E+02
0.122500E+04	0.159772E+02	0.166640E+02	0.152904E+02
0.122600E+04	0.159798E+02	0.166662E+02	0.152934E+02
0.122700E+04	0.159512E+02	0.166321E+02	0.152703E+02
0.122800E+04	0.159185E+02	0.165928E+02	0.152442E+02
0.122900E+04	0.157488E+02	0.164060E+02	0.150916E+02
0.123000E+04	0.155640E+02	0.161868E+02	0.149411E+02
0.123100E+04	0.157756E+02	0.162876E+02	0.152636E+02
0.123200E+04	0.159056E+02	0.163980E+02	0.154133E+02
0.123300E+04	0.159822E+02	0.164718E+02	0.154927E+02
0.123400E+04	0.160216E+02	0.165128E+02	0.155304E+02
0.123500E+04	0.160469E+02	0.165448E+02	0.155489E+02
0.123600E+04	0.160638E+02	0.165696E+02	0.155579E+02
0.123700E+04	0.160753E+02	0.165892E+02	0.155615E+02

0.123800E+04	0.160834E+02	0.166051E+02	0.155618E+02
0.123900E+04	0.160918E+02	0.166181E+02	0.155654E+02
0.124000E+04	0.160957E+02	0.166290E+02	0.155623E+02
0.124100E+04	0.160987E+02	0.166380E+02	0.155594E+02
0.124200E+04	0.161230E+02	0.166886E+02	0.155574E+02
0.124300E+04	0.161230E+02	0.166895E+02	0.155566E+02
0.124400E+04	0.161223E+02	0.166907E+02	0.155539E+02
0.124500E+04	0.161217E+02	0.166926E+02	0.155509E+02
0.124600E+04	0.161211E+02	0.166942E+02	0.155479E+02
0.124700E+04	0.161202E+02	0.166954E+02	0.155449E+02
0.124800E+04	0.161119E+02	0.166962E+02	0.155277E+02
0.124900E+04	0.161002E+02	0.166964E+02	0.155039E+02
0.125000E+04	0.160896E+02	0.166961E+02	0.154831E+02
0.125100E+04	0.160803E+02	0.166953E+02	0.154653E+02
0.125200E+04	0.160221E+02	0.166938E+02	0.153503E+02
0.125300E+04	0.159889E+02	0.166911E+02	0.152866E+02
0.125400E+04	0.159666E+02	0.166870E+02	0.152462E+02
0.125500E+04	0.159499E+02	0.166818E+02	0.152181E+02
0.125600E+04	0.159376E+02	0.166759E+02	0.151992E+02
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0.125800E+04	0.159206E+02	0.166642E+02	0.151771E+02
0.125900E+04	0.154807E+02	0.161494E+02	0.148121E+02
0.126000E+04	0.152572E+02	0.160683E+02	0.144461E+02
0.126100E+04	0.154588E+02	0.163821E+02	0.145355E+02
0.126200E+04	0.156558E+02	0.165738E+02	0.147379E+02
0.126300E+04	0.157923E+02	0.166953E+02	0.148893E+02
0.126400E+04	0.158568E+02	0.167406E+02	0.149730E+02
0.126500E+04	0.158900E+02	0.167545E+02	0.150255E+02
0.126600E+04	0.159115E+02	0.167589E+02	0.150640E+02
0.126700E+04	0.159227E+02	0.167575E+02	0.150880E+02
0.126800E+04	0.159307E+02	0.167536E+02	0.151077E+02
0.126900E+04	0.159367E+02	0.167486E+02	0.151247E+02
0.127000E+04	0.159415E+02	0.167434E+02	0.151395E+02
0.127100E+04	0.159453E+02	0.167383E+02	0.151523E+02
0.127200E+04	0.159485E+02	0.167336E+02	0.151634E+02
0.127300E+04	0.159510E+02	0.167292E+02	0.151729E+02
0.127400E+04	0.159530E+02	0.167251E+02	0.151809E+02
0.127500E+04	0.158544E+02	0.166053E+02	0.151035E+02
0.127600E+04	0.157431E+02	0.164816E+02	0.150046E+02
0.127700E+04	0.157788E+02	0.165214E+02	0.150362E+02
0.127800E+04	0.158412E+02	0.165867E+02	0.150956E+02
0.127900E+04	0.158710E+02	0.166153E+02	0.151268E+02
0.128000E+04	0.158755E+02	0.166076E+02	0.151434E+02
0.128100E+04	0.158771E+02	0.165999E+02	0.151544E+02
0.128200E+04	0.158361E+02	0.165112E+02	0.151610E+02
0.128300E+04	0.158180E+02	0.164730E+02	0.151631E+02
0.128400E+04	0.158099E+02	0.164557E+02	0.151641E+02
0.128500E+04	0.156680E+02	0.162921E+02	0.150440E+02
0.128600E+04	0.155212E+02	0.161200E+02	0.149223E+02
0.128700E+04	0.156037E+02	0.162401E+02	0.149673E+02
0.128800E+04	0.158194E+02	0.163373E+02	0.153015E+02
0.128900E+04	0.158806E+02	0.163862E+02	0.153750E+02
0.129000E+04	0.159281E+02	0.164155E+02	0.154407E+02
0.129100E+04	0.159485E+02	0.164389E+02	0.154580E+02
0.129200E+04	0.159630E+02	0.164605E+02	0.154654E+02
0.129300E+04	0.159730E+02	0.164790E+02	0.154671E+02
0.129400E+04	0.159836E+02	0.164952E+02	0.154720E+02
0.129500E+04	0.158516E+02	0.163463E+02	0.153569E+02
0.129600E+04	0.157273E+02	0.162135E+02	0.152410E+02
0.129700E+04	0.157762E+02	0.162788E+02	0.152737E+02
0.129800E+04	0.158534E+02	0.163750E+02	0.153318E+02
0.129900E+04	0.158826E+02	0.164088E+02	0.153563E+02
0.130000E+04	0.159022E+02	0.164376E+02	0.153668E+02

0.130100E+04	0.159166E+02	0.164602E+02	0.153729E+02
0.130200E+04	0.159277E+02	0.164786E+02	0.153768E+02
0.130300E+04	0.159365E+02	0.164937E+02	0.153794E+02
0.130400E+04	0.159437E+02	0.165063E+02	0.153812E+02
0.130500E+04	0.159498E+02	0.165171E+02	0.153825E+02
0.130600E+04	0.159550E+02	0.165265E+02	0.153835E+02
0.130700E+04	0.159595E+02	0.165348E+02	0.153843E+02
0.130800E+04	0.159634E+02	0.165420E+02	0.153849E+02
0.130900E+04	0.159669E+02	0.165483E+02	0.153854E+02
0.131000E+04	0.159925E+02	0.165984E+02	0.153867E+02
0.131100E+04	0.159960E+02	0.166017E+02	0.153903E+02
0.131200E+04	0.159968E+02	0.166020E+02	0.153916E+02
0.131300E+04	0.159915E+02	0.166036E+02	0.153793E+02
0.131400E+04	0.159816E+02	0.166054E+02	0.153578E+02
0.131500E+04	0.159730E+02	0.166070E+02	0.153391E+02
0.131600E+04	0.159365E+02	0.166080E+02	0.152649E+02
0.131700E+04	0.158919E+02	0.166079E+02	0.151758E+02
0.131800E+04	0.158676E+02	0.166061E+02	0.151291E+02
0.131900E+04	0.158506E+02	0.166035E+02	0.150976E+02
0.132000E+04	0.158387E+02	0.166006E+02	0.150767E+02
0.132100E+04	0.158288E+02	0.165975E+02	0.150601E+02
0.132200E+04	0.158235E+02	0.165944E+02	0.150526E+02
0.132300E+04	0.158210E+02	0.165916E+02	0.150504E+02
0.132400E+04	0.158207E+02	0.165893E+02	0.150520E+02
0.132500E+04	0.158220E+02	0.165876E+02	0.150563E+02
0.132600E+04	0.158244E+02	0.165863E+02	0.150624E+02
0.132700E+04	0.158276E+02	0.165856E+02	0.150696E+02
0.132800E+04	0.158312E+02	0.165849E+02	0.150774E+02
0.132900E+04	0.157124E+02	0.164412E+02	0.149837E+02
0.133000E+04	0.156000E+02	0.163193E+02	0.148807E+02
0.133100E+04	0.156443E+02	0.163665E+02	0.149222E+02
0.133200E+04	0.157169E+02	0.164435E+02	0.149904E+02
0.133300E+04	0.157558E+02	0.164836E+02	0.150280E+02
0.133400E+04	0.157793E+02	0.165071E+02	0.150516E+02
0.133500E+04	0.157970E+02	0.165239E+02	0.150701E+02
0.133600E+04	0.158117E+02	0.165374E+02	0.150860E+02
0.133700E+04	0.158245E+02	0.165490E+02	0.151000E+02
0.133800E+04	0.158357E+02	0.165590E+02	0.151124E+02
0.133900E+04	0.158458E+02	0.165679E+02	0.151236E+02
0.134000E+04	0.158546E+02	0.165757E+02	0.151335E+02
0.134100E+04	0.158623E+02	0.165823E+02	0.151422E+02
0.134200E+04	0.158690E+02	0.165880E+02	0.151499E+02
0.134300E+04	0.158749E+02	0.165931E+02	0.151568E+02
0.134400E+04	0.158803E+02	0.165976E+02	0.151630E+02
0.134500E+04	0.157810E+02	0.164796E+02	0.150824E+02
0.134600E+04	0.156860E+02	0.163782E+02	0.149939E+02
0.134700E+04	0.157263E+02	0.164183E+02	0.150343E+02
0.134800E+04	0.157903E+02	0.164873E+02	0.150932E+02
0.134900E+04	0.158240E+02	0.165247E+02	0.151232E+02
0.135000E+04	0.158390E+02	0.165469E+02	0.151311E+02
0.135100E+04	0.158509E+02	0.165625E+02	0.151392E+02
0.135200E+04	0.158613E+02	0.165743E+02	0.151483E+02
0.135300E+04	0.158701E+02	0.165835E+02	0.151567E+02
0.135400E+04	0.158775E+02	0.165910E+02	0.151640E+02
0.135500E+04	0.158838E+02	0.165971E+02	0.151705E+02
0.135600E+04	0.158893E+02	0.166023E+02	0.151763E+02
0.135700E+04	0.158942E+02	0.166068E+02	0.151815E+02
0.135800E+04	0.158986E+02	0.166109E+02	0.151863E+02
0.135900E+04	0.159026E+02	0.166145E+02	0.151906E+02
0.136000E+04	0.159062E+02	0.166178E+02	0.151946E+02
0.136100E+04	0.159095E+02	0.166209E+02	0.151982E+02
0.136200E+04	0.159126E+02	0.166236E+02	0.152016E+02
0.136300E+04	0.159155E+02	0.166262E+02	0.152047E+02

0.136400E+04	0.159181E+02	0.166286E+02	0.152076E+02
0.136500E+04	0.159206E+02	0.166308E+02	0.152104E+02
0.136600E+04	0.159229E+02	0.166328E+02	0.152130E+02
0.136700E+04	0.159251E+02	0.166348E+02	0.152155E+02
0.136800E+04	0.159272E+02	0.166366E+02	0.152178E+02
0.136900E+04	0.159292E+02	0.166383E+02	0.152201E+02
0.137000E+04	0.159311E+02	0.166400E+02	0.152223E+02
0.137100E+04	0.159330E+02	0.166415E+02	0.152244E+02
0.137200E+04	0.159347E+02	0.166430E+02	0.152265E+02
0.137300E+04	0.159364E+02	0.166444E+02	0.152285E+02
0.137400E+04	0.159380E+02	0.166457E+02	0.152303E+02
0.137500E+04	0.158966E+02	0.165967E+02	0.151964E+02
0.137600E+04	0.158502E+02	0.165415E+02	0.151589E+02
0.137700E+04	0.158650E+02	0.165592E+02	0.151707E+02
0.137800E+04	0.158934E+02	0.165937E+02	0.151931E+02
0.137900E+04	0.159088E+02	0.166121E+02	0.152055E+02
0.138000E+04	0.159172E+02	0.166217E+02	0.152128E+02
0.138100E+04	0.159231E+02	0.166279E+02	0.152182E+02
0.138200E+04	0.159275E+02	0.166324E+02	0.152227E+02
0.138300E+04	0.159311E+02	0.166357E+02	0.152264E+02
0.138400E+04	0.159339E+02	0.166382E+02	0.152295E+02
0.138500E+04	0.159361E+02	0.166400E+02	0.152322E+02
0.138600E+04	0.159378E+02	0.166412E+02	0.152344E+02
0.138700E+04	0.158964E+02	0.165921E+02	0.152007E+02
0.138800E+04	0.158500E+02	0.165366E+02	0.151633E+02
0.138900E+04	0.158645E+02	0.165539E+02	0.151751E+02
0.139000E+04	0.158926E+02	0.165878E+02	0.151973E+02
0.139100E+04	0.159075E+02	0.166056E+02	0.152094E+02
0.139200E+04	0.159154E+02	0.166145E+02	0.152164E+02
0.139300E+04	0.159206E+02	0.166199E+02	0.152213E+02
0.139400E+04	0.159242E+02	0.166233E+02	0.152250E+02
0.139500E+04	0.159268E+02	0.166256E+02	0.152280E+02
0.139600E+04	0.159285E+02	0.166268E+02	0.152302E+02
0.139700E+04	0.159293E+02	0.166270E+02	0.152317E+02
0.139800E+04	0.159296E+02	0.166266E+02	0.152327E+02
0.139900E+04	0.159295E+02	0.166257E+02	0.152332E+02
0.140000E+04	0.159290E+02	0.166246E+02	0.152335E+02
0.140100E+04	0.159285E+02	0.166234E+02	0.152336E+02
0.140200E+04	0.159281E+02	0.166224E+02	0.152338E+02
0.140300E+04	0.159278E+02	0.166215E+02	0.152341E+02
0.140400E+04	0.159274E+02	0.166206E+02	0.152342E+02
0.140500E+04	0.159270E+02	0.166197E+02	0.152344E+02
0.140600E+04	0.159266E+02	0.166188E+02	0.152345E+02
0.140700E+04	0.159262E+02	0.166178E+02	0.152345E+02
0.140800E+04	0.158868E+02	0.165715E+02	0.152022E+02
0.140900E+04	0.158420E+02	0.165183E+02	0.151656E+02
0.141000E+04	0.158664E+02	0.165566E+02	0.151763E+02
0.141100E+04	0.158905E+02	0.165843E+02	0.151967E+02
0.141200E+04	0.159030E+02	0.165986E+02	0.152075E+02
0.141300E+04	0.159094E+02	0.166055E+02	0.152134E+02
0.141400E+04	0.159135E+02	0.166096E+02	0.152175E+02
0.141500E+04	0.159161E+02	0.166118E+02	0.152204E+02
0.141600E+04	0.159174E+02	0.166124E+02	0.152223E+02
0.141700E+04	0.159178E+02	0.166121E+02	0.152234E+02
0.141800E+04	0.159176E+02	0.166111E+02	0.152240E+02
0.141900E+04	0.159169E+02	0.166096E+02	0.152241E+02
0.142000E+04	0.159159E+02	0.166079E+02	0.152239E+02
0.142100E+04	0.159149E+02	0.166062E+02	0.152236E+02
0.142200E+04	0.159140E+02	0.166047E+02	0.152234E+02
0.142300E+04	0.159132E+02	0.166033E+02	0.152231E+02
0.142400E+04	0.159124E+02	0.166020E+02	0.152228E+02
0.142500E+04	0.159116E+02	0.166007E+02	0.152225E+02
0.142600E+04	0.159108E+02	0.165994E+02	0.152222E+02

0.142700E+04	0.159100E+02	0.165981E+02	0.152218E+02
0.142800E+04	0.159089E+02	0.165966E+02	0.152212E+02
0.142900E+04	0.159073E+02	0.165945E+02	0.152201E+02
0.143000E+04	0.159054E+02	0.165921E+02	0.152188E+02
0.143100E+04	0.159033E+02	0.165894E+02	0.152172E+02
0.143200E+04	0.159011E+02	0.165867E+02	0.152155E+02
0.143300E+04	0.158987E+02	0.165838E+02	0.152137E+02
0.143400E+04	0.158695E+02	0.165499E+02	0.151891E+02
0.143500E+04	0.158398E+02	0.165154E+02	0.151643E+02
0.143600E+04	0.158475E+02	0.165247E+02	0.151703E+02
0.143700E+04	0.158607E+02	0.165407E+02	0.151806E+02
0.143800E+04	0.158662E+02	0.165476E+02	0.151849E+02
0.143900E+04	0.158682E+02	0.165500E+02	0.151863E+02
0.144000E+04	0.158687E+02	0.165506E+02	0.151867E+02
0.144100E+04	0.158684E+02	0.165502E+02	0.151865E+02
0.144200E+04	0.158678E+02	0.165494E+02	0.151862E+02
0.144300E+04	0.158674E+02	0.165489E+02	0.151860E+02
0.144400E+04	0.158671E+02	0.165484E+02	0.151859E+02
0.144500E+04	0.158668E+02	0.165480E+02	0.151857E+02
0.144600E+04	0.158666E+02	0.165475E+02	0.151856E+02
0.144700E+04	0.158663E+02	0.165471E+02	0.151855E+02
0.144800E+04	0.158660E+02	0.165467E+02	0.151853E+02
0.144900E+04	0.158657E+02	0.165463E+02	0.151852E+02
0.145000E+04	0.158655E+02	0.165459E+02	0.151850E+02
0.145100E+04	0.158652E+02	0.165456E+02	0.151849E+02
0.145200E+04	0.158649E+02	0.165451E+02	0.151847E+02
0.145300E+04	0.156986E+02	0.163494E+02	0.150478E+02
0.145400E+04	0.155209E+02	0.161407E+02	0.149010E+02
0.145500E+04	0.157223E+02	0.162074E+02	0.152372E+02
0.145600E+04	0.158517E+02	0.163244E+02	0.153790E+02
0.145700E+04	0.159077E+02	0.163858E+02	0.154296E+02
0.145800E+04	0.159363E+02	0.164214E+02	0.154512E+02
0.145900E+04	0.157969E+02	0.162550E+02	0.153387E+02
0.146000E+04	0.155383E+02	0.159649E+02	0.151117E+02
0.146100E+04	0.154816E+02	0.159199E+02	0.150434E+02
0.146200E+04	0.156008E+02	0.160635E+02	0.151380E+02
0.146300E+04	0.157161E+02	0.161978E+02	0.152344E+02
0.146400E+04	0.157779E+02	0.162756E+02	0.152803E+02
0.146500E+04	0.158130E+02	0.163221E+02	0.153038E+02
0.146600E+04	0.157942E+02	0.163031E+02	0.152853E+02
0.146700E+04	0.157648E+02	0.162694E+02	0.152601E+02
0.146800E+04	0.157932E+02	0.163077E+02	0.152787E+02
0.146900E+04	0.158317E+02	0.163593E+02	0.153042E+02
0.147000E+04	0.158545E+02	0.163903E+02	0.153187E+02
0.147100E+04	0.158691E+02	0.164102E+02	0.153280E+02
0.147200E+04	0.158802E+02	0.164253E+02	0.153350E+02
0.147300E+04	0.159115E+02	0.164797E+02	0.153434E+02
0.147400E+04	0.159169E+02	0.164839E+02	0.153498E+02
0.147500E+04	0.159220E+02	0.164894E+02	0.153546E+02
0.147600E+04	0.159266E+02	0.164947E+02	0.153586E+02
0.147700E+04	0.159309E+02	0.164996E+02	0.153622E+02
0.147800E+04	0.159350E+02	0.165043E+02	0.153657E+02
0.147900E+04	0.159388E+02	0.165085E+02	0.153690E+02
0.148000E+04	0.159372E+02	0.165125E+02	0.153620E+02
0.148100E+04	0.158914E+02	0.164707E+02	0.153122E+02
0.148200E+04	0.158569E+02	0.164401E+02	0.152738E+02
0.148300E+04	0.158195E+02	0.164051E+02	0.152338E+02
0.148400E+04	0.158050E+02	0.164048E+02	0.152052E+02
0.148500E+04	0.158148E+02	0.164485E+02	0.151811E+02
0.148600E+04	0.157900E+02	0.164782E+02	0.151018E+02
0.148700E+04	0.157779E+02	0.164903E+02	0.150655E+02
0.148800E+04	0.157811E+02	0.164964E+02	0.150659E+02
0.148900E+04	0.157809E+02	0.164998E+02	0.150620E+02

0.149000E+04	0.157796E+02	0.165015E+02	0.150577E+02
0.149100E+04	0.157791E+02	0.165020E+02	0.150562E+02
0.149200E+04	0.157799E+02	0.165020E+02	0.150578E+02
0.149300E+04	0.157818E+02	0.165018E+02	0.150619E+02
0.149400E+04	0.157847E+02	0.165016E+02	0.150678E+02
0.149500E+04	0.157421E+02	0.164482E+02	0.150361E+02
0.149600E+04	0.156978E+02	0.163923E+02	0.150032E+02
0.149700E+04	0.157180E+02	0.164116E+02	0.150243E+02
0.149800E+04	0.157474E+02	0.164401E+02	0.150546E+02
0.149900E+04	0.157617E+02	0.164504E+02	0.150730E+02
0.150000E+04	0.157724E+02	0.164588E+02	0.150861E+02
0.150100E+04	0.157814E+02	0.164655E+02	0.150973E+02
0.150200E+04	0.157892E+02	0.164712E+02	0.151072E+02
0.150300E+04	0.157961E+02	0.164760E+02	0.151162E+02
0.150400E+04	0.157634E+02	0.164350E+02	0.150919E+02
0.150500E+04	0.157249E+02	0.163868E+02	0.150630E+02
0.150600E+04	0.157419E+02	0.164051E+02	0.150788E+02
0.150700E+04	0.157725E+02	0.164402E+02	0.151047E+02
0.150800E+04	0.157905E+02	0.164605E+02	0.151205E+02
0.150900E+04	0.158017E+02	0.164724E+02	0.151309E+02
0.151000E+04	0.158103E+02	0.164812E+02	0.151393E+02
0.151100E+04	0.158174E+02	0.164884E+02	0.151463E+02
0.151200E+04	0.158233E+02	0.164944E+02	0.151523E+02
0.151300E+04	0.158283E+02	0.164993E+02	0.151573E+02
0.151400E+04	0.158325E+02	0.165034E+02	0.151616E+02
0.151500E+04	0.158360E+02	0.165068E+02	0.151652E+02
0.151600E+04	0.158391E+02	0.165099E+02	0.151684E+02
0.151700E+04	0.158418E+02	0.165126E+02	0.151711E+02
0.151800E+04	0.158442E+02	0.165151E+02	0.151734E+02
0.151900E+04	0.158464E+02	0.165174E+02	0.151754E+02
0.152000E+04	0.158485E+02	0.165197E+02	0.151773E+02
0.152100E+04	0.158505E+02	0.165220E+02	0.151790E+02
0.152200E+04	0.158523E+02	0.165241E+02	0.151805E+02
0.152300E+04	0.158541E+02	0.165262E+02	0.151819E+02
0.152400E+04	0.158556E+02	0.165280E+02	0.151832E+02
0.152500E+04	0.158570E+02	0.165298E+02	0.151843E+02
0.152600E+04	0.158584E+02	0.165314E+02	0.151853E+02
0.152700E+04	0.157598E+02	0.164234E+02	0.150961E+02
0.152800E+04	0.156533E+02	0.162994E+02	0.150073E+02
0.152900E+04	0.156942E+02	0.163413E+02	0.150471E+02
0.153000E+04	0.157584E+02	0.164157E+02	0.151010E+02
0.153100E+04	0.157864E+02	0.164467E+02	0.151262E+02
0.153200E+04	0.157988E+02	0.164660E+02	0.151317E+02
0.153300E+04	0.158070E+02	0.164795E+02	0.151346E+02
0.153400E+04	0.158147E+02	0.164895E+02	0.151400E+02
0.153500E+04	0.158212E+02	0.164971E+02	0.151452E+02
0.153600E+04	0.158266E+02	0.165033E+02	0.151499E+02
0.153700E+04	0.158312E+02	0.165085E+02	0.151540E+02
0.153800E+04	0.158351E+02	0.165127E+02	0.151575E+02
0.153900E+04	0.158383E+02	0.165161E+02	0.151606E+02
0.154000E+04	0.158410E+02	0.165189E+02	0.151632E+02
0.154100E+04	0.158435E+02	0.165214E+02	0.151656E+02
0.154200E+04	0.158457E+02	0.165237E+02	0.151677E+02
0.154300E+04	0.158477E+02	0.165258E+02	0.151696E+02
0.154400E+04	0.158495E+02	0.165277E+02	0.151714E+02
0.154500E+04	0.158512E+02	0.165294E+02	0.151730E+02
0.154600E+04	0.158527E+02	0.165310E+02	0.151744E+02
0.154700E+04	0.158541E+02	0.165324E+02	0.151757E+02
0.154800E+04	0.158553E+02	0.165337E+02	0.151769E+02
0.154900E+04	0.158564E+02	0.165349E+02	0.151780E+02
0.155000E+04	0.158574E+02	0.165359E+02	0.151790E+02
0.155100E+04	0.158583E+02	0.165368E+02	0.151798E+02
0.155200E+04	0.158591E+02	0.165375E+02	0.151806E+02

0.155300E+04	0.158597E+02	0.165381E+02	0.151813E+02
0.155400E+04	0.158603E+02	0.165387E+02	0.151819E+02
0.155500E+04	0.158608E+02	0.165391E+02	0.151825E+02
0.155600E+04	0.158612E+02	0.165395E+02	0.151830E+02
0.155700E+04	0.158616E+02	0.165398E+02	0.151834E+02
0.155800E+04	0.158620E+02	0.165401E+02	0.151839E+02
0.155900E+04	0.158623E+02	0.165402E+02	0.151843E+02
0.156000E+04	0.158626E+02	0.165405E+02	0.151848E+02
0.156100E+04	0.158631E+02	0.165409E+02	0.151853E+02
0.156200E+04	0.158636E+02	0.165413E+02	0.151860E+02
0.156300E+04	0.158642E+02	0.165418E+02	0.151866E+02
0.156400E+04	0.157724E+02	0.164418E+02	0.151029E+02
0.156500E+04	0.156692E+02	0.163206E+02	0.150179E+02
0.156600E+04	0.157063E+02	0.163577E+02	0.150550E+02
0.156700E+04	0.157687E+02	0.164302E+02	0.151072E+02
0.156800E+04	0.157953E+02	0.164588E+02	0.151319E+02
0.156900E+04	0.158074E+02	0.164769E+02	0.151379E+02
0.157000E+04	0.157880E+02	0.164580E+02	0.151180E+02
0.157100E+04	0.157674E+02	0.164338E+02	0.151011E+02
0.157200E+04	0.157842E+02	0.164534E+02	0.151150E+02
0.157300E+04	0.158059E+02	0.164792E+02	0.151326E+02
0.157400E+04	0.158187E+02	0.164940E+02	0.151434E+02
0.157500E+04	0.158270E+02	0.165031E+02	0.151509E+02
0.157600E+04	0.158334E+02	0.165097E+02	0.151570E+02
0.157700E+04	0.158386E+02	0.165150E+02	0.151622E+02
0.157800E+04	0.158433E+02	0.165196E+02	0.151670E+02
0.157900E+04	0.158475E+02	0.165236E+02	0.151713E+02
0.158000E+04	0.158512E+02	0.165272E+02	0.151753E+02
0.158100E+04	0.158547E+02	0.165305E+02	0.151789E+02
0.158200E+04	0.158579E+02	0.165334E+02	0.151823E+02
0.158300E+04	0.158609E+02	0.165362E+02	0.151855E+02
0.158400E+04	0.158637E+02	0.165389E+02	0.151885E+02
0.158500E+04	0.158663E+02	0.165412E+02	0.151913E+02
0.158600E+04	0.158686E+02	0.165433E+02	0.151938E+02
0.158700E+04	0.157132E+02	0.163666E+02	0.150598E+02
0.158800E+04	0.154744E+02	0.160886E+02	0.148602E+02
0.158900E+04	0.156158E+02	0.161042E+02	0.151275E+02
0.159000E+04	0.157461E+02	0.162183E+02	0.152740E+02
0.159100E+04	0.158410E+02	0.163176E+02	0.153645E+02
0.159200E+04	0.158870E+02	0.163685E+02	0.154054E+02
0.159300E+04	0.159142E+02	0.164041E+02	0.154242E+02
0.159400E+04	0.159325E+02	0.164313E+02	0.154336E+02
0.159500E+04	0.159455E+02	0.164532E+02	0.154379E+02
0.159600E+04	0.159551E+02	0.164710E+02	0.154392E+02
0.159700E+04	0.159644E+02	0.164859E+02	0.154430E+02
0.159800E+04	0.159701E+02	0.164982E+02	0.154419E+02
0.159900E+04	0.159745E+02	0.165086E+02	0.154403E+02
0.160000E+04	0.160005E+02	0.165604E+02	0.154407E+02
0.160100E+04	0.158122E+02	0.163475E+02	0.152769E+02
0.160200E+04	0.155901E+02	0.160843E+02	0.150960E+02
0.160300E+04	0.156584E+02	0.161822E+02	0.151345E+02
0.160400E+04	0.157541E+02	0.162916E+02	0.152167E+02
0.160500E+04	0.158219E+02	0.163701E+02	0.152738E+02
0.160600E+04	0.158609E+02	0.164181E+02	0.153037E+02
0.160700E+04	0.158846E+02	0.164478E+02	0.153213E+02
0.160800E+04	0.159013E+02	0.164688E+02	0.153337E+02
0.160900E+04	0.159137E+02	0.164844E+02	0.153430E+02
0.161000E+04	0.159234E+02	0.164964E+02	0.153503E+02
0.161100E+04	0.159310E+02	0.165057E+02	0.153562E+02
0.161200E+04	0.159371E+02	0.165130E+02	0.153611E+02
0.161300E+04	0.158360E+02	0.163919E+02	0.152802E+02
0.161400E+04	0.157406E+02	0.162851E+02	0.151960E+02
0.161500E+04	0.157794E+02	0.163302E+02	0.152285E+02

0.161600E+04	0.158420E+02	0.164039E+02	0.152801E+02
0.161700E+04	0.158742E+02	0.164425E+02	0.153060E+02
0.161800E+04	0.158916E+02	0.164651E+02	0.153181E+02
0.161900E+04	0.158932E+02	0.164807E+02	0.153057E+02
0.162000E+04	0.158925E+02	0.164920E+02	0.152929E+02
0.162100E+04	0.158471E+02	0.165003E+02	0.151940E+02
0.162200E+04	0.156965E+02	0.163644E+02	0.150287E+02
0.162300E+04	0.155671E+02	0.162420E+02	0.148922E+02
0.162400E+04	0.156052E+02	0.162909E+02	0.149196E+02
0.162500E+04	0.156690E+02	0.163711E+02	0.149668E+02
0.162600E+04	0.156993E+02	0.164112E+02	0.149874E+02
0.162700E+04	0.157160E+02	0.164336E+02	0.149985E+02
0.162800E+04	0.157286E+02	0.164485E+02	0.150087E+02
0.162900E+04	0.157391E+02	0.164591E+02	0.150191E+02
0.163000E+04	0.157487E+02	0.164672E+02	0.150301E+02
0.163100E+04	0.157575E+02	0.164737E+02	0.150414E+02
0.163200E+04	0.157656E+02	0.164787E+02	0.150526E+02
0.163300E+04	0.157729E+02	0.164825E+02	0.150632E+02
0.163400E+04	0.157794E+02	0.164855E+02	0.150733E+02
0.163500E+04	0.157854E+02	0.164880E+02	0.150828E+02
0.163600E+04	0.157909E+02	0.164902E+02	0.150916E+02
0.163700E+04	0.157960E+02	0.164921E+02	0.150998E+02
0.163800E+04	0.158006E+02	0.164938E+02	0.151074E+02
0.163900E+04	0.158049E+02	0.164955E+02	0.151143E+02
0.164000E+04	0.158090E+02	0.164973E+02	0.151207E+02
0.164100E+04	0.156164E+02	0.162750E+02	0.149578E+02
0.164200E+04	0.153906E+02	0.160159E+02	0.147653E+02
0.164300E+04	0.154635E+02	0.161100E+02	0.148171E+02
0.164400E+04	0.155646E+02	0.162184E+02	0.149108E+02
0.164500E+04	0.156245E+02	0.162818E+02	0.149673E+02
0.164600E+04	0.156531E+02	0.163139E+02	0.149922E+02
0.164700E+04	0.156822E+02	0.163524E+02	0.150120E+02
0.164800E+04	0.157101E+02	0.163854E+02	0.150349E+02
0.164900E+04	0.157302E+02	0.164077E+02	0.150528E+02
0.165000E+04	0.157455E+02	0.164238E+02	0.150671E+02
0.165100E+04	0.157577E+02	0.164364E+02	0.150791E+02
0.165200E+04	0.157678E+02	0.164464E+02	0.150892E+02
0.165300E+04	0.157760E+02	0.164544E+02	0.150976E+02
0.165400E+04	0.157828E+02	0.164609E+02	0.151047E+02
0.165500E+04	0.157884E+02	0.164662E+02	0.151106E+02
0.165600E+04	0.157930E+02	0.164705E+02	0.151154E+02
0.165700E+04	0.157968E+02	0.164741E+02	0.151195E+02
0.165800E+04	0.157999E+02	0.164770E+02	0.151227E+02
0.165900E+04	0.158024E+02	0.164794E+02	0.151254E+02
0.166000E+04	0.158046E+02	0.164816E+02	0.151277E+02
0.166100E+04	0.158068E+02	0.164838E+02	0.151298E+02
0.166200E+04	0.158089E+02	0.164860E+02	0.151317E+02
0.166300E+04	0.158107E+02	0.164879E+02	0.151334E+02
0.166400E+04	0.158124E+02	0.164898E+02	0.151350E+02
0.166500E+04	0.158139E+02	0.164916E+02	0.151363E+02
0.166600E+04	0.158154E+02	0.164932E+02	0.151375E+02
0.166700E+04	0.157219E+02	0.163835E+02	0.150603E+02
0.166800E+04	0.156393E+02	0.162928E+02	0.149858E+02
0.166900E+04	0.156740E+02	0.163283E+02	0.150197E+02
0.167000E+04	0.157309E+02	0.163948E+02	0.150671E+02
0.167100E+04	0.157546E+02	0.164201E+02	0.150892E+02
0.167200E+04	0.157647E+02	0.164366E+02	0.150927E+02
0.167300E+04	0.157717E+02	0.164485E+02	0.150949E+02
0.167400E+04	0.156464E+02	0.163025E+02	0.149903E+02
0.167500E+04	0.155271E+02	0.161725E+02	0.148816E+02
0.167600E+04	0.155809E+02	0.162270E+02	0.149348E+02
0.167700E+04	0.156587E+02	0.163162E+02	0.150011E+02
0.167800E+04	0.156979E+02	0.163612E+02	0.150346E+02

0.167900E+04	0.157186E+02	0.163878E+02	0.150495E+02
0.168000E+04	0.157301E+02	0.164064E+02	0.150538E+02
0.168100E+04	0.156317E+02	0.162918E+02	0.149716E+02
0.168200E+04	0.155379E+02	0.161918E+02	0.148840E+02
0.168300E+04	0.155854E+02	0.162408E+02	0.149301E+02
0.168400E+04	0.156550E+02	0.163166E+02	0.149935E+02
0.168500E+04	0.156910E+02	0.163567E+02	0.150252E+02
0.168600E+04	0.157096E+02	0.163811E+02	0.150380E+02
0.168700E+04	0.157209E+02	0.163983E+02	0.150434E+02
0.168800E+04	0.157316E+02	0.164110E+02	0.150521E+02
0.168900E+04	0.157115E+02	0.163869E+02	0.150362E+02
0.169000E+04	0.156984E+02	0.163702E+02	0.150266E+02
0.169100E+04	0.157224E+02	0.163974E+02	0.150473E+02
0.169200E+04	0.157407E+02	0.164185E+02	0.150628E+02
0.169300E+04	0.157510E+02	0.164299E+02	0.150722E+02
0.169400E+04	0.157587E+02	0.164379E+02	0.150795E+02
0.169500E+04	0.156370E+02	0.163016E+02	0.149724E+02
0.169600E+04	0.155058E+02	0.161448E+02	0.148669E+02
0.169700E+04	0.155564E+02	0.161998E+02	0.149130E+02
0.169800E+04	0.157199E+02	0.162960E+02	0.151438E+02
0.169900E+04	0.158122E+02	0.163454E+02	0.152790E+02
0.170000E+04	0.158754E+02	0.163766E+02	0.153742E+02
0.170100E+04	0.158976E+02	0.164003E+02	0.153949E+02
0.170200E+04	0.159116E+02	0.164191E+02	0.154040E+02
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0.170400E+04	0.159261E+02	0.164471E+02	0.154052E+02
0.170500E+04	0.159296E+02	0.164575E+02	0.154016E+02
0.170600E+04	0.159315E+02	0.164661E+02	0.153970E+02
0.170700E+04	0.159355E+02	0.164732E+02	0.153978E+02
0.170800E+04	0.159350E+02	0.164792E+02	0.153908E+02
0.170900E+04	0.159350E+02	0.164842E+02	0.153859E+02
0.171000E+04	0.159347E+02	0.164882E+02	0.153812E+02
0.171100E+04	0.159342E+02	0.164915E+02	0.153769E+02
0.171200E+04	0.159335E+02	0.164942E+02	0.153728E+02
0.171300E+04	0.159328E+02	0.164964E+02	0.153692E+02
0.171400E+04	0.159322E+02	0.164984E+02	0.153660E+02
0.171500E+04	0.159316E+02	0.165001E+02	0.153631E+02
0.171600E+04	0.159311E+02	0.165015E+02	0.153606E+02
0.171700E+04	0.159307E+02	0.165030E+02	0.153585E+02
0.171800E+04	0.159305E+02	0.165043E+02	0.153567E+02
0.171900E+04	0.159303E+02	0.165055E+02	0.153551E+02
0.172000E+04	0.159302E+02	0.165066E+02	0.153538E+02
0.172100E+04	0.159253E+02	0.165081E+02	0.153424E+02
0.172200E+04	0.159150E+02	0.165100E+02	0.153200E+02
0.172300E+04	0.159065E+02	0.165122E+02	0.153009E+02
0.172400E+04	0.158735E+02	0.165143E+02	0.152328E+02
0.172500E+04	0.158276E+02	0.165158E+02	0.151394E+02
0.172600E+04	0.158046E+02	0.165163E+02	0.150928E+02
0.172700E+04	0.157892E+02	0.165163E+02	0.150621E+02
0.172800E+04	0.157790E+02	0.165157E+02	0.150422E+02
0.172900E+04	0.156549E+02	0.163865E+02	0.149232E+02
0.173000E+04	0.155742E+02	0.162819E+02	0.148665E+02
0.173100E+04	0.156523E+02	0.163685E+02	0.149361E+02
0.173200E+04	0.156991E+02	0.164177E+02	0.149806E+02
0.173300E+04	0.157211E+02	0.164410E+02	0.150013E+02
0.173400E+04	0.157368E+02	0.164564E+02	0.150171E+02
0.173500E+04	0.157494E+02	0.164676E+02	0.150312E+02
0.173600E+04	0.157606E+02	0.164766E+02	0.150446E+02
0.173700E+04	0.157712E+02	0.164847E+02	0.150577E+02
0.173800E+04	0.157812E+02	0.164920E+02	0.150703E+02
0.173900E+04	0.157401E+02	0.164398E+02	0.150405E+02
0.174000E+04	0.157122E+02	0.164027E+02	0.150218E+02
0.174100E+04	0.157494E+02	0.164427E+02	0.150561E+02

0.174200E+04	0.157783E+02	0.164745E+02	0.150821E+02
0.174300E+04	0.157942E+02	0.164905E+02	0.150979E+02
0.174400E+04	0.158061E+02	0.165016E+02	0.151105E+02
0.174500E+04	0.158159E+02	0.165104E+02	0.151214E+02
0.174600E+04	0.158238E+02	0.165178E+02	0.151299E+02
0.174700E+04	0.158280E+02	0.165242E+02	0.151318E+02
0.174800E+04	0.158320E+02	0.165297E+02	0.151343E+02
0.174900E+04	0.158362E+02	0.165347E+02	0.151376E+02
0.175000E+04	0.158403E+02	0.165393E+02	0.151414E+02
0.175100E+04	0.158445E+02	0.165437E+02	0.151454E+02
0.175200E+04	0.158486E+02	0.165478E+02	0.151495E+02
0.175300E+04	0.158526E+02	0.165517E+02	0.151536E+02
0.175400E+04	0.158565E+02	0.165555E+02	0.151576E+02
0.175500E+04	0.158603E+02	0.165592E+02	0.151615E+02
0.175600E+04	0.158640E+02	0.165628E+02	0.151652E+02
0.175700E+04	0.158675E+02	0.165663E+02	0.151686E+02
0.175800E+04	0.158708E+02	0.165697E+02	0.151720E+02
0.175900E+04	0.158740E+02	0.165729E+02	0.151751E+02
0.176000E+04	0.158771E+02	0.165761E+02	0.151781E+02
0.176100E+04	0.158801E+02	0.165793E+02	0.151809E+02
0.176200E+04	0.158830E+02	0.165824E+02	0.151836E+02
0.176300E+04	0.158858E+02	0.165854E+02	0.151862E+02
0.176400E+04	0.158884E+02	0.165883E+02	0.151886E+02
0.176500E+04	0.158907E+02	0.165908E+02	0.151906E+02
0.176600E+04	0.158928E+02	0.165931E+02	0.151925E+02
0.176700E+04	0.158948E+02	0.165953E+02	0.151943E+02
0.176800E+04	0.158968E+02	0.165975E+02	0.151960E+02
0.176900E+04	0.158986E+02	0.165997E+02	0.151976E+02
0.177000E+04	0.159004E+02	0.166018E+02	0.151991E+02
0.177100E+04	0.159022E+02	0.166038E+02	0.152006E+02
0.177200E+04	0.159037E+02	0.166055E+02	0.152018E+02
0.177300E+04	0.159048E+02	0.166068E+02	0.152027E+02
0.177400E+04	0.159056E+02	0.166078E+02	0.152034E+02
0.177500E+04	0.159062E+02	0.166085E+02	0.152039E+02
0.177600E+04	0.159067E+02	0.166091E+02	0.152043E+02
0.177700E+04	0.159071E+02	0.166096E+02	0.152046E+02
0.177800E+04	0.159073E+02	0.166099E+02	0.152048E+02
0.177900E+04	0.159075E+02	0.166101E+02	0.152049E+02
0.178000E+04	0.159077E+02	0.166105E+02	0.152050E+02
0.178100E+04	0.159083E+02	0.166111E+02	0.152054E+02
0.178200E+04	0.159090E+02	0.166120E+02	0.152060E+02
0.178300E+04	0.157935E+02	0.164815E+02	0.151055E+02
0.178400E+04	0.157001E+02	0.163788E+02	0.150214E+02
0.178500E+04	0.157815E+02	0.164667E+02	0.150963E+02
0.178600E+04	0.158285E+02	0.165167E+02	0.151403E+02
0.178700E+04	0.158482E+02	0.165407E+02	0.151558E+02
0.178800E+04	0.158572E+02	0.165566E+02	0.151577E+02
0.178900E+04	0.158192E+02	0.165136E+02	0.151247E+02
0.179000E+04	0.157765E+02	0.164634E+02	0.150896E+02
0.179100E+04	0.157986E+02	0.164896E+02	0.151075E+02
0.179200E+04	0.158325E+02	0.165302E+02	0.151348E+02
0.179300E+04	0.158520E+02	0.165532E+02	0.151509E+02
0.179400E+04	0.158640E+02	0.165667E+02	0.151613E+02
0.179500E+04	0.158729E+02	0.165764E+02	0.151694E+02
0.179600E+04	0.158800E+02	0.165840E+02	0.151761E+02
0.179700E+04	0.158859E+02	0.165900E+02	0.151818E+02
0.179800E+04	0.158909E+02	0.165950E+02	0.151868E+02
0.179900E+04	0.158952E+02	0.165992E+02	0.151911E+02
0.180000E+04	0.158989E+02	0.166028E+02	0.151949E+02
0.180100E+04	0.159021E+02	0.166058E+02	0.151984E+02
0.180200E+04	0.159050E+02	0.166085E+02	0.152015E+02
0.180300E+04	0.159076E+02	0.166109E+02	0.152043E+02
0.180400E+04	0.159099E+02	0.166130E+02	0.152068E+02

0.180500E+04	0.159121E+02	0.166149E+02	0.152092E+02
0.180600E+04	0.159140E+02	0.166166E+02	0.152114E+02
0.180700E+04	0.159159E+02	0.166182E+02	0.152135E+02
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0.180900E+04	0.157218E+02	0.163974E+02	0.150462E+02
0.181000E+04	0.154993E+02	0.161375E+02	0.148611E+02
0.181100E+04	0.157017E+02	0.162308E+02	0.151726E+02
0.181200E+04	0.158325E+02	0.163398E+02	0.153252E+02
0.181300E+04	0.159143E+02	0.164185E+02	0.154101E+02
0.181400E+04	0.159529E+02	0.164565E+02	0.154494E+02
0.181500E+04	0.157646E+02	0.162434E+02	0.152857E+02
0.181600E+04	0.155564E+02	0.160077E+02	0.151051E+02
0.181700E+04	0.156148E+02	0.160786E+02	0.151510E+02
0.181800E+04	0.157353E+02	0.162270E+02	0.152435E+02
0.181900E+04	0.158176E+02	0.163268E+02	0.153083E+02
0.182000E+04	0.158677E+02	0.163933E+02	0.153421E+02
0.182100E+04	0.158986E+02	0.164357E+02	0.153615E+02
0.182200E+04	0.159207E+02	0.164668E+02	0.153746E+02
0.182300E+04	0.159374E+02	0.164906E+02	0.153842E+02
0.182400E+04	0.159502E+02	0.165091E+02	0.153913E+02
0.182500E+04	0.159601E+02	0.165235E+02	0.153967E+02
0.182600E+04	0.159679E+02	0.165349E+02	0.154009E+02
0.182700E+04	0.159741E+02	0.165440E+02	0.154042E+02
0.182800E+04	0.159999E+02	0.165907E+02	0.154092E+02
0.182900E+04	0.159912E+02	0.165920E+02	0.153905E+02
0.183000E+04	0.159379E+02	0.165399E+02	0.153359E+02
0.183100E+04	0.157279E+02	0.163124E+02	0.151434E+02
0.183200E+04	0.155800E+02	0.161112E+02	0.150487E+02
0.183300E+04	0.156912E+02	0.162503E+02	0.151321E+02
0.183400E+04	0.158029E+02	0.163730E+02	0.152328E+02
0.183500E+04	0.157465E+02	0.163030E+02	0.151900E+02
0.183600E+04	0.156679E+02	0.162129E+02	0.151230E+02
0.183700E+04	0.157287E+02	0.162837E+02	0.151737E+02
0.183800E+04	0.158057E+02	0.163697E+02	0.152417E+02
0.183900E+04	0.158486E+02	0.164182E+02	0.152791E+02
0.184000E+04	0.158378E+02	0.164036E+02	0.152719E+02
0.184100E+04	0.158158E+02	0.163752E+02	0.152564E+02
0.184200E+04	0.158456E+02	0.164108E+02	0.152804E+02
0.184300E+04	0.158193E+02	0.163896E+02	0.152489E+02
0.184400E+04	0.158042E+02	0.164076E+02	0.152007E+02
0.184500E+04	0.158174E+02	0.164451E+02	0.151897E+02
0.184600E+04	0.158041E+02	0.164926E+02	0.151157E+02
0.184700E+04	0.158029E+02	0.165163E+02	0.150895E+02
0.184800E+04	0.158024E+02	0.165330E+02	0.150719E+02
0.184900E+04	0.158036E+02	0.165450E+02	0.150622E+02
0.185000E+04	0.158055E+02	0.165542E+02	0.150568E+02
0.185100E+04	0.158085E+02	0.165609E+02	0.150560E+02
0.185200E+04	0.158131E+02	0.165659E+02	0.150604E+02
0.185300E+04	0.158188E+02	0.165698E+02	0.150677E+02
0.185400E+04	0.157939E+02	0.165368E+02	0.150510E+02
0.185500E+04	0.157779E+02	0.165132E+02	0.150425E+02
0.185600E+04	0.158030E+02	0.165378E+02	0.150681E+02
0.185700E+04	0.158234E+02	0.165572E+02	0.150896E+02
0.185800E+04	0.158362E+02	0.165672E+02	0.151053E+02
0.185900E+04	0.158468E+02	0.165744E+02	0.151191E+02
0.186000E+04	0.158561E+02	0.165804E+02	0.151318E+02
0.186100E+04	0.158647E+02	0.165858E+02	0.151436E+02
0.186200E+04	0.158729E+02	0.165911E+02	0.151547E+02
0.186300E+04	0.158808E+02	0.165964E+02	0.151652E+02
0.186400E+04	0.158883E+02	0.166016E+02	0.151750E+02
0.186500E+04	0.158954E+02	0.166066E+02	0.151841E+02
0.186600E+04	0.159021E+02	0.166116E+02	0.151926E+02
0.186700E+04	0.159085E+02	0.166165E+02	0.152004E+02

0.186800E+04	0.159146E+02	0.166214E+02	0.152078E+02
0.186900E+04	0.159205E+02	0.166263E+02	0.152146E+02
0.187000E+04	0.159262E+02	0.166313E+02	0.152211E+02
0.187100E+04	0.159316E+02	0.166361E+02	0.152271E+02
0.187200E+04	0.159367E+02	0.166409E+02	0.152326E+02
0.187300E+04	0.159416E+02	0.166455E+02	0.152378E+02
0.187400E+04	0.159463E+02	0.166500E+02	0.152426E+02
0.187500E+04	0.159508E+02	0.166545E+02	0.152471E+02
0.187600E+04	0.159553E+02	0.166591E+02	0.152515E+02
0.187700E+04	0.159597E+02	0.166637E+02	0.152557E+02
0.187800E+04	0.159640E+02	0.166683E+02	0.152597E+02
0.187900E+04	0.159683E+02	0.166730E+02	0.152636E+02
0.188000E+04	0.159725E+02	0.166776E+02	0.152673E+02
0.188100E+04	0.159765E+02	0.166821E+02	0.152709E+02
0.188200E+04	0.159802E+02	0.166863E+02	0.152742E+02
0.188300E+04	0.158486E+02	0.165397E+02	0.151574E+02
0.188400E+04	0.157016E+02	0.163715E+02	0.150317E+02
0.188500E+04	0.157490E+02	0.164271E+02	0.150709E+02
0.188600E+04	0.158348E+02	0.165263E+02	0.151433E+02
0.188700E+04	0.158795E+02	0.165783E+02	0.151808E+02
0.188800E+04	0.159051E+02	0.166083E+02	0.152019E+02
0.188900E+04	0.159234E+02	0.166294E+02	0.152174E+02
0.189000E+04	0.159376E+02	0.166455E+02	0.152296E+02
0.189100E+04	0.159488E+02	0.166582E+02	0.152395E+02
0.189200E+04	0.159579E+02	0.166682E+02	0.152476E+02
0.189300E+04	0.159653E+02	0.166763E+02	0.152544E+02
0.189400E+04	0.159717E+02	0.166832E+02	0.152601E+02
0.189500E+04	0.159772E+02	0.166892E+02	0.152651E+02
0.189600E+04	0.159820E+02	0.166944E+02	0.152695E+02
0.189700E+04	0.159862E+02	0.166990E+02	0.152734E+02
0.189800E+04	0.159900E+02	0.167032E+02	0.152768E+02
0.189900E+04	0.159934E+02	0.167069E+02	0.152799E+02
0.190000E+04	0.159966E+02	0.167103E+02	0.152828E+02
0.190100E+04	0.159993E+02	0.167133E+02	0.152852E+02
0.190200E+04	0.158608E+02	0.165511E+02	0.151705E+02
0.190300E+04	0.157279E+02	0.164063E+02	0.150494E+02
0.190400E+04	0.157739E+02	0.164598E+02	0.150879E+02
0.190500E+04	0.158541E+02	0.165522E+02	0.151561E+02
0.190600E+04	0.158950E+02	0.165994E+02	0.151905E+02
0.190700E+04	0.159034E+02	0.166092E+02	0.151977E+02
0.190800E+04	0.159088E+02	0.166150E+02	0.152027E+02
0.190900E+04	0.159292E+02	0.166383E+02	0.152201E+02
0.191000E+04	0.159447E+02	0.166561E+02	0.152333E+02
0.191100E+04	0.159555E+02	0.166681E+02	0.152429E+02
0.191200E+04	0.158836E+02	0.165834E+02	0.151838E+02
0.191300E+04	0.158140E+02	0.165108E+02	0.151173E+02
0.191400E+04	0.158155E+02	0.165123E+02	0.151187E+02
0.191500E+04	0.158501E+02	0.165527E+02	0.151476E+02
0.191600E+04	0.158950E+02	0.166010E+02	0.151891E+02
0.191700E+04	0.159249E+02	0.166345E+02	0.152153E+02
0.191800E+04	0.159439E+02	0.166558E+02	0.152321E+02
0.191900E+04	0.159585E+02	0.166716E+02	0.152453E+02
0.192000E+04	0.159702E+02	0.166841E+02	0.152563E+02
0.192100E+04	0.159805E+02	0.166950E+02	0.152661E+02
0.192200E+04	0.159903E+02	0.167052E+02	0.152754E+02
0.192300E+04	0.159995E+02	0.167148E+02	0.152842E+02
0.192400E+04	0.159574E+02	0.166645E+02	0.152503E+02
0.192500E+04	0.159090E+02	0.166066E+02	0.152114E+02
0.192600E+04	0.159314E+02	0.166321E+02	0.152306E+02
0.192700E+04	0.159712E+02	0.166795E+02	0.152628E+02
0.192800E+04	0.159950E+02	0.167074E+02	0.152825E+02
0.192900E+04	0.160100E+02	0.167243E+02	0.152957E+02
0.193000E+04	0.160216E+02	0.167368E+02	0.153063E+02

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0.193200E+04	0.160423E+02	0.167587E+02	0.153259E+02
0.193300E+04	0.160526E+02	0.167695E+02	0.153356E+02
0.193400E+04	0.160627E+02	0.167801E+02	0.153453E+02
0.193500E+04	0.160726E+02	0.167905E+02	0.153547E+02
0.193600E+04	0.160806E+02	0.167985E+02	0.153626E+02
0.193700E+04	0.160852E+02	0.168028E+02	0.153677E+02
0.193800E+04	0.160877E+02	0.168045E+02	0.153710E+02
0.193900E+04	0.160889E+02	0.168047E+02	0.153731E+02
0.194000E+04	0.160891E+02	0.168038E+02	0.153743E+02
0.194100E+04	0.160906E+02	0.168047E+02	0.153765E+02
0.194200E+04	0.160951E+02	0.168091E+02	0.153811E+02
0.194300E+04	0.161016E+02	0.168160E+02	0.153873E+02
0.194400E+04	0.161094E+02	0.168243E+02	0.153945E+02
0.194500E+04	0.161178E+02	0.168334E+02	0.154023E+02
0.194600E+04	0.161244E+02	0.168402E+02	0.154085E+02
0.194700E+04	0.161273E+02	0.168428E+02	0.154119E+02
0.194800E+04	0.161281E+02	0.168428E+02	0.154134E+02
0.194900E+04	0.161276E+02	0.168414E+02	0.154138E+02
0.195000E+04	0.161263E+02	0.168391E+02	0.154135E+02
0.195100E+04	0.161257E+02	0.168377E+02	0.154136E+02
0.195200E+04	0.161266E+02	0.168383E+02	0.154150E+02
0.195300E+04	0.161287E+02	0.168402E+02	0.154172E+02
0.195400E+04	0.161314E+02	0.168429E+02	0.154200E+02
0.195500E+04	0.161348E+02	0.168464E+02	0.154233E+02
0.195600E+04	0.161219E+02	0.168308E+02	0.154130E+02
0.195700E+04	0.161122E+02	0.168189E+02	0.154054E+02
0.195800E+04	0.161226E+02	0.168309E+02	0.154143E+02
0.195900E+04	0.161304E+02	0.168401E+02	0.154208E+02
0.196000E+04	0.161354E+02	0.168455E+02	0.154252E+02
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0.196200E+04	0.161092E+02	0.168142E+02	0.154043E+02
0.196300E+04	0.160903E+02	0.167918E+02	0.153888E+02
0.196400E+04	0.160471E+02	0.167367E+02	0.153574E+02
0.196500E+04	0.160007E+02	0.166845E+02	0.153168E+02
0.196600E+04	0.160069E+02	0.167019E+02	0.153118E+02
0.196700E+04	0.160263E+02	0.167247E+02	0.153280E+02
0.196800E+04	0.160322E+02	0.167322E+02	0.153323E+02
0.196900E+04	0.160108E+02	0.167077E+02	0.153139E+02
0.197000E+04	0.160088E+02	0.167053E+02	0.153123E+02
0.197100E+04	0.160394E+02	0.167384E+02	0.153403E+02
0.197200E+04	0.160742E+02	0.167784E+02	0.153699E+02
0.197300E+04	0.160989E+02	0.168073E+02	0.153906E+02
0.197400E+04	0.161076E+02	0.168168E+02	0.153985E+02
0.197500E+04	0.160913E+02	0.167967E+02	0.153859E+02
0.197600E+04	0.160825E+02	0.167854E+02	0.153797E+02
0.197700E+04	0.161111E+02	0.168181E+02	0.154040E+02
0.197800E+04	0.161441E+02	0.168565E+02	0.154316E+02
0.197900E+04	0.161642E+02	0.168794E+02	0.154491E+02
0.198000E+04	0.161841E+02	0.169015E+02	0.154667E+02
0.198100E+04	0.162102E+02	0.169308E+02	0.154897E+02
0.198200E+04	0.161477E+02	0.168565E+02	0.154390E+02
0.198300E+04	0.160077E+02	0.166964E+02	0.153191E+02
0.198400E+04	0.159574E+02	0.166407E+02	0.152742E+02
0.198500E+04	0.160346E+02	0.167284E+02	0.153408E+02
0.198600E+04	0.161027E+02	0.168017E+02	0.154037E+02
0.198700E+04	0.161461E+02	0.168496E+02	0.154425E+02
0.198800E+04	0.161877E+02	0.168970E+02	0.154783E+02
0.198900E+04	0.162273E+02	0.169422E+02	0.155124E+02
0.199000E+04	0.162600E+02	0.169788E+02	0.155411E+02
0.199100E+04	0.162304E+02	0.169413E+02	0.155195E+02
0.199200E+04	0.160971E+02	0.167983E+02	0.153959E+02
0.199300E+04	0.160231E+02	0.167158E+02	0.153304E+02

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0.199400E+04	0.160947E+02	0.167964E+02	0.153929E+02
0.199500E+04	0.161794E+02	0.168877E+02	0.154710E+02
0.199600E+04	0.162493E+02	0.169667E+02	0.155319E+02
0.199700E+04	0.162987E+02	0.170180E+02	0.155794E+02
0.199800E+04	0.163396E+02	0.170587E+02	0.156205E+02

```

#          91
# IPCC AR4 Millenium Runs output (vary solar forcing)
# ++++++
#
# Model: Bern2.5CC version with active C-cycle
# -----
# Prescribed forcing timeseries as described in file
# readme_doRuns_IPCC_Chap6_millennium_21jan06.txt
# provided by F. Joos, University of Bern.
#
# Contact:
# -----
# Gian-Kasper Plattner
# Climate and Environmental Physics
# Physics Institute, University of Bern
# Sidlerstrasse 5, CH-3012 Bern, Switzerland
# plattner@climate.unibe.ch
# http://www.climate.unibe.ch/~plattner/
# tel: ++41 (0)31 631-44-67
# fax: ++41 (0)31 631-87-42
#
# Some model setup informations:
# -----
# All runs with horizontal/vertical diffusion
#
# Run with standard ocean parameters
#   as used in Plattner et al. 2001/2002
#   with Kv (diffusivity) 4*10^-5 m2/s
#
# Climate sens. set to ~ 3.2 degrees C
# parameterized see Knutti et al. (Clim. Dyn. 2003)
#
# Model version is annual mean.
#
# No radiation code, CO2 radiative forcing calculated
# for as RF=5.35*ln(CO2/CO2_preind),
# Non-co2 radiative forcing prescribed according to
# Joos et al. GBC 2001 with updates for solar forcing
#
# More model description:
# -----
# Zonally averaged dynamical ocean with 3 basins and
# Southern Ocean, zonally averaged one layer energy
# and moisture balance atmosphere, thermodynamic
# sea ice (Stocker et al., J. Climate 1992).
#
# Carbon cycle components: Ocean/Atm/Terr.biosphere;
# Ocean carbon cycle is a description of the cycles
# of organic carbon and CaCO3 (Marchal et al., Tellus
# Tellus B), based on Redfield approach using PO4 as
# biolimiting nutrient.
#
# Land Biota: Lund-Jena-Postdam Dynamical Global
# Vegetation Model (LPJ-DGVM)
# at GCM resolution (Gerber et al. 2003, Climate
# Dynamics; Sitch et al. 2003, Global Change Biology)
#

```

```

# LPJ forced by Cramer/Leemans annual mean
# climatology plus interannual climate variability
# from Hadley simulation (30-recycled climate) plus
# changes in the fields of surface temperature,
# precipitation, and cloudcover as simulated with the
# Impulse-EOF version of ECHAM-3/LSG in response to
# projected radiative forcing changes.
#
# Land use changes are not explicitly considered.
#
# Impact of climate change on terrestrial C-storage
# included
#
# References:
# -----
# Carbon cycle Ocean: Marchal et al., Tellus 1998
# Carbon cycle Terr. Bio: Sitch et al., GCB 2003
# Gerber et al., Clim. Dyn. 2003
# Ccycle-climate feedbacks and global warming:
# Plattner et al., Tellus 2001
# Plattner et al., GCB 2002
# Non-CO2 forcing: Joos et al., GCB 2001
# Climate model: Stocker et al., J. Climate 1992
# Sea level: Knutti et al., J. Climate 2000
# Global warming Physics: Knutti et al., Nature 2002
# Knutti et al., Cl. Dyn. 2003
# and refs therein.
#
# Output columns:
# -----
# Time (yr AD)
# Global mean air temperature (deg C)
# NH-averaged air temperature (deg C)
# SH-averaged air temperature (deg C)
0.100100E+04 0.158198E+02 0.164832E+02 0.151565E+02
0.100200E+04 0.158243E+02 0.164878E+02 0.151609E+02
0.100300E+04 0.158278E+02 0.164912E+02 0.151644E+02
0.100400E+04 0.157993E+02 0.164574E+02 0.151413E+02
0.100500E+04 0.157659E+02 0.164170E+02 0.151147E+02
0.100600E+04 0.157759E+02 0.164288E+02 0.151229E+02
0.100700E+04 0.157951E+02 0.164521E+02 0.151380E+02
0.100800E+04 0.158040E+02 0.164631E+02 0.151448E+02
0.100900E+04 0.158072E+02 0.164670E+02 0.151474E+02
0.101000E+04 0.158081E+02 0.164681E+02 0.151481E+02
0.101100E+04 0.158077E+02 0.164676E+02 0.151478E+02
0.101200E+04 0.158057E+02 0.164648E+02 0.151465E+02
0.101300E+04 0.158043E+02 0.164635E+02 0.151451E+02
0.101400E+04 0.158024E+02 0.164611E+02 0.151437E+02
0.101500E+04 0.157049E+02 0.163571E+02 0.150527E+02
0.101600E+04 0.155972E+02 0.162248E+02 0.149697E+02
0.101700E+04 0.156922E+02 0.162643E+02 0.151202E+02
0.101800E+04 0.158353E+02 0.163405E+02 0.153301E+02
0.101900E+04 0.158968E+02 0.163819E+02 0.154116E+02
0.102000E+04 0.159173E+02 0.164048E+02 0.154297E+02
0.102100E+04 0.159278E+02 0.164205E+02 0.154351E+02
0.102200E+04 0.159328E+02 0.164321E+02 0.154335E+02
0.102300E+04 0.159343E+02 0.164407E+02 0.154280E+02
0.102400E+04 0.159336E+02 0.164470E+02 0.154202E+02
0.102500E+04 0.159334E+02 0.164515E+02 0.154153E+02
0.102600E+04 0.158073E+02 0.163080E+02 0.153065E+02
0.102700E+04 0.156707E+02 0.161542E+02 0.151872E+02
0.102800E+04 0.157090E+02 0.162032E+02 0.152148E+02
0.102900E+04 0.157763E+02 0.162882E+02 0.152644E+02

```

0.103000E+04	0.158056E+02	0.163276E+02	0.152836E+02
0.103100E+04	0.158192E+02	0.163487E+02	0.152896E+02
0.103200E+04	0.158266E+02	0.163619E+02	0.152913E+02
0.103300E+04	0.158306E+02	0.163703E+02	0.152909E+02
0.103400E+04	0.158323E+02	0.163755E+02	0.152891E+02
0.103500E+04	0.158325E+02	0.163784E+02	0.152866E+02
0.103600E+04	0.158318E+02	0.163799E+02	0.152837E+02
0.103700E+04	0.158306E+02	0.163806E+02	0.152807E+02
0.103800E+04	0.158291E+02	0.163805E+02	0.152777E+02
0.103900E+04	0.158272E+02	0.163798E+02	0.152746E+02
0.104000E+04	0.158251E+02	0.163787E+02	0.152715E+02
0.104100E+04	0.158228E+02	0.163772E+02	0.152684E+02
0.104200E+04	0.158204E+02	0.163754E+02	0.152653E+02
0.104300E+04	0.158178E+02	0.163734E+02	0.152623E+02
0.104400E+04	0.158152E+02	0.163712E+02	0.152592E+02
0.104500E+04	0.158126E+02	0.163690E+02	0.152563E+02
0.104600E+04	0.158103E+02	0.163669E+02	0.152536E+02
0.104700E+04	0.158080E+02	0.163649E+02	0.152510E+02
0.104800E+04	0.158058E+02	0.163630E+02	0.152486E+02
0.104900E+04	0.158037E+02	0.163611E+02	0.152462E+02
0.105000E+04	0.158016E+02	0.163592E+02	0.152439E+02
0.105100E+04	0.157995E+02	0.163574E+02	0.152417E+02
0.105200E+04	0.157976E+02	0.163555E+02	0.152396E+02
0.105300E+04	0.157956E+02	0.163537E+02	0.152375E+02
0.105400E+04	0.157937E+02	0.163520E+02	0.152355E+02
0.105500E+04	0.157920E+02	0.163503E+02	0.152336E+02
0.105600E+04	0.157904E+02	0.163489E+02	0.152320E+02
0.105700E+04	0.157890E+02	0.163477E+02	0.152304E+02
0.105800E+04	0.156301E+02	0.161679E+02	0.150922E+02
0.105900E+04	0.154447E+02	0.159496E+02	0.149398E+02
0.106000E+04	0.155357E+02	0.160581E+02	0.150132E+02
0.106100E+04	0.156325E+02	0.161633E+02	0.151018E+02
0.106200E+04	0.156342E+02	0.161646E+02	0.151038E+02
0.106300E+04	0.156119E+02	0.161382E+02	0.150856E+02
0.106400E+04	0.156460E+02	0.161794E+02	0.151126E+02
0.106500E+04	0.156822E+02	0.162208E+02	0.151436E+02
0.106600E+04	0.157069E+02	0.162513E+02	0.151626E+02
0.106700E+04	0.157247E+02	0.162733E+02	0.151762E+02
0.106800E+04	0.157394E+02	0.162911E+02	0.151878E+02
0.106900E+04	0.157523E+02	0.163065E+02	0.151981E+02
0.107000E+04	0.157640E+02	0.163203E+02	0.152077E+02
0.107100E+04	0.157749E+02	0.163330E+02	0.152168E+02
0.107200E+04	0.157851E+02	0.163448E+02	0.152254E+02
0.107300E+04	0.157949E+02	0.163560E+02	0.152337E+02
0.107400E+04	0.158043E+02	0.163667E+02	0.152418E+02
0.107500E+04	0.158134E+02	0.163771E+02	0.152497E+02
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0.107700E+04	0.158298E+02	0.163957E+02	0.152639E+02
0.107800E+04	0.158370E+02	0.164038E+02	0.152702E+02
0.107900E+04	0.158400E+02	0.164116E+02	0.152683E+02
0.108000E+04	0.158048E+02	0.163826E+02	0.152269E+02
0.108100E+04	0.157708E+02	0.163494E+02	0.151922E+02
0.108200E+04	0.157538E+02	0.163680E+02	0.151397E+02
0.108300E+04	0.157311E+02	0.163982E+02	0.150640E+02
0.108400E+04	0.157226E+02	0.164154E+02	0.150299E+02
0.108500E+04	0.157160E+02	0.164249E+02	0.150071E+02
0.108600E+04	0.157110E+02	0.164313E+02	0.149906E+02
0.108700E+04	0.157089E+02	0.164360E+02	0.149817E+02
0.108800E+04	0.157096E+02	0.164399E+02	0.149794E+02
0.108900E+04	0.157124E+02	0.164433E+02	0.149816E+02
0.109000E+04	0.157168E+02	0.164467E+02	0.149869E+02
0.109100E+04	0.157223E+02	0.164502E+02	0.149944E+02
0.109200E+04	0.157287E+02	0.164539E+02	0.150035E+02

0.109300E+04	0.157358E+02	0.164580E+02	0.150136E+02
0.109400E+04	0.157432E+02	0.164622E+02	0.150242E+02
0.109500E+04	0.157509E+02	0.164668E+02	0.150350E+02
0.109600E+04	0.157588E+02	0.164717E+02	0.150458E+02
0.109700E+04	0.156945E+02	0.163925E+02	0.149966E+02
0.109800E+04	0.156362E+02	0.163297E+02	0.149426E+02
0.109900E+04	0.156661E+02	0.163605E+02	0.149717E+02
0.110000E+04	0.157151E+02	0.164127E+02	0.150175E+02
0.110100E+04	0.157415E+02	0.164386E+02	0.150443E+02
0.110200E+04	0.157598E+02	0.164572E+02	0.150623E+02
0.110300E+04	0.157741E+02	0.164720E+02	0.150762E+02
0.110400E+04	0.157834E+02	0.164844E+02	0.150824E+02
0.110500E+04	0.157919E+02	0.164952E+02	0.150887E+02
0.110600E+04	0.158000E+02	0.165047E+02	0.150953E+02
0.110700E+04	0.158079E+02	0.165135E+02	0.151023E+02
0.110800E+04	0.158155E+02	0.165217E+02	0.151093E+02
0.110900E+04	0.158233E+02	0.165301E+02	0.151166E+02
0.111000E+04	0.158318E+02	0.165391E+02	0.151245E+02
0.111100E+04	0.158407E+02	0.165486E+02	0.151327E+02
0.111200E+04	0.158496E+02	0.165582E+02	0.151411E+02
0.111300E+04	0.158587E+02	0.165679E+02	0.151494E+02
0.111400E+04	0.158678E+02	0.165777E+02	0.151578E+02
0.111500E+04	0.158761E+02	0.165868E+02	0.151655E+02
0.111600E+04	0.158832E+02	0.165944E+02	0.151721E+02
0.111700E+04	0.158895E+02	0.166011E+02	0.151780E+02
0.111800E+04	0.158952E+02	0.166071E+02	0.151833E+02
0.111900E+04	0.159005E+02	0.166128E+02	0.151883E+02
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0.112600E+04	0.159303E+02	0.166450E+02	0.152155E+02
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0.112800E+04	0.159373E+02	0.166528E+02	0.152219E+02
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0.113000E+04	0.159440E+02	0.166602E+02	0.152279E+02
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0.113200E+04	0.159504E+02	0.166671E+02	0.152336E+02
0.113300E+04	0.159538E+02	0.166708E+02	0.152367E+02
0.113400E+04	0.159577E+02	0.166752E+02	0.152403E+02
0.113500E+04	0.159618E+02	0.166797E+02	0.152439E+02
0.113600E+04	0.159657E+02	0.166839E+02	0.152474E+02
0.113700E+04	0.159694E+02	0.166880E+02	0.152509E+02
0.113800E+04	0.159731E+02	0.166919E+02	0.152543E+02
0.113900E+04	0.159765E+02	0.166955E+02	0.152575E+02
0.114000E+04	0.159795E+02	0.166986E+02	0.152604E+02
0.114100E+04	0.159821E+02	0.167012E+02	0.152629E+02
0.114200E+04	0.159844E+02	0.167036E+02	0.152653E+02
0.114300E+04	0.159866E+02	0.167057E+02	0.152676E+02
0.114400E+04	0.159887E+02	0.167077E+02	0.152697E+02
0.114500E+04	0.159906E+02	0.167095E+02	0.152718E+02
0.114600E+04	0.159925E+02	0.167112E+02	0.152737E+02
0.114700E+04	0.159940E+02	0.167125E+02	0.152754E+02
0.114800E+04	0.159950E+02	0.167133E+02	0.152767E+02
0.114900E+04	0.159957E+02	0.167137E+02	0.152778E+02
0.115000E+04	0.159962E+02	0.167138E+02	0.152786E+02
0.115100E+04	0.159965E+02	0.167137E+02	0.152793E+02
0.115200E+04	0.159966E+02	0.167134E+02	0.152798E+02
0.115300E+04	0.159966E+02	0.167130E+02	0.152803E+02
0.115400E+04	0.159965E+02	0.167124E+02	0.152806E+02
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0.115800E+04	0.159930E+02	0.167066E+02	0.152793E+02
0.115900E+04	0.159911E+02	0.167041E+02	0.152782E+02
0.116000E+04	0.159891E+02	0.167013E+02	0.152769E+02
0.116100E+04	0.159869E+02	0.166984E+02	0.152754E+02
0.116200E+04	0.159852E+02	0.166961E+02	0.152744E+02
0.116300E+04	0.159846E+02	0.166950E+02	0.152742E+02
0.116400E+04	0.159845E+02	0.166946E+02	0.152745E+02
0.116500E+04	0.159849E+02	0.166947E+02	0.152751E+02
0.116600E+04	0.159428E+02	0.166451E+02	0.152404E+02
0.116700E+04	0.158959E+02	0.165897E+02	0.152021E+02
0.116800E+04	0.159091E+02	0.166057E+02	0.152125E+02
0.116900E+04	0.159352E+02	0.166373E+02	0.152331E+02
0.117000E+04	0.159482E+02	0.166529E+02	0.152434E+02
0.117100E+04	0.159542E+02	0.166597E+02	0.152486E+02
0.117200E+04	0.159575E+02	0.166631E+02	0.152518E+02
0.117300E+04	0.159593E+02	0.166647E+02	0.152539E+02
0.117400E+04	0.159602E+02	0.166651E+02	0.152553E+02
0.117500E+04	0.157061E+02	0.163789E+02	0.150332E+02
0.117600E+04	0.155551E+02	0.160890E+02	0.150211E+02
0.117700E+04	0.156680E+02	0.161564E+02	0.151796E+02
0.117800E+04	0.158097E+02	0.162988E+02	0.153207E+02
0.117900E+04	0.159020E+02	0.163952E+02	0.154089E+02
0.118000E+04	0.159557E+02	0.164593E+02	0.154521E+02
0.118100E+04	0.159869E+02	0.164999E+02	0.154740E+02
0.118200E+04	0.160078E+02	0.165298E+02	0.154859E+02
0.118300E+04	0.160225E+02	0.165528E+02	0.154922E+02
0.118400E+04	0.160353E+02	0.165710E+02	0.154997E+02
0.118500E+04	0.160428E+02	0.165854E+02	0.155002E+02
0.118600E+04	0.160485E+02	0.165969E+02	0.155001E+02
0.118700E+04	0.160526E+02	0.166060E+02	0.154991E+02
0.118800E+04	0.160766E+02	0.166547E+02	0.154985E+02
0.118900E+04	0.160785E+02	0.166574E+02	0.154996E+02
0.119000E+04	0.160782E+02	0.166579E+02	0.154985E+02
0.119100E+04	0.160780E+02	0.166591E+02	0.154970E+02
0.119200E+04	0.160753E+02	0.166606E+02	0.154901E+02
0.119300E+04	0.160652E+02	0.166627E+02	0.154678E+02
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0.119500E+04	0.158724E+02	0.164638E+02	0.152809E+02
0.119600E+04	0.158950E+02	0.164984E+02	0.152916E+02
0.119700E+04	0.159428E+02	0.165637E+02	0.153219E+02
0.119800E+04	0.159032E+02	0.165916E+02	0.152148E+02
0.119900E+04	0.158916E+02	0.166071E+02	0.151761E+02
0.120000E+04	0.158844E+02	0.166165E+02	0.151523E+02
0.120100E+04	0.158801E+02	0.166220E+02	0.151382E+02
0.120200E+04	0.158785E+02	0.166253E+02	0.151316E+02
0.120300E+04	0.158775E+02	0.166273E+02	0.151277E+02
0.120400E+04	0.158785E+02	0.166281E+02	0.151289E+02
0.120500E+04	0.158302E+02	0.165689E+02	0.150915E+02
0.120600E+04	0.157769E+02	0.165023E+02	0.150514E+02
0.120700E+04	0.158087E+02	0.165443E+02	0.150730E+02
0.120800E+04	0.158443E+02	0.165808E+02	0.151079E+02
0.120900E+04	0.158653E+02	0.166001E+02	0.151305E+02
0.121000E+04	0.158786E+02	0.166102E+02	0.151469E+02
0.121100E+04	0.158889E+02	0.166169E+02	0.151609E+02
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0.121600E+04	0.159224E+02	0.166335E+02	0.152113E+02
0.121700E+04	0.159272E+02	0.166357E+02	0.152186E+02
0.121800E+04	0.159263E+02	0.166278E+02	0.152248E+02

0.121900E+04	0.159273E+02	0.166248E+02	0.152299E+02
0.122000E+04	0.159301E+02	0.166254E+02	0.152348E+02
0.122100E+04	0.159331E+02	0.166269E+02	0.152393E+02
0.122200E+04	0.159361E+02	0.166288E+02	0.152434E+02
0.122300E+04	0.159390E+02	0.166308E+02	0.152472E+02
0.122400E+04	0.159418E+02	0.166328E+02	0.152507E+02
0.122500E+04	0.159444E+02	0.166350E+02	0.152539E+02
0.122600E+04	0.159470E+02	0.166371E+02	0.152568E+02
0.122700E+04	0.159183E+02	0.166029E+02	0.152336E+02
0.122800E+04	0.158857E+02	0.165640E+02	0.152075E+02
0.122900E+04	0.157160E+02	0.163768E+02	0.150552E+02
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0.123100E+04	0.156023E+02	0.162576E+02	0.149471E+02
0.123200E+04	0.158348E+02	0.163672E+02	0.153024E+02
0.123300E+04	0.159388E+02	0.164432E+02	0.154343E+02
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0.123900E+04	0.160539E+02	0.165807E+02	0.155271E+02
0.124000E+04	0.160592E+02	0.165906E+02	0.155278E+02
0.124100E+04	0.160611E+02	0.165986E+02	0.155237E+02
0.124200E+04	0.160843E+02	0.166467E+02	0.155218E+02
0.124300E+04	0.160824E+02	0.166463E+02	0.155184E+02
0.124400E+04	0.160807E+02	0.166474E+02	0.155139E+02
0.124500E+04	0.160789E+02	0.166485E+02	0.155093E+02
0.124600E+04	0.160769E+02	0.166490E+02	0.155047E+02
0.124700E+04	0.160746E+02	0.166490E+02	0.155002E+02
0.124800E+04	0.160721E+02	0.166484E+02	0.154957E+02
0.124900E+04	0.160626E+02	0.166474E+02	0.154779E+02
0.125000E+04	0.160491E+02	0.166458E+02	0.154524E+02
0.125100E+04	0.160367E+02	0.166437E+02	0.154298E+02
0.125200E+04	0.160257E+02	0.166410E+02	0.154104E+02
0.125300E+04	0.159714E+02	0.166378E+02	0.153049E+02
0.125400E+04	0.159320E+02	0.166324E+02	0.152317E+02
0.125500E+04	0.159047E+02	0.166241E+02	0.151854E+02
0.125600E+04	0.158828E+02	0.166139E+02	0.151518E+02
0.125700E+04	0.158651E+02	0.166026E+02	0.151276E+02
0.125800E+04	0.158516E+02	0.165919E+02	0.151112E+02
0.125900E+04	0.154066E+02	0.160746E+02	0.147385E+02
0.126000E+04	0.151789E+02	0.159923E+02	0.143655E+02
0.126100E+04	0.153780E+02	0.163057E+02	0.144502E+02
0.126200E+04	0.155707E+02	0.164931E+02	0.146483E+02
0.126300E+04	0.157044E+02	0.166117E+02	0.147971E+02
0.126400E+04	0.157668E+02	0.166547E+02	0.148790E+02
0.126500E+04	0.157988E+02	0.166676E+02	0.149300E+02
0.126600E+04	0.158190E+02	0.166698E+02	0.149681E+02
0.126700E+04	0.158328E+02	0.166672E+02	0.149984E+02
0.126800E+04	0.158402E+02	0.166622E+02	0.150182E+02
0.126900E+04	0.158443E+02	0.166562E+02	0.150324E+02
0.127000E+04	0.158475E+02	0.166500E+02	0.150451E+02
0.127100E+04	0.158502E+02	0.166441E+02	0.150563E+02
0.127200E+04	0.158528E+02	0.166392E+02	0.150663E+02
0.127300E+04	0.158547E+02	0.166344E+02	0.150751E+02
0.127400E+04	0.158561E+02	0.166298E+02	0.150824E+02
0.127500E+04	0.157561E+02	0.165083E+02	0.150038E+02
0.127600E+04	0.156436E+02	0.163829E+02	0.149043E+02
0.127700E+04	0.156838E+02	0.164215E+02	0.149462E+02
0.127800E+04	0.157466E+02	0.164854E+02	0.150078E+02
0.127900E+04	0.157763E+02	0.165146E+02	0.150380E+02
0.128000E+04	0.157896E+02	0.165289E+02	0.150502E+02
0.128100E+04	0.157950E+02	0.165382E+02	0.150519E+02

0.128200E+04	0.158011E+02	0.165447E+02	0.150575E+02
0.128300E+04	0.158063E+02	0.165496E+02	0.150630E+02
0.128400E+04	0.158105E+02	0.165533E+02	0.150677E+02
0.128500E+04	0.156789E+02	0.164073E+02	0.149505E+02
0.128600E+04	0.155441E+02	0.162566E+02	0.148316E+02
0.128700E+04	0.156781E+02	0.163160E+02	0.150403E+02
0.128800E+04	0.158254E+02	0.164030E+02	0.152478E+02
0.128900E+04	0.158797E+02	0.164310E+02	0.153284E+02
0.129000E+04	0.158992E+02	0.164390E+02	0.153593E+02
0.129100E+04	0.158601E+02	0.163505E+02	0.153698E+02
0.129200E+04	0.158519E+02	0.163342E+02	0.153696E+02
0.129300E+04	0.158478E+02	0.163252E+02	0.153704E+02
0.129400E+04	0.158432E+02	0.163233E+02	0.153632E+02
0.129500E+04	0.157342E+02	0.162231E+02	0.152453E+02
0.129600E+04	0.155999E+02	0.160736E+02	0.151262E+02
0.129700E+04	0.156462E+02	0.161356E+02	0.151568E+02
0.129800E+04	0.157221E+02	0.162319E+02	0.152122E+02
0.129900E+04	0.157562E+02	0.162769E+02	0.152354E+02
0.130000E+04	0.157744E+02	0.163043E+02	0.152444E+02
0.130100E+04	0.157867E+02	0.163246E+02	0.152488E+02
0.130200E+04	0.157957E+02	0.163406E+02	0.152509E+02
0.130300E+04	0.158027E+02	0.163537E+02	0.152517E+02
0.130400E+04	0.158081E+02	0.163645E+02	0.152517E+02
0.130500E+04	0.158125E+02	0.163737E+02	0.152513E+02
0.130600E+04	0.158160E+02	0.163814E+02	0.152505E+02
0.130700E+04	0.158188E+02	0.163879E+02	0.152496E+02
0.130800E+04	0.158210E+02	0.163935E+02	0.152485E+02
0.130900E+04	0.158229E+02	0.163984E+02	0.152473E+02
0.131000E+04	0.158244E+02	0.164028E+02	0.152461E+02
0.131100E+04	0.158258E+02	0.164066E+02	0.152449E+02
0.131200E+04	0.158269E+02	0.164101E+02	0.152437E+02
0.131300E+04	0.158278E+02	0.164131E+02	0.152426E+02
0.131400E+04	0.158286E+02	0.164157E+02	0.152415E+02
0.131500E+04	0.158292E+02	0.164180E+02	0.152404E+02
0.131600E+04	0.158297E+02	0.164201E+02	0.152394E+02
0.131700E+04	0.158301E+02	0.164218E+02	0.152384E+02
0.131800E+04	0.158304E+02	0.164233E+02	0.152374E+02
0.131900E+04	0.158305E+02	0.164245E+02	0.152365E+02
0.132000E+04	0.158306E+02	0.164256E+02	0.152356E+02
0.132100E+04	0.158306E+02	0.164264E+02	0.152347E+02
0.132200E+04	0.158305E+02	0.164271E+02	0.152339E+02
0.132300E+04	0.158305E+02	0.164278E+02	0.152332E+02
0.132400E+04	0.158307E+02	0.164287E+02	0.152327E+02
0.132500E+04	0.158312E+02	0.164299E+02	0.152324E+02
0.132600E+04	0.158315E+02	0.164308E+02	0.152322E+02
0.132700E+04	0.158319E+02	0.164318E+02	0.152321E+02
0.132800E+04	0.158324E+02	0.164327E+02	0.152320E+02
0.132900E+04	0.157141E+02	0.162918E+02	0.151363E+02
0.133000E+04	0.156046E+02	0.161702E+02	0.150389E+02
0.133100E+04	0.156442E+02	0.162173E+02	0.150711E+02
0.133200E+04	0.157106E+02	0.162948E+02	0.151263E+02
0.133300E+04	0.157420E+02	0.163337E+02	0.151504E+02
0.133400E+04	0.157600E+02	0.163560E+02	0.151639E+02
0.133500E+04	0.157732E+02	0.163725E+02	0.151740E+02
0.133600E+04	0.157850E+02	0.163868E+02	0.151833E+02
0.133700E+04	0.157958E+02	0.163998E+02	0.151919E+02
0.133800E+04	0.158060E+02	0.164118E+02	0.152001E+02
0.133900E+04	0.158156E+02	0.164232E+02	0.152080E+02
0.134000E+04	0.158241E+02	0.164330E+02	0.152151E+02
0.134100E+04	0.158309E+02	0.164408E+02	0.152210E+02
0.134200E+04	0.158366E+02	0.164472E+02	0.152260E+02
0.134300E+04	0.158416E+02	0.164526E+02	0.152305E+02
0.134400E+04	0.158414E+02	0.164574E+02	0.152255E+02

0.134500E+04	0.157354E+02	0.163394E+02	0.151314E+02
0.134600E+04	0.156320E+02	0.162377E+02	0.150263E+02
0.134700E+04	0.156879E+02	0.162778E+02	0.150981E+02
0.134800E+04	0.157488E+02	0.163464E+02	0.151512E+02
0.134900E+04	0.157809E+02	0.163830E+02	0.151788E+02
0.135000E+04	0.157996E+02	0.164046E+02	0.151947E+02
0.135100E+04	0.158130E+02	0.164199E+02	0.152062E+02
0.135200E+04	0.158234E+02	0.164316E+02	0.152152E+02
0.135300E+04	0.158316E+02	0.164408E+02	0.152224E+02
0.135400E+04	0.158384E+02	0.164484E+02	0.152285E+02
0.135500E+04	0.158404E+02	0.164547E+02	0.152261E+02
0.135600E+04	0.158336E+02	0.164599E+02	0.152073E+02
0.135700E+04	0.158276E+02	0.164644E+02	0.151908E+02
0.135800E+04	0.157768E+02	0.164683E+02	0.150853E+02
0.135900E+04	0.157462E+02	0.164709E+02	0.150215E+02
0.136000E+04	0.157277E+02	0.164723E+02	0.149831E+02
0.136100E+04	0.157152E+02	0.164728E+02	0.149575E+02
0.136200E+04	0.157056E+02	0.164729E+02	0.149383E+02
0.136300E+04	0.157006E+02	0.164726E+02	0.149286E+02
0.136400E+04	0.156988E+02	0.164725E+02	0.149252E+02
0.136500E+04	0.156995E+02	0.164725E+02	0.149264E+02
0.136600E+04	0.157020E+02	0.164730E+02	0.149309E+02
0.136700E+04	0.157058E+02	0.164739E+02	0.149378E+02
0.136800E+04	0.157107E+02	0.164752E+02	0.149461E+02
0.136900E+04	0.157162E+02	0.164769E+02	0.149555E+02
0.137000E+04	0.157223E+02	0.164791E+02	0.149655E+02
0.137100E+04	0.157287E+02	0.164817E+02	0.149756E+02
0.137200E+04	0.157352E+02	0.164846E+02	0.149859E+02
0.137300E+04	0.157418E+02	0.164878E+02	0.149959E+02
0.137400E+04	0.157482E+02	0.164909E+02	0.150055E+02
0.137500E+04	0.157110E+02	0.164436E+02	0.149784E+02
0.137600E+04	0.156687E+02	0.163899E+02	0.149474E+02
0.137700E+04	0.156873E+02	0.164093E+02	0.149653E+02
0.137800E+04	0.157195E+02	0.164457E+02	0.149934E+02
0.137900E+04	0.157384E+02	0.164659E+02	0.150109E+02
0.138000E+04	0.157501E+02	0.164773E+02	0.150229E+02
0.138100E+04	0.157590E+02	0.164854E+02	0.150326E+02
0.138200E+04	0.157664E+02	0.164918E+02	0.150409E+02
0.138300E+04	0.157726E+02	0.164971E+02	0.150481E+02
0.138400E+04	0.157778E+02	0.165012E+02	0.150543E+02
0.138500E+04	0.157819E+02	0.165043E+02	0.150595E+02
0.138600E+04	0.157852E+02	0.165066E+02	0.150638E+02
0.138700E+04	0.157449E+02	0.164583E+02	0.150316E+02
0.138800E+04	0.156993E+02	0.164031E+02	0.149955E+02
0.138900E+04	0.157147E+02	0.164210E+02	0.150084E+02
0.139000E+04	0.157435E+02	0.164554E+02	0.150316E+02
0.139100E+04	0.157590E+02	0.164736E+02	0.150443E+02
0.139200E+04	0.157671E+02	0.164825E+02	0.150516E+02
0.139300E+04	0.157720E+02	0.164876E+02	0.150564E+02
0.139400E+04	0.157751E+02	0.164904E+02	0.150597E+02
0.139500E+04	0.157769E+02	0.164918E+02	0.150620E+02
0.139600E+04	0.157773E+02	0.164916E+02	0.150631E+02
0.139700E+04	0.157762E+02	0.164896E+02	0.150628E+02
0.139800E+04	0.157739E+02	0.164864E+02	0.150615E+02
0.139900E+04	0.157709E+02	0.164823E+02	0.150594E+02
0.140000E+04	0.157671E+02	0.164775E+02	0.150567E+02
0.140100E+04	0.157635E+02	0.164729E+02	0.150541E+02
0.140200E+04	0.157606E+02	0.164693E+02	0.150520E+02
0.140300E+04	0.157582E+02	0.164663E+02	0.150501E+02
0.140400E+04	0.157559E+02	0.164635E+02	0.150484E+02
0.140500E+04	0.157537E+02	0.164607E+02	0.150467E+02
0.140600E+04	0.157516E+02	0.164581E+02	0.150451E+02
0.140700E+04	0.157494E+02	0.164554E+02	0.150435E+02

0.140800E+04	0.157081E+02	0.164067E+02	0.150094E+02
0.140900E+04	0.156755E+02	0.163786E+02	0.149725E+02
0.141000E+04	0.156913E+02	0.163894E+02	0.149932E+02
0.141100E+04	0.157153E+02	0.164161E+02	0.150146E+02
0.141200E+04	0.157268E+02	0.164294E+02	0.150242E+02
0.141300E+04	0.157318E+02	0.164352E+02	0.150284E+02
0.141400E+04	0.157296E+02	0.164381E+02	0.150210E+02
0.141500E+04	0.157280E+02	0.164384E+02	0.150176E+02
0.141600E+04	0.157259E+02	0.164361E+02	0.150158E+02
0.141700E+04	0.157228E+02	0.164319E+02	0.150137E+02
0.141800E+04	0.157188E+02	0.164266E+02	0.150111E+02
0.141900E+04	0.157141E+02	0.164204E+02	0.150079E+02
0.142000E+04	0.157089E+02	0.164136E+02	0.150042E+02
0.142100E+04	0.157039E+02	0.164070E+02	0.150007E+02
0.142200E+04	0.156996E+02	0.164015E+02	0.149977E+02
0.142300E+04	0.156958E+02	0.163965E+02	0.149950E+02
0.142400E+04	0.156922E+02	0.163918E+02	0.149925E+02
0.142500E+04	0.156888E+02	0.163876E+02	0.149901E+02
0.142600E+04	0.156855E+02	0.163834E+02	0.149876E+02
0.142700E+04	0.156822E+02	0.163792E+02	0.149853E+02
0.142800E+04	0.156782E+02	0.163742E+02	0.149822E+02
0.142900E+04	0.156789E+02	0.163675E+02	0.149903E+02
0.143000E+04	0.156736E+02	0.163600E+02	0.149871E+02
0.143100E+04	0.156667E+02	0.163519E+02	0.149814E+02
0.143200E+04	0.156592E+02	0.163436E+02	0.149748E+02
0.143300E+04	0.156511E+02	0.163347E+02	0.149676E+02
0.143400E+04	0.156158E+02	0.162944E+02	0.149373E+02
0.143500E+04	0.155802E+02	0.162536E+02	0.149068E+02
0.143600E+04	0.155822E+02	0.162570E+02	0.149073E+02
0.143700E+04	0.155892E+02	0.162663E+02	0.149121E+02
0.143800E+04	0.155886E+02	0.162665E+02	0.149107E+02
0.143900E+04	0.155844E+02	0.162622E+02	0.149066E+02
0.144000E+04	0.155787E+02	0.162559E+02	0.149014E+02
0.144100E+04	0.155718E+02	0.162480E+02	0.148956E+02
0.144200E+04	0.155658E+02	0.162415E+02	0.148902E+02
0.144300E+04	0.155610E+02	0.162361E+02	0.148859E+02
0.144400E+04	0.155568E+02	0.162312E+02	0.148823E+02
0.144500E+04	0.155533E+02	0.162274E+02	0.148791E+02
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0.144700E+04	0.155471E+02	0.162203E+02	0.148738E+02
0.144800E+04	0.155443E+02	0.162171E+02	0.148714E+02
0.144900E+04	0.155417E+02	0.162140E+02	0.148693E+02
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0.145100E+04	0.155369E+02	0.162083E+02	0.148655E+02
0.145200E+04	0.155344E+02	0.162054E+02	0.148635E+02
0.145300E+04	0.153648E+02	0.160061E+02	0.147235E+02
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0.145800E+04	0.156014E+02	0.160718E+02	0.151311E+02
0.145900E+04	0.154650E+02	0.159178E+02	0.150122E+02
0.146000E+04	0.152136E+02	0.156044E+02	0.148229E+02
0.146100E+04	0.151641E+02	0.155570E+02	0.147711E+02
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0.146500E+04	0.155104E+02	0.159613E+02	0.150596E+02
0.146600E+04	0.154927E+02	0.159418E+02	0.150437E+02
0.146700E+04	0.154644E+02	0.159083E+02	0.150206E+02
0.146800E+04	0.154940E+02	0.159471E+02	0.150409E+02
0.146900E+04	0.155300E+02	0.159986E+02	0.150615E+02
0.147000E+04	0.155468E+02	0.160300E+02	0.150637E+02

0.147100E+04	0.155793E+02	0.160950E+02	0.150636E+02
0.147200E+04	0.155849E+02	0.161063E+02	0.150635E+02
0.147300E+04	0.155898E+02	0.161174E+02	0.150622E+02
0.147400E+04	0.155946E+02	0.161279E+02	0.150612E+02
0.147500E+04	0.155993E+02	0.161376E+02	0.150610E+02
0.147600E+04	0.156039E+02	0.161464E+02	0.150615E+02
0.147700E+04	0.156090E+02	0.161549E+02	0.150631E+02
0.147800E+04	0.156148E+02	0.161637E+02	0.150659E+02
0.147900E+04	0.156212E+02	0.161726E+02	0.150698E+02
0.148000E+04	0.156280E+02	0.161817E+02	0.150744E+02
0.148100E+04	0.155971E+02	0.161451E+02	0.150490E+02
0.148200E+04	0.155858E+02	0.161388E+02	0.150329E+02
0.148300E+04	0.155628E+02	0.161126E+02	0.150129E+02
0.148400E+04	0.155432E+02	0.160886E+02	0.149978E+02
0.148500E+04	0.155828E+02	0.161357E+02	0.150299E+02
0.148600E+04	0.156093E+02	0.161681E+02	0.150505E+02
0.148700E+04	0.156222E+02	0.161836E+02	0.150608E+02
0.148800E+04	0.156306E+02	0.161932E+02	0.150679E+02
0.148900E+04	0.156365E+02	0.161998E+02	0.150733E+02
0.149000E+04	0.156410E+02	0.162044E+02	0.150776E+02
0.149100E+04	0.156445E+02	0.162079E+02	0.150811E+02
0.149200E+04	0.156472E+02	0.162104E+02	0.150840E+02
0.149300E+04	0.156494E+02	0.162123E+02	0.150864E+02
0.149400E+04	0.156511E+02	0.162138E+02	0.150885E+02
0.149500E+04	0.156076E+02	0.161618E+02	0.150535E+02
0.149600E+04	0.155622E+02	0.161069E+02	0.150174E+02
0.149700E+04	0.155793E+02	0.161269E+02	0.150317E+02
0.149800E+04	0.156076E+02	0.161619E+02	0.150533E+02
0.149900E+04	0.156224E+02	0.161805E+02	0.150643E+02
0.150000E+04	0.156306E+02	0.161907E+02	0.150704E+02
0.150100E+04	0.156361E+02	0.161976E+02	0.150746E+02
0.150200E+04	0.156403E+02	0.162028E+02	0.150778E+02
0.150300E+04	0.156435E+02	0.162067E+02	0.150804E+02
0.150400E+04	0.156085E+02	0.161654E+02	0.150517E+02
0.150500E+04	0.155694E+02	0.161186E+02	0.150201E+02
0.150600E+04	0.155831E+02	0.161352E+02	0.150310E+02
0.150700E+04	0.156089E+02	0.161672E+02	0.150506E+02
0.150800E+04	0.156231E+02	0.161853E+02	0.150609E+02
0.150900E+04	0.156312E+02	0.161957E+02	0.150667E+02
0.151000E+04	0.156370E+02	0.162032E+02	0.150708E+02
0.151100E+04	0.156414E+02	0.162089E+02	0.150739E+02
0.151200E+04	0.156446E+02	0.162131E+02	0.150761E+02
0.151300E+04	0.156465E+02	0.162158E+02	0.150773E+02
0.151400E+04	0.156476E+02	0.162174E+02	0.150777E+02
0.151500E+04	0.156480E+02	0.162183E+02	0.150777E+02
0.151600E+04	0.156479E+02	0.162186E+02	0.150772E+02
0.151700E+04	0.156474E+02	0.162184E+02	0.150763E+02
0.151800E+04	0.156466E+02	0.162179E+02	0.150752E+02
0.151900E+04	0.156458E+02	0.162175E+02	0.150740E+02
0.152000E+04	0.156452E+02	0.162174E+02	0.150730E+02
0.152100E+04	0.156448E+02	0.162175E+02	0.150721E+02
0.152200E+04	0.156444E+02	0.162177E+02	0.150711E+02
0.152300E+04	0.156440E+02	0.162179E+02	0.150702E+02
0.152400E+04	0.156436E+02	0.162181E+02	0.150692E+02
0.152500E+04	0.156432E+02	0.162183E+02	0.150682E+02
0.152600E+04	0.156428E+02	0.162185E+02	0.150671E+02
0.152700E+04	0.155372E+02	0.160940E+02	0.149803E+02
0.152800E+04	0.154258E+02	0.159622E+02	0.148893E+02
0.152900E+04	0.154593E+02	0.160037E+02	0.149149E+02
0.153000E+04	0.155211E+02	0.160789E+02	0.149633E+02
0.153100E+04	0.155452E+02	0.161057E+02	0.149848E+02
0.153200E+04	0.155586E+02	0.161225E+02	0.149946E+02
0.153300E+04	0.155672E+02	0.161339E+02	0.150006E+02

0.153400E+04	0.155731E+02	0.161418E+02	0.150044E+02
0.153500E+04	0.155772E+02	0.161475E+02	0.150069E+02
0.153600E+04	0.155804E+02	0.161519E+02	0.150088E+02
0.153700E+04	0.155824E+02	0.161547E+02	0.150100E+02
0.153800E+04	0.155844E+02	0.161578E+02	0.150109E+02
0.153900E+04	0.155857E+02	0.161601E+02	0.150114E+02
0.154000E+04	0.155863E+02	0.161610E+02	0.150115E+02
0.154100E+04	0.155873E+02	0.161630E+02	0.150117E+02
0.154200E+04	0.155884E+02	0.161649E+02	0.150120E+02
0.154300E+04	0.155892E+02	0.161661E+02	0.150122E+02
0.154400E+04	0.155904E+02	0.161683E+02	0.150125E+02
0.154500E+04	0.155915E+02	0.161702E+02	0.150128E+02
0.154600E+04	0.155925E+02	0.161719E+02	0.150131E+02
0.154700E+04	0.155934E+02	0.161735E+02	0.150133E+02
0.154800E+04	0.155943E+02	0.161750E+02	0.150135E+02
0.154900E+04	0.155951E+02	0.161765E+02	0.150137E+02
0.155000E+04	0.155958E+02	0.161778E+02	0.150137E+02
0.155100E+04	0.155962E+02	0.161788E+02	0.150136E+02
0.155200E+04	0.155966E+02	0.161797E+02	0.150134E+02
0.155300E+04	0.155968E+02	0.161804E+02	0.150132E+02
0.155400E+04	0.155954E+02	0.161809E+02	0.150098E+02
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0.155600E+04	0.155949E+02	0.161817E+02	0.150080E+02
0.155700E+04	0.155947E+02	0.161820E+02	0.150074E+02
0.155800E+04	0.155946E+02	0.161823E+02	0.150069E+02
0.155900E+04	0.155945E+02	0.161826E+02	0.150063E+02
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0.156200E+04	0.155963E+02	0.161860E+02	0.150066E+02
0.156300E+04	0.155974E+02	0.161877E+02	0.150071E+02
0.156400E+04	0.155110E+02	0.160943E+02	0.149278E+02
0.156500E+04	0.154094E+02	0.159699E+02	0.148489E+02
0.156600E+04	0.154425E+02	0.160088E+02	0.148763E+02
0.156700E+04	0.155046E+02	0.160843E+02	0.149249E+02
0.156800E+04	0.155374E+02	0.161253E+02	0.149495E+02
0.156900E+04	0.155543E+02	0.161476E+02	0.149610E+02
0.157000E+04	0.155396E+02	0.161316E+02	0.149477E+02
0.157100E+04	0.155226E+02	0.161116E+02	0.149337E+02
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0.158300E+04	0.156321E+02	0.162419E+02	0.150223E+02
0.158400E+04	0.156377E+02	0.162482E+02	0.150271E+02
0.158500E+04	0.156429E+02	0.162542E+02	0.150317E+02
0.158600E+04	0.156477E+02	0.162596E+02	0.150359E+02
0.158700E+04	0.154871E+02	0.160651E+02	0.149092E+02
0.158800E+04	0.152509E+02	0.157880E+02	0.147137E+02
0.158900E+04	0.152486E+02	0.157976E+02	0.146996E+02
0.159000E+04	0.153508E+02	0.159154E+02	0.147863E+02
0.159100E+04	0.154407E+02	0.160158E+02	0.148657E+02
0.159200E+04	0.154879E+02	0.160683E+02	0.149075E+02
0.159300E+04	0.155184E+02	0.161039E+02	0.149329E+02
0.159400E+04	0.155419E+02	0.161315E+02	0.149523E+02
0.159500E+04	0.155616E+02	0.161546E+02	0.149686E+02
0.159600E+04	0.155788E+02	0.161747E+02	0.149829E+02

0.159700E+04	0.155940E+02	0.161924E+02	0.149957E+02
0.159800E+04	0.156078E+02	0.162083E+02	0.150074E+02
0.159900E+04	0.156174E+02	0.162228E+02	0.150121E+02
0.160000E+04	0.156392E+02	0.162773E+02	0.150011E+02
0.160100E+04	0.154486E+02	0.160671E+02	0.148300E+02
0.160200E+04	0.152501E+02	0.158072E+02	0.146930E+02
0.160300E+04	0.153277E+02	0.159076E+02	0.147479E+02
0.160400E+04	0.154305E+02	0.160211E+02	0.148398E+02
0.160500E+04	0.155049E+02	0.161033E+02	0.149066E+02
0.160600E+04	0.155498E+02	0.161548E+02	0.149448E+02
0.160700E+04	0.155790E+02	0.161881E+02	0.149700E+02
0.160800E+04	0.156009E+02	0.162127E+02	0.149890E+02
0.160900E+04	0.156182E+02	0.162320E+02	0.150044E+02
0.161000E+04	0.156313E+02	0.162476E+02	0.150150E+02
0.161100E+04	0.156314E+02	0.162607E+02	0.150021E+02
0.161200E+04	0.155915E+02	0.162714E+02	0.149115E+02
0.161300E+04	0.154522E+02	0.161522E+02	0.147522E+02
0.161400E+04	0.153279E+02	0.160461E+02	0.146098E+02
0.161500E+04	0.153687E+02	0.160909E+02	0.146466E+02
0.161600E+04	0.154274E+02	0.161655E+02	0.146894E+02
0.161700E+04	0.154562E+02	0.162047E+02	0.147077E+02
0.161800E+04	0.154727E+02	0.162277E+02	0.147178E+02
0.161900E+04	0.154856E+02	0.162438E+02	0.147275E+02
0.162000E+04	0.154970E+02	0.162559E+02	0.147381E+02
0.162100E+04	0.155077E+02	0.162657E+02	0.147497E+02
0.162200E+04	0.153965E+02	0.161321E+02	0.146609E+02
0.162300E+04	0.152880E+02	0.160132E+02	0.145628E+02
0.162400E+04	0.153391E+02	0.160663E+02	0.146120E+02
0.162500E+04	0.154177E+02	0.161510E+02	0.146845E+02
0.162600E+04	0.154616E+02	0.161970E+02	0.147262E+02
0.162700E+04	0.154892E+02	0.162248E+02	0.147536E+02
0.162800E+04	0.155104E+02	0.162450E+02	0.147759E+02
0.162900E+04	0.155279E+02	0.162608E+02	0.147951E+02
0.163000E+04	0.155429E+02	0.162737E+02	0.148121E+02
0.163100E+04	0.155560E+02	0.162846E+02	0.148273E+02
0.163200E+04	0.155668E+02	0.162932E+02	0.148404E+02
0.163300E+04	0.155732E+02	0.162989E+02	0.148474E+02
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0.163600E+04	0.155799E+02	0.163060E+02	0.148538E+02
0.163700E+04	0.155812E+02	0.163064E+02	0.148560E+02
0.163800E+04	0.155821E+02	0.163062E+02	0.148580E+02
0.163900E+04	0.155828E+02	0.163058E+02	0.148598E+02
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0.164100E+04	0.153829E+02	0.160814E+02	0.146844E+02
0.164200E+04	0.151608E+02	0.158185E+02	0.145032E+02
0.164300E+04	0.153669E+02	0.159113E+02	0.148225E+02
0.164400E+04	0.155055E+02	0.160204E+02	0.149907E+02
0.164500E+04	0.155739E+02	0.160860E+02	0.150619E+02
0.164600E+04	0.156051E+02	0.161200E+02	0.150903E+02
0.164700E+04	0.156373E+02	0.161604E+02	0.151142E+02
0.164800E+04	0.156620E+02	0.161950E+02	0.151291E+02
0.164900E+04	0.156765E+02	0.162182E+02	0.151347E+02
0.165000E+04	0.156849E+02	0.162345E+02	0.151354E+02
0.165100E+04	0.156898E+02	0.162463E+02	0.151332E+02
0.165200E+04	0.156922E+02	0.162549E+02	0.151295E+02
0.165300E+04	0.156926E+02	0.162607E+02	0.151245E+02
0.165400E+04	0.156912E+02	0.162638E+02	0.151187E+02
0.165500E+04	0.156885E+02	0.162648E+02	0.151122E+02
0.165600E+04	0.156849E+02	0.162643E+02	0.151055E+02
0.165700E+04	0.156806E+02	0.162626E+02	0.150986E+02
0.165800E+04	0.156756E+02	0.162597E+02	0.150916E+02
0.165900E+04	0.156703E+02	0.162560E+02	0.150845E+02

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0.166000E+04	0.156652E+02	0.162524E+02	0.150780E+02
0.166100E+04	0.156610E+02	0.162496E+02	0.150725E+02
0.166200E+04	0.156574E+02	0.162472E+02	0.150676E+02
0.166300E+04	0.156541E+02	0.162450E+02	0.150631E+02
0.166400E+04	0.156509E+02	0.162428E+02	0.150590E+02
0.166500E+04	0.156480E+02	0.162407E+02	0.150553E+02
0.166600E+04	0.156451E+02	0.162385E+02	0.150518E+02
0.166700E+04	0.156422E+02	0.162363E+02	0.150483E+02
0.166800E+04	0.156393E+02	0.162341E+02	0.150447E+02
0.166900E+04	0.156364E+02	0.162319E+02	0.150411E+02
0.167000E+04	0.156335E+02	0.162297E+02	0.150375E+02
0.167100E+04	0.156306E+02	0.162275E+02	0.150339E+02
0.167200E+04	0.156277E+02	0.162253E+02	0.150303E+02
0.167300E+04	0.156248E+02	0.162231E+02	0.150267E+02
0.167400E+04	0.156219E+02	0.162209E+02	0.150231E+02
0.167500E+04	0.156190E+02	0.162187E+02	0.150195E+02
0.167600E+04	0.156161E+02	0.162165E+02	0.150159E+02
0.167700E+04	0.156132E+02	0.162143E+02	0.150123E+02
0.167800E+04	0.156103E+02	0.162121E+02	0.150087E+02
0.167900E+04	0.156074E+02	0.162099E+02	0.150051E+02
0.168000E+04	0.156045E+02	0.162077E+02	0.150015E+02
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0.168300E+04	0.155958E+02	0.162011E+02	0.149907E+02
0.168400E+04	0.155929E+02	0.161989E+02	0.149871E+02
0.168500E+04	0.155900E+02	0.161967E+02	0.149835E+02
0.168600E+04	0.155871E+02	0.161945E+02	0.149799E+02
0.168700E+04	0.155842E+02	0.161923E+02	0.149763E+02
0.168800E+04	0.155813E+02	0.161901E+02	0.149727E+02
0.168900E+04	0.155784E+02	0.161879E+02	0.149691E+02
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0.169100E+04	0.155726E+02	0.161835E+02	0.149619E+02
0.169200E+04	0.155697E+02	0.161813E+02	0.149583E+02
0.169300E+04	0.155668E+02	0.161791E+02	0.149547E+02
0.169400E+04	0.155639E+02	0.161769E+02	0.149511E+02
0.169500E+04	0.155610E+02	0.161747E+02	0.149475E+02
0.169600E+04	0.155581E+02	0.161725E+02	0.149439E+02
0.169700E+04	0.155552E+02	0.161703E+02	0.149403E+02
0.169800E+04	0.155523E+02	0.161681E+02	0.149367E+02
0.169900E+04	0.155494E+02	0.161659E+02	0.149331E+02
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0.170100E+04	0.155436E+02	0.161615E+02	0.149259E+02
0.170200E+04	0.155407E+02	0.161593E+02	0.149223E+02
0.170300E+04	0.155378E+02	0.161571E+02	0.149187E+02
0.170400E+04	0.155349E+02	0.161549E+02	0.149151E+02
0.170500E+04	0.155320E+02	0.161527E+02	0.149115E+02
0.170600E+04	0.155291E+02	0.161505E+02	0.149079E+02
0.170700E+04	0.155262E+02	0.161483E+02	0.149043E+02
0.170800E+04	0.155233E+02	0.161461E+02	0.149007E+02
0.170900E+04	0.155204E+02	0.161439E+02	0.148971E+02
0.171000E+04	0.155175E+02	0.161417E+02	0.148935E+02
0.171100E+04	0.155146E+02	0.161395E+02	0.148899E+02
0.171200E+04	0.155117E+02	0.161373E+02	0.148863E+02
0.171300E+04	0.155088E+02	0.161351E+02	0.148827E+02
0.171400E+04	0.155059E+02	0.161329E+02	0.148791E+02
0.171500E+04	0.155030E+02	0.161307E+02	0.148755E+02
0.171600E+04	0.155001E+02	0.161285E+02	0.148719E+02
0.171700E+04	0.154972E+02	0.161263E+02	0.148683E+02
0.171800E+04	0.154943E+02	0.161241E+02	0.148647E+02
0.171900E+04	0.154914E+02	0.161219E+02	0.148611E+02
0.172000E+04	0.154885E+02	0.161197E+02	0.148575E+02
0.172100E+04	0.154856E+02	0.161175E+02	0.148539E+02
0.172200E+04	0.154827E+02	0.161153E+02	0.148503E+02

0.172300E+04	0.154858E+02	0.162031E+02	0.147685E+02
0.172400E+04	0.154740E+02	0.162115E+02	0.147366E+02
0.172500E+04	0.154687E+02	0.162198E+02	0.147175E+02
0.172600E+04	0.154663E+02	0.162284E+02	0.147042E+02
0.172700E+04	0.154694E+02	0.162372E+02	0.147016E+02
0.172800E+04	0.154750E+02	0.162454E+02	0.147046E+02
0.172900E+04	0.153625E+02	0.161226E+02	0.146023E+02
0.173000E+04	0.152918E+02	0.160248E+02	0.145589E+02
0.173100E+04	0.153823E+02	0.161184E+02	0.146463E+02
0.173200E+04	0.154383E+02	0.161748E+02	0.147018E+02
0.173300E+04	0.154680E+02	0.162052E+02	0.147309E+02
0.173400E+04	0.154904E+02	0.162274E+02	0.147533E+02
0.173500E+04	0.155091E+02	0.162452E+02	0.147729E+02
0.173600E+04	0.155263E+02	0.162612E+02	0.147914E+02
0.173700E+04	0.155433E+02	0.162770E+02	0.148097E+02
0.173800E+04	0.155601E+02	0.162925E+02	0.148277E+02
0.173900E+04	0.155257E+02	0.162484E+02	0.148030E+02
0.174000E+04	0.155039E+02	0.162188E+02	0.147891E+02
0.174100E+04	0.155467E+02	0.162658E+02	0.148277E+02
0.174200E+04	0.155780E+02	0.163026E+02	0.148534E+02
0.174300E+04	0.155946E+02	0.163232E+02	0.148660E+02
0.174400E+04	0.156077E+02	0.163386E+02	0.148768E+02
0.174500E+04	0.156193E+02	0.163514E+02	0.148871E+02
0.174600E+04	0.156298E+02	0.163626E+02	0.148971E+02
0.174700E+04	0.156396E+02	0.163726E+02	0.149066E+02
0.174800E+04	0.156489E+02	0.163819E+02	0.149159E+02
0.174900E+04	0.156576E+02	0.163905E+02	0.149246E+02
0.175000E+04	0.156658E+02	0.163986E+02	0.149330E+02
0.175100E+04	0.156737E+02	0.164064E+02	0.149410E+02
0.175200E+04	0.156813E+02	0.164139E+02	0.149487E+02
0.175300E+04	0.156885E+02	0.164211E+02	0.149560E+02
0.175400E+04	0.156955E+02	0.164281E+02	0.149629E+02
0.175500E+04	0.157023E+02	0.164349E+02	0.149696E+02
0.175600E+04	0.157087E+02	0.164415E+02	0.149760E+02
0.175700E+04	0.157148E+02	0.164476E+02	0.149819E+02
0.175800E+04	0.157205E+02	0.164535E+02	0.149875E+02
0.175900E+04	0.157260E+02	0.164591E+02	0.149928E+02
0.176000E+04	0.157313E+02	0.164646E+02	0.149980E+02
0.176100E+04	0.157364E+02	0.164699E+02	0.150029E+02
0.176200E+04	0.157414E+02	0.164751E+02	0.150076E+02
0.176300E+04	0.157462E+02	0.164802E+02	0.150122E+02
0.176400E+04	0.157506E+02	0.164847E+02	0.150164E+02
0.176500E+04	0.157542E+02	0.164884E+02	0.150199E+02
0.176600E+04	0.157572E+02	0.164914E+02	0.150229E+02
0.176700E+04	0.157597E+02	0.164939E+02	0.150255E+02
0.176800E+04	0.157620E+02	0.164961E+02	0.150279E+02
0.176900E+04	0.157640E+02	0.164980E+02	0.150299E+02
0.177000E+04	0.157657E+02	0.164997E+02	0.150318E+02
0.177100E+04	0.157673E+02	0.165011E+02	0.150334E+02
0.177200E+04	0.157681E+02	0.165017E+02	0.150344E+02
0.177300E+04	0.157676E+02	0.165008E+02	0.150344E+02
0.177400E+04	0.157663E+02	0.164990E+02	0.150336E+02
0.177500E+04	0.157644E+02	0.164965E+02	0.150324E+02
0.177600E+04	0.157621E+02	0.164935E+02	0.150307E+02
0.177700E+04	0.157594E+02	0.164901E+02	0.150286E+02
0.177800E+04	0.157563E+02	0.164864E+02	0.150263E+02
0.177900E+04	0.157530E+02	0.164824E+02	0.150237E+02
0.178000E+04	0.157501E+02	0.164788E+02	0.150213E+02
0.178100E+04	0.157479E+02	0.164762E+02	0.150197E+02
0.178200E+04	0.157463E+02	0.164742E+02	0.150184E+02
0.178300E+04	0.156261E+02	0.163438E+02	0.149083E+02
0.178400E+04	0.155333E+02	0.162369E+02	0.148298E+02
0.178500E+04	0.156131E+02	0.163227E+02	0.149036E+02

0.178600E+04	0.156603E+02	0.163735E+02	0.149471E+02
0.178700E+04	0.156767E+02	0.163922E+02	0.149613E+02
0.178800E+04	0.156833E+02	0.164052E+02	0.149614E+02
0.178900E+04	0.156432E+02	0.163596E+02	0.149268E+02
0.179000E+04	0.155990E+02	0.163077E+02	0.148903E+02
0.179100E+04	0.156196E+02	0.163320E+02	0.149071E+02
0.179200E+04	0.156518E+02	0.163703E+02	0.149334E+02
0.179300E+04	0.156697E+02	0.163911E+02	0.149483E+02
0.179400E+04	0.156801E+02	0.164025E+02	0.149576E+02
0.179500E+04	0.156874E+02	0.164101E+02	0.149647E+02
0.179600E+04	0.156930E+02	0.164156E+02	0.149703E+02
0.179700E+04	0.156973E+02	0.164197E+02	0.149750E+02
0.179800E+04	0.157008E+02	0.164226E+02	0.149789E+02
0.179900E+04	0.157035E+02	0.164248E+02	0.149821E+02
0.180000E+04	0.157056E+02	0.164262E+02	0.149849E+02
0.180100E+04	0.157072E+02	0.164272E+02	0.149872E+02
0.180200E+04	0.157085E+02	0.164278E+02	0.149892E+02
0.180300E+04	0.157095E+02	0.164280E+02	0.149909E+02
0.180400E+04	0.157101E+02	0.164279E+02	0.149923E+02
0.180500E+04	0.157106E+02	0.164276E+02	0.149935E+02
0.180600E+04	0.157108E+02	0.164271E+02	0.149945E+02
0.180700E+04	0.157109E+02	0.164264E+02	0.149953E+02
0.180800E+04	0.157108E+02	0.164256E+02	0.149960E+02
0.180900E+04	0.155137E+02	0.162025E+02	0.148248E+02
0.181000E+04	0.152895E+02	0.159392E+02	0.146398E+02
0.181100E+04	0.154880E+02	0.160312E+02	0.149448E+02
0.181200E+04	0.156221E+02	0.161370E+02	0.151071E+02
0.181300E+04	0.157050E+02	0.162175E+02	0.151925E+02
0.181400E+04	0.157493E+02	0.162665E+02	0.152321E+02
0.181500E+04	0.155576E+02	0.160427E+02	0.150725E+02
0.181600E+04	0.153323E+02	0.157830E+02	0.148815E+02
0.181700E+04	0.154100E+02	0.158924E+02	0.149276E+02
0.181800E+04	0.155228E+02	0.160270E+02	0.150186E+02
0.181900E+04	0.155969E+02	0.161128E+02	0.150811E+02
0.182000E+04	0.156399E+02	0.161682E+02	0.151116E+02
0.182100E+04	0.156658E+02	0.162037E+02	0.151280E+02
0.182200E+04	0.156838E+02	0.162292E+02	0.151383E+02
0.182300E+04	0.156966E+02	0.162482E+02	0.151451E+02
0.182400E+04	0.157058E+02	0.162623E+02	0.151494E+02
0.182500E+04	0.157120E+02	0.162722E+02	0.151518E+02
0.182600E+04	0.157377E+02	0.163216E+02	0.151539E+02
0.182700E+04	0.157400E+02	0.163229E+02	0.151570E+02
0.182800E+04	0.157398E+02	0.163221E+02	0.151574E+02
0.182900E+04	0.157391E+02	0.163215E+02	0.151567E+02
0.183000E+04	0.156933E+02	0.162668E+02	0.151197E+02
0.183100E+04	0.154905E+02	0.160377E+02	0.149432E+02
0.183200E+04	0.153467E+02	0.158828E+02	0.148107E+02
0.183300E+04	0.154298E+02	0.159780E+02	0.148815E+02
0.183400E+04	0.155394E+02	0.161016E+02	0.149771E+02
0.183500E+04	0.154825E+02	0.160311E+02	0.149339E+02
0.183600E+04	0.154041E+02	0.159426E+02	0.148656E+02
0.183700E+04	0.154654E+02	0.160153E+02	0.149156E+02
0.183800E+04	0.155479E+02	0.161118E+02	0.149841E+02
0.183900E+04	0.155871E+02	0.161520E+02	0.150221E+02
0.184000E+04	0.155765E+02	0.161373E+02	0.150157E+02
0.184100E+04	0.155558E+02	0.161102E+02	0.150013E+02
0.184200E+04	0.155873E+02	0.161477E+02	0.150270E+02
0.184300E+04	0.155919E+02	0.161696E+02	0.150143E+02
0.184400E+04	0.155708E+02	0.161519E+02	0.149898E+02
0.184500E+04	0.156038E+02	0.161861E+02	0.150215E+02
0.184600E+04	0.156508E+02	0.162418E+02	0.150597E+02
0.184700E+04	0.156624E+02	0.162643E+02	0.150606E+02
0.184800E+04	0.156222E+02	0.162831E+02	0.149613E+02

0.184900E+04	0.156010E+02	0.162973E+02	0.149048E+02
0.185000E+04	0.155901E+02	0.163079E+02	0.148722E+02
0.185100E+04	0.155834E+02	0.163157E+02	0.148512E+02
0.185200E+04	0.155803E+02	0.163217E+02	0.148388E+02
0.185300E+04	0.155781E+02	0.163266E+02	0.148296E+02
0.185400E+04	0.155480E+02	0.162943E+02	0.148018E+02
0.185500E+04	0.155287E+02	0.162715E+02	0.147859E+02
0.185600E+04	0.155520E+02	0.162970E+02	0.148070E+02
0.185700E+04	0.155716E+02	0.163172E+02	0.148260E+02
0.185800E+04	0.155843E+02	0.163280E+02	0.148406E+02
0.185900E+04	0.155950E+02	0.163357E+02	0.148544E+02
0.186000E+04	0.156049E+02	0.163420E+02	0.148677E+02
0.186100E+04	0.156142E+02	0.163477E+02	0.148807E+02
0.186200E+04	0.156232E+02	0.163531E+02	0.148932E+02
0.186300E+04	0.156318E+02	0.163583E+02	0.149052E+02
0.186400E+04	0.156401E+02	0.163634E+02	0.149167E+02
0.186500E+04	0.156481E+02	0.163685E+02	0.149277E+02
0.186600E+04	0.156556E+02	0.163734E+02	0.149378E+02
0.186700E+04	0.156625E+02	0.163779E+02	0.149471E+02
0.186800E+04	0.156689E+02	0.163822E+02	0.149556E+02
0.186900E+04	0.156749E+02	0.163864E+02	0.149635E+02
0.187000E+04	0.156806E+02	0.163905E+02	0.149707E+02
0.187100E+04	0.156859E+02	0.163945E+02	0.149773E+02
0.187200E+04	0.156909E+02	0.163984E+02	0.149834E+02
0.187300E+04	0.156956E+02	0.164023E+02	0.149889E+02
0.187400E+04	0.157001E+02	0.164061E+02	0.149941E+02
0.187500E+04	0.157043E+02	0.164098E+02	0.149988E+02
0.187600E+04	0.157084E+02	0.164135E+02	0.150032E+02
0.187700E+04	0.157122E+02	0.164172E+02	0.150072E+02
0.187800E+04	0.157158E+02	0.164207E+02	0.150109E+02
0.187900E+04	0.157192E+02	0.164242E+02	0.150143E+02
0.188000E+04	0.157224E+02	0.164274E+02	0.150173E+02
0.188100E+04	0.157253E+02	0.164305E+02	0.150201E+02
0.188200E+04	0.157280E+02	0.164335E+02	0.150225E+02
0.188300E+04	0.155987E+02	0.162925E+02	0.149049E+02
0.188400E+04	0.154475E+02	0.161172E+02	0.147778E+02
0.188500E+04	0.155007E+02	0.161725E+02	0.148289E+02
0.188600E+04	0.155887E+02	0.162750E+02	0.149023E+02
0.188700E+04	0.156298E+02	0.163209E+02	0.149386E+02
0.188800E+04	0.156481E+02	0.163477E+02	0.149486E+02
0.188900E+04	0.156615E+02	0.163662E+02	0.149568E+02
0.189000E+04	0.156726E+02	0.163797E+02	0.149656E+02
0.189100E+04	0.156816E+02	0.163900E+02	0.149731E+02
0.189200E+04	0.156887E+02	0.163980E+02	0.149794E+02
0.189300E+04	0.156947E+02	0.164046E+02	0.149847E+02
0.189400E+04	0.157000E+02	0.164104E+02	0.149895E+02
0.189500E+04	0.157047E+02	0.164155E+02	0.149938E+02
0.189600E+04	0.157088E+02	0.164200E+02	0.149975E+02
0.189700E+04	0.157124E+02	0.164240E+02	0.150008E+02
0.189800E+04	0.157153E+02	0.164270E+02	0.150036E+02
0.189900E+04	0.157179E+02	0.164298E+02	0.150060E+02
0.190000E+04	0.157204E+02	0.164325E+02	0.150083E+02
0.190100E+04	0.157228E+02	0.164351E+02	0.150105E+02
0.190200E+04	0.155967E+02	0.162975E+02	0.148958E+02
0.190300E+04	0.154530E+02	0.161298E+02	0.147763E+02
0.190400E+04	0.155055E+02	0.161848E+02	0.148262E+02
0.190500E+04	0.155896E+02	0.162827E+02	0.148965E+02
0.190600E+04	0.156290E+02	0.163265E+02	0.149316E+02
0.190700E+04	0.156345E+02	0.163360E+02	0.149329E+02
0.190800E+04	0.156364E+02	0.163424E+02	0.149303E+02
0.190900E+04	0.156563E+02	0.163665E+02	0.149461E+02
0.191000E+04	0.156723E+02	0.163852E+02	0.149594E+02
0.191100E+04	0.156832E+02	0.163974E+02	0.149690E+02

0.191200E+04	0.156106E+02	0.163119E+02	0.149093E+02
0.191300E+04	0.155412E+02	0.162397E+02	0.148427E+02
0.191400E+04	0.155432E+02	0.162397E+02	0.148468E+02
0.191500E+04	0.155825E+02	0.162795E+02	0.148855E+02
0.191600E+04	0.156308E+02	0.163332E+02	0.149283E+02
0.191700E+04	0.156565E+02	0.163617E+02	0.149513E+02
0.191800E+04	0.156706E+02	0.163823E+02	0.149589E+02
0.191900E+04	0.156842E+02	0.163986E+02	0.149698E+02
0.192000E+04	0.156962E+02	0.164119E+02	0.149806E+02
0.192100E+04	0.157069E+02	0.164232E+02	0.149906E+02
0.192200E+04	0.157166E+02	0.164332E+02	0.150000E+02
0.192300E+04	0.157255E+02	0.164422E+02	0.150088E+02
0.192400E+04	0.156825E+02	0.163907E+02	0.149743E+02
0.192500E+04	0.156331E+02	0.163316E+02	0.149346E+02
0.192600E+04	0.156682E+02	0.163808E+02	0.149555E+02
0.192700E+04	0.157066E+02	0.164245E+02	0.149886E+02
0.192800E+04	0.157245E+02	0.164405E+02	0.150084E+02
0.192900E+04	0.157362E+02	0.164512E+02	0.150212E+02
0.193000E+04	0.157466E+02	0.164617E+02	0.150315E+02
0.193100E+04	0.157556E+02	0.164708E+02	0.150404E+02
0.193200E+04	0.157634E+02	0.164786E+02	0.150483E+02
0.193300E+04	0.157704E+02	0.164854E+02	0.150554E+02
0.193400E+04	0.157767E+02	0.164915E+02	0.150619E+02
0.193500E+04	0.157825E+02	0.164971E+02	0.150680E+02
0.193600E+04	0.157880E+02	0.165023E+02	0.150737E+02
0.193700E+04	0.157932E+02	0.165073E+02	0.150791E+02
0.193800E+04	0.157982E+02	0.165121E+02	0.150843E+02
0.193900E+04	0.158030E+02	0.165167E+02	0.150894E+02
0.194000E+04	0.158077E+02	0.165212E+02	0.150942E+02
0.194100E+04	0.158123E+02	0.165255E+02	0.150990E+02
0.194200E+04	0.158167E+02	0.165298E+02	0.151036E+02
0.194300E+04	0.158211E+02	0.165340E+02	0.151081E+02
0.194400E+04	0.158254E+02	0.165381E+02	0.151126E+02
0.194500E+04	0.158291E+02	0.165417E+02	0.151166E+02
0.194600E+04	0.158320E+02	0.165442E+02	0.151198E+02
0.194700E+04	0.158342E+02	0.165460E+02	0.151224E+02
0.194800E+04	0.158360E+02	0.165473E+02	0.151247E+02
0.194900E+04	0.158376E+02	0.165484E+02	0.151268E+02
0.195000E+04	0.158389E+02	0.165492E+02	0.151286E+02
0.195100E+04	0.158401E+02	0.165500E+02	0.151302E+02
0.195200E+04	0.158413E+02	0.165508E+02	0.151318E+02
0.195300E+04	0.158424E+02	0.165515E+02	0.151333E+02
0.195400E+04	0.158435E+02	0.165522E+02	0.151348E+02
0.195500E+04	0.158446E+02	0.165529E+02	0.151362E+02
0.195600E+04	0.158296E+02	0.165350E+02	0.151242E+02
0.195700E+04	0.158189E+02	0.165220E+02	0.151158E+02
0.195800E+04	0.158290E+02	0.165337E+02	0.151243E+02
0.195900E+04	0.158366E+02	0.165427E+02	0.151306E+02
0.196000E+04	0.158404E+02	0.165468E+02	0.151340E+02
0.196100E+04	0.158274E+02	0.165313E+02	0.151235E+02
0.196200E+04	0.158072E+02	0.165072E+02	0.151071E+02
0.196300E+04	0.157852E+02	0.164815E+02	0.150889E+02
0.196400E+04	0.157480E+02	0.164482E+02	0.150479E+02
0.196500E+04	0.157029E+02	0.163927E+02	0.150131E+02
0.196600E+04	0.156912E+02	0.163798E+02	0.150026E+02
0.196700E+04	0.157050E+02	0.163969E+02	0.150132E+02
0.196800E+04	0.157040E+02	0.163964E+02	0.150115E+02
0.196900E+04	0.156759E+02	0.163646E+02	0.149871E+02
0.197000E+04	0.156684E+02	0.163565E+02	0.149802E+02
0.197100E+04	0.156973E+02	0.163906E+02	0.150040E+02
0.197200E+04	0.157282E+02	0.164260E+02	0.150305E+02
0.197300E+04	0.157417E+02	0.164392E+02	0.150442E+02
0.197400E+04	0.157413E+02	0.164378E+02	0.150447E+02

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0.197500E+04	0.157155E+02	0.164070E+02	0.150241E+02
0.197600E+04	0.156971E+02	0.163846E+02	0.150096E+02
0.197700E+04	0.157168E+02	0.164076E+02	0.150260E+02
0.197800E+04	0.157391E+02	0.164340E+02	0.150442E+02
0.197900E+04	0.157474E+02	0.164436E+02	0.150513E+02
0.198000E+04	0.157548E+02	0.164516E+02	0.150579E+02
0.198100E+04	0.157652E+02	0.164633E+02	0.150672E+02
0.198200E+04	0.156852E+02	0.163693E+02	0.150011E+02
0.198300E+04	0.155303E+02	0.161987E+02	0.148620E+02
0.198400E+04	0.154723E+02	0.161257E+02	0.148188E+02
0.198500E+04	0.155419E+02	0.162041E+02	0.148797E+02
0.198600E+04	0.157389E+02	0.162850E+02	0.151928E+02
0.198700E+04	0.157905E+02	0.163191E+02	0.152618E+02
0.198800E+04	0.158442E+02	0.163553E+02	0.153331E+02
0.198900E+04	0.158770E+02	0.163913E+02	0.153627E+02
0.199000E+04	0.158991E+02	0.164196E+02	0.153785E+02
0.199100E+04	0.158582E+02	0.163750E+02	0.153414E+02
0.199200E+04	0.157078E+02	0.162064E+02	0.152093E+02
0.199300E+04	0.156069E+02	0.160907E+02	0.151230E+02
0.199400E+04	0.156640E+02	0.161649E+02	0.151631E+02
0.199500E+04	0.157382E+02	0.162594E+02	0.152170E+02
0.199600E+04	0.157874E+02	0.163231E+02	0.152517E+02
0.199700E+04	0.158211E+02	0.163693E+02	0.152729E+02
0.199800E+04	0.158468E+02	0.164049E+02	0.152886E+02

```
#          91
# IPCC AR4 Millenium Runs output (vary solar forcing)
# ++++++
#
# Model: Bern2.5CC version with active C-cycle
# -----
# Prescribed forcing timeseries as described in file
# readme_doRuns_IPCC_Chap6_millennium_21jan06.txt
# provided by F. Joos, University of Bern.
#
# Contact:
# -----
# Gian-Kasper Plattner
# Climate and Environmental Physics
# Physics Institute, University of Bern
# Sidlerstrasse 5, CH-3012 Bern, Switzerland
# plattner@climate.unibe.ch
# http://www.climate.unibe.ch/~plattner/
# tel: ++41 (0)31 631-44-67
# fax: ++41 (0)31 631-87-42
#
# Some model setup informations:
# -----
# All runs with horizontal/vertical diffusion
#
# Run with standard ocean parameters
#   as used in Plattner et al. 2001/2002
#   with Kv (diffusivity) 4*10^-5 m2/s
#
# Climate sens. set to ~ 3.2 degrees C
# parameterized see Knutti et al. (Clim. Dyn. 2003)
#
# Model version is annual mean.
#
# No radiation code, CO2 radiative forcing calculated
# for as RF=5.35*ln(CO2/CO2_preind),
# Non-co2 radiative forcing prescribed according to
# Joos et al. GBC 2001 with updates for solar forcing
```

```

#
# More model description:
# -----
# Zonally averaged dynamical ocean with 3 basins and
# Southern Ocean, zonally averaged one layer energy
# and moisture balance atmosphere, thermodynamic
# sea ice (Stocker et al., J. Climate 1992).
#
# Carbon cycle components: Ocean/Atm/Terr.biosphere;
# Ocean carbon cycle is a description of the cycles
# of organic carbon and CaCO3 (Marchal et al., Tellus
# Tellus B), based on Redfield approach using PO4 as
# biolimiting nutrient.
#
# Land Biota: Lund-Jena-Postdam Dynamical Global
# Vegetation Model (LPJ-DGVM)
# at GCM resolution (Gerber et al. 2003, Climate
# Dynamics; Sitch et al. 2003, Global Change Biology)
#
# LPJ forced by Cramer/Leemans annual mean
# climatology plus interannual climate variability
# from Hadley simulation (30-recycled climate) plus
# changes in the fields of surface temperature,
# precipitation, and cloudcover as simulated with the
# Impulse-EOF version of ECHAM-3/LSG in response to
# projected radiative forcing changes.
#
# Land use changes are not explicitly considered.
#
# Impact of climate change on terrestrial C-storage
# included
#
# References:
# -----
# Carbon cycle Ocean: Marchal et al., Tellus 1998
# Carbon cycle Terr. Bio: Sitch et al., GCB 2003
# Gerber et al., Clim. Dyn. 2003
# Ccycle-climate feedbacks and global warming:
# Plattner et al., Tellus 2001
# Plattner et al., GBC 2002
# Non-CO2 forcing: Joos et al., GBC 2001
# Climate model: Stocker et al., J. Climate 1992
# Sea level: Knutti et al., J. Climate 2000
# Global warming Physics: Knutti et al., Nature 2002
# Knutti et al., Cl. Dyn. 2003
# and refs therein.
#
# Output columns:
# -----
# Time (yr AD)
# Global mean air temperature (deg C)
# NH-averaged air temperature (deg C)
# SH-averaged air temperature (deg C)
0.100100E+04 0.158198E+02 0.164832E+02 0.151565E+02
0.100200E+04 0.158243E+02 0.164878E+02 0.151609E+02
0.100300E+04 0.158278E+02 0.164912E+02 0.151644E+02
0.100400E+04 0.157993E+02 0.164574E+02 0.151413E+02
0.100500E+04 0.157659E+02 0.164170E+02 0.151147E+02
0.100600E+04 0.157759E+02 0.164288E+02 0.151229E+02
0.100700E+04 0.157951E+02 0.164521E+02 0.151380E+02
0.100800E+04 0.158040E+02 0.164631E+02 0.151448E+02
0.100900E+04 0.158072E+02 0.164670E+02 0.151474E+02
0.101000E+04 0.158081E+02 0.164681E+02 0.151481E+02

```

0.101100E+04	0.158077E+02	0.164676E+02	0.151478E+02
0.101200E+04	0.158057E+02	0.164648E+02	0.151465E+02
0.101300E+04	0.158043E+02	0.164635E+02	0.151451E+02
0.101400E+04	0.158024E+02	0.164611E+02	0.151437E+02
0.101500E+04	0.157049E+02	0.163571E+02	0.150527E+02
0.101600E+04	0.155972E+02	0.162248E+02	0.149697E+02
0.101700E+04	0.156922E+02	0.162643E+02	0.151202E+02
0.101800E+04	0.158353E+02	0.163405E+02	0.153301E+02
0.101900E+04	0.158968E+02	0.163819E+02	0.154116E+02
0.102000E+04	0.159173E+02	0.164048E+02	0.154297E+02
0.102100E+04	0.159278E+02	0.164205E+02	0.154351E+02
0.102200E+04	0.159328E+02	0.164321E+02	0.154335E+02
0.102300E+04	0.159343E+02	0.164407E+02	0.154280E+02
0.102400E+04	0.159336E+02	0.164470E+02	0.154202E+02
0.102500E+04	0.159334E+02	0.164515E+02	0.154153E+02
0.102600E+04	0.158073E+02	0.163080E+02	0.153065E+02
0.102700E+04	0.156707E+02	0.161542E+02	0.151872E+02
0.102800E+04	0.157090E+02	0.162032E+02	0.152148E+02
0.102900E+04	0.157763E+02	0.162882E+02	0.152644E+02
0.103000E+04	0.158056E+02	0.163276E+02	0.152836E+02
0.103100E+04	0.158192E+02	0.163487E+02	0.152896E+02
0.103200E+04	0.158266E+02	0.163619E+02	0.152913E+02
0.103300E+04	0.158306E+02	0.163703E+02	0.152909E+02
0.103400E+04	0.158323E+02	0.163755E+02	0.152891E+02
0.103500E+04	0.158325E+02	0.163784E+02	0.152866E+02
0.103600E+04	0.158318E+02	0.163799E+02	0.152837E+02
0.103700E+04	0.158306E+02	0.163806E+02	0.152807E+02
0.103800E+04	0.158291E+02	0.163805E+02	0.152777E+02
0.103900E+04	0.158272E+02	0.163798E+02	0.152746E+02
0.104000E+04	0.158251E+02	0.163787E+02	0.152715E+02
0.104100E+04	0.158228E+02	0.163772E+02	0.152684E+02
0.104200E+04	0.158204E+02	0.163754E+02	0.152653E+02
0.104300E+04	0.158178E+02	0.163734E+02	0.152623E+02
0.104400E+04	0.158152E+02	0.163712E+02	0.152592E+02
0.104500E+04	0.158126E+02	0.163690E+02	0.152563E+02
0.104600E+04	0.158103E+02	0.163669E+02	0.152536E+02
0.104700E+04	0.158080E+02	0.163649E+02	0.152510E+02
0.104800E+04	0.158058E+02	0.163630E+02	0.152486E+02
0.104900E+04	0.158037E+02	0.163611E+02	0.152462E+02
0.105000E+04	0.158016E+02	0.163592E+02	0.152439E+02
0.105100E+04	0.157995E+02	0.163574E+02	0.152417E+02
0.105200E+04	0.157976E+02	0.163555E+02	0.152396E+02
0.105300E+04	0.157956E+02	0.163537E+02	0.152375E+02
0.105400E+04	0.157937E+02	0.163520E+02	0.152355E+02
0.105500E+04	0.157920E+02	0.163503E+02	0.152336E+02
0.105600E+04	0.157904E+02	0.163489E+02	0.152320E+02
0.105700E+04	0.157890E+02	0.163477E+02	0.152304E+02
0.105800E+04	0.156301E+02	0.161679E+02	0.150922E+02
0.105900E+04	0.154447E+02	0.159496E+02	0.149398E+02
0.106000E+04	0.155357E+02	0.160581E+02	0.150132E+02
0.106100E+04	0.156325E+02	0.161633E+02	0.151018E+02
0.106200E+04	0.156342E+02	0.161646E+02	0.151038E+02
0.106300E+04	0.156119E+02	0.161382E+02	0.150856E+02
0.106400E+04	0.156460E+02	0.161794E+02	0.151126E+02
0.106500E+04	0.156822E+02	0.162208E+02	0.151436E+02
0.106600E+04	0.157069E+02	0.162513E+02	0.151626E+02
0.106700E+04	0.157247E+02	0.162733E+02	0.151762E+02
0.106800E+04	0.157394E+02	0.162911E+02	0.151878E+02
0.106900E+04	0.157523E+02	0.163065E+02	0.151981E+02
0.107000E+04	0.157640E+02	0.163203E+02	0.152077E+02
0.107100E+04	0.157749E+02	0.163330E+02	0.152168E+02
0.107200E+04	0.157851E+02	0.163448E+02	0.152254E+02
0.107300E+04	0.157949E+02	0.163560E+02	0.152337E+02

0.107400E+04	0.158043E+02	0.163667E+02	0.152418E+02
0.107500E+04	0.158134E+02	0.163771E+02	0.152497E+02
0.107600E+04	0.158220E+02	0.163869E+02	0.152571E+02
0.107700E+04	0.158298E+02	0.163957E+02	0.152639E+02
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0.107900E+04	0.158400E+02	0.164116E+02	0.152683E+02
0.108000E+04	0.158048E+02	0.163826E+02	0.152269E+02
0.108100E+04	0.157708E+02	0.163494E+02	0.151922E+02
0.108200E+04	0.157538E+02	0.163680E+02	0.151397E+02
0.108300E+04	0.157311E+02	0.163982E+02	0.150640E+02
0.108400E+04	0.157226E+02	0.164154E+02	0.150299E+02
0.108500E+04	0.157160E+02	0.164249E+02	0.150071E+02
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0.108700E+04	0.157089E+02	0.164360E+02	0.149817E+02
0.108800E+04	0.157096E+02	0.164399E+02	0.149794E+02
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0.109000E+04	0.157168E+02	0.164467E+02	0.149869E+02
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0.109500E+04	0.157509E+02	0.164668E+02	0.150350E+02
0.109600E+04	0.157588E+02	0.164717E+02	0.150458E+02
0.109700E+04	0.156945E+02	0.163925E+02	0.149966E+02
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0.110100E+04	0.157415E+02	0.164386E+02	0.150443E+02
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0.110400E+04	0.157834E+02	0.164844E+02	0.150824E+02
0.110500E+04	0.157919E+02	0.164952E+02	0.150887E+02
0.110600E+04	0.158000E+02	0.165047E+02	0.150953E+02
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0.110800E+04	0.158155E+02	0.165217E+02	0.151093E+02
0.110900E+04	0.158233E+02	0.165301E+02	0.151166E+02
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0.111200E+04	0.158496E+02	0.165582E+02	0.151411E+02
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0.111500E+04	0.158761E+02	0.165868E+02	0.151655E+02
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0.111700E+04	0.158895E+02	0.166011E+02	0.151780E+02
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0.112500E+04	0.159265E+02	0.166410E+02	0.152121E+02
0.112600E+04	0.159303E+02	0.166450E+02	0.152155E+02
0.112700E+04	0.159339E+02	0.166490E+02	0.152187E+02
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0.113000E+04	0.159440E+02	0.166602E+02	0.152279E+02
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0.113200E+04	0.159504E+02	0.166671E+02	0.152336E+02
0.113300E+04	0.159538E+02	0.166708E+02	0.152367E+02
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0.113500E+04	0.159618E+02	0.166797E+02	0.152439E+02
0.113600E+04	0.159657E+02	0.166839E+02	0.152474E+02

0.113700E+04	0.159694E+02	0.166880E+02	0.152509E+02
0.113800E+04	0.159731E+02	0.166919E+02	0.152543E+02
0.113900E+04	0.159765E+02	0.166955E+02	0.152575E+02
0.114000E+04	0.159795E+02	0.166986E+02	0.152604E+02
0.114100E+04	0.159821E+02	0.167012E+02	0.152629E+02
0.114200E+04	0.159844E+02	0.167036E+02	0.152653E+02
0.114300E+04	0.159866E+02	0.167057E+02	0.152676E+02
0.114400E+04	0.159887E+02	0.167077E+02	0.152697E+02
0.114500E+04	0.159906E+02	0.167095E+02	0.152718E+02
0.114600E+04	0.159925E+02	0.167112E+02	0.152737E+02
0.114700E+04	0.159940E+02	0.167125E+02	0.152754E+02
0.114800E+04	0.159950E+02	0.167133E+02	0.152767E+02
0.114900E+04	0.159957E+02	0.167137E+02	0.152778E+02
0.115000E+04	0.159962E+02	0.167138E+02	0.152786E+02
0.115100E+04	0.159965E+02	0.167137E+02	0.152793E+02
0.115200E+04	0.159966E+02	0.167134E+02	0.152798E+02
0.115300E+04	0.159966E+02	0.167130E+02	0.152803E+02
0.115400E+04	0.159965E+02	0.167124E+02	0.152806E+02
0.115500E+04	0.159962E+02	0.167117E+02	0.152808E+02
0.115600E+04	0.159956E+02	0.167106E+02	0.152807E+02
0.115700E+04	0.159945E+02	0.167088E+02	0.152802E+02
0.115800E+04	0.159930E+02	0.167066E+02	0.152793E+02
0.115900E+04	0.159911E+02	0.167041E+02	0.152782E+02
0.116000E+04	0.159891E+02	0.167013E+02	0.152769E+02
0.116100E+04	0.159869E+02	0.166984E+02	0.152754E+02
0.116200E+04	0.159852E+02	0.166961E+02	0.152744E+02
0.116300E+04	0.159846E+02	0.166950E+02	0.152742E+02
0.116400E+04	0.159845E+02	0.166946E+02	0.152745E+02
0.116500E+04	0.159849E+02	0.166947E+02	0.152751E+02
0.116600E+04	0.159428E+02	0.166451E+02	0.152404E+02
0.116700E+04	0.158959E+02	0.165897E+02	0.152021E+02
0.116800E+04	0.159091E+02	0.166057E+02	0.152125E+02
0.116900E+04	0.159352E+02	0.166373E+02	0.152331E+02
0.117000E+04	0.159482E+02	0.166529E+02	0.152434E+02
0.117100E+04	0.159542E+02	0.166597E+02	0.152486E+02
0.117200E+04	0.159575E+02	0.166631E+02	0.152518E+02
0.117300E+04	0.159593E+02	0.166647E+02	0.152539E+02
0.117400E+04	0.159602E+02	0.166651E+02	0.152553E+02
0.117500E+04	0.157061E+02	0.163789E+02	0.150332E+02
0.117600E+04	0.155551E+02	0.160890E+02	0.150211E+02
0.117700E+04	0.156680E+02	0.161564E+02	0.151796E+02
0.117800E+04	0.158097E+02	0.162988E+02	0.153207E+02
0.117900E+04	0.159020E+02	0.163952E+02	0.154089E+02
0.118000E+04	0.159557E+02	0.164593E+02	0.154521E+02
0.118100E+04	0.159869E+02	0.164999E+02	0.154740E+02
0.118200E+04	0.160078E+02	0.165298E+02	0.154859E+02
0.118300E+04	0.160225E+02	0.165528E+02	0.154922E+02
0.118400E+04	0.160353E+02	0.165710E+02	0.154997E+02
0.118500E+04	0.160428E+02	0.165854E+02	0.155002E+02
0.118600E+04	0.160485E+02	0.165969E+02	0.155001E+02
0.118700E+04	0.160526E+02	0.166060E+02	0.154991E+02
0.118800E+04	0.160766E+02	0.166547E+02	0.154985E+02
0.118900E+04	0.160785E+02	0.166574E+02	0.154996E+02
0.119000E+04	0.160782E+02	0.166579E+02	0.154985E+02
0.119100E+04	0.160780E+02	0.166591E+02	0.154970E+02
0.119200E+04	0.160753E+02	0.166606E+02	0.154901E+02
0.119300E+04	0.160652E+02	0.166627E+02	0.154678E+02
0.119400E+04	0.159646E+02	0.165549E+02	0.153743E+02
0.119500E+04	0.158724E+02	0.164638E+02	0.152809E+02
0.119600E+04	0.158950E+02	0.164984E+02	0.152916E+02
0.119700E+04	0.159428E+02	0.165637E+02	0.153219E+02
0.119800E+04	0.159032E+02	0.165916E+02	0.152148E+02
0.119900E+04	0.158916E+02	0.166071E+02	0.151761E+02

0.120000E+04	0.158844E+02	0.166165E+02	0.151523E+02
0.120100E+04	0.158801E+02	0.166220E+02	0.151382E+02
0.120200E+04	0.158785E+02	0.166253E+02	0.151316E+02
0.120300E+04	0.158775E+02	0.166273E+02	0.151277E+02
0.120400E+04	0.158785E+02	0.166281E+02	0.151289E+02
0.120500E+04	0.158302E+02	0.165689E+02	0.150915E+02
0.120600E+04	0.157769E+02	0.165023E+02	0.150514E+02
0.120700E+04	0.158087E+02	0.165443E+02	0.150730E+02
0.120800E+04	0.158443E+02	0.165808E+02	0.151079E+02
0.120900E+04	0.158653E+02	0.166001E+02	0.151305E+02
0.121000E+04	0.158786E+02	0.166102E+02	0.151469E+02
0.121100E+04	0.158889E+02	0.166169E+02	0.151609E+02
0.121200E+04	0.158974E+02	0.166217E+02	0.151732E+02
0.121300E+04	0.159048E+02	0.166253E+02	0.151842E+02
0.121400E+04	0.159113E+02	0.166284E+02	0.151942E+02
0.121500E+04	0.159171E+02	0.166310E+02	0.152032E+02
0.121600E+04	0.159224E+02	0.166335E+02	0.152113E+02
0.121700E+04	0.159272E+02	0.166357E+02	0.152186E+02
0.121800E+04	0.159263E+02	0.166278E+02	0.152248E+02
0.121900E+04	0.159273E+02	0.166248E+02	0.152299E+02
0.122000E+04	0.159301E+02	0.166254E+02	0.152348E+02
0.122100E+04	0.159331E+02	0.166269E+02	0.152393E+02
0.122200E+04	0.159361E+02	0.166288E+02	0.152434E+02
0.122300E+04	0.159390E+02	0.166308E+02	0.152472E+02
0.122400E+04	0.159418E+02	0.166328E+02	0.152507E+02
0.122500E+04	0.159444E+02	0.166350E+02	0.152539E+02
0.122600E+04	0.159470E+02	0.166371E+02	0.152568E+02
0.122700E+04	0.159183E+02	0.166029E+02	0.152336E+02
0.122800E+04	0.158857E+02	0.165640E+02	0.152075E+02
0.122900E+04	0.157160E+02	0.163768E+02	0.150552E+02
0.123000E+04	0.155305E+02	0.161578E+02	0.149031E+02
0.123100E+04	0.156023E+02	0.162576E+02	0.149471E+02
0.123200E+04	0.158348E+02	0.163672E+02	0.153024E+02
0.123300E+04	0.159388E+02	0.164432E+02	0.154343E+02
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0.123600E+04	0.160305E+02	0.165364E+02	0.155247E+02
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0.124200E+04	0.160843E+02	0.166467E+02	0.155218E+02
0.124300E+04	0.160824E+02	0.166463E+02	0.155184E+02
0.124400E+04	0.160807E+02	0.166474E+02	0.155139E+02
0.124500E+04	0.160789E+02	0.166485E+02	0.155093E+02
0.124600E+04	0.160769E+02	0.166490E+02	0.155047E+02
0.124700E+04	0.160746E+02	0.166490E+02	0.155002E+02
0.124800E+04	0.160721E+02	0.166484E+02	0.154957E+02
0.124900E+04	0.160626E+02	0.166474E+02	0.154779E+02
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0.125200E+04	0.160257E+02	0.166410E+02	0.154104E+02
0.125300E+04	0.159714E+02	0.166378E+02	0.153049E+02
0.125400E+04	0.159320E+02	0.166324E+02	0.152317E+02
0.125500E+04	0.159047E+02	0.166241E+02	0.151854E+02
0.125600E+04	0.158828E+02	0.166139E+02	0.151518E+02
0.125700E+04	0.158651E+02	0.166026E+02	0.151276E+02
0.125800E+04	0.158516E+02	0.165919E+02	0.151112E+02
0.125900E+04	0.154066E+02	0.160746E+02	0.147385E+02
0.126000E+04	0.151789E+02	0.159923E+02	0.143655E+02
0.126100E+04	0.153780E+02	0.163057E+02	0.144502E+02
0.126200E+04	0.155707E+02	0.164931E+02	0.146483E+02

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0.126400E+04	0.157668E+02	0.166547E+02	0.148790E+02
0.126500E+04	0.157988E+02	0.166676E+02	0.149300E+02
0.126600E+04	0.158190E+02	0.166698E+02	0.149681E+02
0.126700E+04	0.158328E+02	0.166672E+02	0.149984E+02
0.126800E+04	0.158402E+02	0.166622E+02	0.150182E+02
0.126900E+04	0.158443E+02	0.166562E+02	0.150324E+02
0.127000E+04	0.158475E+02	0.166500E+02	0.150451E+02
0.127100E+04	0.158502E+02	0.166441E+02	0.150563E+02
0.127200E+04	0.158528E+02	0.166392E+02	0.150663E+02
0.127300E+04	0.158547E+02	0.166344E+02	0.150751E+02
0.127400E+04	0.158561E+02	0.166298E+02	0.150824E+02
0.127500E+04	0.157561E+02	0.165083E+02	0.150038E+02
0.127600E+04	0.156436E+02	0.163829E+02	0.149043E+02
0.127700E+04	0.156838E+02	0.164215E+02	0.149462E+02
0.127800E+04	0.157466E+02	0.164854E+02	0.150078E+02
0.127900E+04	0.157763E+02	0.165146E+02	0.150380E+02
0.128000E+04	0.157896E+02	0.165289E+02	0.150502E+02
0.128100E+04	0.157950E+02	0.165382E+02	0.150519E+02
0.128200E+04	0.158011E+02	0.165447E+02	0.150575E+02
0.128300E+04	0.158063E+02	0.165496E+02	0.150630E+02
0.128400E+04	0.158105E+02	0.165533E+02	0.150677E+02
0.128500E+04	0.156789E+02	0.164073E+02	0.149505E+02
0.128600E+04	0.155441E+02	0.162566E+02	0.148316E+02
0.128700E+04	0.156781E+02	0.163160E+02	0.150403E+02
0.128800E+04	0.158254E+02	0.164030E+02	0.152478E+02
0.128900E+04	0.158797E+02	0.164310E+02	0.153284E+02
0.129000E+04	0.158992E+02	0.164390E+02	0.153593E+02
0.129100E+04	0.158601E+02	0.163505E+02	0.153698E+02
0.129200E+04	0.158519E+02	0.163342E+02	0.153696E+02
0.129300E+04	0.158478E+02	0.163252E+02	0.153704E+02
0.129400E+04	0.158432E+02	0.163233E+02	0.153632E+02
0.129500E+04	0.157342E+02	0.162231E+02	0.152453E+02
0.129600E+04	0.155999E+02	0.160736E+02	0.151262E+02
0.129700E+04	0.156462E+02	0.161356E+02	0.151568E+02
0.129800E+04	0.157221E+02	0.162319E+02	0.152122E+02
0.129900E+04	0.157562E+02	0.162769E+02	0.152354E+02
0.130000E+04	0.157744E+02	0.163043E+02	0.152444E+02
0.130100E+04	0.157867E+02	0.163246E+02	0.152488E+02
0.130200E+04	0.157957E+02	0.163406E+02	0.152509E+02
0.130300E+04	0.158027E+02	0.163537E+02	0.152517E+02
0.130400E+04	0.158081E+02	0.163645E+02	0.152517E+02
0.130500E+04	0.158125E+02	0.163737E+02	0.152513E+02
0.130600E+04	0.158160E+02	0.163814E+02	0.152505E+02
0.130700E+04	0.158188E+02	0.163879E+02	0.152496E+02
0.130800E+04	0.158210E+02	0.163935E+02	0.152485E+02
0.130900E+04	0.158229E+02	0.163984E+02	0.152473E+02
0.131000E+04	0.158244E+02	0.164028E+02	0.152461E+02
0.131100E+04	0.158258E+02	0.164066E+02	0.152449E+02
0.131200E+04	0.158269E+02	0.164101E+02	0.152437E+02
0.131300E+04	0.158278E+02	0.164131E+02	0.152426E+02
0.131400E+04	0.158286E+02	0.164157E+02	0.152415E+02
0.131500E+04	0.158292E+02	0.164180E+02	0.152404E+02
0.131600E+04	0.158297E+02	0.164201E+02	0.152394E+02
0.131700E+04	0.158301E+02	0.164218E+02	0.152384E+02
0.131800E+04	0.158304E+02	0.164233E+02	0.152374E+02
0.131900E+04	0.158305E+02	0.164245E+02	0.152365E+02
0.132000E+04	0.158306E+02	0.164256E+02	0.152356E+02
0.132100E+04	0.158306E+02	0.164264E+02	0.152347E+02
0.132200E+04	0.158305E+02	0.164271E+02	0.152339E+02
0.132300E+04	0.158305E+02	0.164278E+02	0.152332E+02
0.132400E+04	0.158307E+02	0.164287E+02	0.152327E+02
0.132500E+04	0.158312E+02	0.164299E+02	0.152324E+02

0.132600E+04	0.158315E+02	0.164308E+02	0.152322E+02
0.132700E+04	0.158319E+02	0.164318E+02	0.152321E+02
0.132800E+04	0.158324E+02	0.164327E+02	0.152320E+02
0.132900E+04	0.157141E+02	0.162918E+02	0.151363E+02
0.133000E+04	0.156046E+02	0.161702E+02	0.150389E+02
0.133100E+04	0.156442E+02	0.162173E+02	0.150711E+02
0.133200E+04	0.157106E+02	0.162948E+02	0.151263E+02
0.133300E+04	0.157420E+02	0.163337E+02	0.151504E+02
0.133400E+04	0.157600E+02	0.163560E+02	0.151639E+02
0.133500E+04	0.157732E+02	0.163725E+02	0.151740E+02
0.133600E+04	0.157850E+02	0.163868E+02	0.151833E+02
0.133700E+04	0.157958E+02	0.163998E+02	0.151919E+02
0.133800E+04	0.158060E+02	0.164118E+02	0.152001E+02
0.133900E+04	0.158156E+02	0.164232E+02	0.152080E+02
0.134000E+04	0.158241E+02	0.164330E+02	0.152151E+02
0.134100E+04	0.158309E+02	0.164408E+02	0.152210E+02
0.134200E+04	0.158366E+02	0.164472E+02	0.152260E+02
0.134300E+04	0.158416E+02	0.164526E+02	0.152305E+02
0.134400E+04	0.158414E+02	0.164574E+02	0.152255E+02
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0.134600E+04	0.156320E+02	0.162377E+02	0.150263E+02
0.134700E+04	0.156879E+02	0.162778E+02	0.150981E+02
0.134800E+04	0.157488E+02	0.163464E+02	0.151512E+02
0.134900E+04	0.157809E+02	0.163830E+02	0.151788E+02
0.135000E+04	0.157996E+02	0.164046E+02	0.151947E+02
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0.135200E+04	0.158234E+02	0.164316E+02	0.152152E+02
0.135300E+04	0.158316E+02	0.164408E+02	0.152224E+02
0.135400E+04	0.158384E+02	0.164484E+02	0.152285E+02
0.135500E+04	0.158404E+02	0.164547E+02	0.152261E+02
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0.135700E+04	0.158276E+02	0.164644E+02	0.151908E+02
0.135800E+04	0.157768E+02	0.164683E+02	0.150853E+02
0.135900E+04	0.157462E+02	0.164709E+02	0.150215E+02
0.136000E+04	0.157277E+02	0.164723E+02	0.149831E+02
0.136100E+04	0.157152E+02	0.164728E+02	0.149575E+02
0.136200E+04	0.157056E+02	0.164729E+02	0.149383E+02
0.136300E+04	0.157006E+02	0.164726E+02	0.149286E+02
0.136400E+04	0.156988E+02	0.164725E+02	0.149252E+02
0.136500E+04	0.156995E+02	0.164725E+02	0.149264E+02
0.136600E+04	0.157020E+02	0.164730E+02	0.149309E+02
0.136700E+04	0.157058E+02	0.164739E+02	0.149378E+02
0.136800E+04	0.157107E+02	0.164752E+02	0.149461E+02
0.136900E+04	0.157162E+02	0.164769E+02	0.149555E+02
0.137000E+04	0.157223E+02	0.164791E+02	0.149655E+02
0.137100E+04	0.157287E+02	0.164817E+02	0.149756E+02
0.137200E+04	0.157352E+02	0.164846E+02	0.149859E+02
0.137300E+04	0.157418E+02	0.164878E+02	0.149959E+02
0.137400E+04	0.157482E+02	0.164909E+02	0.150055E+02
0.137500E+04	0.157110E+02	0.164436E+02	0.149784E+02
0.137600E+04	0.156687E+02	0.163899E+02	0.149474E+02
0.137700E+04	0.156873E+02	0.164093E+02	0.149653E+02
0.137800E+04	0.157195E+02	0.164457E+02	0.149934E+02
0.137900E+04	0.157384E+02	0.164659E+02	0.150109E+02
0.138000E+04	0.157501E+02	0.164773E+02	0.150229E+02
0.138100E+04	0.157590E+02	0.164854E+02	0.150326E+02
0.138200E+04	0.157664E+02	0.164918E+02	0.150409E+02
0.138300E+04	0.157726E+02	0.164971E+02	0.150481E+02
0.138400E+04	0.157778E+02	0.165012E+02	0.150543E+02
0.138500E+04	0.157819E+02	0.165043E+02	0.150595E+02
0.138600E+04	0.157852E+02	0.165066E+02	0.150638E+02
0.138700E+04	0.157449E+02	0.164583E+02	0.150316E+02
0.138800E+04	0.156993E+02	0.164031E+02	0.149955E+02

0.138900E+04	0.157147E+02	0.164210E+02	0.150084E+02
0.139000E+04	0.157435E+02	0.164554E+02	0.150316E+02
0.139100E+04	0.157590E+02	0.164736E+02	0.150443E+02
0.139200E+04	0.157671E+02	0.164825E+02	0.150516E+02
0.139300E+04	0.157720E+02	0.164876E+02	0.150564E+02
0.139400E+04	0.157751E+02	0.164904E+02	0.150597E+02
0.139500E+04	0.157769E+02	0.164918E+02	0.150620E+02
0.139600E+04	0.157773E+02	0.164916E+02	0.150631E+02
0.139700E+04	0.157762E+02	0.164896E+02	0.150628E+02
0.139800E+04	0.157739E+02	0.164864E+02	0.150615E+02
0.139900E+04	0.157709E+02	0.164823E+02	0.150594E+02
0.140000E+04	0.157671E+02	0.164775E+02	0.150567E+02
0.140100E+04	0.157635E+02	0.164729E+02	0.150541E+02
0.140200E+04	0.157606E+02	0.164693E+02	0.150520E+02
0.140300E+04	0.157582E+02	0.164663E+02	0.150501E+02
0.140400E+04	0.157559E+02	0.164635E+02	0.150484E+02
0.140500E+04	0.157537E+02	0.164607E+02	0.150467E+02
0.140600E+04	0.157516E+02	0.164581E+02	0.150451E+02
0.140700E+04	0.157494E+02	0.164554E+02	0.150435E+02
0.140800E+04	0.157081E+02	0.164067E+02	0.150094E+02
0.140900E+04	0.156755E+02	0.163786E+02	0.149725E+02
0.141000E+04	0.156913E+02	0.163894E+02	0.149932E+02
0.141100E+04	0.157153E+02	0.164161E+02	0.150146E+02
0.141200E+04	0.157268E+02	0.164294E+02	0.150242E+02
0.141300E+04	0.157318E+02	0.164352E+02	0.150284E+02
0.141400E+04	0.157296E+02	0.164381E+02	0.150210E+02
0.141500E+04	0.157280E+02	0.164384E+02	0.150176E+02
0.141600E+04	0.157259E+02	0.164361E+02	0.150158E+02
0.141700E+04	0.157228E+02	0.164319E+02	0.150137E+02
0.141800E+04	0.157188E+02	0.164266E+02	0.150111E+02
0.141900E+04	0.157141E+02	0.164204E+02	0.150079E+02
0.142000E+04	0.157089E+02	0.164136E+02	0.150042E+02
0.142100E+04	0.157039E+02	0.164070E+02	0.150007E+02
0.142200E+04	0.156996E+02	0.164015E+02	0.149977E+02
0.142300E+04	0.156958E+02	0.163965E+02	0.149950E+02
0.142400E+04	0.156922E+02	0.163918E+02	0.149925E+02
0.142500E+04	0.156888E+02	0.163876E+02	0.149901E+02
0.142600E+04	0.156855E+02	0.163834E+02	0.149876E+02
0.142700E+04	0.156822E+02	0.163792E+02	0.149853E+02
0.142800E+04	0.156782E+02	0.163742E+02	0.149822E+02
0.142900E+04	0.156789E+02	0.163675E+02	0.149903E+02
0.143000E+04	0.156736E+02	0.163600E+02	0.149871E+02
0.143100E+04	0.156667E+02	0.163519E+02	0.149814E+02
0.143200E+04	0.156592E+02	0.163436E+02	0.149748E+02
0.143300E+04	0.156511E+02	0.163347E+02	0.149676E+02
0.143400E+04	0.156158E+02	0.162944E+02	0.149373E+02
0.143500E+04	0.155802E+02	0.162536E+02	0.149068E+02
0.143600E+04	0.155822E+02	0.162570E+02	0.149073E+02
0.143700E+04	0.155892E+02	0.162663E+02	0.149121E+02
0.143800E+04	0.155886E+02	0.162665E+02	0.149107E+02
0.143900E+04	0.155844E+02	0.162622E+02	0.149066E+02
0.144000E+04	0.155787E+02	0.162559E+02	0.149014E+02
0.144100E+04	0.155718E+02	0.162480E+02	0.148956E+02
0.144200E+04	0.155658E+02	0.162415E+02	0.148902E+02
0.144300E+04	0.155610E+02	0.162361E+02	0.148859E+02
0.144400E+04	0.155568E+02	0.162312E+02	0.148823E+02
0.144500E+04	0.155533E+02	0.162274E+02	0.148791E+02
0.144600E+04	0.155500E+02	0.162238E+02	0.148763E+02
0.144700E+04	0.155471E+02	0.162203E+02	0.148738E+02
0.144800E+04	0.155443E+02	0.162171E+02	0.148714E+02
0.144900E+04	0.155417E+02	0.162140E+02	0.148693E+02
0.145000E+04	0.155392E+02	0.162111E+02	0.148673E+02
0.145100E+04	0.155369E+02	0.162083E+02	0.148655E+02

0.145200E+04	0.155344E+02	0.162054E+02	0.148635E+02
0.145300E+04	0.153648E+02	0.160061E+02	0.147235E+02
0.145400E+04	0.153195E+02	0.157941E+02	0.148450E+02
0.145500E+04	0.154361E+02	0.158967E+02	0.149755E+02
0.145600E+04	0.155373E+02	0.160004E+02	0.150742E+02
0.145700E+04	0.155806E+02	0.160455E+02	0.151157E+02
0.145800E+04	0.156014E+02	0.160718E+02	0.151311E+02
0.145900E+04	0.154650E+02	0.159178E+02	0.150122E+02
0.146000E+04	0.152136E+02	0.156044E+02	0.148229E+02
0.146100E+04	0.151641E+02	0.155570E+02	0.147711E+02
0.146200E+04	0.152892E+02	0.157025E+02	0.148759E+02
0.146300E+04	0.154100E+02	0.158396E+02	0.149805E+02
0.146400E+04	0.154736E+02	0.159152E+02	0.150320E+02
0.146500E+04	0.155104E+02	0.159613E+02	0.150596E+02
0.146600E+04	0.154927E+02	0.159418E+02	0.150437E+02
0.146700E+04	0.154644E+02	0.159083E+02	0.150206E+02
0.146800E+04	0.154940E+02	0.159471E+02	0.150409E+02
0.146900E+04	0.155300E+02	0.159986E+02	0.150615E+02
0.147000E+04	0.155468E+02	0.160300E+02	0.150637E+02
0.147100E+04	0.155793E+02	0.160950E+02	0.150636E+02
0.147200E+04	0.155849E+02	0.161063E+02	0.150635E+02
0.147300E+04	0.155898E+02	0.161174E+02	0.150622E+02
0.147400E+04	0.155946E+02	0.161279E+02	0.150612E+02
0.147500E+04	0.155993E+02	0.161376E+02	0.150610E+02
0.147600E+04	0.156039E+02	0.161464E+02	0.150615E+02
0.147700E+04	0.156090E+02	0.161549E+02	0.150631E+02
0.147800E+04	0.156148E+02	0.161637E+02	0.150659E+02
0.147900E+04	0.156212E+02	0.161726E+02	0.150698E+02
0.148000E+04	0.156280E+02	0.161817E+02	0.150744E+02
0.148100E+04	0.155971E+02	0.161451E+02	0.150490E+02
0.148200E+04	0.155858E+02	0.161388E+02	0.150329E+02
0.148300E+04	0.155628E+02	0.161126E+02	0.150129E+02
0.148400E+04	0.155432E+02	0.160886E+02	0.149978E+02
0.148500E+04	0.155828E+02	0.161357E+02	0.150299E+02
0.148600E+04	0.156093E+02	0.161681E+02	0.150505E+02
0.148700E+04	0.156222E+02	0.161836E+02	0.150608E+02
0.148800E+04	0.156306E+02	0.161932E+02	0.150679E+02
0.148900E+04	0.156365E+02	0.161998E+02	0.150733E+02
0.149000E+04	0.156410E+02	0.162044E+02	0.150776E+02
0.149100E+04	0.156445E+02	0.162079E+02	0.150811E+02
0.149200E+04	0.156472E+02	0.162104E+02	0.150840E+02
0.149300E+04	0.156494E+02	0.162123E+02	0.150864E+02
0.149400E+04	0.156511E+02	0.162138E+02	0.150885E+02
0.149500E+04	0.156076E+02	0.161618E+02	0.150535E+02
0.149600E+04	0.155622E+02	0.161069E+02	0.150174E+02
0.149700E+04	0.155793E+02	0.161269E+02	0.150317E+02
0.149800E+04	0.156076E+02	0.161619E+02	0.150533E+02
0.149900E+04	0.156224E+02	0.161805E+02	0.150643E+02
0.150000E+04	0.156306E+02	0.161907E+02	0.150704E+02
0.150100E+04	0.156361E+02	0.161976E+02	0.150746E+02
0.150200E+04	0.156403E+02	0.162028E+02	0.150778E+02
0.150300E+04	0.156435E+02	0.162067E+02	0.150804E+02
0.150400E+04	0.156085E+02	0.161654E+02	0.150517E+02
0.150500E+04	0.155694E+02	0.161186E+02	0.150201E+02
0.150600E+04	0.155831E+02	0.161352E+02	0.150310E+02
0.150700E+04	0.156089E+02	0.161672E+02	0.150506E+02
0.150800E+04	0.156231E+02	0.161853E+02	0.150609E+02
0.150900E+04	0.156312E+02	0.161957E+02	0.150667E+02
0.151000E+04	0.156370E+02	0.162032E+02	0.150708E+02
0.151100E+04	0.156414E+02	0.162089E+02	0.150739E+02
0.151200E+04	0.156446E+02	0.162131E+02	0.150761E+02
0.151300E+04	0.156465E+02	0.162158E+02	0.150773E+02
0.151400E+04	0.156476E+02	0.162174E+02	0.150777E+02

0.151500E+04	0.156480E+02	0.162183E+02	0.150777E+02
0.151600E+04	0.156479E+02	0.162186E+02	0.150772E+02
0.151700E+04	0.156474E+02	0.162184E+02	0.150763E+02
0.151800E+04	0.156466E+02	0.162179E+02	0.150752E+02
0.151900E+04	0.156458E+02	0.162175E+02	0.150740E+02
0.152000E+04	0.156452E+02	0.162174E+02	0.150730E+02
0.152100E+04	0.156448E+02	0.162175E+02	0.150721E+02
0.152200E+04	0.156444E+02	0.162177E+02	0.150711E+02
0.152300E+04	0.156440E+02	0.162179E+02	0.150702E+02
0.152400E+04	0.156436E+02	0.162181E+02	0.150692E+02
0.152500E+04	0.156432E+02	0.162183E+02	0.150682E+02
0.152600E+04	0.156428E+02	0.162185E+02	0.150671E+02
0.152700E+04	0.155372E+02	0.160940E+02	0.149803E+02
0.152800E+04	0.154258E+02	0.159622E+02	0.148893E+02
0.152900E+04	0.154593E+02	0.160037E+02	0.149149E+02
0.153000E+04	0.155211E+02	0.160789E+02	0.149633E+02
0.153100E+04	0.155452E+02	0.161057E+02	0.149848E+02
0.153200E+04	0.155586E+02	0.161225E+02	0.149946E+02
0.153300E+04	0.155672E+02	0.161339E+02	0.150006E+02
0.153400E+04	0.155731E+02	0.161418E+02	0.150044E+02
0.153500E+04	0.155772E+02	0.161475E+02	0.150069E+02
0.153600E+04	0.155804E+02	0.161519E+02	0.150088E+02
0.153700E+04	0.155824E+02	0.161547E+02	0.150100E+02
0.153800E+04	0.155844E+02	0.161578E+02	0.150109E+02
0.153900E+04	0.155857E+02	0.161601E+02	0.150114E+02
0.154000E+04	0.155863E+02	0.161610E+02	0.150115E+02
0.154100E+04	0.155873E+02	0.161630E+02	0.150117E+02
0.154200E+04	0.155884E+02	0.161649E+02	0.150120E+02
0.154300E+04	0.155892E+02	0.161661E+02	0.150122E+02
0.154400E+04	0.155904E+02	0.161683E+02	0.150125E+02
0.154500E+04	0.155915E+02	0.161702E+02	0.150128E+02
0.154600E+04	0.155925E+02	0.161719E+02	0.150131E+02
0.154700E+04	0.155934E+02	0.161735E+02	0.150133E+02
0.154800E+04	0.155943E+02	0.161750E+02	0.150135E+02
0.154900E+04	0.155951E+02	0.161765E+02	0.150137E+02
0.155000E+04	0.155958E+02	0.161778E+02	0.150137E+02
0.155100E+04	0.155962E+02	0.161788E+02	0.150136E+02
0.155200E+04	0.155966E+02	0.161797E+02	0.150134E+02
0.155300E+04	0.155968E+02	0.161804E+02	0.150132E+02
0.155400E+04	0.155954E+02	0.161809E+02	0.150098E+02
0.155500E+04	0.155951E+02	0.161813E+02	0.150088E+02
0.155600E+04	0.155949E+02	0.161817E+02	0.150080E+02
0.155700E+04	0.155947E+02	0.161820E+02	0.150074E+02
0.155800E+04	0.155946E+02	0.161823E+02	0.150069E+02
0.155900E+04	0.155945E+02	0.161826E+02	0.150063E+02
0.156000E+04	0.155947E+02	0.161833E+02	0.150061E+02
0.156100E+04	0.155953E+02	0.161844E+02	0.150062E+02
0.156200E+04	0.155963E+02	0.161860E+02	0.150066E+02
0.156300E+04	0.155974E+02	0.161877E+02	0.150071E+02
0.156400E+04	0.155110E+02	0.160943E+02	0.149278E+02
0.156500E+04	0.154094E+02	0.159699E+02	0.148489E+02
0.156600E+04	0.154425E+02	0.160088E+02	0.148763E+02
0.156700E+04	0.155046E+02	0.160843E+02	0.149249E+02
0.156800E+04	0.155374E+02	0.161253E+02	0.149495E+02
0.156900E+04	0.155543E+02	0.161476E+02	0.149610E+02
0.157000E+04	0.155396E+02	0.161316E+02	0.149477E+02
0.157100E+04	0.155226E+02	0.161116E+02	0.149337E+02
0.157200E+04	0.155401E+02	0.161324E+02	0.149479E+02
0.157300E+04	0.155613E+02	0.161582E+02	0.149643E+02
0.157400E+04	0.155742E+02	0.161740E+02	0.149743E+02
0.157500E+04	0.155830E+02	0.161848E+02	0.149812E+02
0.157600E+04	0.155901E+02	0.161932E+02	0.149869E+02
0.157700E+04	0.155964E+02	0.162007E+02	0.149921E+02

0.157800E+04	0.156027E+02	0.162081E+02	0.149973E+02
0.157900E+04	0.156088E+02	0.162152E+02	0.150024E+02
0.158000E+04	0.156148E+02	0.162221E+02	0.150075E+02
0.158100E+04	0.156206E+02	0.162288E+02	0.150124E+02
0.158200E+04	0.156264E+02	0.162354E+02	0.150174E+02
0.158300E+04	0.156321E+02	0.162419E+02	0.150223E+02
0.158400E+04	0.156377E+02	0.162482E+02	0.150271E+02
0.158500E+04	0.156429E+02	0.162542E+02	0.150317E+02
0.158600E+04	0.156477E+02	0.162596E+02	0.150359E+02
0.158700E+04	0.154871E+02	0.160651E+02	0.149092E+02
0.158800E+04	0.152509E+02	0.157880E+02	0.147137E+02
0.158900E+04	0.152486E+02	0.157976E+02	0.146996E+02
0.159000E+04	0.153508E+02	0.159154E+02	0.147863E+02
0.159100E+04	0.154407E+02	0.160158E+02	0.148657E+02
0.159200E+04	0.154879E+02	0.160683E+02	0.149075E+02
0.159300E+04	0.155184E+02	0.161039E+02	0.149329E+02
0.159400E+04	0.155419E+02	0.161315E+02	0.149523E+02
0.159500E+04	0.155616E+02	0.161546E+02	0.149686E+02
0.159600E+04	0.155788E+02	0.161747E+02	0.149829E+02
0.159700E+04	0.155940E+02	0.161924E+02	0.149957E+02
0.159800E+04	0.156078E+02	0.162083E+02	0.150074E+02
0.159900E+04	0.156174E+02	0.162228E+02	0.150121E+02
0.160000E+04	0.156392E+02	0.162773E+02	0.150011E+02
0.160100E+04	0.154486E+02	0.160671E+02	0.148300E+02
0.160200E+04	0.152501E+02	0.158072E+02	0.146930E+02
0.160300E+04	0.153277E+02	0.159076E+02	0.147479E+02
0.160400E+04	0.154305E+02	0.160211E+02	0.148398E+02
0.160500E+04	0.155049E+02	0.161033E+02	0.149066E+02
0.160600E+04	0.155498E+02	0.161548E+02	0.149448E+02
0.160700E+04	0.155790E+02	0.161881E+02	0.149700E+02
0.160800E+04	0.156009E+02	0.162127E+02	0.149890E+02
0.160900E+04	0.156182E+02	0.162320E+02	0.150044E+02
0.161000E+04	0.156313E+02	0.162476E+02	0.150150E+02
0.161100E+04	0.156314E+02	0.162607E+02	0.150021E+02
0.161200E+04	0.155915E+02	0.162714E+02	0.149115E+02
0.161300E+04	0.154522E+02	0.161522E+02	0.147522E+02
0.161400E+04	0.153279E+02	0.160461E+02	0.146098E+02
0.161500E+04	0.153687E+02	0.160909E+02	0.146466E+02
0.161600E+04	0.154274E+02	0.161655E+02	0.146894E+02
0.161700E+04	0.154562E+02	0.162047E+02	0.147077E+02
0.161800E+04	0.154727E+02	0.162277E+02	0.147178E+02
0.161900E+04	0.154856E+02	0.162438E+02	0.147275E+02
0.162000E+04	0.154970E+02	0.162559E+02	0.147381E+02
0.162100E+04	0.155077E+02	0.162657E+02	0.147497E+02
0.162200E+04	0.153965E+02	0.161321E+02	0.146609E+02
0.162300E+04	0.152880E+02	0.160132E+02	0.145628E+02
0.162400E+04	0.153391E+02	0.160663E+02	0.146120E+02
0.162500E+04	0.154177E+02	0.161510E+02	0.146845E+02
0.162600E+04	0.154616E+02	0.161970E+02	0.147262E+02
0.162700E+04	0.154892E+02	0.162248E+02	0.147536E+02
0.162800E+04	0.155104E+02	0.162450E+02	0.147759E+02
0.162900E+04	0.155279E+02	0.162608E+02	0.147951E+02
0.163000E+04	0.155429E+02	0.162737E+02	0.148121E+02
0.163100E+04	0.155560E+02	0.162846E+02	0.148273E+02
0.163200E+04	0.155668E+02	0.162932E+02	0.148404E+02
0.163300E+04	0.155732E+02	0.162989E+02	0.148474E+02
0.163400E+04	0.155760E+02	0.163026E+02	0.148494E+02
0.163500E+04	0.155782E+02	0.163048E+02	0.148516E+02
0.163600E+04	0.155799E+02	0.163060E+02	0.148538E+02
0.163700E+04	0.155812E+02	0.163064E+02	0.148560E+02
0.163800E+04	0.155821E+02	0.163062E+02	0.148580E+02
0.163900E+04	0.155828E+02	0.163058E+02	0.148598E+02
0.164000E+04	0.155836E+02	0.163055E+02	0.148617E+02

0.164100E+04	0.153829E+02	0.160814E+02	0.146844E+02
0.164200E+04	0.151608E+02	0.158185E+02	0.145032E+02
0.164300E+04	0.153669E+02	0.159113E+02	0.148225E+02
0.164400E+04	0.155055E+02	0.160204E+02	0.149907E+02
0.164500E+04	0.155739E+02	0.160860E+02	0.150619E+02
0.164600E+04	0.156051E+02	0.161200E+02	0.150903E+02
0.164700E+04	0.156373E+02	0.161604E+02	0.151142E+02
0.164800E+04	0.156620E+02	0.161950E+02	0.151291E+02
0.164900E+04	0.156765E+02	0.162182E+02	0.151347E+02
0.165000E+04	0.156849E+02	0.162345E+02	0.151354E+02
0.165100E+04	0.156898E+02	0.162463E+02	0.151332E+02
0.165200E+04	0.156922E+02	0.162549E+02	0.151295E+02
0.165300E+04	0.156926E+02	0.162607E+02	0.151245E+02
0.165400E+04	0.156912E+02	0.162638E+02	0.151187E+02
0.165500E+04	0.156885E+02	0.162648E+02	0.151122E+02
0.165600E+04	0.156849E+02	0.162643E+02	0.151055E+02
0.165700E+04	0.156806E+02	0.162626E+02	0.150986E+02
0.165800E+04	0.156756E+02	0.162597E+02	0.150916E+02
0.165900E+04	0.156703E+02	0.162560E+02	0.150845E+02
0.166000E+04	0.156652E+02	0.162524E+02	0.150780E+02
0.166100E+04	0.156610E+02	0.162496E+02	0.150725E+02
0.166200E+04	0.156574E+02	0.162472E+02	0.150676E+02
0.166300E+04	0.156541E+02	0.162450E+02	0.150631E+02
0.166400E+04	0.156509E+02	0.162428E+02	0.150590E+02
0.166500E+04	0.156480E+02	0.162407E+02	0.150553E+02
0.166600E+04	0.156451E+02	0.162385E+02	0.150518E+02
0.166700E+04	0.156427E+02	0.162364E+02	0.150485E+02
0.166800E+04	0.156403E+02	0.162343E+02	0.150453E+02
0.166900E+04	0.156380E+02	0.162323E+02	0.150422E+02
0.167000E+04	0.156357E+02	0.162303E+02	0.150392E+02
0.167100E+04	0.156335E+02	0.162283E+02	0.150363E+02
0.167200E+04	0.156313E+02	0.162263E+02	0.150334E+02
0.167300E+04	0.156292E+02	0.162243E+02	0.150306E+02
0.167400E+04	0.156271E+02	0.162223E+02	0.150278E+02
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0.167600E+04	0.156230E+02	0.162183E+02	0.150224E+02
0.167700E+04	0.156210E+02	0.162163E+02	0.150197E+02
0.167800E+04	0.156190E+02	0.162143E+02	0.150171E+02
0.167900E+04	0.156170E+02	0.162123E+02	0.150145E+02
0.168000E+04	0.156150E+02	0.162103E+02	0.150120E+02
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0.168400E+04	0.156070E+02	0.162023E+02	0.150020E+02
0.168500E+04	0.156050E+02	0.162003E+02	0.150000E+02
0.168600E+04	0.156030E+02	0.161983E+02	0.149980E+02
0.168700E+04	0.156010E+02	0.161963E+02	0.149960E+02
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0.169300E+04	0.155890E+02	0.161843E+02	0.149840E+02
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0.169600E+04	0.155830E+02	0.161783E+02	0.149780E+02
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0.169800E+04	0.155790E+02	0.161743E+02	0.149740E+02
0.169900E+04	0.155770E+02	0.161723E+02	0.149720E+02
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0.170300E+04	0.155690E+02	0.161643E+02	0.149640E+02

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0.170500E+04	0.155024E+02	0.160910E+02	0.149138E+02
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0.173500E+04	0.155091E+02	0.162452E+02	0.147729E+02
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0.174100E+04	0.155467E+02	0.162658E+02	0.148277E+02
0.174200E+04	0.155780E+02	0.163026E+02	0.148534E+02
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0.174500E+04	0.156193E+02	0.163514E+02	0.148871E+02
0.174600E+04	0.156298E+02	0.163626E+02	0.148971E+02
0.174700E+04	0.156396E+02	0.163726E+02	0.149066E+02
0.174800E+04	0.156489E+02	0.163819E+02	0.149159E+02
0.174900E+04	0.156576E+02	0.163905E+02	0.149246E+02
0.175000E+04	0.156658E+02	0.163986E+02	0.149330E+02
0.175100E+04	0.156737E+02	0.164064E+02	0.149410E+02
0.175200E+04	0.156813E+02	0.164139E+02	0.149487E+02
0.175300E+04	0.156885E+02	0.164211E+02	0.149560E+02
0.175400E+04	0.156955E+02	0.164281E+02	0.149629E+02
0.175500E+04	0.157023E+02	0.164349E+02	0.149696E+02
0.175600E+04	0.157087E+02	0.164415E+02	0.149760E+02
0.175700E+04	0.157148E+02	0.164476E+02	0.149819E+02
0.175800E+04	0.157205E+02	0.164535E+02	0.149875E+02
0.175900E+04	0.157260E+02	0.164591E+02	0.149928E+02
0.176000E+04	0.157313E+02	0.164646E+02	0.149980E+02
0.176100E+04	0.157364E+02	0.164699E+02	0.150029E+02
0.176200E+04	0.157414E+02	0.164751E+02	0.150076E+02
0.176300E+04	0.157462E+02	0.164802E+02	0.150122E+02
0.176400E+04	0.157506E+02	0.164847E+02	0.150164E+02
0.176500E+04	0.157541E+02	0.164883E+02	0.150199E+02
0.176600E+04	0.157571E+02	0.164914E+02	0.150229E+02

0.176700E+04	0.157599E+02	0.164941E+02	0.150256E+02
0.176800E+04	0.157624E+02	0.164965E+02	0.150282E+02
0.176900E+04	0.157646E+02	0.164988E+02	0.150305E+02
0.177000E+04	0.157667E+02	0.165008E+02	0.150326E+02
0.177100E+04	0.157687E+02	0.165027E+02	0.150346E+02
0.177200E+04	0.157699E+02	0.165037E+02	0.150360E+02
0.177300E+04	0.157698E+02	0.165034E+02	0.150363E+02
0.177400E+04	0.157690E+02	0.165020E+02	0.150360E+02
0.177500E+04	0.157676E+02	0.165001E+02	0.150351E+02
0.177600E+04	0.157658E+02	0.164977E+02	0.150339E+02
0.177700E+04	0.157636E+02	0.164949E+02	0.150323E+02
0.177800E+04	0.157610E+02	0.164917E+02	0.150304E+02
0.177900E+04	0.157583E+02	0.164883E+02	0.150283E+02
0.178000E+04	0.157559E+02	0.164853E+02	0.150264E+02
0.178100E+04	0.157543E+02	0.164833E+02	0.150253E+02
0.178200E+04	0.157533E+02	0.164820E+02	0.150246E+02
0.178300E+04	0.156334E+02	0.163519E+02	0.149150E+02
0.178400E+04	0.155417E+02	0.162459E+02	0.148376E+02
0.178500E+04	0.156190E+02	0.163322E+02	0.149058E+02
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0.178700E+04	0.156803E+02	0.164026E+02	0.149580E+02
0.178800E+04	0.156926E+02	0.164167E+02	0.149685E+02
0.178900E+04	0.156547E+02	0.163720E+02	0.149375E+02
0.179000E+04	0.156117E+02	0.163208E+02	0.149025E+02
0.179100E+04	0.156331E+02	0.163458E+02	0.149203E+02
0.179200E+04	0.156662E+02	0.163851E+02	0.149473E+02
0.179300E+04	0.156849E+02	0.164069E+02	0.149629E+02
0.179400E+04	0.156960E+02	0.164192E+02	0.149727E+02
0.179500E+04	0.157041E+02	0.164278E+02	0.149803E+02
0.179600E+04	0.157104E+02	0.164342E+02	0.149866E+02
0.179700E+04	0.157155E+02	0.164391E+02	0.149918E+02
0.179800E+04	0.157196E+02	0.164430E+02	0.149963E+02
0.179900E+04	0.157231E+02	0.164460E+02	0.150002E+02
0.180000E+04	0.157260E+02	0.164485E+02	0.150036E+02
0.180100E+04	0.157285E+02	0.164504E+02	0.150067E+02
0.180200E+04	0.157306E+02	0.164519E+02	0.150094E+02
0.180300E+04	0.157324E+02	0.164531E+02	0.150118E+02
0.180400E+04	0.157340E+02	0.164540E+02	0.150139E+02
0.180500E+04	0.157353E+02	0.164547E+02	0.150159E+02
0.180600E+04	0.157365E+02	0.164552E+02	0.150177E+02
0.180700E+04	0.157375E+02	0.164556E+02	0.150194E+02
0.180800E+04	0.157384E+02	0.164558E+02	0.150210E+02
0.180900E+04	0.155422E+02	0.162337E+02	0.148508E+02
0.181000E+04	0.153184E+02	0.159712E+02	0.146656E+02
0.181100E+04	0.155004E+02	0.160637E+02	0.149371E+02
0.181200E+04	0.156427E+02	0.161703E+02	0.151151E+02
0.181300E+04	0.157315E+02	0.162517E+02	0.152114E+02
0.181400E+04	0.157770E+02	0.163020E+02	0.152519E+02
0.181500E+04	0.155874E+02	0.160790E+02	0.150958E+02
0.181600E+04	0.153670E+02	0.158212E+02	0.149128E+02
0.181700E+04	0.154459E+02	0.159315E+02	0.149603E+02
0.181800E+04	0.155600E+02	0.160674E+02	0.150526E+02
0.181900E+04	0.156354E+02	0.161548E+02	0.151161E+02
0.182000E+04	0.156802E+02	0.162126E+02	0.151478E+02
0.182100E+04	0.157076E+02	0.162499E+02	0.151652E+02
0.182200E+04	0.157268E+02	0.162771E+02	0.151766E+02
0.182300E+04	0.157411E+02	0.162977E+02	0.151844E+02
0.182400E+04	0.157515E+02	0.163133E+02	0.151898E+02
0.182500E+04	0.157590E+02	0.163248E+02	0.151933E+02
0.182600E+04	0.157644E+02	0.163333E+02	0.151955E+02
0.182700E+04	0.157903E+02	0.163808E+02	0.151999E+02
0.182800E+04	0.157910E+02	0.163802E+02	0.152018E+02
0.182900E+04	0.157915E+02	0.163806E+02	0.152024E+02

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0.183000E+04	0.157469E+02	0.163273E+02	0.151666E+02
0.183100E+04	0.155480E+02	0.160997E+02	0.149963E+02
0.183200E+04	0.154008E+02	0.159421E+02	0.148595E+02
0.183300E+04	0.154870E+02	0.160421E+02	0.149320E+02
0.183400E+04	0.155980E+02	0.161671E+02	0.150288E+02
0.183500E+04	0.155429E+02	0.160988E+02	0.149871E+02
0.183600E+04	0.154657E+02	0.160115E+02	0.149200E+02
0.183700E+04	0.155285E+02	0.160857E+02	0.149713E+02
0.183800E+04	0.156098E+02	0.161788E+02	0.150409E+02
0.183900E+04	0.156530E+02	0.162258E+02	0.150801E+02
0.184000E+04	0.156445E+02	0.162138E+02	0.150752E+02
0.184100E+04	0.156254E+02	0.161886E+02	0.150623E+02
0.184200E+04	0.156574E+02	0.162278E+02	0.150869E+02
0.184300E+04	0.156305E+02	0.162097E+02	0.150513E+02
0.184400E+04	0.156200E+02	0.162337E+02	0.150063E+02
0.184500E+04	0.156095E+02	0.162705E+02	0.149484E+02
0.184600E+04	0.156160E+02	0.163226E+02	0.149095E+02
0.184700E+04	0.156185E+02	0.163466E+02	0.148904E+02
0.184800E+04	0.156213E+02	0.163649E+02	0.148777E+02
0.184900E+04	0.156257E+02	0.163790E+02	0.148723E+02
0.185000E+04	0.156293E+02	0.163901E+02	0.148686E+02
0.185100E+04	0.156359E+02	0.163991E+02	0.148728E+02
0.185200E+04	0.156437E+02	0.164065E+02	0.148808E+02
0.185300E+04	0.156523E+02	0.164130E+02	0.148915E+02
0.185400E+04	0.156302E+02	0.163826E+02	0.148778E+02
0.185500E+04	0.156170E+02	0.163616E+02	0.148724E+02
0.185600E+04	0.156450E+02	0.163891E+02	0.149009E+02
0.185700E+04	0.156683E+02	0.164112E+02	0.149253E+02
0.185800E+04	0.156838E+02	0.164238E+02	0.149437E+02
0.185900E+04	0.156966E+02	0.164333E+02	0.149599E+02
0.186000E+04	0.157079E+02	0.164412E+02	0.149747E+02
0.186100E+04	0.157185E+02	0.164485E+02	0.149885E+02
0.186200E+04	0.157285E+02	0.164555E+02	0.150015E+02
0.186300E+04	0.157381E+02	0.164624E+02	0.150137E+02
0.186400E+04	0.157472E+02	0.164692E+02	0.150252E+02
0.186500E+04	0.157559E+02	0.164759E+02	0.150360E+02
0.186600E+04	0.157641E+02	0.164822E+02	0.150459E+02
0.186700E+04	0.157716E+02	0.164882E+02	0.150550E+02
0.186800E+04	0.157787E+02	0.164939E+02	0.150634E+02
0.186900E+04	0.157854E+02	0.164996E+02	0.150712E+02
0.187000E+04	0.157918E+02	0.165051E+02	0.150784E+02
0.187100E+04	0.157979E+02	0.165105E+02	0.150852E+02
0.187200E+04	0.158036E+02	0.165158E+02	0.150914E+02
0.187300E+04	0.158090E+02	0.165209E+02	0.150972E+02
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0.187500E+04	0.158192E+02	0.165308E+02	0.151076E+02
0.187600E+04	0.158241E+02	0.165358E+02	0.151124E+02
0.187700E+04	0.158289E+02	0.165408E+02	0.151170E+02
0.187800E+04	0.158336E+02	0.165458E+02	0.151215E+02
0.187900E+04	0.158382E+02	0.165508E+02	0.151257E+02
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0.188300E+04	0.157210E+02	0.164220E+02	0.150200E+02
0.188400E+04	0.155719E+02	0.162501E+02	0.148936E+02
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0.188600E+04	0.157060E+02	0.164062E+02	0.150057E+02
0.188700E+04	0.157493E+02	0.164560E+02	0.150426E+02
0.188800E+04	0.157738E+02	0.164846E+02	0.150630E+02
0.188900E+04	0.157911E+02	0.165045E+02	0.150776E+02
0.189000E+04	0.158041E+02	0.165194E+02	0.150888E+02
0.189100E+04	0.158142E+02	0.165308E+02	0.150977E+02
0.189200E+04	0.158220E+02	0.165394E+02	0.151047E+02

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0.189600E+04	0.158429E+02	0.165624E+02	0.151234E+02
0.189700E+04	0.158466E+02	0.165666E+02	0.151267E+02
0.189800E+04	0.158499E+02	0.165702E+02	0.151296E+02
0.189900E+04	0.158528E+02	0.165735E+02	0.151321E+02
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0.190100E+04	0.158581E+02	0.165795E+02	0.151368E+02
0.190200E+04	0.157342E+02	0.164393E+02	0.150291E+02
0.190300E+04	0.155866E+02	0.162729E+02	0.149003E+02
0.190400E+04	0.156364E+02	0.163265E+02	0.149464E+02
0.190500E+04	0.157209E+02	0.164212E+02	0.150206E+02
0.190600E+04	0.157591E+02	0.164660E+02	0.150521E+02
0.190700E+04	0.157628E+02	0.164753E+02	0.150504E+02
0.190800E+04	0.157669E+02	0.164809E+02	0.150528E+02
0.190900E+04	0.157869E+02	0.165043E+02	0.150695E+02
0.191000E+04	0.158024E+02	0.165223E+02	0.150826E+02
0.191100E+04	0.158133E+02	0.165343E+02	0.150922E+02
0.191200E+04	0.157415E+02	0.164498E+02	0.150331E+02
0.191300E+04	0.156730E+02	0.163787E+02	0.149673E+02
0.191400E+04	0.156750E+02	0.163807E+02	0.149694E+02
0.191500E+04	0.157107E+02	0.164221E+02	0.149994E+02
0.191600E+04	0.157579E+02	0.164736E+02	0.150423E+02
0.191700E+04	0.157884E+02	0.165069E+02	0.150698E+02
0.191800E+04	0.158088E+02	0.165296E+02	0.150881E+02
0.191900E+04	0.158250E+02	0.165473E+02	0.151028E+02
0.192000E+04	0.158386E+02	0.165618E+02	0.151153E+02
0.192100E+04	0.158508E+02	0.165748E+02	0.151269E+02
0.192200E+04	0.158628E+02	0.165874E+02	0.151381E+02
0.192300E+04	0.158743E+02	0.165996E+02	0.151491E+02
0.192400E+04	0.158345E+02	0.165518E+02	0.151172E+02
0.192500E+04	0.157885E+02	0.164966E+02	0.150803E+02
0.192600E+04	0.158139E+02	0.165257E+02	0.151020E+02
0.192700E+04	0.158561E+02	0.165755E+02	0.151366E+02
0.192800E+04	0.158823E+02	0.166060E+02	0.151587E+02
0.192900E+04	0.158999E+02	0.166255E+02	0.151742E+02
0.193000E+04	0.159137E+02	0.166405E+02	0.151870E+02
0.193100E+04	0.159263E+02	0.166538E+02	0.151989E+02
0.193200E+04	0.159388E+02	0.166669E+02	0.152107E+02
0.193300E+04	0.159511E+02	0.166799E+02	0.152224E+02
0.193400E+04	0.159633E+02	0.166926E+02	0.152340E+02
0.193500E+04	0.159752E+02	0.167051E+02	0.152454E+02
0.193600E+04	0.159852E+02	0.167153E+02	0.152552E+02
0.193700E+04	0.159919E+02	0.167216E+02	0.152623E+02
0.193800E+04	0.159965E+02	0.167255E+02	0.152675E+02
0.193900E+04	0.159998E+02	0.167279E+02	0.152716E+02
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0.194100E+04	0.160056E+02	0.167323E+02	0.152790E+02
0.194200E+04	0.160123E+02	0.167390E+02	0.152856E+02
0.194300E+04	0.160210E+02	0.167481E+02	0.152938E+02
0.194400E+04	0.160308E+02	0.167586E+02	0.153030E+02
0.194500E+04	0.160411E+02	0.167696E+02	0.153126E+02
0.194600E+04	0.160489E+02	0.167776E+02	0.153202E+02
0.194700E+04	0.160527E+02	0.167809E+02	0.153245E+02
0.194800E+04	0.160541E+02	0.167814E+02	0.153268E+02
0.194900E+04	0.160541E+02	0.167803E+02	0.153278E+02
0.195000E+04	0.160531E+02	0.167782E+02	0.153280E+02
0.195100E+04	0.160527E+02	0.167768E+02	0.153285E+02
0.195200E+04	0.160539E+02	0.167775E+02	0.153303E+02
0.195300E+04	0.160562E+02	0.167795E+02	0.153328E+02
0.195400E+04	0.160591E+02	0.167823E+02	0.153359E+02
0.195500E+04	0.160627E+02	0.167859E+02	0.153395E+02

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0.195600E+04	0.160499E+02	0.167704E+02	0.153294E+02
0.195700E+04	0.160402E+02	0.167584E+02	0.153220E+02
0.195800E+04	0.160508E+02	0.167705E+02	0.153312E+02
0.195900E+04	0.160587E+02	0.167796E+02	0.153378E+02
0.196000E+04	0.160637E+02	0.167850E+02	0.153423E+02
0.196100E+04	0.160540E+02	0.167732E+02	0.153347E+02
0.196200E+04	0.160377E+02	0.167536E+02	0.153217E+02
0.196300E+04	0.160190E+02	0.167315E+02	0.153065E+02
0.196400E+04	0.159764E+02	0.166772E+02	0.152756E+02
0.196500E+04	0.159424E+02	0.166489E+02	0.152359E+02
0.196600E+04	0.159362E+02	0.166419E+02	0.152306E+02
0.196700E+04	0.159562E+02	0.166654E+02	0.152469E+02
0.196800E+04	0.159624E+02	0.166732E+02	0.152515E+02
0.196900E+04	0.159412E+02	0.166490E+02	0.152334E+02
0.197000E+04	0.159398E+02	0.166474E+02	0.152321E+02
0.197100E+04	0.159711E+02	0.166815E+02	0.152606E+02
0.197200E+04	0.160057E+02	0.167209E+02	0.152906E+02
0.197300E+04	0.160307E+02	0.167499E+02	0.153115E+02
0.197400E+04	0.160397E+02	0.167598E+02	0.153197E+02
0.197500E+04	0.160237E+02	0.167400E+02	0.153074E+02
0.197600E+04	0.160153E+02	0.167290E+02	0.153015E+02
0.197700E+04	0.160442E+02	0.167622E+02	0.153262E+02
0.197800E+04	0.160776E+02	0.168010E+02	0.153543E+02
0.197900E+04	0.160982E+02	0.168242E+02	0.153721E+02
0.198000E+04	0.161184E+02	0.168467E+02	0.153901E+02
0.198100E+04	0.161449E+02	0.168765E+02	0.154134E+02
0.198200E+04	0.160827E+02	0.168025E+02	0.153630E+02
0.198300E+04	0.159438E+02	0.166442E+02	0.152435E+02
0.198400E+04	0.158949E+02	0.165877E+02	0.152020E+02
0.198500E+04	0.159714E+02	0.166762E+02	0.152667E+02
0.198600E+04	0.160409E+02	0.167520E+02	0.153298E+02
0.198700E+04	0.160830E+02	0.167974E+02	0.153685E+02
0.198800E+04	0.161246E+02	0.168447E+02	0.154045E+02
0.198900E+04	0.161644E+02	0.168900E+02	0.154388E+02
0.199000E+04	0.161972E+02	0.169266E+02	0.154678E+02
0.199100E+04	0.161592E+02	0.168724E+02	0.154460E+02
0.199200E+04	0.160325E+02	0.167425E+02	0.153225E+02
0.199300E+04	0.159410E+02	0.166259E+02	0.152560E+02
0.199400E+04	0.160105E+02	0.167030E+02	0.153180E+02
0.199500E+04	0.160975E+02	0.167987E+02	0.153963E+02
0.199600E+04	0.161645E+02	0.168722E+02	0.154568E+02
0.199700E+04	0.162201E+02	0.169358E+02	0.155044E+02
0.199800E+04	0.162686E+02	0.169907E+02	0.155464E+02

```
# 91
# IPCC AR4 Millenium Runs output (vary solar forcing)
# ++++++
#
# Model: Bern2.5CC version with active C-cycle
# -----
# Prescribed forcing timeseries as described in file
# readme_doRuns_IPCC_Chap6_millennium_21jan06.txt
# provided by F. Joos, University of Bern.
#
# Contact:
# -----
# Gian-Kasper Plattner
# Climate and Environmental Physics
# Physics Institute, University of Bern
# Sidlerstrasse 5, CH-3012 Bern, Switzerland
# plattner@climate.unibe.ch
# http://www.climate.unibe.ch/~plattner/
# tel: ++41 (0)31 631-44-67
```

```
# fax: ++41 (0)31 631-87-42
#
# Some model setup informations:
# -----
# All runs with horizontal/vertical diffusion
#
# Run with standard ocean parameters
#   as used in Plattner et al. 2001/2002
#   with Kv (diffusivity) 4*10^-5 m2/s
#
# Climate sens. set to ~ 3.2 degrees C
# parameterized see Knutti et al. (Clim. Dyn. 2003)
#
# Model version is annual mean.
#
# No radiation code, CO2 radiative forcing calculated
# for as RF=5.35*ln(CO2/CO2_preind),
# Non-co2 radiative forcing prescribed according to
# Joos et al. GBC 2001 with updates for solar forcing
#
# More model description:
# -----
# Zonally averaged dynamical ocean with 3 basins and
# Southern Ocean, zonally averaged one layer energy
# and moisture balance atmosphere, thermodynamic
# sea ice (Stocker et al., J. Climate 1992).
#
# Carbon cycle components: Ocean/Atm/Terr.biosphere;
# Ocean carbon cycle is a description of the cycles
# of organic carbon and CaCO3 (Marchal et al., Tellus
# Tellus B), based on Redfield approach using PO4 as
# biolimiting nutrient.
#
# Land Biota: Lund-Jena-Postdam Dynamical Global
#   Vegetation Model (LPJ-DGVM)
# at GCM resolution (Gerber et al. 2003, Climate
# Dynamics; Sitch et al. 2003, Global Change Biology)
#
# LPJ forced by Cramer/Leemans annual mean
# climatology plus interannual climate variability
# from Hadley simulation (30-recycled climate) plus
# changes in the fields of surface temperature,
# precipitation, and cloudcover as simulated with the
# Impulse-EOF version of ECHAM-3/LSG in response to
# projected radiative forcing changes.
#
# Land use changes are not explicitly considered.
#
# Impact of climate change on terrestrial C-storage
# included
#
# References:
# -----
# Carbon cycle Ocean: Marchal et al., Tellus 1998
# Carbon cycle Terr. Bio: Sitch et al., GCB 2003
#   Gerber et al., Clim. Dyn. 2003
# Ccycle-climate feedbacks and global warming:
#   Plattner et al., Tellus 2001
#   Plattner et al., GBC 2002
# Non-CO2 forcing: Joos et al., GBC 2001
# Climate model: Stocker et al., J. Climate 1992
# Sea level: Knutti et al., J. Climate 2000
# Global warming Physics: Knutti et al., Nature 2002
```

```
# Knutti et al., Cl. Dyn. 2003
# and refs therein.
#
# Output columns:
# -----
# Time (yr AD)
# Global mean air temperature (deg C)
# NH-averaged air temperature (deg C)
# SH-averaged air temperature (deg C)
0.100100E+04 0.160288E+02 0.166890E+02 0.153687E+02
0.100200E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.100300E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.100400E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.100500E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.100600E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.100700E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.100800E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.100900E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101000E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101100E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101200E+04 0.160288E+02 0.166890E+02 0.153687E+02
0.101300E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101400E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101500E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101600E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101700E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.101800E+04 0.160288E+02 0.166890E+02 0.153687E+02
0.101900E+04 0.160288E+02 0.166889E+02 0.153687E+02
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0.102100E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102200E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102300E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102400E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102500E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102600E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102700E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102800E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.102900E+04 0.160288E+02 0.166890E+02 0.153687E+02
0.103000E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.103100E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.103200E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.103300E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.103400E+04 0.160288E+02 0.166889E+02 0.153687E+02
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0.103700E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.103800E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.103900E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104000E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104100E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104200E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104300E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104400E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104500E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104600E+04 0.160288E+02 0.166890E+02 0.153687E+02
0.104700E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104800E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.104900E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.105000E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.105100E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.105200E+04 0.160288E+02 0.166890E+02 0.153687E+02
0.105300E+04 0.160288E+02 0.166889E+02 0.153687E+02
0.105400E+04 0.160288E+02 0.166889E+02 0.153687E+02
```


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Attachment Converted:
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Attachment Converted:
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Attachment Converted:
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611. 1138734209.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Eystein Jansen <eystein.jansen@geo.uib.no>, Jonathan Overpeck <jto@u.arizona.edu>
Subject: MWP paper / possible figure / data
Date: Tue, 31 Jan 2006 14:03:29 +0000
Cc: Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>
Dear Eystein and Peck,

sorry for the overlong silence at this end. We *are* working on the revised figures, etc. and thanks for the CLIMBER and BERN EMIC data - Keith and I must look at this and see how best to show it.

In the meantime, I just wanted to forward to you a paper that we have coming out in Science next Friday - see the *uncorrected* page proofs attached. Please treat this in confidence and for IPCC purposes only - I'm sure you're aware of their strict embargo policy.

The reason we thought it worth forwarding was because it is useful for comparing implied MWP and 20th century NH temperatures and thus might be appropriate for use in the IPCC "MWP box". The approach is similar to that which Susan Solomon seemed to be keen on - looking at individual series, but simply counting how many simultaneously imply warmth or cold conditions. There's also the possibility that one of its figures (perhaps panel 3B) might be useful in the "MWP box". If you have time for a quick read, please tell us what you think.

Eystein - you were also wanting some regional proxy series and I thought I'd send you the data shown in Fig 1 of this paper, because I'm preparing a file to accompany the paper anyway and this will kill two birds with one stone. Are these data what you were hoping for? I'll send them later today if they are.

Cheers

Tim

</x-flowed>

Attachment Converted: "c:\eudora\attach\osborn_uncorrectedproofs.pdf"
<x-flowed>
Dr Timothy J Osborn
Climatic Research Unit

mail.2006

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Norwich NR4 7TJ, UK

e-mail: t.osborn@uea.ac.uk
phone: +44 1603 592089
fax: +44 1603 507784
web: http://www.cru.uea.ac.uk/~timo/
sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm
</x-flowed>

612. 1138995069.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Eystein.Jansen@geo.uib.no
Subject: Fwd: new fig
Date: Fri Feb 3 14:31:09 2006

Peck and Eystein
we are having trouble to express the real message of the reconstructions - being scientifically sound in representing uncertainty, while still getting the crux of the information across clearly. It is not right to ignore uncertainty, but expressing this merely in an arbitrary way (and as a total range as before) allows the uncertainty to swamp the magnitude of the changes through time. We have settled on this version (attached) of the Figure which we hope you will agree gets the message over but with the rigor required for such an important document. We have added a box to show the "probability surface" for the most likely estimate of past temperatures based on all published data. By overlapping all reconstructions and giving a score of 2 to all areas within the 1 standard error range of the estimates for each reconstruction, and a score of 1 for the area between 1 and 2 standard errors, you build up a composite picture of the most likely or "consensus" path that temperatures took over the last 1200 years (note - now with a linear time axis). This still shows the outlier ranges, preserving all the information, but you see the central most likely area well, and the comparison of past and recent temperature levels is not as influenced by the outlier estimates. What do you think? We have experimented with different versions of the shading and this one shows up quite well - but we may have to use some all grey version as the background to the overlay of the model results. We have also experimented with changing the normalisation base for the model/reconstruction Figure, but using the same short modern period as for the first Figure is not satisfactory - more on this later. We have added in Oerlemans curve as many insisted - but we only have the GLOBAL curve - can you get the separate North and Southern Hemisphere curves (with uncertainty). I do not see that the new model runs from Germany/Switzerland will

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fit

easily in the existing Figure and need to be separate! I am really struggling with the text also - really need more time!!!! More later
Keith

X-Mailer: QUALCOMM windows Eudora Version 7.0.0.16
Date: Fri, 03 Feb 2006 10:42:15 +0000
To: Keith Briffa <k.briffa@uea.ac.uk>
From: Tim Osborn <t.osborn@uea.ac.uk>
Subject: new fig
Dr Timothy J Osborn
Climatic Research Unit
School of Environmental Sciences, University of East Anglia
Norwich NR4 7TJ, UK
e-mail: t.osborn@uea.ac.uk
phone: +44 1603 592089
fax: +44 1603 507784
web: [1]http://www.cru.uea.ac.uk/~timo/
sunclock: [2]http://www.cru.uea.ac.uk/~timo/sunclock.htm

--
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Fax: +44-1603-507784
[3]http://www.cru.uea.ac.uk/cru/people/briffa/

References

- 1. http://www.cru.uea.ac.uk/~timo/
- 2. http://www.cru.uea.ac.uk/~timo/sunclock.htm
- 3. http://www.cru.uea.ac.uk/cru/people/briffa/

613. 1139006752.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>
Subject: Re: Fwd: new fig
Date: Fri Feb 3 17:45:52 2006

Eystein
can you also check that Fortunat is addressing the few comments (ie revising the text) that relate to his bit of my section and Henry Pollack is helping us to asses the comments and revise the text to do with the Ground Surface Temperature section. I presume Ricardo and Peck are dealing with all the regional stuff. Thanks
At 17:32 03/02/2006, you wrote:

Hi,
I can contact Oerlemans, have met him a few times.
Cheers,
Eystein

thanks for this - the new runs I think best in a separate panel .

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Keith

At 16:44 03/02/2006, Jonathan Overpeck wrote:

Hi Keith and Tim (and Eystein): Your new figure is quite compelling, and a nice complement to the other two panels. I agree it would be good to get the Northern Hem Oerleman's plot - Eystein do you know him well enough to ask? (I never even met him, but could ask if you don't know him).
What you have created will take some good work on the caption to explain, but it has my vote.
What is your plan for dealing with the new German/Swiss model results? A new figure? Are you sure these runs can't be worked in, perhaps as a new panel? At least we have Susan's support for the new runs, so we do what we have to do.
As for work and time, we are running out. Just do the best you can, and hopefully the new section will emerge sometime next week.
Highest priority (please do first) - we need 3 TS-contender figures (and captions) by early next week:
1) the new fig showing all the sites used in the recons - with caption
2) the fig you've attached to this email - with caption (were we going to try to put all the model runs/refs/color key into a table, so the caption could be shorter than in the FOD? Think this would be better, so caption is shorter)
3) the new fig comparing the obs to the model runs (update of the fig we showed for first time in ChCh - using a version of the lower panel you attached to this email - with caption
There is little doubt you guys have the hardest job of all LAs in our chapter, and possibly the entire WG1 report. Your work will have huge impact, and the extra effort is really appreciated well beyond me and Eystein. I wish we could offer up a time machine to make it easier, but... just keep plugging.
thanks! Peck

Peck and Eystein

we are having trouble to express the real message of the reconstructions - being scientifically sound in representing uncertainty, while still getting the crux of the information across clearly. It is not right to ignore uncertainty, but expressing this merely in an arbitrary way (and as a total range as before) allows the uncertainty to swamp the magnitude of the changes through time. We have settled on this version (attached) of the Figure which we hope you will agree gets the message over but with the rigor required for such an important document.
We have added a box to show the "probability surface" for the most likely estimate of past temperatures based on all published data. By overlapping all reconstructions and giving a score of 2 to all areas within the 1 standard error range of the estimates for

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each reconstruction , and a score of 1 for the area between 1 and 2 standard errors, you build up a composite picture of the most likely or "consensus" path that temperatures took over the last 1200 years (note - now with a linear time axis). This still shows the outlier ranges , preserving all the information, but you see the central most likely area well , and the comparison of past and recent temperature levels is not as influenced by the outlier estimates. What do you think? We have experimented with different versions of the shading and this one shows up quite well - but we may have to use some all grey version as the background to the overlay of the model results. We have also experimented with changing the normalisation base for the model/reconstruction Figure , but using the same short modern period as for the first Figure is not satisfactory - more on this later. We have added in Oerlemans curve as many insisted - but we only have the GLOBAL curve - can you get the separate North and Southern Hemisphere curves (with uncertainty) . I do not see that the new model runs from Germany/Switzerland will fit easily in the existing Figure and need to be separate! I am really struggling with the text also - really need more time!!!! More later
Keith

X-Mailer: QUALCOMM Windows Eudora Version 7.0.0.16
Date: Fri, 03 Feb 2006 10:42:15 +0000
To: Keith Briffa <k.briffa@uea.ac.uk>
From: Tim Osborn <t.osborn@uea.ac.uk>
Subject: new fig
Dr Timothy J Osborn
Climatic Research Unit
School of Environmental Sciences, University of East Anglia
Norwich NR4 7TJ, UK
e-mail: t.osborn@uea.ac.uk
phone: +44 1603 592089
fax: +44 1603 507784
web: [1]<http://www.cru.uea.ac.uk/~timo/>
sunclock: [2]<http://www.cru.uea.ac.uk/~timo/sunclock.htm>

--
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Fax: +44-1603-507784
[3]<http://www.cru.uea.ac.uk/cru/people/briffa/>
Attachment converted: Macintosh HD:ipcc_nhrecon_new1.pdf (PDF /«IC») (0010B41B)

--
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Director, Institute for the Study of Planet Earth
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Mail and Fedex Address:
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[5]<http://www.ispe.arizona.edu/>

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Fax: +44-1603-507784
[6]<http://www.cru.uea.ac.uk/cru/people/briffa/>

--

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--
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Phone: +44-1603-593909
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[7]<http://www.cru.uea.ac.uk/cru/people/briffa/>

References

1. <http://www.cru.uea.ac.uk/~timo/>
2. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
3. <http://www.cru.uea.ac.uk/cru/people/briffa/>
4. <http://www.geo.arizona.edu/>
5. <http://www.ispe.arizona.edu/>
6. <http://www.cru.uea.ac.uk/cru/people/briffa/>
7. <http://www.cru.uea.ac.uk/cru/people/briffa/>

614. 1139242164.txt

#####

From: "Olga Solomina" <olgasolomina@yandex.ru>
To: "Jonathan Overpeck" <jto@u.arizona.edu>, "Eystein Jansen" <Eystein.Jansen@geo.uib.no>
Subject: glacier box sod
Date: Mon, 6 Feb 2006 11:09:24 +0300
Cc: "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>, "Keith Briffa" <k.briffa@uea.ac.uk>, Val rie Masson-Delmotte <Valerie.Masson@cea.fr>

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Dear Eystein and Peck,

Many thanks for your reply and contribution for the glacier box. Everything is fine with me except for the sentence:

"Comparing the ongoing retreat of glaciers with the reconstructed records, it is evident that the current global pattern is unprecedented within the Holocene, as there is no known period with a global homogenous trend of retreating glaciers over centennial and shorter timescales."

The reason of my disagreement is the following: the resolution and the spatial and temporal coverage of the Holocene glacial records is not enough to compare it seriously at the century level. For most of regions we even cannot estimate the synchronicity of the records. Looking at the figure a reader will see that there was actually a period with "a global homogenous trend of retreating glaciers" during at least a millennium (at least 7000-8000 bp) - not a century like now! To resolve this problem we can discuss in a broader audience and ask the opinion of more experts if you wish - I can think of Luckman, Nesje, Grove, Porter, Karlen.

I corrected a little the second paragraph - removed three references - they are not used in our picture and, in fact not that good in terms of real reconstructions. I think we should stress clearly that the records from Scandinavia is now the most reliable and detailed.

Regards,

Olga

----- Original Message -----

From: "Eystein Jansen" <Eystein.Jansen@geo.uib.no>

To: "Olga Solomina" <olgasolomina@yandex.ru>

Cc: "Jonathan Overpeck" <jto@u.arizona.edu>

Sent: Saturday, February 04, 2006 3:04 AM

Subject: Fwd: Re: glacier box

Dear Olga,

both Peck and I like the new version, both figure and shorter text.

Please find enclosed a suggestion from us with some revisions, one file with track changes, one with all changes accepted. I have added a little to your short text, but not much. If you are happy with this, please send the final version inserted into the template of the SOD we sent out so that the style is correct, the figure separately, and an endnote file with references. Best wishes and thanks for all your efforts, Eystein

--

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Fax: +47-55-584330

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615. 1139323214.txt

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From: simon.tett@metoffice.gov.uk
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: congratulations for the science paper!
Date: Tue, 07 Feb 2006 09:40:14 +0000
Cc: Eduardo Zorita <Eduardo.Zorita@gkss.de>, Tim Osborn <t.osborn@uea.ac.uk>, Hans von Storch <Hans.von.Storch@gkss.de>, Simon Tett <simon.tett@metoffice.gov.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

My view is that paleo is not important enough for the Hadley Centre for us to spend much (or any) time helping Millennium unless there is some cash on the table to buy some staff time. I am working 75% at the moment so need to focus on staff management. If I do have time it will be focused on completing the SOAP work.

Simon

On Tue, 2006-02-07 at 09:34, Keith Briffa wrote:

> Hi Eduardo
> Thanks for this and for letting us know about Millennium.
> I think it is outrageous that the millennium group submitted what
> was patently an inferior proposal compared to Imprint. Having then
> succeeded in getting the funding, they are now resorting to
> "poaching" members of the Imprint team to provide the essential model
> simulation element that was pitifully deficient in their original
> submission. To me this is tantamount to receiving money under false
> pretences! I believe the European system for allocating research
> funds has been seriously abused .
>
> Keith
>
>
> At 23:30 06/02/2006, Eduardo Zorita wrote:
>
> >Tim, Keith
> >
> >Hans and myself were in Oxford last week to meet Myles Allen and
> >Danny McCarroll,
> >among others. Myles has been in contact with us in the last couple of months,
> >and they are interested in a GKSS participation in Millennium. It seems
> >that our collaboration there is getting clearer, although we will not get
> >funding from the EU. We will probably assist in the design of their
> >global simulations

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> >and perhaps also in some regional simulations. Likely GKSS will perform some
> >ensembles for certain periods to estimate the internal variability
> >at regional scales.
> >
> >Simon could not attend the meeting in the last moment, but probably he will be
> >involved too, although I do not know exactly how.
> >
> >
> >eduardo
> >
> --
> Professor Keith Briffa,
> Climatic Research Unit
> University of East Anglia
> Norwich, NR4 7TJ, U.K.
> >
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> <http://www.cru.uea.ac.uk/cru/people/briffa/>
> --

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I work in Exeter about 2 days/week.
E-mail: simon.tett@metoffice.gov.uk <http://www.metoffice.gov.uk>

616. 1139331621.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>, Keith Briffa
<k.briffa@uea.ac.uk>, Jonathan Overpeck <jto@u.arizona.edu>
Subject: Re: Data for IPCC
Date: Tue, 07 Feb 2006 12:00:21 +0000

<x-flowed>

Hi Eystein and Peck,

sorry, but I'm *still* working on the figures. On the simulations
one, we were requested to include results from the new Stendel et al.
(2005, Clim. Dyn.) simulation with ECHAM4-OPYC3 for the last 500
years. Did you get these data already? I've just emailed Martin
Stendel to ask for them, but thought I'd check in case you already had them.

Cheers

Tim

Dr Timothy J Osborn
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phone: +44 1603 592089
fax: +44 1603 507784
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sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

</x-flowed>

617. 1139357516.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>
Subject: Re: Fwd: Re: Data for IPCC
Date: Tue, 7 Feb 2006 19:11:56 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, tshanaha@email.arizona.edu

<x-flowed>

Hi Eystein, Keith and Tim - this seems odd to me, given that the N hem data must completely dominate his global recon. BUT, since the data and recon are his, and our job is to assess what is published, we don't have much choice. We have three options (or more if you can think of them):

option 1) forget about his recon. Although I sense that there might be some interest in this, we must include his study/data/fig

option 2) we could make a separate fig to highlight just his global recon, perhaps compared to the global borehole recon. We are dying for space, so I suspect this option isn't ideal either. Expert review of the SOD might suggest it, but in the meantime, I suggest we try to get away with...

option 3) we include it in the big recon plot, and just make it clear in the caption (and table that goes with the caption if you're going with the table idea) that the Oerleman's curve, though labeled global in the original paper, appears to be representative of (or weighted mostly by, or ?) glaciers in the Northern Hemisphere (per his Fig 3a). I think we should leave it to Keith and Tim to figure out the best language, but I think this will work. Could be done as a footnote to the table instead of the caption.

Make sense? thanks, Peck

>Hi, this is what I got from Oerlemans.
>If we go with his data it has to be the global curve it seems....

>

>Eystein

>

>>From: "J. Oerlemans" <J.Oerlemans@phys.uu.nl>
>>Subject: Re: Data for IPCC
>>Date: Sun, 5 Feb 2006 22:31:19 +0100
>>To: Eystein Jansen <Eystein.Jansen@geo.uib.no>
>>X-checked-clean: by exiscan on noralf
>>X-UiB-SpamFlag: NO UIB: -15 hits, 8.0 required
>>X-UiB-SpamReport: spamassassin found;
>> -15 From is listed in 'whitelist_SA'
>>

>>Dear Eystein,

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>>
>>Just returned from abroad and have some time now to look at your request.

>>
>>I don' t think it is a very good idea to
>>consider hemispheric temperatures from glacier
>>records separately. The error bars are just too
>>large. I am currently extending the dataset
>>substantially, but it will take some time
>>before hemispheric averages have a similar
>>error bar as the global mean right now (figure
>>3b in my paper).
>>So I propose you only present the estimated
>>global mean temperature, which I give below.

>>
>>with best wishes,
>>Hans
>>=====

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>>

>>On Feb 3, 2006, at 7:08 PM, Eystein Jansen wrote:

>>
>>>>Dear Hans,
>>>>I am co-ordinating lead author for the IPCC
>>>>AR4 Paleoclimate chapter. In our section on
>>>>the last 2000 years we would like to include
>>>>your T-reconstruction from glaciers that was
>>>>published in Science. We would like to have
>>>>the data separate for each hemisphere plus the
>>>>global mean and include this into a figure
>>>>showing a suite of T reconstructions. There is
>>>>an urgency to this and we hope that you could
>>>>send us the data very soon, in order for the
>>>>data to bbe incorporated into the 2nd draft of
>>>>the report.

>>>>
>>>>Best wishes
>>>>Eystein
>>>>--

>>>>

>>>>Eystein Jansen
>>>>Professor/Director
>>>>Bjerknes Centre for Climate Research and
>>>>Dep. of Earth Science, Univ. of Bergen
>>>>Allégaten 55
>>>>N-5007 Bergen
>>>>NORWAY
>>>>e-mail: eystein.jansen@geo.uib.no
>>>>Phone: +47-55-583491 - Home: +47-55-910661
>>>>Fax: +47-55-584330

>
>
>--
>

>Eystein Jansen
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>Phone: +47-55-583491 - Home: +47-55-910661
>Fax: +47-55-584330
>
>Attachment converted: Macintosh HD:for Eystein.xls (XLS8/XCEL) (0010C0BC)

--

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</x-flowed>

618. 1139413326.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: just checking - important
Date: Wed, 8 Feb 2006 10:42:06 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Tim - thanks for the update. Just think of the beer at the end of the tunnel. This week's deadline is a TSU deadline for figs being considered for the Tech Summary. You're looking good to get some of your figs/science in the TS, and this means big impact. Hopefully, provides the extra juice to find the extra time needed to get them done.

thx, peck

>update:

>
>reconstructions + observations: you've seen the multiple shading
>extra panel already, but I've made a few more tweaks to this and
>added oerlemans (global, but looks similar to his NH regions, by
>eye) reconstruction.
>
>forcings + model NH temps: waiting for Stendel data, added new
>ECHO-G run without drift problem, tried replacing reconstruction
>"envelope" with the multiple shading approach used in the extra
>panel of the first figure. Not sure how clear it is - obviously
>adding shades of grey behind coloured lines can make it a little
>harder to distinguish them.
>

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>extra runs from EMICS: draft plot of NH temps made, got to put the
>reconstruction shading under that too, not yet done and the whole
>thing needs some tidying up so that it can be an extra panel of the
>previous figure.
>
>extra panel showing a volcanic forcing time series unsmoothed (i.e.,
>with spikes): draft done but again needs tidying so it can be an
>extra panel of the forcings/models figure.
>
>maps of proxy locations - still lots of work to be done.
>
>Cheers
>
>Tim
>
>
>
>At 03:01 08/02/2006, you wrote:
>>Hi Tim - I did, thanks. And this is where the "hybid" MWP box idea
>>came from. Speaking of which, how are all your figs going? We
>>really need those being considered for the Tech Summary asap
>>(deadline is this week). Please update at least. Thanks, Peck
>>
>>>Hi Peck - sorry, forgot to reply to this. Yes, please do share it
>>>with them, if you haven't already. - Tim
>>>
>>>At 05:38 01/02/2006, Jonathan Overpeck wrote:
>>>>Hi Tim and Keith - I assume I can share your pre-pub Science pdf
>>>>with Susan and Martin? Of course, I'll point out the need for
>>>>confidentiality, but I'm sure they know the deal and can be
>>>>trusted. Just wanted to make sure this is ok w/ you, so that we
>>>>can get their opinions on what's best for the MWP box.
>>>>
>>>>thanks, Peck
>>>>--
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From: Jesus Fidel Gonzalez Rouco <fidelgr@fis.ucm.es>
To: t.osborn@uea.ac.uk
Subject: Re: erik2
Date: wed, 08 Feb 2006 18:34:25 +0100
Cc: k briffa <k.briffa@uea.ac.uk>

Dear Tim,
attach the data (erikII.dat): NH averages with standard latitude weighting.
Yes, the forced simulations are identical in forcing, just different initial
conditions.

Just for complementary info on the data file a rough plot of the data in the
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file

erikII.dat in comparison with NH avgs in ErikI: ErikI-II.ps

Also for complementary info, I attach nhavg.jpg and nhano.jpg...plots of anomalies and

absolute values in the NH for all the forced runs:

columbus erikI,II and control.

Let me know if there are any queries or problems.

Best regards

Fidel

ps.- I will be glad to have a pdf of the magicc paper when you consider it appropriate.

Congratulations for this.

Tim Osborn wrote:

Hi again Fidel,

we are in the very final stages of preparing a revised figure for the IPCC and so your email has come at just the right time (if you can provide the data quickly). Assuming the forcings are identical to erik1, then all we would need is a time series (in plain text) of annual-mean NH temperature.

If you can provide this, then we can include it. (My paper comparing erik1 against a simulation with the simple energy balance model MAGICC has at last been accepted by Climate Dynamics - there were no problems at all, just very slow reviewers and very slow editorial decisions!).

Best wishes

Tim

On Mon, February 6, 2006 8:37 pm, Jesus Fidel Gonzalez Rouco wrote:

Dear Tim and Keith,

the erik2 paper which I mentioned in Bern was under review came out some weeks ago.

You mentioned then that it might be of interest to include these data in the IPCC rep. Let me know what you need for this when it suits you.

I attach the pdf.

Thanks a lot for that btw.

Best regards from Madrid

Fidel

--

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References

1. <http://chubasco.fis.ucm.es/%7Efi/>
2. <http://chubasco.fis.ucm.es/%7Efi/>

620. 1139504822.txt

#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: paper in this Friday's Science
Date: Thu, 09 Feb 2006 12:07:02 -0500
Reply-to: mann@psu.edu
Cc: k.briffa@uea.ac.uk

<x-flowed>
Guys,

A final revised version attached. I'm expecting the embargo to lift at
midnight east coast U.S., but let me know if you hear otherwise. I will
make sure the science website has posted the paper before posting myself...

mike

Tim Osborn wrote:

> Hi Mike,
>
> thanks for putting this together, Mike. It is a nice summary plus
> drawing out of the important strands etc. I especially like "might be
> likened in shape to a certain implement used in a popular North
> American winter sport" - Keith thinks you must mean a "ski"?
>
> The only negative thing I have to say is that you get in a couple of
> "digs" at the sceptics which might unnecessarily rankle readers. e.g.
> *astronomers* Soon and Baliunas; *unbridled* cherry picking. Still,
> it's your name that's attached to this piece, so it's up to you to dig
> if you want.
>
> Cheers and thanks again
>
> Tim
>
> At 13:42 09/02/2006, Michael E. Mann wrote:
>
>> Hi Tim,
>>
>> Maybe Science can still fix (at least, the online version?). I
>> wouldn't lose sleep over this though. As typos go, its relatively minor.
>>
>> I must confess that I scavenged a figure off your page proofs. As the
>> piece won't go online until after the article goes up on Science's
>> website, shouldn't matter what the source was though...
>>
>> I've attached the piece in word format. Hyperlinks are still there,

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>> but not clickable in word format. I've already given it a good
>> go-over w/ Gavin, Stefan, and William Connelley (our internal "peer
>> review" process at RC), so I think its in pretty good shape. Let me
>> know if any comments...

>>
>> thanks,

>>
>> Mike

>>
>> Tim Osborn wrote:

>>
>>> Bugger. You read and re-read the manuscript and the proofs and
>>> *still* you miss things! Yes, it should be 1856. Thanks for
>>> spotting this.

>>>
>>> I didn't reply yet about RealClimate because I thought Keith or I
>>> would have to prepare something and wasn't sure if we'd have time
>>> (IPCC deadlines!), but as you've done the work instead, that's great
>>> - though we'd like to see it beforehand if possible. Did you
>>> need/want a copy of a figure or have you got hold of one from
>>> Science/journalist?

>>>
>>> Cheers

>>>
>>> Tim

>>>
>>> At 19:53 08/02/2006, Michael E. Mann wrote:

>>>
>>>> Tim/Keith,

>>>>
>>>> I've worked up an article for RC to go online when the embargo is
>>>> lifted. will send later when finalized. One issue came up in an
>>>> interview w/ a writer at Science, and I didn't know the answer. Is
>>>> the shorter reference period you mention in caption of fig 3 really
>>>> 1865, or is that a typo (i.e., supposed to be 1856). I couldn't
>>>> think of a reason for why the latter date would be used, and
>>>> guessed that "65" just got transposed accidentally? Please let me
>>>> know if you can what the answer is. Its a minor point, but nice to
>>>> get things right if possible...

>>>>
>>>> mike

>>>>
>>>> --

>>>> Michael E. Mann
>>>> Associate Professor
>>>> Director, Earth System Science Center (ESSC)

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>>>>
>>>>

>>>> <<http://www.met.psu.edu/dept/faculty/mann.htm>><http://www.met.psu.edu/dept/faculty/mann.htm>

>>>>
>>>>

>>>>
>>>> Dr Timothy J Osborn
>>>> Climatic Research Unit
>>>> School of Environmental Sciences, University of East Anglia
>>>> Norwich NR4 7TJ, UK

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>>>
>>> e-mail: <mailto:t.osborn@uea.ac.uk>t.osborn@uea.ac.uk
>>> phone: +44 1603 592089
>>> fax: +44 1603 507784
>>> web:
>>> <http://www.cru.uea.ac.uk/~timo/>http://www.cru.uea.ac.uk/~timo/
>>> sunclock:
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>> --
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>
> Dr Timothy J Osborn
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>
> e-mail: t.osborn@uea.ac.uk
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> fax: +44 1603 507784
> web: http://www.cru.uea.ac.uk/~timo/
> sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm
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Michael E. Mann
Associate Professor
Director, Earth System Science Center (ESSC)
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The Pennsylvania State University email: mann@psu.edu
University Park, PA 16802-5013
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<http://www.met.psu.edu/dept/faculty/mann.htm>

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>
Subject: progress
Date: Thu, 9 Feb 2006 14:56:51 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>

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Hi Keith and Tim - Eystein and I just talked about Henry's request to be able to read and comment on your SOD text, and it seems highly appropriate that we work super hard to make this possible. It is taking place w/ other sections of the SOD, and your section is the one that has to be the most perfect.

I'm guessing that we'll have final figs this week or over the weekend (please!), and the edited section a day or two later (at the most). As per the last email to you and Henry, you can save everyone time if you send sections relevant to him (all the multi-proxy and proxy sections) as soon as they are done.

Sorry to keep the pressure on, but we are running out of time.

thanks, peck

--

Jonathan T. Overpeck
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<http://www.ispe.arizona.edu/>
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#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>, Keith Briffa <k.briffa@uea.ac.uk>
Subject: update
Date: Thu, 09 Feb 2006 16:51:53 -0500
Reply-to: mann@psu.edu
Cc: Gavin Schmidt <gschmidt@giss.nasa.gov>

<x-flowed>

guys, I see that Science has already gone online w/ the new issue, so we put up the RC post. By now, you've probably read that nasty McIntyre thing. Apparently, he violated the embargo on his website (I don't go there personally, but so I'm informed).

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Anyway, I wanted you guys to know that you're free to use RC in any way you think would be helpful. Gavin and I are going to be careful about what comments we screen through, and we'll be very careful to answer any questions that come up to any extent we can. On the other hand, you might want to visit the thread and post replies yourself. We can hold comments up in the queue and contact you about whether or not you think they should be screened through or not, and if so, any comments you'd like us to include.

You're also welcome to do a followup guest post, etc. think of RC as a resource that is at your disposal to combat any disinformation put forward by the McIntyres of the world. Just let us know. We'll use our best discretion to make sure the skeptics don't get to use the RC comments as a megaphone...

mike

--
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Director, Earth System Science Center (ESSC)

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<http://www.met.psu.edu/dept/faculty/mann.htm>

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: "Wahl, Eugene R" <wahl@alfred.edu>
Subject: RE: Wahl-Ammann paper and UAZ position
Date: Fri, 10 Feb 2006 12:05:44 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

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Hi Eugene - this is good news... I hope. Please contact Steve and see if we will have "in press" status before the end of the month. He knows the drill, but also the downside of not being precise. Let me, Eystein and Keith know as soon as you know. Bit nuts right now, really appreciate your help.

thanks, peck

>Hi Peck:

>

>well, as I have understood it in our communications with Steve,
>final acceptance is equivalent to being in press for Climatic Change
>because it is a "journal of record". However, this would need to be
>confirmed to be quite sure.

>

>If that is the case, then in press is still possible by the end of

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>the month. I think.

>

>which would be best at this point, for me to write and ask Steve
>this, or would it be better for you to ask? I'm happy to do so, I
>just want to act in the most time-effective and appropriate way.

>

>I apologize for the fact that it is coming right down to the wire.
>The status right now is that I am waiting for final analytical
>results from Caspar re: Pearson's r and CE results on all the
>scenarios we have done. These results will go in an appendix table
>and I have to write a brief text to go with them for
>contextualization purposes--I already have in mind what I want to
>say. The entire rest of the document is essentially done.

>

>Steve turned around the change from "in review" to "provisionally
>accepted" within days last December after receiving back the final
>independent re-review (it had been due a month earlier), so I can
>imagine that he could potentially turn around the change from
>"provisional acceptance" to "full acceptance" similarly quickly.

>

>Please advise about who is best to contact Steve--and if me I will
>get on it today.

>

>

>Peace, Gene
>Dr. Eugene R. Wahl
>Asst. Professor of Environmental Studies
>Alfred University

>

>

>From: Jonathan Overpeck [mailto:jto@u.arizona.edu]
>Sent: Fri 2/10/2006 12:39 PM
>To: Wahl, Eugene R
>Cc: Eystein Jansen; Keith Briffa; t.osborn@uea.ac.uk
>Subject: RE: Wahl-Ammann paper and UAZ position

>

>

>

>Hi Gene - First the IPCC, then I'll send another email wrt UA Geography

>

>Based on your update (which is much appreciated), I'm not sure we'll
>be able to cite either in the SOD due at the end of this month
>(sections will have to be done this week, or earliest next week to
>meet this deadline). The rule is that we can't cite any papers not in
>press by end of Feb.

>

> From what you are saying, there isn't much chance for in press by the
>end of the month? If this is not true, please let me, Keith, Tim and
>Eystein know, and make sure you send the in press doc as soon as it
>is officially in press (as in you have written confirmation). We have
>to be careful on these issues.

>

>Thanks again, Peck

>

>>Hi Peck:

>>

>>Two quick things...

>>

>>1) Regarding the Wahl-Ammann (WA) Climatic Change paper...Caspar
>>and I are in the very final stages of completing the requirements
>>Steve Schneider set for bringing this paper into full (vs.

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>>provisional) acceptance. We have an internal goal of a week from
>>now for resubmission.

>>
>>We have had an equally pressing deadline with Science re: our
>>comment on the vonStorch et al. 2004 criticism of MBH [that was
>>based on an improper (and undisclosed) detrending step], which has
>>taken some extra work to be sure we have our mathematics exactly
>>correct. We have been multitasking on both this and WA, and so far
>>have been quite close to meeting our internal time goals. I feel the
>>week time frame will be fairly accurate.

>>
>>
>>2) I am aware of a position now open at UAZ in the Geography and
>>Regional Development Dept. I think I make a good fit with the
>>position profile--actually quite good--however, I have met
>>roadblocks in geography departments before because my degree is not
>>in geography. Geographers seem to have particular sensitivities to
>>their discipline being "watered down". Also, the geography depts at
>>some research grade institutions (UMN for example) require pretty
> >heavy teaching loads, which makes a nice challenge to keep up with
>>research--don't I know!! And finally, the position is subject to
>>budgetary approval, which makes me wonder if there are significant,
>>deeper budgetary issues that it would be good to know about.

>>
>>Do you have any read on this position and the budget issues? I have
>>a lot of contacts there in climatology/earth system-related
>>areas--including you, Malcolm Hughes, Tom Swetnam, Owen Davis, and
>>also Julio Betancourt of the USGS--which is something that would be
>>considered a strength for this position. From my perspective, the
>>fit would be very good, but I don't want to invest effort in the
>>application process if it is clear that not being a geography PhD is
>>a stopper, or if there is some other significant red flag I should
>>know about. Any thoughts you might have will be welcome.

>>
>>I'll be contacting Malcolm for his read also, and then talk to the
>>search chair.

>>
>>
>>Peace, Gene
>>Dr. Eugene R. Wahl
>>Asst. Professor of Environmental Studies
>>Alfred University

>>
>>607-871-2604
>>1 Saxon Drive
>>Alfred, NY 14802

>>
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>--
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From: Jonathan Overpeck <jto@u.arizona.edu>
To: rahmstorf@ozean-klima.de, joos <joos@climate.unibe.ch>, Eystein Jansen <eystein.jansen@geo.uib.no>, t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>
Subject: Fwd: some figures at last!
Date: Fri, 10 Feb 2006 12:21:17 -0700

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Hi Stefan and Fortunat: Attached are the draft figs that include proxy obs, simulations, and comparisons of the two. As you can see, Tim just sent them. Big job, but they look great in my eyes.

See Tim's email below for more background info.

We need fast feedback from you both, specifically:

- 1) any general comments on the figs - this is a crux set of figures and we need your eyes to look at them carefully
- 2) is it wise to keep the new EMIC run panel attached to the second figure as attached? I vote yes, but what do you think. It fits w/ the other panels pretty well.
- 3) either way, we need caption prose from you (perhaps Fortunat start, and Stefan edit, or vice versa if Stefan can start first) on the new EMIC panel.
- 4) also, we need a new para, or prose that can be added to a para, that describes the panel and it's implications as it informs our assessment. Keith will then integrate this into the section. I'm not sure of this, but perhaps you could start with a new question heading, and then have a short para to go under it - something like "what is the significance of the new reduced-amplitude estimates of past solar variability?"

Of course, we need your feedback and prose asap. Please send to me, Eystein, Keith and Tim.

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Thanks in advance for the help. Best, peck

>X-Sieve: CMU Sieve 2.2
>Date: Fri, 10 Feb 2006 18:00:19 +0000
>To: Jonathan Overpeck <jto@u.arizona.edu>,
> Eystein Jansen <eystein.jansen@geo.uib.no>
>From: Tim Osborn <t.osborn@uea.ac.uk>
>Subject: some figures at last!
>Cc: Keith Briffa <k.briffa@uea.ac.uk>
>X-UEA-Spam-Score: -102.8
>X-UEA-Spam-Level: -----
>X-UEA-Spam-Flag: NO
>
>Dear Peck and Eystein,
>
>the attached word file contains the latest versions of two of our figures.
>
>First, is the reconstructions with many requests now done: linear
>time scale, dotted early instrumental temperatures not solid line,
>Oerlemans added, new panel showing shading for the overlapping
>regions of temperature reconstructions.
>
>Second, is the forcings and models. Stendel ECHAM simulation added
>(1500-2000). New ECHO-G Erik2 simulation just published in GRL from
>Gonzalez-Ruoco et al. added (1000-1990). Reconstruction "envelope"
>replaced by new shading of overlaps in the temperature
>reconstructions. Correction of some labelling errors. Those runs
>that did not include 20th century sulphate aerosol cooling are
>dotted or dashed after 1900 (the two low ones also omitted CH4, N2O,
>CFCs, O3, hence still cool despite omitting aerosol cooling). The
>ECHO-G Erik1 simulation with the very out-of-equilibrium initial
>conditions is dashed. Finally, the extra panel with the new EMIC
>runs is included as panel (e), again with the new shading of
>overlapping temperature reconstructions.
>
>Keith suggests sending to Stefan and Fortunat too for their views -
>can you do that (they may now be gone for the weekend, of course).
>
>Best wishes and sorry this is late. Am I right in thinking that the
>only other possible-TS figure is the location maps? Still working
>on those (had very little time in last 2 days due to media etc.
>attention re. Science paper).
>
>Cheers
>
>Tim
>
>
>
>Dr Timothy J Osborn
>Climatic Research Unit
>School of Environmental Sciences, University of East Anglia
>Norwich NR4 7TJ, UK
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mail.2006

Jonathan T. Overpeck
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Professor, Department of Geosciences
Professor, Department of Atmospheric Sciences

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direct tel: +1 520 622-9065
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<http://www.geo.arizona.edu/>
<http://www.ispe.arizona.edu/>
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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: pulling teeth and hair out
Date: Fri, 10 Feb 2006 12:59:50 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Keith - figs look great for now, and hopefully the flurry of emails just cc'd to you will take care of everything except Oerlemans. To help here, I've dug up the Chap 4 pdfs. (going to the CLA would not be quick, nor necessarily any better).

In the Ch04 figs file, go to Fig 4.5.4 on pg 4-72 for caption material that seems pretty bland.

In the Ch04 Text file, go to first full para on p 4-22 for what chap 4 had on the Oerleman's work. I suspect this is the last time they thought about it.

You can keep this really short and sweet - main thing is that it's another independent data set that shows unprecedented recent warming. A short para should do it.

Are you going to use a table to help with the figure captions?

On the weekend/evenings, I can be reached at home 1-970-728-0780, and during the week on my cell 520-907-6480. I'm single parenting, so on the weekends and evenings I might have to call back if 4 yr old Jack is doing something less than enjoyable to 1 yr old Eli. Julie is in Germany for IODP sampling. During the week, the boys are in school, and Julie's Mom arrives in time for next weekend. After the boys go to bed, I also work.

We're getting there - thanks!

best, peck

>Peck (tried to phone) -

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>i please get Henry P to correct the text regarding the Section on
>Ground Surface temperatures. I am not going to mess with this and I
>can not get into which refs we need to include. Generally , I am
>happy to go with what we have for this section but the comments ,
>especially by Beltrami need to be at least considered. Thanks
>We have come to the best that we can re the Figures. The text of
>course now needs to expand , especially re the justification for the
>the new EMIC runs . How about you think on this and get the input
>from Fortunat and Stefan especially re what we need to say and ,
>whether the last panel on second Figure ought to be in another
>Figure with the specific forcings above as in the original second
>Figure? These Figures (and even the few new additions to the
>original model/data comparison) are opening cans of worms re having
>to explain/justify different results. Someone also promised (from
>the Cyrosphere chapter) presumably the CLA to send the appropriate
>text to describe the Oerlemans Figure - but nothing has been sent .
>Can you check this out - or I will just write something naive.
>Remind Fortunat he is editing in relation to his section in my
>section!!!!!!!

>Keith

>

>

>

>Keith

>

>

>

>--

>Professor Keith Briffa,
>Climatic Research Unit
>University of East Anglia
>Norwich, NR4 7TJ, U.K.

>

>Phone: +44-1603-593909

>Fax: +44-1603-507784

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--

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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: t.osborn@uea.ac.uk
Subject: Re: some figures at last!
Date: Fri, 10 Feb 2006 16:43:24 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Hi Tim - it is a wonderful figure, and we are writing about a paper's worth about it - very condensed stuff, but loaded with impact.

Let's see what Keith and Eystein suggest, but I'm happy w/ the fig and ref period you've used. Would rather have you working on more award winning figs than updating this one. Can do that later depending on feedback the SOD gets.

well done, thx, peck

>Glad you like it. Regarding the positive radiative forcing, the volcano series (smoothed and spikey) were expressed as anomalies from the 1500-1899 mean, as were all other data in all panels of this figure. I can provide the entire figure expressed as anomalies from their 1961-1990 mean on Monday, but the volcanic forcing will again have +ve and -ve values because the 1961-1990 mean has some volcanic events during it.

>We could set maxima of each volcanic series to zero. But I like to think of it in this way: positive volcanic forcing *can* occur during periods with *less* volcanic activity than "normal", where "normal" is defined as the mean volcanic activity during the reference period (this is partly why we prefer the longer 1500-1899 reference than the shorter 1961-1990 reference, because a 30-year reference period can't really be representative for a sporadic forcing like volcanoes). So, while I'm personally comfortable with both positive and negative volcanic forcing values, I'm happy to shift them to peak at zero during quiescent periods. >Just let me know... and Keith/Eystein?

>I can't believe how much info there is in this figure now. We could write an entire paper on the construction of this one diagram!

>Cheers

>Tim

>On Fri, February 10, 2006 10:33 pm, Jonathan Overpeck wrote:

>> Hi Tim - nice service, thanks! This will help with the diplomacy, since Susan did want to see these data. Also, maybe we'll get a prize for the most information backed figure in the AR4?

>> I like it, and I don't think it's too distracting. How did you decide to put the baseline where you did? And how do we get positive volcanic radiative forcing? Why not bottom out all the raw and smoothed curves at zero? Suspect you have a good reason, but thought I'd check.

>> I think I know have all the figs I'm supposed to have for transmission to TSU for TS

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>> consideration, and they all look good. Not that
>> they are all finished, but that's ok for this
>> fine day.
>>
>> Thanks again, Peck
>>
>>>Hi again Peck,
>>>
>>>sorry, forgot about the raw volcanic series. Originally I had it as a
>>>separate panel - yes! yet another panel! - but then I tried underlaying
>>> it
>>>on the smoothed series in a pale grey. Please see attached files (pdf
>>> and
>>>gif of the model/forcing figure). What do you think? Is it too
>>>distracting to have these grey spikes? Also note that they are on the
>>>same scale as the rest of the forcings and unfortunately some spikes are
>>>truncated at the bottom of the forcings panel - especially 1259 event.
>>>This particular series I've used is from Ammann and you can see the link
>>>between the spikes and the smoothed green-colour volcanic curve.
>>>
>>>Finally, note that this is just panels A-D. If you like this version,
>>>then you can insert it into the word file I sent before, in place of
>>>panels A-D (use the gif file for this purpose). You'll see that panel E
>>>is a separate piece of figure, and can stay unchanged in the word file.
>>>Hope you follow this bit.
>>>
>>>PS. Keith hasn't seen this version - not sure what his views are on the
>>>distracting of the grey spikes!
>>>
>>>Must go now,
>>>
>>>Tim
>>>
>>>
>>>On Fri, February 10, 2006 7:40 pm, Jonathan Overpeck wrote:
>>>> Hi Tim - see prev email regarding this fig. I do
>>>> like it, and I'll get feedback fast from
>>>> Susan/Martin.
>>>>
>>>> what happened to the more raw volcanic series?
>>>> Susan really wants this, but I'm not sure how to
>>>> best provide. Could we include at the top of the
>>>> forcing fig - underneath the smoothed volc
>>>> forcing curves?
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>>>> If Keith is doing all the text revision, I guess
>>>> the next fig job would be to try to create the
>>>> new hybrid MWP fig - the old FOD concept merged
>>>> with (new panel or just right below?) the curve
>>>> from your just-out Science paper (which is great,
>>>> by the way).
>>>>
>>>> Thanks again for getting these by today - it's a huge help.
>>>>
>>>> best, peck
>>>>
>>>>>Dear Peck and Eystein,
>>>>>
>>>>>proxy location maps are half done! I've
>>>>>attached what I have. Do not use this for real
>>>>>because they are not correct!!!
>>>>>
>>>>>I've done them for 1000, 1500 and 1750. They include:

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>>>>>
>>>>>boreholes (circles) and this is correct for all 3 times.
>>>>>
>>>>>schweingruber tree-ring density/width network as used by briffa and
>>>>> this
>>>>>is correct for all 3 times (triangles)
>>>>>
>>>>>esper tree-ring data is also correct for all 3 times (also triangles)
>>>>>
>>>>>squares are a few selected records from Mann et
>>>>>al. (1998) and although they are in the correct
>>>>>locations, they are a strange subset and they
>>>>>also currently appear in all three panels EVEN
>>>>>THOUGH ACTUALLY SOME OF THESE ARE SHORTER AND
>>>>>SHOULD DROP OUT OF THE EARLIER PANELS. I can
>>>>>fix this soon but not yet.
>>>>>
>>>>>I can add extra locations from Mann et al., Mann
>>>>>and Jones, Crowley etc. It's a little time
>>>>>consuming but not too bad.
>>>>>
>>>>>I can also change symbols and colour etc. pretty easily.
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>>>>>don't tell me to try loads of different ones and
>>>>>show them all to you before deciding - that
>>>>>won't help me! I wasn't sure if you wanted the
>>>>>whole globe or just NH, but thought whole globe
>>>>>looked good. Also did you want pre-1000, e.g.
>>>>> >>AD 500 coverage?
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>>>>>Hope this is ok as a "placeholder"
>>>>>
>>>>>Cheers
>>>>>
>>>>>Tim
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>>>>>Attachment converted: Macintosh HD:proxylocations.pdf (PDF /«IC»)
>>>>> (00112850)
>>>>>Dr Timothy J Osborn
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627. 1139627770.txt

#####

From: "Tim Osborn" <t.osborn@uea.ac.uk>
To: "Jonathan Overpeck" <jto@u.arizona.edu>
Subject: Re: some figures at last!
Date: Fri, 10 Feb 2006 22:16:10 -0000 (GMT)
Reply-to: t.osborn@uea.ac.uk
Cc: "Tim Osborn" <t.osborn@uea.ac.uk>, "Eystein Jansen" <eystein.jansen@geo.uib.no>, k.briffa@uea.ac.uk

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#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: IN CONFIDENCE - opinion sought
Date: Mon, 13 Feb 2006 08:01:03 -0500
Reply-to: mann@psu.edu

<x-flowed>
Hi Keith,

I'm pretty sure they're just asking for a neutral discussion of the science that you've done that is relevant to the issues being reviewed by the committee (after all this is the U.S. National Academy of Sciences, not the U.S. Senate, etc). But I understand where you're coming from nonetheless. Perhaps you could suggest an alternate? Any possibility Tim could do this instead? He's less intimately involved w/ the paleo chapter of IPCC, so I think it might be less of a worry for him? Or Phil? Its your prerogative to suggest alternates, and I think they'll take your suggestions very seriously. My greatest fear is that McIntyre dominates the discussion. Its important that they hear from the legitimate scientists.

Thanks,
mike

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Keith Briffa wrote:

> Mike
> thanks for this but after a lot of soul searching this weekend , I
> have decided to decline the invitation. Pressure of stuff here is
> intense - but the real reason is that I really think it could be
> politic to retreat into "neutral" mode , at least until after the IPCC
> Report is out. I know you can argue this various ways but the sceptics
> are starting to attack on this "non neutral" stance, and the less
> public I am at the moment the better I think. Hope you do not think I
> am a wimp here - just trying to go the way I think best.
> best wishes
> Keith

> At 17:14 09/02/2006, you wrote:

>> Hi Keith,

>> I think you really *should* do this if you possibly can. The panel is
>> entirely legitimate, and the report was requested by Sherwood
>> Boehlert, who as you probably know has been very supportive of us in
>> the whole Barton affair. The assumption is that an honest
>> review of the science will buttress us against any attempt for Barton
>> to continue his attacks (there is some indication that he hasn't
>> given up yet). Especially, with the new Science article by you and
>> Tim I think its really important that one of you attend, if at all
>> possible.

>> I'm scheduled to arrive Thursday March 2nd, and give a presentation
>> friday morning March 2nd. I believe Malcolm is planning on
>> participating, not sure about Ray. I would guess that Tom C and
>> Caspar A have been invited as well, but haven't heard anything.

>> The panel is solid. Gerry North should do a good job in chairing
>> this, and the other members are all solid. Chrisy is the token
>> skeptic, but there are many others to keep him in check:

>> <http://www4.nas.edu/webcr.nsf/8f6526d9731740728525663500684166/2dbbe64b5fe9981b8525710f007025b2?OpenDocument>

>> So I would encourage you to strongly reconsider! Let me know if you'd
>> like to chat over the phone at all about any of this. My cell phone
>> number is 814-876-0485. I teach in about an hour, for about 1.5
>> hours, but then free most of the day...

>> mike

>> Keith Briffa wrote:

>>> Mike
>>> IN STRICT CONFIDENCE I am sending this for your opinion. To be
>>> frank, I am inclined to decline . what do think?
>>> Presumably you and others are already in the frame?
>>> Keith

>>>> X-SBRS: None
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>>>> d="doc'32?scan'32,208,32"; a="8557254:sNHT39904420"
>>>> Subject: Invitation to speak to the NRC Committee on Surface
>>>> Temperature Reconstructions

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>>>> Date: wed, 8 Feb 2006 14:55:58 -0500
>>>> X-MS-Has-Attach: yes
>>>> X-MS-TNEF-Correlator:
>>>> Thread-Topic: Invitation to speak to the NRC Committee on Surface
>>>> Temperature Reconstructions
>>>> Thread-Index:
>>>>
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ADHXgALyVAVAAJatBWAACel8AABGFiWAAGtjsAAXF4z0A==

>>>> From: "Kraucunas, Ian" <IKraucunas@nas.edu>
>>>> To: <k.briffa@uea.ac.uk>
>>>> X-UEA-Spam-Score: 0.0
>>>> X-UEA-Spam-Level: /
>>>> X-UEA-Spam-Flag: NO

>>>> Dear Dr. Briffa,

>>>> The National Research Council of The National Academies of the United
>>>> States is empanelling a committee to study "Surface Temperature
>>>> Reconstructions for the Past 1,000-2,000 Years". The committee
>>>> will be
>>>> asked to summarize the current scientific information on the
>>>> temperature
>>>> record over the past two millennia, describe the proxy records that
>>>> have
>>>> been used to reconstruct pre-instrumental climatic conditions, assess
>>>> the methods employed to combine multiple proxy data over large spatial
>>>> scales, evaluate the overall accuracy and precision of such
>>>> reconstructions, and explain how central the debate over the
>>>> paleoclimate temperature record is to the state of scientific
>>>> knowledge
>>>> on global climate change. I have attached the complete study proposal
>>>> (word document).

>>>> Since this issue has been the subject of considerable controversy, we
>>>> have taken great care to assemble an unbiased panel of scientific
>>>> experts with the appropriate range of expertise to produce an
>>>> authoritative report on the subject. The committee slate will be
>>>> formally announced on Wednesday, but I can tell you that Jerry North
>>>> (Texas A&M) will be chairing the committee, and NAS Members Mike
>>>> Wallace, Karl Turekian, and Bob Dickinson will be on the panel, in
>>>> addition to a half-dozen other scientists with expertise in
>>>> statistics,
>>>> climate variability, and several different types of paleoclimate proxy
>>>> data.

>>>> The committee would like to invite you to come to Washington DC on
>>>> Thursday, March 2nd to speak about your extensive work with this area
>>>> and to discuss your perspective on the issues noted above and in the
>>>> study proposal. The committee will be familiar with the relevant
>>>> peer-reviewed literature, but is also interested in any recently
>>>> submitted or accepted papers. We will be inviting 8-10 other
>>>> experts to
>>>> speak; a complete agenda will be made available prior to the meeting,
>>>> and the meeting will be open to the public. Speakers will be
>>>> reimbursed
>>>> for travel expenses and invited to stay for the entire open session of
>>>> the meeting (which will include a reception on Thursday evening and a
>>>> few speakers on Friday morning).

>>>> Thank you in advance for your time and interest, I hope that you are
>>>> available and willing to meet with our committee. If you are not

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>>>> available on March 2nd, we have a limited number of timeslots
>>>> available
>>>> on March 3rd. We are trying to finalize the meeting schedule by
>>>> Friday
>>>> so please let me know if there is a particularly convenient time
>>>> that I
>>>> could call you this week to discuss details and answer any
>>>> questions you
>>>> might have (or feel free to call me directly).

>>>> Sincerely,

>>>> Ian Kraucunas

>>>> ~~~

>>>> Ian Kraucunas, Ph.D.
>>>> Board on Atmospheric Sciences and Climate
>>>> National Research Council of The National Academies
>>>> 500 Fifth Street NW, Keck 705
>>>> Washington, DC 20001
>>>> Email: ikraucunas@nas.edu
>>>> Phone: (202) 334-2546
>>>> Fax: (202) 334-3825

>>>>

>>>> --

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>>>> --

>>> Michael E. Mann
>>> Associate Professor
>>> Director, Earth System Science Center (ESSC)

>>>> Department of Meteorology Phone: (814) 863-4075
>>>> 503 Walker Building FAX: (814) 865-3663
>>>> The Pennsylvania State University email: mann@psu.edu
>>>> University Park, PA 16802-5013

>>>> <http://www.met.psu.edu/dept/faculty/mann.htm>

>>>>

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The Pennsylvania State University email: mann@psu.edu
University Park, PA 16802-5013

<http://www.met.psu.edu/dept/faculty/mann.htm>

</x-flowed>

629. 1139845689.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: "Wahl, Eugene R" <wahl@alfred.edu>
Subject: Re: FW: Wahl and Ammann ms 3321
Date: Mon, 13 Feb 2006 10:48:09 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

thanks Gene - let us know if you can get it in press. I think that's what he's saying. Best, peck

>Hi Peck and Caspar:

>

>Here is Steve Schneider's response to what "in press" means for Climatic
>Change. It is hopeful.

>

>OK Caspar, here we go! Let's do it.

>

>Peace, Gene

>

>

>*****

>

>-----Original Message-----

>From: Stephen H Schneider [mailto:shs@stanford.edu]

>Sent: Saturday, February 11, 2006 1:56 AM

>To: Wahl, Eugene R

>Cc: katarina kivel

>Subject: RE: Wahl and Ammann ms 3321

>

>your interpretation is fine--get me the revision soon so I have time to
>assess your responses in light of reviews in time! Look forward to
>recieving it, Steve

>

>

>*****

>

>On Sat, 11 Feb 2006, Wahl, Eugene R wrote:

>

>> Hello Steve:

>>

>> Caspar and I expect to have the final manuscript to you in 7-10 days

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>with all the revisions you requested in December. I have recently had
>some correspondence with Jonathan Overpeck about this, in his IPCC role.
>He says that the paper needs to be in press by the end of February to be
>acceptable to be cited in the SOD.

>>

>> He and I have communicated re: what "in press" means for Climatic
>Change, and I agreed to contact you to have a clear definition. What I
>have understood from our conversations before is that if you receive the
>mss and move it from "provisionally accepted" status to "accepted", then
>this can be considered in press, in light of CC being a journal of
>record.

>>

>> However, I recognize that this may not be a correct interpretation.
>If you can clarify, I'd be very grateful. Also, if I do have these
>definitions interpreted correctly--and if Caspar and I meet the target
>set above (paper to you by Feb 17-20)--is there any chance it might be
>fully "accepted" by the end of the month? I realize this is very close,
>for which I accept all responsibility. And of course, I also fully
>recognize that this kind of timeline is very likely out of the realm of
>possibility for you. I mean no pressure in asking, I only want to get
>info to then bring back to Peck.

>>

>> I hope this finds you well, and look forward to your response.

>>

>>

>> Peace, Gene
>> Dr. Eugene R. Wahl
>> Asst. Professor of Environmental Studies
>> Alfred University

>>

>> 607-871-2604
>> 1 Saxon Drive
>> Alfred, NY 14802

>>

>>

>

>-----

>Stephen H. Schneider
>Melvin and Joan Lane Professor for Interdisciplinary
> Environmental Studies;
>Professor, Department of Biological Sciences;
>Co-Director, Center for Environmental Science and Policy at
>the Stanford Institute for International Studies

>

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>

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> (or: climatechange.net)
>cancer book website: patientfromhell.org

--

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mail.2006

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</x-flowed>

630. 1139847614.txt

#####

From: Anders Levermann <Anders.Levermann@pik-potsdam.de>
To: Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: Millennium Simulations
Date: Mon, 13 Feb 2006 11:20:14 +0100
Cc: Jonathan Overpeck <jto@u.arizona.edu>, Stefan Rahmstorf
<rahmstorf@ozean-klima.de>, Anders Levermann <levermann@pik-potsdam.de>, Eva Bauer
<eva.bauer@pik-potsdam.de>, plattner@climate.unibe.ch, Eystein Jansen
<eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>
Dear all,

here is the data from the Climber-3alpha simulations. I know they are too late, but perhaps there is still a way to include them. The structure of the files is the same as Eva's. The file names correspond to the ones you gave in the simulation protocol.

Cheers,
Anders

Fortunat Joos wrote:

> Dear all,
>
> Please find attached an update of the simulation protocol and input data description.
>
> Kasper Plattner pointed out that I forgot the obvious. We need of course a control run to correct for potential model drift. The readme file has been modified accordingly adding a brief description on how the control should be done.
>
> I am looking forward to any additional comments. Hope everything is clear.
>
> Kasper is currently working to perform the simulation with the Bern2.5CC.
>
> Regards, Fortunat
>
> Fortunat Joos wrote:

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>
>> Dear all,
>>
>> I have now compiled the input data set and written a protocol how to
>> perform the runs. It seems to me that it would make sense if we
>> perform the simulations first with the Bern Model and with the
>> Climber 2 model. We can then still decide if we need Climber 3.
>>
>> Please let me know if there are any questions.
>>
>> I could also provide files where the radiative forcing of solar,
>> volcanoes and non-CO2-anthropogenic has been added together.
>>
>> With best wishes,
>>
>> Fortunat
>>
>>
>> Jonathan Overpeck wrote:
>>
>>> Dear Eva and Fortunat - thanks for working on getting things moving.
>>> It seems that the detailed forcing recommendations laid out below by
>>> Fortunat build nicely on what Eva first suggested, and that going
>>> with the forcing series suggested below by Foortunat (and the 6
>>> simulations) is going to be just right for the IPCC AR4 Chap 6
>>> needs. Does everyone agree?
>>>
>>> Thanks Fortunat for preparing/sharing the standard forcing series.
>>>
>>> Best, peck
>>>
>>>> Dear Eva,
>>>>
>>>> We are working on the forcing series and they should be ready by
>>>> the end of the week. Stefan assured us that you can run this
>>>> within a few hours.
>>>>
>>>> What we are preparing are the following series of radiative forcing
>>>> in W/m2:
>>>>
>>>> a) RF from atmospheric constituents (well-mixed GHGs (CO2, CH4,
>>>> N2O, many Halocarbons) tropo and strato Ozone, various
>>>> anthropogenic aerosols) as used in the Bern CC TAR version and the
>>>> TAR (see Joos et al., GBC, 2001; pdf is on my homepage and TAR
>>>> appendix).
>>>> b) volcanic from Crowley, Sci, 2000
>>>> c) solar based on Lean and Bard et al.
>>>>
>>>> For the solar we will prepare 3 combinations:
>>>>
>>>> c1) original serie from Lean (2005) provided to you already
>>>> c2) Bard et al., Be-10 record linearly scaled to match the Maunder
>>>> Minimum Average of Lean-AR4
>>>> c3) Bard et al., Be-10 scaled to a MM reduction of 0.25 permil,
>>>> i.e. the low case in the Bard et, Tellus, publication corresponding
>>>> to the Lean et al, 1995 scaling
>>>>
>>>> For the RF by atmospheric components two cases are foreseen:
>>>> a1) standard case with reconstructed evolution over past 1150 years
>>>> a2) RF kept at 1765 value after 1765, i.e. a simulation with
>>>> natural forcings only.
>>>>

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>>>> This will yield in total 6 simulations 3 over the full length from
>>>> 850 AD to 2000 and 3 brach-off simulatons from 1765 with natural
>>>> only forcing.
>>>>
>>>> An important point in IPCC is that things are published, consistent
>>>> among chapters, and it helps if approaches are tracable to earlier
>>>> accepted and approved IPCC work. The arguments for these series are
>>>> as follows:
>>>>
>>>> a) Considering as many components relevant for RF as possible (more
>>>> than just CO2). The series are fully compatible with TAR and that
>>>> the setup is tracable to the TAR for the industrial era increase.
>>>> The same series will be used in the projection chapter 10 for the
>>>> SRES calculation
>>>>
>>>> b) volcanic: a widely cited record
>>>>
>>>> c) solar: c1) and c3) are published series; c2 follows the same
>>>> approach and spirit as used to derive c3, i.e. scaling the Be-10
>>>> serie linearly with a given Maunder Minimum reduction. The impact
>>>> of the 11-yr solar cycle can be looked at in the original Lean-AR4
>>>> serie.
>>>>
>>>> I hope this help.
>>>>
>>>> with kind regards,
>>>>
>>>> Fortunat
>>>>
>>>> Eva Bauer wrote:
>>>>
>>>>>> Dear Jonathan, dear Fortunat:
>>>>>>
>>>>>> Happy New Year!
>>>>>>
>>>>>> Stefan, Anders and me just have discussed how to set up our
>>>>>> CLIMBER2/3alpha runs, to produce something useful for the IPCC WGI
>>>>>> chapter 6. This chapter appears to touch the impact on the NH
>>>>>> temperature related to low and high solar forcing.
>>>>>>
>>>>>> For a reasonable comparison, we think two 1000-year simulations
>>>>>> differing only by a low and a high solar forcing, conducted with both
>>>>>> CLIMBER models, would be ideal. To do so, we would have to extend the
>>>>>> solar forcing time series based on Lean (GRL, 2000) and on Wang et
>>>>>> al. (2005) distributed in previous e-mails back to the year 1000.
>>>>>> This
>>>>>> would require some splicing as was done, for instance, by Crowley.
>>>>>>
>>>>>> I'm thinking of some scaling applied to a series of Crowley (say the
>>>>>> data called Be10/Lean splice in Science, 2000) such that the
>>>>>> amplitude
>>>>>> of the solar variability from the 11-year cycle is conserved after
>>>>>> ~1720. I have to check but it appears that the variation in the TSI
>>>>>> due to the 11-year cycle contained in the Crowley series agrees
>>>>>> perfectly with the 11yr-cycle data in the file based on Lean (2000).
>>>>>> Before starting such an exercise I like to ask you what you think
>>>>>> about. We would be happy to receive your response quite soon to be
>>>>>> able to finish the calculations with our slow model in time for the
>>>>>> IPCC report.
>>>>>>
>>>>>> Could you please also comment on the other forcings we should

Shirley, JAp, 2005.

>
>It is estimated that the Maunder Minimum irradiance is reduce by 0.08 percent
>relative to today and that the present irradiance is 1366 w/m2 from the wang et al.
>data.

>
>A case with a Maunder Minimum reduction of 0.08 percent is calculated from the Bard
>et al. data by scaling the original Bard series appropriately.

>The original Bard series are offset by 1.3 w/m2 in irradiance to bring them to
>a present irradiance of 1366 w/m2. For this excercise we will utilize a Maunder
>Minimum reduction in irradiance relative to today of 0.08 percent and of 0.25
>percent (other cases with high MM reduction are included in the files).

>
>Irradiance has been converted to radiative forcing: $RF = (IRR - 1366) / 4 * 0.7$

>
>Volcanic forcing is from Crowley science, 2000, with albedo factored in (e.g. as
>for solar forcing). To avoid a cold start of the model, the serie is extended to 850
>AD by mirroring the Crowley data from 1001 to 1150 to the period 850 to 1000.

>
>NonCO2 forcing is following TAR (updated for an error in tropo O3 in the TAR).

>
>CO2 is a spline through the Etheridge, JGR, 97 data and the Siegenthaler, TELLus,
>2005 data.

>
>
>INPUT FILES DESCRIPTION:

>-----

>
>It is recommended to linearly interpolate between data points.

>
>A1: solar irradiance and radiative forcing following Bard from 850 to 2000

>
>(Tag description)
>solBard08 2. col: Maunder Minimum reduction of 0.08 percent
>solBard25 3. col: Maunder Minimu reduction of 0.25 percent

>
>Note: data from Bard have been linearlz interplated on an annual time step

>
> files:
> bard00tel_solar_RF_IPCC_Chap6_Joos_11jan06.out
> bard00tel_solar_irradiance_offset-13_IPCC_Chap6_Joos_11jan06.out

>
>A2: Solar irradiance and radiative forcing following wang, Lean, Shirley, 2005
> from 1610 to 2004

>
> annual resolution

>
>Tag: WLS-05

>
> files:
> wang05jastr_lean_RF_IPCC_chap6_Joos_11jan06.out
> wang05jastr_lean_irradiance_IPCC_chap6_Joos_11jan06.out

>
>A3: CO2 concentration in ppm from 850 to 2000

>
> annual resolution

>
>Tag: CO2
> file: co2_850-2000_splined_IPCC_Chap6_Joos_11jan06.out

>
>A4: volcanic forcing after Crowley from 1001 to 1998 AD, extended by artificial
> data from 850 to 1000 AD by mirroring the forcing from 1000 to 1150 to the

period 850 to 1000

>
>Tag: volcCrow
>
> annual resolution
>
> file: crowley00sci_RFvolcanic_IPCC_Chap6_Joos_11jan05.out
>
>A5: radiative forcing by non-CO2 agents
>
> annual resolution
>
>Tag: nonco2
>
> files
> rf_nonco2_1yr_1765_2000_individ_IPCC_Chap6_Joos_11jan06.out
> rf_nonco2_1yr_850_2000_IPCC_Chap6_Joos_11jan06.out
>
>
>

>B) SIMULATIONS

>-----
>
>B1. 2 Long simulations from 850 AD to 1998
>
>-----
>
>Simulation B1.1. tag: bard08_volcCrow_CO2_nonCO2_850-1998
>
>Solar forcing from Bard et al. with MM reduction of 0.08 percent, volcanic forcing and forcing from CO2 and other anthropogenic (non-CO2) agents.
>
>Start of simulation 850 AD
>End of simulation: 1998 AD
>initial condition: model spinup for year 850 (or similiar)
>
>Analysis period: 1001 AD to 1998 AD
>start-up period: 850 to 1000 with artificial volcanic data
>
>-----
>
>Simulation B1.2 tag: bard25_volcCrow_CO2_nonCO2_850-1998
>
>as B1.1 but with solar forcing from Bard et al. reduced by 0.25 percent for the Maunder Minimum.
>
>Start of simulation 850 AD
>End of simulation: 1998 AD
>initial condition: model spinup for year 850 (or similiar)
>
>Analysis period: 1001 AD to 1998 AD
>start-up period: 850 to 1000 with artificial volcanic data
>
>-----
>
>Simulation B2: A simulation from 1610 to 1998 restarted from bard08_volcCrow_CO2_nonCO2
>
>with solar forcing from wang et al., 2005, volcanic forcing and forcing from CO2 and other anthropogenic (non-CO2) agents.
>
>B2 tag: WLS-2005_volcCrow_CO2_nonCO2_1610-1998
>

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```
>Start of simulation: 1610 AD
>End of simulation: 1998 AD
>initial condition: restart from simulation B1.1. bard08_volcCrow_CO2_nonCO2
> at year 1610
>
>Analysis period: 1610 AD to 1998 AD
>
>
>-----
>
>B3: 3 simulations from 1765 to 1998 with natural forcing only
>
> non-CO2 radiative forcing is kept to zero
> (except for volcanoes and solar)
>
> CO2 is kept at its 1765 value.
>
>Simulation B3.1: tag bard08_volcCrow_1765_1998
>
>Start of simulation: 1765 AD
>End of simulation: 1998 AD
>initial condition: restart from simulation B1.1. bard08_volcCrow_CO2_nonCO2
> at year 1765
>
>Analysis period: 1765 to 1998 AD
>
>-----
>
>Simulation B3.2: tag bard25_volcCrow_1765_1998
>
>Start of simulation: 1765 AD
>End of simulation: 1998 AD
>initial condition: restart from simulation B1.2. bard25_volcCrow_CO2_nonCO2
> at year 1765
>
>Analysis period: 1765 to 1998 AD
>
>-----
>
>Simulation B3.1: tag WLS-2005_volcCrow_1765_1998
>
>Start of simulation: 1765 AD
>End of simulation: 1998 AD
>initial condition: restart from simulation B2. WLS-2005_volcCrow_CO2_nonCO2
> at year 1765
>
>Analysis period: 1765 to 1998 AD
>
>-----
>
>Simulation B4: tag ctrl_850-1998
>
>Control simulation without any forcing
>
>Start of simulation 850 AD
>End of simulation: 1998 AD
>initial condition: model spinup for year 850 (or similiar)
>
>Analysis period: 850 to 1998
>
>
>OUTPUT
>-----
```

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>
>I guess minimal output is global and NH mean surface temperature.
>
>

--

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anders.levermann@pik-potsdam.de www.pik-potsdam.de/~anders

</x-flowed>

Attachment Converted: "c:\eudora\attach\c3a_b1_1.dat"
Attachment Converted: "c:\eudora\attach\c3a_b1_2.dat"
Attachment Converted: "c:\eudora\attach\c3a_b2.dat"
Attachment Converted: "c:\eudora\attach\c3a_b3_1.dat"
Attachment Converted: "c:\eudora\attach\c3a_b3_2.dat"
Attachment Converted: "c:\eudora\attach\c3a_b3_3.dat"

631. 1139850906.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Henry Pollack <hpollack@umich.edu>
Subject: Re: Fwd: [Wg1-ar4-ch06] SOD- template and FOD document
Date: Mon, 13 Feb 2006 12:15:06 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Hi Henry (and Keith) - thanks for the quick effort! Regarding your comments, here's some feedback - it's good Keith beat me too it.

1. For Fig. 6.9b, there is a new version that resulted in lots of discussion at our last meeting. Keith can elaborate when he has time (we're pushing him real hard now for the SOD text), but we agree the caption has to be clear.
2. I'm worried about your discussion of southern hemisphere records, and trust Keith will get it right. Too bad your paper isn't in press too - it would be nice to include.
3. Hope you can help Keith with uncertainty prose. We are over length and hence we can't have more figures (e.g., with confidence intervals shown for all data). Please help him work it into the SOD text.
4. It is unclear if we'll have time for review of the whole chapter, but I'm still hoping Keith

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will send you all of Section 6.6 to look at. That assumes he has it done today or very soon at least. The more people that can look at text the better, but we also have to get the draft done - it can then be reviewed, and we will make sure CAS get to review in a more timely fashion this time.

Thanks again, Peck

>Hi Peck, Eystein and Keith,

>
>Attached in Borehole SOD.doc is a 'rewrite' of the borehole stuff. You
>will recognize the 'rewrite', as it still addresses everything in
>the FOD draft sent to me, with much the same language. It is, however,
>an improvement in
>structure, and has a more balanced discussion. Keith, if you want more
>insight into why I
>have presented the material this way, I'll be happy to elaborate.

>
>The rewrite occupies lines 32-57 of page 6-30 SOD and lines 1-12 of page 6-31.

>
>Also attached is the full SOD template with the 'rewrite' and
>references inserted. It is not clear from your instructions that you
>wanted this to be done, but now you have it if you want it.

>
>Also attached are my replies to the reviewers of the FOD.

>
>I am sending everything today (Sunday), so everyone will get it as
>early as possible.

>
>Some additional comments in areas outside the narrowly defined
>'borehole' section:

>
>In Figure 6.9b, I recommend removing the instrumental record prior to
>1860, because it
>apparently represents only four European stations. The figure is
>captioned to represent
>the entire northern hemisphere.

>
>In section 6.6.2 Southern Hemisphere Temperature Variability page 6-32,
>lines 56-57: The
>two geothermal reconstructions shown, for southern Africa and
>Australia, do NOT indicate
>unusually warm conditions prevailing in the 20th century. Both
>reconstructions miss the
>rapid warming in the last two decades of the 20th century because many
>of the boreholes
>were logged prior to that excursion. The two reconstructions do match
>well the pre-1980
>SAT trends. I discuss this in a paper now in review by J. Quaternary
>Sci., titled "Five
>centuries of climate change in Australia: the view from underground."
>The southern
>hemisphere is NOT discussed in Pollack and Smerdon (2004), which you
>have cited there.

>
>If you will find it helpful, I can scan the entire chapter and provide
>comments, but
>perhaps that could wait until you have passed the immediate deadline in
>front of you.

>
>Cheers,

>Henry

>

>

>

> [_____]
> | \ / |
> | MICHIGAN |
> [_____] \ / [_____]

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University of Michigan
Ann Arbor, Michigan 48109-1005, U.S.A.

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> e-mail: hpollack@umich.edu
> URL: www.geo.lsa.umich.edu/~hpollack/
> URL: www-personal.umich.edu/~hpollack/book.html

>

>Quoting Jonathan Overpeck <jto@u.arizona.edu>:

>

>>Hi Henry - yes, it's true, but that's why we all get things done. Thanks.

>>

>>We have a serious space problem with the chapter, and need to
>>generally reduce it's size. However, if you need a couple more lines
>>to do it well, and to get the proper refs in there (there are
>>undoubtedly new ones?), you may do so. We can always cut later... (so
>>don't add more than just a few lines max).

>>

>>As soon as you're done, pls email to me, Eystein and Keith. The
>>sooner Keith can finish the complete section, the sooner we can all
>>look at it and edit.

>>

>>The NAS/NRC mtg is at a crappy time. I can't travel then since I'm
>>alone w/ the kids, but I've been discussing helping by phone if
>>possible. The problem is that March 3 (the day they really want my
>>input) is the deadline for the SOD. If it's anything like last time
>>(FOD), I won't have time but for a quick trip to the bathroom now and
>>then to recycle coffee. But, I'm glad to hear you're in the loop. I
>>might still be able to help, since we're trying to do this so it
>>isn't a madhouse at the very end.

>>

>>Best, peck

>>

>>>Hi Peck,

>>>

>>>Yes, I will be working weekends -- don't we always??

>>>

>>>Are you attending the NAS/NRC hearing on surface temperature
>>>reconstructions on March 2?

>>>

>>>I will take you up on the invitation to (re)write the 40 lines of the
>>>borehole section.

>>>

>>>Cheers,

>>>Henry

>>>

>>> [_____]
>>> | \ / |
>>> | MICHIGAN |
>>> [_____] \ / [_____]

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>>>

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>>> URL: www.geo.lsa.umich.edu/~hpollack/
>>> URL: www-personal.umich.edu/~hpollack/book.html

>>>

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>>>
>>>Quoting Jonathan Overpeck <jto@u.arizona.edu>:
>>>
>>>>Hi Henry - see the notes below on how to best update your section
>>>>using the attached files (and comments you already have).
>>>>
>>>>Julie is flying to Germany tomorrow, so I'll be single-parenting and
>>>>my email will be at night on the weekend. If you have urgent need for
>>>>input, you can call me:
>>>>
>>>>970-728-0780 (home)
>>>>520-907-6480 (cell - only good if I'm in town - best to use home on
>>>>weekends, and cell weekdays)
>>>>
>>>>Thanks again, peck
>>>>
>>>>>X-Sieve: CMU Sieve 2.2
>>>>>Date: Tue, 17 Jan 2006 08:59:33 +0100
>>>>>To: wg1-ar4-ch06@joss.ucar.edu
>>>>>From: Eystein Jansen <Eystein.Jansen@geo.uib.no>
>>>>>Subject: [wg1-ar4-ch06] SOD- template and FOD document
>>>>>X-BeenThere: wg1-ar4-ch06@joss.ucar.edu
>>>>>List-Id: <wg1-ar4-ch06.joss.ucar.edu>
>>>>>List-Help: <mailto:wg1-ar4-ch06-request@joss.ucar.edu?subject=help>
>>>>>List-Post: <mailto:wg1-ar4-ch06@joss.ucar.edu>
>>>>>List-Subscribe: <http://www.joss.ucar.edu/mailman/listinfo/wg1-ar4-ch06>,
>>>>> <mailto:wg1-ar4-ch06-request@joss.ucar.edu?subject=subscribe>
>>>>>List-Archive: <http://www.joss.ucar.edu/mailman/private/wg1-ar4-ch06>
>>>>>List-Unsubscribe:
>>>>><http://www.joss.ucar.edu/mailman/listinfo/wg1-ar4-ch06>,
>>>>> <mailto:wg1-ar4-ch06-request@joss.ucar.edu?subject=unsubscribe>
>>>>>Sender: wg1-ar4-ch06-bounces@joss.ucar.edu
>>>>>
>>>>>Dear friends,
>>>>>In preparation for your rewriting of the FOD as SOD, we send you
>>>>>the following documents.
>>>>>1. A new template for the FOD which is restructured so that the
>>>>>decisions on structure we made in Christchurch have been taken into
>>>>>account. We also send you the word version of the FOD which is the
>>>>>final version used for the review, in case you do not have this.
>>>>>This is the version for which the comments refer to.
>>>>>In the rewriting we would ask you to rewrite into the SOD template
>>>>>document, thus:
>>>>>1. Find the relevant comment or section to be rewritten in the FOD.
>>>>>2. Then the corresponding section in the SOD document, and rewrite
>>>>>the text there. References should also be inserted into the SOD
>>>>>document.
>>>>>You have to work in parallel with both documents, but we do not see
>>>>>any way around this in order to arrive at a SOD without too many
>>>>>problems of technical sort.
>>>>>
>>>>>Cheers, and best luck.
>>>>>Peck and Eystein
>>>>>--
>>>>>

>>>>>Eystein Jansen
>>>>>Professor/Director
>>>>>Bjerknes Centre for Climate Research and
>>>>>Dep. of Earth Science, Univ. of Bergen
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>>>>>N-5007 Bergen
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>>>>>e-mail: eystein.jansen@geo.uib.no

mail.2006
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>>>>Fax: +47-55-584330
>>>>
>>>>
>>>>
>>>>

>>>>wg1-ar4-ch06 mailing list
>>>>wg1-ar4-ch06@joss.ucar.edu
>>>>http://www.joss.ucar.edu/mailman/listinfo/wg1-ar4-ch06
>>>>
>>>>

>>>>--
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>Attachment converted: Macintosh HD:Boreholes SOD.doc (WDBN/«IC») (001131FA)
>Attachment converted: Macintosh HD:Ch06_SOD_1A 2.doc (WDBN/«IC») (001131FC)
>Attachment converted: Macintosh HD:Pollack_comm.doc (WDBN/«IC») (00113211)

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Page 227

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</x-flowed>

632. 1139923663.txt

#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: update
Date: Tue, 14 Feb 2006 08:27:43 -0500
Reply-to: mann@psu.edu
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Gavin Schmidt <gschmidt@giss.nasa.gov>

<x-flowed>
Hi Tim,

Thanks, I agree. I don't think there is any need for you/Keith to do this. We've pretty much got things under control at RC and it is probably wise to hold your ammunition for any possible comment to Science. In my view the McIntyre criticisms are weak and disingenuous. But what's new w/ that?

mike

Tim Osborn wrote:

> Hi Mike and Gavin,
>
> thanks for the things that are doing at RC, it has developed into an
> excellent resource for this type of situation. I think we'll hold off
> from posting any reply to criticisms for the moment, I somehow don't
> think that we would even then make much headway with the hard-core
> critics. They might even submit some formal criticism to Science and
> we can reserve our response for that if they do.
>
> So, no need to hold up any comments etc., we'll just let things run.
> Sorry if this puts the onus upon you or others at RC, but the comments
> on this particular thread seem to be petering out anyway, so hopefully
> not too much left to deal with.
>
> Best wishes and thanks for your support,
>
> Tim
>
> At 21:51 09/02/2006, Michael E. Mann wrote:
>
>> guys, I see that Science has already gone online w/ the new issue, so
>> we put up the RC post. By now, you've probably read that nasty
>> McIntyre thing. Apparently, he violated the embargo on his website (I
>> don't go there personally, but so I'm informed).
>>

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>> Anyway, I wanted you guys to know that you're free to use RC in any
>> way you think would be helpful. Gavin and I are going to be careful
>> about what comments we screen through, and we'll be very careful to
>> answer any questions that come up to any extent we can. On the other
>> hand, you might want to visit the thread and post replies yourself.
>> We can hold comments up in the queue and contact you about whether or
>> not you think they should be screened through or not, and if so, any
>> comments you'd like us to include.

>>
>> You're also welcome to do a followup guest post, etc. think of RC as
>> a resource that is at your disposal to combat any disinformation put
>> forward by the McIntyres of the world. Just let us know. We'll use
>> our best discretion to make sure the skeptics don't get to use the RC
>> comments as a megaphone...

>> mike

>>

>>

>>

>>

>> --

>> Michael E. Mann
>> Associate Professor
>> Director, Earth System Science Center (ESSC)

>> Department of Meteorology Phone: (814) 863-4075
>> 503 Walker Building FAX: (814) 865-3663
>> The Pennsylvania State University email: mann@psu.edu
>> University Park, PA 16802-5013

>> <http://www.met.psu.edu/dept/faculty/mann.htm>

>>

>

> Dr Timothy J Osborn
> Climatic Research Unit
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> Norwich NR4 7TJ, UK

>

> e-mail: t.osborn@uea.ac.uk
> phone: +44 1603 592089
> fax: +44 1603 507784
> web: <http://www.cru.uea.ac.uk/~timo/>
> sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

>

--

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633. 1139932579.txt

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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: Fwd: some figures at last!
Date: Tue, 14 Feb 2006 10:56:19 -0700
Cc: rahmstorf@ozean-klima.de, Eystein Jansen <eystein.jansen@geo.uib.no>, t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Hi all - I commented on the reference period issue in my previous email, and hope we can resolve it today, or tomorrow at the latest? Tim and Keith should help convince Fortunat that their choice is strong.

Tim - can you make the other changes suggested by Fortunat?

Thanks, peck

>Hi,

>
>I have now found the time to look over the figures. First
>congratulations to this effort. Looks great! A tremendous job - I
>assume many hours of work.

>
>I have, however, a few points

>
>1) The instrumental record - our best piece of information is
>missing in panel e. Please add to the EMIC panel.

>
>2) I am not very enthusiastic to normalize model results with
>respect to 1500-1899. The EMIC panel is to illustrate two points -
>the difference between low and high solar forcing and with/without
>anthropogenic forcing.

>
>I think panel e (EMIC panel) would be more informative in this
>respect if all runs with anthropogenic forcing and the proxies are
>normalized as in panel b) (19061-1990) and the runs without anth.
>forcing start at the same point as the ones with anth. forcing

>
>I have no strong opinion on panel d.

>
>3) Please change Bern2.5c to Bern2.5CC

>
>Thanks for considering this.

>
>Best regards,

>
>Fortunat

>
>Jonathan Overpeck wrote:

>>Hi Stefan and Fortunat: Attached are the draft figs that include
>>proxy obs, simulations, and comparisons of the two. As you can see,
>>Tim just sent them. Big job, but they look great in my eyes.

>>
>>See Tim's email below for more background info.

>>
>>We need fast feedback from you both, specifically:

>>
>>1) any general comments on the figs - this is a crux set of figures
>>and we need your eyes to look at them carefully

>>

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>>2) is it wise to keep the new EMIC run panel attached to the second
>>figure as attached? I vote yes, but what do you think. It fits w/
>>the other panels pretty well.

>>

>>3) either way, we need caption prose from you (perhaps Fortunat
>>start, and Stefan edit, or vice versa if Stefan can start first) on
>>the new EMIC panel.

>>

>>4) also, we need a new para, or prose that can be added to a para,
>>that describes the panel and it's implications as it informs our
>>assessment. Keith will then integrate this into the section. I'm
>>not sure of this, but perhaps you could start with a new question
>>heading, and then have a short para to go under it - something like
>>"What is the significance of the new reduced-amplitude estimates of
>>past solar variability?"

>>

>>Of course, we need your feedback and prose asap. Please send to me,
>>Eystein, Keith and Tim.

>>

>>Thanks in advance for the help. Best, peck

>>

>>>X-Sieve: CMU Sieve 2.2
>>>Date: Fri, 10 Feb 2006 18:00:19 +0000
>>>To: Jonathan Overpeck <jto@u.arizona.edu>,
>>> Eystein Jansen <eystein.jansen@geo.uib.no>
>>>From: Tim Osborn <t.osborn@uea.ac.uk>
>>>Subject: some figures at last!
>>>Cc: Keith Briffa <k.briffa@uea.ac.uk>
>>>X-UEA-Spam-Score: -102.8
>>>X-UEA-Spam-Level: -----
>>>X-UEA-Spam-Flag: NO

>>>

>>>Dear Peck and Eystein,

>>>

>>>the attached word file contains the latest versions of two of our figures.

>>>

>>>First, is the reconstructions with many requests now done: linear
>>>time scale, dotted early instrumental temperatures not solid line,
>>>Oerlemans added, new panel showing shading for the overlapping
>>>regions of temperature reconstructions.

>>>

>>>Second, is the forcings and models. Stendel ECHAM simulation
>>>added (1500-2000). New ECHO-G Erik2 simulation just published in
>>>GRL from Gonzalez-Ruoco et al. added (1000-1990). Reconstruction
>>>"envelope" replaced by new shading of overlaps in the temperature
>>>reconstructions. Correction of some labelling errors. Those runs
>>>that did not include 20th century sulphate aerosol cooling are
>>>dotted or dashed after 1900 (the two low ones also omitted CH4,
>>>N2O, CFCs, O3, hence still cool despite omitting aerosol cooling).
>>>The ECHO-G Erik1 simulation with the very out-of-equilibrium
>>>initial conditions is dashed. Finally, the extra panel with the
>>>new EMIC runs is included as panel (e), again with the new shading
>>>of overlapping temperature reconstructions.

>>>

>>>Keith suggests sending to Stefan and Fortunat too for their views
>>>- can you do that (they may now be gone for the weekend, of
>>>course).

>>>

>>>Best wishes and sorry this is late. Am I right in thinking that
>>>the only other possible-TS figure is the location maps? Still
>>>working on those (had very little time in last 2 days due to media
>>>etc. attention re. Science paper).

>>>

mail.2006

>>>Cheers

>>>

>>>Tim

>>>

>>>

>>>

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>>>Climatic Research Unit

>>>School of Environmental Sciences, University of East Anglia

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>>>

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>>>sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm

>>

>>

>>

>

>--

>

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> Internet: http://www.climate.unibe.ch/~joos/

--

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http://www.ispe.arizona.edu/
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634. 1139942831.txt

#####

From: Phil Jones <p.jones@uea.ac.uk>
To: c.goodess@uea.ac.uk,k.briffa@uea.ac.uk
Subject: Fwd: Invitation to an EU project
Date: Tue, 14 Feb 2006 13:47:11 +0000

Clare, Keith,
Any thoughts on this?
Phil

From: "Andras Vag" <andras.vag@atlasco.hu>
To: <p.jones@uea.ac.uk>

mail.2006

Subject: Invitation to an EU project
Date: Tue, 14 Feb 2006 13:00:25 +0100
Organization: ATLAS
X-Mailer: Microsoft Outlook Express 6.00.2900.2180
X-UEA-Spam-Score: 0.1
X-UEA-Spam-Level: /
X-UEA-Spam-Flag: NO

Dear Prof. Jones

My name is Andras Vag, I am working for a Hungarian organization (ATLAS Innoglobe), which deals with environmental consultancy. We are preparing an EU project proposal for the following call: Scientific Support to Policies, Identifier: [FP6-2005-SSP-5-A] Budget: 77 million Closing Date(s): 22 March 2006 at 17.00 (Brussels local time) Specific programme: [Integrating and Strengthening the European Research Area], Activity area(s): [Policy-orientated research]

[1]http://fp6.cordis.europa.eu.int/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=268

Are you / CRU is interested in the cooperation? The co-work with you would be a great honour for us and definitely would improve the quality of the project. Please see the attached Letter of Invitation to the planned project. I hope you like the idea.

Best wishes

Andras Vag
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Hungary
+36-20-574-9262
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Attachment Converted: "c:\eudora\attach\LetterOfInvitation.pdf"

References

- 1. file:///localhost/tmp/convertmbox13876.html??
- 2. file:///localhost/tmp/convertmbox13876.html??

635. 1140009927.txt

#####

mail.2006

From: Fortunat Joos <joos@climate.unibe.ch>
To: Jonathan Overpeck <jto@u.arizona.edu>
Subject: Re: Fwd: Re: Millennium Simulations
Date: Wed, 15 Feb 2006 08:25:27 +0100
Cc: Tim Osborn <t.osborn@uea.ac.uk>, Stefan Rahmstorf <rahmstorf@ozean-klima.de>, Anders Levermann <levermann@pik-potsdam.de>, Eva Bauer <eva.bauer@pik-potsdam.de>, plattner@climate.unibe.ch, Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, oyvind.paasche@bjerknes.uib.no

<x-flowed>

O.k. EMIC caption noted. Can go with the 1500-1899 ref period.

Stefan, Anders, and Eva can you provide me the appropriate references for your models and the official names.

Regards, Fortunat

Jonathan Overpeck wrote:

> Hi Tim and Fortunat: This looks nice (thanks) and my slight bias is that
> we should include the Climber3a results. What do you think, Fortunat? I
> think Stefan likes it based on his email.

>
> Regarding the reference period, I would side w/ Tim and Keith on using
> 1500-1899. We need to use the same ref period for everything on these
> two figs (obs and forcing/simulations), and I think the EMIC panel still
> convey's the main message. Keith/Tim/Fortunat - we have to resolve this
> FAST, so please weigh in more on this issue. Thanks.

>
> Regarding captions, yes, you should do all but the EMICS, and you should
> make sure you send to Stefan so he can help make sure it makes sense
> (e.g., the red/grey shading). We have asked Fortunat to do the EMIC
> caption. Can you do this Fortunat? Thanks.

>
> Best, Peck

>
>
>
>
>
>> Dear all,

>>
>> please see the attached diagram (both the same, PDF or GIF) with all
>> three EMICs on now. Climber3a seems to lie between Climber2 and
>> Bern2.5CC mostly. Does it add to the message of the figure to use all
>> three? If so, please use this version from now on, for drafting
>> captions etc.

>>
>> Nobody said much about the previous version, so hopefully this
>> indicates general agreement! I didn't show the "Bard08" runs, because
>> they were so close to the runs I have labelled "WLS", but of course in
>> those runs the pre-1610 solar forcing is Bard08 - so maybe the labels
>> should be altered to somehow indicate them, or this could just be
>> stated in the caption.

>>
>> Am I right that Keith and I need to provide an updated caption for
>> panels (a)-(d), but that someone else will write a caption for the
>> EMIC panel (e)?

>>
>> Cheers

>>
>> Tim

>>
>> At 19:20 13/02/2006, Jonathan Overpeck wrote:

mail.2006

>>
>>> Hi Anders and Tim - It could be too late, but this is up to Tim. Can
>>> you get these data onto the new EMIC panel? I think it'd be worth
>>> it, but only if you and Keith can get everything else done first.
>>> Best make sure you have all the data needed, just in case.
>>>
>>> thanks Anders too.
>>>
>>> best, peck
>>>
>>>> X-Sieve: CMU Sieve 2.2
>>>> Date: Mon, 13 Feb 2006 11:20:14 +0100
>>>> From: Anders Levermann <Anders.Levermann@pik-potsdam.de>
>>>> Organization: PIK
>>>> X-Accept-Language: en-us, en
>>>> To: Fortunat Joos <joos@climate.unibe.ch>
>>>> Cc: Jonathan Overpeck <jto@u.arizona.edu>,
>>>> Stefan Rahmstorf <rahmstorf@ozean-klima.de>,
>>>> Anders Levermann <levermann@pik-potsdam.de>,
>>>> Eva Bauer <eva.bauer@pik-potsdam.de>,
>>>> plattner@climate.unibe.ch,
>>>> Eystein Jansen <eystein.jansen@geo.uib.no>,
>>>> Keith Briffa <k.briffa@uea.ac.uk>
>>>> Subject: Re: Millennium Simulations
>>>>
>>>> Dear all,
>>>>
>>>> here is the data from the Climber-3alpha simulations. I know they
>>>> are too late, but
>>>> perhaps there is still a way to include them. The structure of the
>>>> files is the
>>>> same as Eva's. The file names correspond to the ones you gave in the
>>>> simulation
>>>> protocol.
>>>>
>>>> Cheers,
>>>> Anders
>>>>
>>>> Fortunat Joos wrote:
>>>>
>>>>> Dear all,
>>>>>
>>>>> Please find attached an update of the simulation protocol and input
>>>>> data description.
>>>>>
>>>>> Kasper Plattner pointed out that I forgot the obvious. We need of
>>>>> course a control run to correct for potential model drift. The
>>>>> readme file has been modified accordingly adding a brief
>>>>> description on how the control should be done.
>>>>>
>>>>> I am looking forward to any additional comments. Hope everything is
>>>>> clear.
>>>>>
>>>>> Kasper is currently working to perform the simulation with the
>>>>> Bern2.5CC.
>>>>>
>>>>> Regards, Fortunat
>>>>>
>>>>> Fortunat Joos wrote:
>>>>>
>>>>>> Dear all,
>>>>>>
>>>>>> I have now compiled the input data set and written a protocol how

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>>>>> to perform the runs. It seems to me that it would make sense if we
>>>>> perform the simulations first with the Bern Model and with the
>>>>> Climber 2 model. We can then still decide if we need Climber 3.

>>>>>

>>>>> Please let me know if there are any questions.

>>>>>

>>>>> I could also provide files where the radiative forcing of solar,
>>>>> volcanoes and non-CO2-anthropogenic has been added together.

>>>>>

>>>>> With best wishes,

>>>>>

>>>>> Fortunat

>>>>>

>>>>>

>>>>>

>>>>> Jonathan Overpeck wrote:

>>>>>

>>>>>> Dear Eva and Fortunat - thanks for working on getting things
>>>>>> moving. It seems that the detailed forcing recommendations laid
>>>>>> out below by Fortunat build nicely on what Eva first suggested,
>>>>>> and that going with the forcing series suggested below by
>>>>>> Fortunat (and the 6 simulations) is going to be just right for
>>>>>> the IPCC AR4 Chap 6 needs. Does everyone agree?

>>>>>>

>>>>>> Thanks Fortunat for preparing/sharing the standard forcing series.

>>>>>>

>>>>>> Best, peck

>>>>>>

>>>>>>> Dear Eva,

>>>>>>>

>>>>>>> We are working on the forcing series and they should be ready by
>>>>>>> the end of the week. Stefan assured us that you can run this
>>>>>>> within a few hours.

>>>>>>>

>>>>>>> What we are preparing are the following series of radiative
>>>>>>> forcing in W/m²:

>>>>>>>

>>>>>>> a) RF from atmospheric constituents (well-mixed GHGs (CO₂, CH₄,
>>>>>>> N₂O, many Halocarbons) tropo and strato Ozone, various
>>>>>>> anthropogenic aerosols) as used in the Bern CC TAR version and
>>>>>>> the TAR (see Joos et al., GBC, 2001; pdf is on my homepage and
>>>>>>> TAR appendix).

>>>>>>> b) volcanic from Crowley, Sci, 2000

>>>>>>> c) solar based on Lean and Bard et al.

>>>>>>>

>>>>>>> For the solar we will prepare 3 combinations:

>>>>>>>

>>>>>>> c1) original serie from Lean (2005) provided to you already

>>>>>>> c2) Bard et al., Be-10 record linearly scaled to match the
>>>>>>> Maunder Minimum Average of Lean-AR4

>>>>>>> c3) Bard et al., Be-10 scaled to a MM reduction of 0.25 permil,
>>>>>>> i.e. the low case in the Bard et, Tellus, publication

>>>>>>> corresponding to the Lean et al, 1995 scaling

>>>>>>>

>>>>>>> For the RF by atmospheric components two cases are foreseen:

>>>>>>> a1) standard case with reconstructed evolution over past 1150 years

>>>>>>> a2) RF kept at 1765 value after 1765, i.e. a simulation with
>>>>>>> natural forcings only.

>>>>>>>

>>>>>>> This will yield in total 6 simulations 3 over the full length
>>>>>>> from 850 AD to 2000 and 3 brach-off simulatons from 1765 with
>>>>>>> natural only forcing.

>>>>>>>

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>>>>>>> An important point in IPCC is that things are published,
>>>>>>> consistent among chapters, and it helps if approaches are
>>>>>>> tracable to earlier accepted and approved IPCC work. The
>>>>>>> arguments for these series are as follows:
>>>>>>>
>>>>>>> a) Considering as many components relevant for RF as possible
>>>>>>> (more than just CO2). The series are fully compatible with TAR
>>>>>>> and that the setup is tracable to the TAR for the industrial era
>>>>>>> increase. The same series will be used in the projection chapter
>>>>>>> 10 for the SRES calculation
>>>>>>>
>>>>>>> b) volcanic: a widely cited record
>>>>>>>
>>>>>>> c) solar: c1) and c3) are published series; c2 follows the same
>>>>>>> approach and spirit as used to derive c3, i.e. scaling the Be-10
>>>>>>> serie linearly with a given Maunder Minimum reduction. The
>>>>>>> impact of the 11-yr solar cycle can be looked at in the original
>>>>>>> Lean-AR4 serie.
>>>>>>>
>>>>>>> I hope this help.
>>>>>>>
>>>>>>> with kind regards,
>>>>>>>
>>>>>>> Fortunat
>>>>>>>
>>>>>>> Eva Bauer wrote:
>>>>>>>
>>>>>>>
>>>>>>> Dear Jonathan, dear Fortunat:
>>>>>>>
>>>>>>> Happy New Year!
>>>>>>>
>>>>>>>
>>>>>>> Stefan, Anders and me just have discussed how to set up our
>>>>>>> CLIMBER2/3alpha runs, to produce something useful for the IPCC WGI
>>>>>>> chapter 6. This chapter appears to touch the impact on the NH
>>>>>>> temperature related to low and high solar forcing.
>>>>>>>
>>>>>>> For a reasonable comparison, we think two 1000-year simulations
>>>>>>> differing only by a low and a high solar forcing, conducted
>>>>>>> with both
>>>>>>> CLIMBER models, would be ideal. To do so, we would have to
>>>>>>> extend the
>>>>>>> solar forcing time series based on Lean (GRL, 2000) and on wang et
>>>>>>> al. (2005) distributed in previous e-mails back to the year
>>>>>>> 1000. This
>>>>>>> would require some splicing as was done, for instance, by Crowley.
>>>>>>>
>>>>>>> I'm thinking of some scaling applied to a series of Crowley
>>>>>>> (say the
>>>>>>> data called Be10/Lean splice in Science, 2000) such that the
>>>>>>> amplitude
>>>>>>> of the solar variability from the 11-year cycle is conserved after
>>>>>>> ~1720. I have to check but it appears that the variation in the
>>>>>>> TSI
>>>>>>> due to the 11-year cycle contained in the Crowley series agrees
>>>>>>> perfectly with the 11yr-cycle data in the file based on Lean
>>>>>>> (2000).
>>>>>>> Before starting such an exercise I like to ask you what you think
>>>>>>> about. We would be happy to receive your response quite soon to be
>>>>>>> able to finish the calculations with our slow model in time for
>>>>>>> the
>>>>>>> IPCC report.

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>>>>>>>>
>>>>>>>> Could you please also comment on the other forcings we should
>>>>>>>> include,
>>>>>>>> namely the volcanic forcing and the CO2 forcing. For the
>>>>>>>> present study
>>>>>>>> we suggest to use the forcing as in Bauer et al (2000) but
>>>>>>>> omitting
>>>>>>>> the land-use. This means, using the volcanic forcing from Crowley,
>>>>>>>> 2000 and the CO2 forcing based on Etheridge et al 1996 and
>>>>>>>> Keeling and
>>>>>>>> whorf, 1996. (If you wish we can distribute these data series.)
>>>>>>>>
>>>>>>>> Also, thinking beyond the IPCC study, the model results may become
>>>>>>>> interesting enough to be discussed in a 3-model comparison study!?
>>>>>>>>
>>>>>>>> Looking forward to your reply.

>>>>>>>> Best wishes

>>>>>>>> Eva

>>>>>>>>
>>>>>>>> --

>>>>>>>> Climate and Environmental Physics,
>>>>>>>> Physics Institute, University of Bern
>>>>>>>> Sidlerstr. 5, CH-3012 Bern
>>>>>>>> Phone: ++41(0)31 631 44 61 Fax: ++41(0)31 631 87 42
>>>>>>>> Internet: <http://www.climate.unibe.ch/~joos/>

>>>>>>>> -----
>>>>>>>>
>>>>>>>> Last Millennium Simulations for IPCC AR4 WG1 Chap 6
>>>>>>>> -----

>>>>>>>> F. Joos,
>>>>>>>> joos@climate.unibe.ch
>>>>>>>> 18 Januar 2006

>>>>>>>> OVERVIEW
>>>>>>>> -----

>>>>>>>> A total of 7 simulations is planned.
>>>>>>>> A control simulation without any forcing
>>>>>>>>
>>>>>>>> Two millennium-long simulations with solar forcing following Bard
>>>>>>>> et al. with a Maunder Minimum reduction of 0.08 and 0.25 percent in
>>>>>>>> total irradiance and volcanic and anthropogenic forcing included
>>>>>>>> A simulation from 1610 to 1998 with solar forcing from Wang et al,
>>>>>>>> 2005 and volcanic and anthropogenic forcing included
>>>>>>>>
>>>>>>>> Three simulations from 1765 to 1998 with only solar and volcanic
>>>>>>>> forcing included, but no anthropogenic forcings. These are branches
>>>>>>>> from the above three simulation.
>>>>>>>>
>>>>>>>> A range of input data files have been prepared. Each contains a
>>>>>>>> header with additional descriptions of the data.

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>>>> Solar irradiance has been taken from Bard et al., Tellus, 1999 and
>>>> from Wang, Lean, Shirley, JAp, 2005.

>>>> It is estimated that the Maunder Minimum irradiance is reduce by
>>>> 0.08 percent
>>>> relative to today and that the present irradiance is 1366 w/m2 from
>>>> the wang et al. data.

>>>> A case with a Maunder Minimum reduction of 0.08 percent is
>>>> calculated from the Bard et al. data by scaling the original Bard
>>>> series appropriately.
>>>> The original Bard series are offset by 1.3 w/m2 in irradiance to
>>>> bring them to a present irradiance of 1366 w/m2. For this excercise
>>>> we will utilize a Maunder
>>>> Minimum reduction in irradiance relative to today of 0.08 percent
>>>> and of 0.25 percent (other cases with high MM reduction are
>>>> included in the files).

>>>> Irradiance has been converted to radiative forcing: RF=
>>>> (IRR-1366)/4*0.7

>>>> Volcanic forcing is from Crowley Science, 2000, with albedo
>>>> factored in (e.g. as for solar forcing). To avoid a cold start of
>>>> the model, the serie is extended to 850 AD by mirroring the Crowley
>>>> data from 1001 to 1150 to the period 850 to 1000.

>>>> NonCO2 forcing is following TAR (updated for an error in tropo 03
>>>> in the TAR).

>>>> CO2 is a spline through the Etheridge, JGR, 97 data and the
>>>> Siegenthaler, TELLus, 2005 data.

>>>>

>>>>

>>>> INPUT FILES DESCRIPTION:

>>>> -----

>>>>

>>>> It is recommended to linearly interpolate between data points.

>>>>

>>>> A1: Solar irradiance and radiative forcing following Bard from 850
>>>> to 2000

>>>> (Tag description)

>>>> solBard08 2. col: Maunder Minimum reduction of 0.08 percent

>>>> solBard25 3. col: Maunder Minimu reduction of 0.25 percent

>>>>

>>>> Note: data from Bard have been linearlz interplated on an annual
>>>> time step

>>>> files:

>>>> bard00tel_solar_RF_IPCC_Chap6_Joos_11jan06.out

>>>> bard00tel_solar_irradiance_offset-13_IPCC_Chap6_Joos_11jan06.out

>>>>

>>>>

>>>> A2: Solar irradiance and radiative forcing following Wang, Lean,
>>>> Shirley, 2005

>>>> from 1610 to 2004 annual resolution

>>>> Tag: WLS-05

>>>>

>>>> files:

>>>> wang05jastr_lean_RF_IPCC_chap6_Joos_11jan06.out

>>>> wang05jastr_lean_irradiance_IPCC_chap6_Joos_11jan06.out

>>>>

>>>> A3: CO2 concentration in ppm from 850 to 2000

>>>>

>>>> annual resolution

>>>> Tag: CO2

>>>> file: co2_850-2000_splined_IPCC_Chap6_Joos_11jan06.out

>>>>

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```

>>>> A4: volcanic forcing after Crowley from 1001 to 1998 AD, extended
>>>> by artificial
>>>> data from 850 to 1000 AD by mirroring the forcing from 1000 to
>>>> 1150 to the period 850 to 1000
>>>> Tag: volcCrow
>>>>
>>>> annual resolution
>>>> file: crowley00sci_RFvolcanic_IPCC_Chap6_Joos_11jan05.out
>>>>
>>>> A5: radiative forcing by non-CO2 agents
>>>> annual resolution
>>>> Tag: nonco2
>>>>
>>>> files
>>>> rf_nonco2_1yr_1765_2000_individ_IPCC_Chap6_Joos_11jan06.out
>>>> rf_nonco2_1yr_850_2000_IPCC_Chap6_Joos_11jan06.out
>>>>
>>>>
>>>> B) SIMULATIONS
>>>> -----
>>>>
>>>> B1. 2 Long simulations from 850 AD to 1998
>>>>
>>>> -----
>>>> Simulation B1.1. tag: bard08_volcCrow_CO2_nonCO2_850-1998
>>>>
>>>> Solar forcing from Bard et al. with MM reduction of 0.08 percent,
>>>> volcanic forcing and forcing from CO2 and other anthropogenic
>>>> (non-CO2) agents.
>>>>
>>>> Start of simulation 850 AD
>>>> End of simulation: 1998 AD
>>>> initial condition: model spinup for year 850 (or similiar)
>>>>
>>>> Analysis period: 1001 AD to 1998 AD
>>>> start-up period: 850 to 1000 with artificial volcanic data
>>>>
>>>> -----
>>>> Simulation B1.2 tag: bard25_volcCrow_CO2_nonCO2_850-1998
>>>>
>>>> as B1.1 but with solar forcing from Bard et al. reduced by 0.25
>>>> percent for the Maunder Minimum.
>>>>
>>>> Start of simulation 850 AD
>>>> End of simulation: 1998 AD
>>>> initial condition: model spinup for year 850 (or similiar)
>>>>
>>>> Analysis period: 1001 AD to 1998 AD
>>>> start-up period: 850 to 1000 with artificial volcanic data
>>>>
>>>> -----
>>>> Simulation B2: A simulation from 1610 to 1998 restarted from
>>>> bard08_volcCrow_CO2_nonCO2
>>>>
>>>> with solar forcing from wang et al., 2005, volcanic forcing
>>>> and forcing from CO2 and other anthropogenic (non-CO2) agents.
>>>>
>>>> B2 tag: WLS-2005_volcCrow_CO2_nonCO2_1610-1998
>>>>

```

```
>>>>> Start of simulation: 1610 AD
>>>>> End of simulation: 1998 AD
>>>>> initial condition: restart from simulation B1.1.
>>>>> bard08_volcCrow_CO2_nonCO2
>>>>> at year 1610
>>>>>
>>>>> Analysis period: 1610 AD to 1998 AD
>>>>>
>>>>> -----
>>>>> B3: 3 Simulations from 1765 to 1998 with natural forcing only
>>>>>
>>>>> non-CO2 radiative forcing is kept to zero (except
>>>>> for volcanoes and solar)
>>>>>
>>>>> CO2 is kept at its 1765 value.
>>>>>
>>>>> simulation B3.1: tag bard08_volcCrow_1765_1998
>>>>>
>>>>> Start of simulation: 1765 AD
>>>>> End of simulation: 1998 AD
>>>>> initial condition: restart from simulation B1.1.
>>>>> bard08_volcCrow_CO2_nonCO2
>>>>> at year 1765
>>>>>
>>>>> Analysis period: 1765 to 1998 AD
>>>>>
>>>>> -----
>>>>> simulation B3.2: tag bard25_volcCrow_1765_1998
>>>>>
>>>>> Start of simulation: 1765 AD
>>>>> End of simulation: 1998 AD
>>>>> initial condition: restart from simulation B1.2.
>>>>> bard25_volcCrow_CO2_nonCO2
>>>>> at year 1765
>>>>>
>>>>> Analysis period: 1765 to 1998 AD
>>>>>
>>>>> -----
>>>>> simulation B3.1: tag WLS-2005_volcCrow_1765_1998
>>>>>
>>>>> Start of simulation: 1765 AD
>>>>> End of simulation: 1998 AD
>>>>> initial condition: restart from simulation B2.
>>>>> WLS-2005_volcCrow_CO2_nonCO2
>>>>> at year 1765
>>>>>
>>>>> Analysis period: 1765 to 1998 AD
>>>>>
>>>>> -----
>>>>> simulation B4: tag ctrl_850-1998
>>>>>
>>>>> Control simulation without any forcing
>>>>>
>>>>> Start of simulation 850 AD
>>>>> End of simulation: 1998 AD
>>>>> initial condition: model spinup for year 850 (or similiar)
>>>>>
>>>>> Analysis period: 850 to 1998
```


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636. 1140021977.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Bullet debate number 1
Date: wed, 15 Feb 2006 11:46:17 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, t.osborn@uea.ac.uk

<x-flowed>

Hi Keith (and Eystein - we need your opinion) - thanks for the quick response. I think it easier (imagining the mess of email that could result) if we focus on one bullet/email. So I'll start w/ the first, and hope that Eystein can also weigh in.

With regard to the first one below, I agree that we can leave statistics out of it. Good point.

But, I think we must at least address Susan's concern. To do otherwise would be counterproductive. She makes sense. I think your MWP results is quite appropriate - they were published in Science, and in my reading of the paper, you are convincing. If it's in the chapter, it makes sense to draw on it for the exec summary. Please defend more convincingly, or suggest an alternative way to deal with Susan's concern - what is the significance (not statistical) of this one record being warmer? We need to say it.

If you really want to leave as is, please write your response in a way that I can forward to Susan - we can't ignore the comment in this case, because other (me, at least) think it makes sense. So we have to convince her too - this is big stuff for the AR4, and will be in the TS/SPM. We can't be as vague as the current bullet is.

And as for the MWP box fig, I think it should be as you suggest - combine the existing fig w/ the new one from Tim and your paper. I think Tim might already be working on it?

Sorry to be a tough guy, but this bullet needs to be more clear.

Thanks, peck

>Peck

>do not think you will like what I say here , but I am going to give
>straight answers to your questions.

>

>First

>

>The new draft says enough in the text now about "far-less-accurately
>dated" and "low-resolution proxy records that can not be rigorously
>calibrated" in relation to this paper (Moberg et al.) . It is not
>appropriate to single the one series out for specific criticism in
>the summary . The use of the word "only" implies we do not believe
>it. Mike Mann's suggestion begs a lot of questions about what

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>constitutes "significantly warmer". You need to have a Null
>Hypothesis to test . If you mean would the estimates in Moberg and
>the other reconstructions (during medieval time) show significantly
>different means using a t-test - then of course not , but this tells
>us nothing other than they are not likely samples from totally
>different populations - an almost impossible test to pass given the
>wide uncertainties on all reconstructions . Incidentally, we do not
>have formal (calibration) uncertainties for Moberg anyway (just
>boot-strapped uncertainty on the average low-frequency curve).
>
>I think the vagueness is necessary - "suggests slightly" and is appropriate.
>
>I would not call out The results of Tim and my paper either. It is
>just an aside in the Medieval box at present , perhaps with a Figure
>to accompany the original if you agree, but without more text in the
>Chapter , which I do not consider appropriate, it should not be
>highlighted as a bullet.
>

--
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637. 1140039406.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>
Subject: Re: Bullet debate number 2
Date: Wed, 15 Feb 2006 16:36:46 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>

thanks. Agree on the attribution front, but what about being more specific (at
least a
little) about what the "subsequent evidence" is. Is there really anything new
that gives us
more confidence?

Keith? Eystein?

thx, peck

Hi,

I think this version of bullett two is best:

o The TAR pointed to the "exceptional warmth of the late 20th century,"
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relative to the past 1000 years". Subsequent evidence reinforces this conclusion. Indeed, it is very likely that average Northern Hemisphere temperatures during the second half of the 20th century were warmer than any other 50-year period in the last 500 years. It is also likely that this was the warmest period in the past 1300 years . The uneven coverage and characteristics of the proxy data mean that these conclusions are most robust over summer, extra-tropical, land areas.

I agree with Keith we cannot enter into the attribution aspects that Susan alludes to.

Eystein

At 11:57 -0700 15-02-06, Jonathan Overpeck wrote:

Hi again - as for bullet issue number 2, I agree that we don't need to go with the suggest stuff on solar/forcing, BUT, I agree w/ Susan that we should try to put more in the bullet about "subsequent evidence" would you pls send a new bullet that has your suggested changes below, and that includes something like:

"Subsequent evidence, including x, y and z, reinforces this conclusion." Need to convince readers that there really has been an increase in knowledge - more evidence. What is it? The bullet can be longer if needed.

Thanks, Peck

Second
Simply make "1000" "1300 years. " and delete "and unusually warm compared with the last 2000 years."
It is certainly NOT our job to be discussing attribution in the 20th century - this is Chapter 9 - and we had no room (or any published material) to allow a discussion of relative forcing contributions in earlier time. Therefore a vague statement about "perhaps due to solar forcing" seems unjustified.

Third
I suggest this should be
Taken together , the sparse evidence of Southern Hemisphere temperatures prior to the period of instrumental records indicates that overall warming has occurred during the last 350 years, but the even fewer longer regional records indicate earlier periods that are as warm, or warmer than, 20th century means.

Fourth
fine , though perhaps "warmth" instead of "warming"?
and need to see EMIC text

Fifth
suggest delete

Sixth
suggest delete

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Peck, you have to consider that since the TAR , there has been a lot of argument re "hockey stick" and the real independence of the inputs to most subsequent analyses is minimal. True, there have been many different techniques used to aggregate and scale data - but the efficacy of these is still far from established. We should be careful not to push the conclusions beyond what we can securely justify - and this is not much other than a confirmation of the general conclusions of the TAR . We must resist being pushed to present the results such that we will be accused of bias - hence no need to attack Moberg . Just need to show the "most likely"course of temperatures over the last 1300 years - which we do well I think. Strong confirmation of TAR is a good result, given that we discuss uncertainty and base it on more data. Let us not try to over egg the pudding. For what it worth , the above comments are my (honestly long considered) views - and I would not be happy to go further . Of course this discussion now needs to go to the wider Chapter authorship, but do not let Susan (or Mike) push you (us) beyond where we know is right.

--
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638. 1140067691.txt

#####

From: Eystein Jansen <Eystein.Jansen@geo.uib.no>
To: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: bullet debate #3
Date: Thu, 16 Feb 2006 00:28:11 +0100

<x-flowed>

This version is fine with me:

At 12:03 -0700 15-02-06, Jonathan Overpeck wrote:
>Hi again... thanks for the work on number #3. It
>seems a bit awkward/vague, so how about:

>
>Taken together, the sparse evidence of Southern
>Hemisphere temperatures prior to the period of
>instrumental records indicates that overall
>warming has occurred during the last 350 years.
>The even sparser records longer than 350 years
>indicate that there may have been periods of
>regional warmth in the past 1000 years that were
>as warm, or warmer than, 20th century means.
>

Eystein

>Thanks, Peck

>

>>Third

>>

>>I suggest this should be

>>

>>Taken together, the sparse evidence of
>>Southern Hemisphere temperatures prior to the
>>period of instrumental records indicates that
>>overall warming has occurred during the last
>>350 years, but the even fewer longer regional

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>>records indicate earlier periods that are as
>>warm, or warmer than, 20th century means.
>>
>>Fourth
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>>fine , though perhaps "warmth" instead of "warming"?
>>
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>>there has been a lot of argument re "hockey
>>stick" and the real independence of the inputs
>>to most subsequent analyses is minimal. True,
>>there have been many different techniques used
>>to aggregate and scale data - but the efficacy
>>of these is still far from established. We
>>should be careful not to push the conclusions
>>beyond what we can securely justify - and this
>>is not much other than a confirmation of the
>>general conclusions of the TAR . We must resist
>>being pushed to present the results such that
>>we will be accused of bias - hence no need to
>>attack Moberg . Just need to show the "most
>>likely"course of temperatures over the last
>>1300 years - which we do well I think. Strong
>>confirmation of TAR is a good result, given
>>that we discuss uncertainty and base it on more
>>data. Let us not try to over egg the pudding.
>>For what it worth , the above comments are my
>>(honestly long considered) views - and I would
>>not be happy to go further . Of course this
>>discussion now needs to go to the wider Chapter
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639. 1140130198.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>, Jonathan Overpeck
<jto@u.arizona.edu>
Subject: Re: Bullet debate number 1
Date: Thu, 16 Feb 2006 17:49:58 +0000
Cc: t.osborn@uea.ac.uk

<x-flowed>
Dear Peck and Eystein

I have to come back again on this.

FIRST

Happy with first sentence.
Then following largely on a suggestion made by Tim , I suggest

The additional variability implies mainly cooler
temperatures (predominantly in the 12th-14th,
17th and 19th centuries) and only one new
reconstruction suggests slightly warmer
conditions (in the 11th century), but well within
the uncertainty range indicated in the TAR.

Failing this, I suggest we omit everything after the first closing bracket.

SECOND

Now suggest insert the bit about our work (Tim
and I) in the second point - after the sentence ending "1300 years." That is..

The regional extent of Northern Hemisphere warmth
was very likely greater during the 20th century
than in any other century during the last 1300 years.

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will finish corrections to my text tomorrow - but hope Fortunat has checked it all, and is doing a paragraph on the EMICS still?

cheers
Keith

At 23:19 15/02/2006, Eystein Jansen wrote:

>Hi,
>I think we should avoid discussing the Moberg et al results in the exec. bullet. I also think we need to have a statement about the MWP in the bullet, and I cannot really understand why the most central conclusion from the very nice recent Osborn et al. Science paper cannot be highlighted in the first bullet. My suggestion is:
>o Some of the post-TAR studies indicate greater multi-centennial Northern Hemisphere temperature variability than was shown in the TAR, due to the particular proxies used, and the specific statistical methods of processing and/or scaling them to represent past temperatures. The additional variability implies cooler temperatures, predominantly during the 12th to 14th, the 17th, and the 19th centuries. The warmer period in the 11th century is in general agreement with the results shown in the TAR. Consideration of the regional records of temperature for the 11th century indicate that it is unlikely that the spatial extent of warming during this time period was as significant as in the second half of the 20th century.

>
>Cheers,
>Eystein

>
>
>
>

>At 11:46 -0700 15-02-06, Jonathan Overpeck wrote:

>>Hi Keith (and Eystein - we need your opinion) -
>>thanks for the quick response. I think it easier (imagining the mess of email that could result) if we focus on one bullet/email. So
>>I'll start w/ the first, and hope that Eystein can also weigh in.

>>
>>with regard to the first one below, I agree
>>that we can leave statistics out of it. Good point.

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>>But, I think we must at least address Susan's concern. To do otherwise would be counterproductive. She makes sense. I think your MWP results is quite appropriate - they were published in Science, and in my reading of the paper, you are convincing. If it's in the chapter, it makes sense to draw on it for the exec summary. Please defend more convincingly, or suggest an alternative way to deal with Susan's concern - what is the significance (not statistical) of this one record being warmer? We need to say it.

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>>And as for the MWP box fig, I think it should
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>>Sorry to be a tough guy, but this bullet needs to be more clear.
>>
>>Thanks, peck
>>>Peck
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>>>but I am going to give straight answers to your questions.
>>>
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>>>
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>>>rigorously calibrated" in relation to this
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>>>to single the one series out for specific
>>>criticism in the summary . The use of the word
>>>"only" implies we do not believe it. Mike
>>>Mann's suggestion begs a lot of questions
>>>about what constitutes "significantly warmer".
>>>You need to have a Null Hypothesis to test .
>>>If you mean would the estimates in Moberg and
>>>the other reconstructions (during medieval
>>>time) show significantly different means using
>>>a t-test - then of course not , but this tells
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>>>samples from totally different populations -
>>>an almost impossible test to pass given the
>>>wide uncertainties on all reconstructions .
>>>Incidentally, we do not have formal
>>>(calibration) uncertainties for Moberg anyway
>>>(just boot-strapped uncertainty on the average low-frequency curve).
>>>
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>>>"suggests slightly" and is appropriate.
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>>>paper either. It is just an aside in the
>>>Medieval box at present , perhaps with a
>>>Figure to accompany the original if you agree,
>>>but without more text in the Chapter , which I
>>>do not consider appropriate, it should not be highlighted as a bullet.
>>
>>--
>>Jonathan T. Overpeck
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640. 1140189328.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: Robust Findings/ Key Uncertainties Table V3
Date: Fri, 17 Feb 2006 10:15:28 -0700
Cc: joos <joos@climate.unibe.ch>

Hi Keith and Eystein - good additions. Thanks. You can see how I edited them in the attached. The only tough issue was Eystein's proposed key uncertainty on ocean circulation. I think it would be awkward to have multiple abrupt change uncertainties listed (our list is already pretty long in general), so I combined your suggested bullet w/ the existing one (to include drought and other types of abrupt change:

"The mechanisms of abrupt climate change (for example, in ocean circulation and drought frequency) are not well understood, nor are the key climate thresholds that, when crossed, could trigger an acceleration in regional climate change."

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If either of you thinks we can improve further, pls track changes edit the attached.

Thanks again, Peck

--

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641. 1140209561.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>
Subject: Fwd: URGENT review requested
Date: Fri Feb 17 15:52:41 2006
Cc: Fortunat Joos <joos@climate.unibe.ch>, eystein.jansen@geo.uib.no

Date: Thu, 16 Feb 2006 23:01:57 -0700
To: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, joos <joos@climate.unibe.ch>
From: Jonathan Overpeck <jto@u.arizona.edu>
Subject: URGENT review requested
X-UEA-Spam-Score: 0.0
X-UEA-Spam-Level: /
X-UEA-Spam-Flag: NO

Hi Eystein, Keith and Fortunat - this is a special request for help from the Euro team, so I know I have solid feedback by the time I get to work tomorrow am. Please respond asap (using track changes if you can).
1) Tomorrow I have to send the TSU our Robust Findings and Key Uncertainties Table. I have attached this table. Please edit, and if you think a Finding or Uncertainty is missing, please suggest exactly how you think it should be worded, and, if it is a Finding, suggest which existing one it should replace (I suspect they don't want more, but we could try). Please keep in mind this table will be part of the TS (not our chapter), and they must be VERY policy relevant - this is not the place for things a policy maker would not understand. Also, we need to use plainer English than in our Exec Summary bullets.

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2) I also attach the latest Exec Summary, with the latest from Keith and Fortunat (e.g., reordered as you suggested). I will send this in to the TSU tomorrow too, so if you want to read and edit (PLEASE USE TRACK CHANGES), that'll help too, but this is less important than working on the Robust/Key table. Many thanks! Cheers, peck

--
Jonathan T. Overpeck
Director, Institute for the Study of Planet Earth
Professor, Department of Geosciences
Professor, Department of Atmospheric Sciences
Suggestions re Box - see attached

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--
Professor Keith Briffa,
Climatic Research Unit
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Norwich, NR4 7TJ, U.K.

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References

- 1. <http://www.geo.arizona.edu/>
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#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: Re: Figures - urgent
Date: Fri, 17 Feb 2006 17:00:44 +0000

<x-flowed>
Hi Peck and Eystein,

just working on this MWP box fig update. Just trying to clarify what is wanted.

The old MWP box fig had 8 series on it. 7 of these were straight from our recent Science paper anyway, and the 8th was the average of 2 more from the Science paper. The other 5 in the paper (making a total of 7+2+5 = 14 series) were not used in the old MWP box fig, as they are too short to cover the MWP period.

(1) Are you asking me to use exactly the 14 series from the science

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paper, overlaid like in the old MWP fig or, if space permits, plotted like fig 1 in our Science paper. And then add below the exact fig 3B of our paper (you say "3b-like" which implied maybe some changes).

(2) Or do you want to stick with the original 8 series, and then have the exact fig 3B from our paper, which wouldn't correspond exactly to the 8 series above because it would be based on the 14.

(3) Or do you want to stick with the original 8 series, and then show a panel similar to our fig 3B, but *recalculated* using just the 8 series shown?

So many questions! ;-)

I attached the original MWP fig (8 series), plus a new one from option (1) above (14 series, looks a bit of a mess, also I removed the "composite mean" which might have been agreed in New Zealand?).

Cheers

Tim

At 05:28 02/02/2006, Jonathan Overpeck wrote:

>Hi Tim and Keith - I have some feedback on the MWP box fig, but
>would to first ask that you update us (me and Eystein) about the
>status of your other figs. We have a particularly urgent need to see
>those that are likely to be elevated to the TS (Tech Summary) - a
>big deal for paleo. Can you promise us these by the end of this
>week, Monday at the latest? Again, see my emails of Dec for details.

>
>It would be great to see a new MWP box fig asap too, but this isn't
>as high priority as the TS figs. Eystein and I agree with both Susan
>and Martin that it would be good to see a new MWP box fig that was a
>hybrid of the old fig concept and the new Fig 3b from your Science
>paper. It would be good to have two versions - if space allows, we
>go with the first, otherwise the 2nd:

>
>Both would have your 3b-like plot, and both would have all the
>normalized time series that were used to create the 3b plot (i.e.,
>those in Fig. 1 of your paper).

>
>Version 1 - has all the input series stacked on top of each other as
>in your Fig. 1, with the summary Fig 3b-like plot below.

>
>Version 2 - is the same, but the input series are all on the same
>axis like in the FOD MWP box fig.

>
>Now, if you think Version 1 plus caption would be smaller than
>Version 2 plus caption, no need for Version 2. Ditto if Version 1
>plus caption was only a little bigger than V 2 plus caption.

>
>Again, thanks for getting all of your new figs to us asap,
>particularly those targeted for TS consideration.

>
>Many thanks, Peck

>--

>Jonathan T. Overpeck
>Director, Institute for the Study of Planet Earth
>Professor, Department of Geosciences
>Professor, Department of Atmospheric Sciences

>
>Mail and Fedex Address:

>

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Attachment Converted: "c:\eudora\attach\ipccar4_mwpbox_a.pdf"

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Dr Timothy J Osborn
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e-mail: t.osborn@uea.ac.uk
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web: <http://www.cru.uea.ac.uk/~timo/>
sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
</x-flowed>

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#####

From: Fortunat Joos <joos@climate.unibe.ch>
To: Keith Briffa <k.briffa@uea.ac.uk>, Jonathan Overpeck <jto@u.arizona.edu>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: section 6.6 material Solar-CO2-aerosols-EMIC figure
Date: Fri, 17 Feb 2006 21:52:42 +0100
Cc: ""@kup.unibe.ch

Hi,

Robust finding/uncertainty table is fine with me. Good job!

Here the 6.6 material from Bern. It includes an update on solar forcing, an update on the section on compatibility of the GHG-proxz-forcing records, new text for the sulfate aerosol figure, new text for the EMIC figure panel e) and a proposed bullet for the last millennium modeling.

Will send an update of the ice core sulfate figure next week with one additional curve from Antarctica and an updated figure caption. Otherwise, I think this is all you need from me for 6.6. Will also hunt recent references for alpine cores highlighted as missing.

Let me know if I missed something else for the last 2ka section.

- The solar subsection in 6.6.3 requires coordination with chapter 2 - Suggest to send the text to Dorland and Lean as soon as agreed among us. Note that we do not have an exec summary bullet on solar forcing - probably captured by chap 2
- should probably also send the para on sulfate aerosols to chap 2 for checking consistency and cross-referencing
- Have tried to be brief and not to add much, have also suggested to delete paragraphs.

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- note new bullet proposed for exec summary on model results. would be nice if sufficient space, but no strong feeling whether this should be included or not; may be covered to some extent by the attribution chapter.

KEITH:

Can you or Tim please provide the number for the smoothing shown in figure

11e:

'The simulated range in decadal smoothed NH surface temperature is about 60% KEITH/TIM CAN YOU CHECK/PROVIDE THIS NUMBER WITH YOUR FILTERED DATA larger for the high amplitude than for the low amplitude case prior to the industrialization.'

Looking forward to your feedbacks and improvements. We can forward to Oyvind when finalized.

With best regards,

Fortunat

--

Climate and Environmental Physics
Sidlerstr. 5, CH-3012 Bern
Phone: ++41(0)31 631 44 61 Fax: ++41(0)31 631 87 42
Internet: <http://www.climate.unibe.ch/~joos/>

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644. 1140453339.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>
Subject: Re: Science letter
Date: Mon, 20 Feb 2006 11:35:39 +0000
Cc: Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Thanks Eystein. We submitted the data to WDC-Paleo in advance and they went online on the day of publication. We didn't provide an "accession" number however.

Cheers

Tim

At 03:14 20/02/2006, you wrote:

>Tim,
>in case you did not see this yet: <http://www.climateaudit.org/?p=537>
>
>Eystein
>--
>
>-----
>Eystein Jansen
>Professor/Director
>Bjerknes Centre for Climate Research and
>Dep. of Earth Science, Univ. of Bergen
>Allégaten 55

mail.2006

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>NORWAY
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web: <http://www.cru.uea.ac.uk/~timo/>
sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

</x-flowed>

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#####

From: "Rob wilson" <rob.dendro@virgin.net>
To: <Sandy.Tudhope@ed.ac.uk>, "Tim Osborn" <t.osborn@uea.ac.uk>
Subject: Re: Fw: 2005JC003188R Decision Letter
Date: Tue, 21 Feb 2006 15:37:10 -0000
Cc: <K.briffa@uea.ac.uk>, "Brohan, Philip" <philip.brohan@metoffice.com>, <simon.tett@metoffice.com>

Thanks Tim,

am working my way through the comments

Have also re-read Mike Evans 2002 paper.

I am frustrated with the associate editors comments. He seems to be overtly defending Mike's reconstruction which are quite different in nature - i.e. he reconstructed 2 spatial fields - the 1st being ENSO related and the 2nd being probably related to the PDO although it is not clear from the text.

The coral data-sets are also quite different, with only ~ 4 series being common to both studies. In fact, many of the coral series used by Mike did not pass my screening process.

Lastly, the only statistic use by Mike for validation is the correlation coefficient. I like to think I have been a little more robust at least in this regard.

I need to diplomatically word all this. I never wanted to criticise Mike's work in anyway way. It was for that reason that I made little mention to it initially.

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anyway, I hope to get a more cleaner version done by early next week.

will keep you all posted

Rob.

PS. do you have the FORTRAN code for Ed Cook's SSA software?

----- Original Message -----

From: [1]Tim Osborn

To: [2]Rob Wilson ; [3]Sandy.Tudhope@ed.ac.uk

Cc: [4]K.briffa@uea.ac.uk ; [5]Brohan, Philip ; [6]simon.tett@metoffice.com

Sent: Tuesday, February 21, 2006 3:00 PM

Subject: Re: Fw: 2005JC003188R Decision Letter

Hi Rob et al.,
seems like there are many points to address - some reasonable, some rather picky.
Some easy things to do... change "all time scales" to "annual to centennial time scales", minor inconsistencies pointed out.
Near the end the comments get a bit picky/stupid. e.g. "according to CE reconstruction is less skillful than climatology". Doesn't RE assume "climatology" (== calibration period mean) while CE compares the skill against the assumption that the mean over the verification period is known (which of course it isn't known for a general period outside the instrumental period)? And I really don't think your average reader will be confused into thinking that you calibrated using observations before 1840! Though wording could be changed to "the explained variance of the reconstruction using records available before 1840 is quite low" or something similar that fits the flow of the sentence. Also, earlier on, isn't it obvious from the editor's own description of the method that you can indeed estimate verification errors for all "nests", including those available during the instrumental period, and thus it is obvious why verification statistics can cover this entire period in Figure 2C,D. The editor just needs to think about things a bit more!
The description of the calibration method can be written in the way that is requested, I'm sure. The difficulty is actually in countering the criticisms that (1) the reconstruction error obtained by regression may no longer be appropriate after the "inflation" step, (2) the use of calibration period residuals rather than verification period residuals to provide the error bars (though here the editor contradicts this suggestion by pointing out that the verification errors apply to no period other than the verification period, but if you assume the same for the calibration errors then where can you get the errors from?).

Hope these quick comments help,
Cheers

Tim

At 11:41 18/02/2006, Rob Wilson wrote:

>Greetings All,

>have just been away for a week to return to this reply from JGR.

>Have only gone through it quickly, but we obviously have a fussy

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>associate editor to please.
>Should have gone for 'atmospheres' rather than 'oceans'.
>
>will go through it properly on Monday.
>Hope you are around over the next few days or so.
>
>regards
>Rob
>PS. have used this e-mail address as the Uni server seems to be down

>----- Original Message -----

>From: <[7]mailto:jgr-oceans@agu.org>jgr-oceans@agu.org
>To: <[8]mailto:rob.wilson@ed.ac.uk>rob.wilson@ed.ac.uk
>Cc: <[9]mailto:rob.dendro@virgin.net>rob.dendro@virgin.net
>Sent: Thursday, February 16, 2006 8:06 PM
>Subject: 2005JC003188R Decision Letter

>Dear Dr. Wilson:

>Thank you for submitting your manuscript "250-years of reconstructed
>and modeled tropical temperatures" [Paper #2005JC003188R].

>I am in agreement with the associate editor and the reviewers that
>your revisions fail to adequately address the original concerns
>about the reconstruction methodologies. If you want to convey that
>this is somehow far superior to earlier reconstructions of SST, then
>it is only fair that readers of JGR get a very very clear
>description of the methods used and a convincing argument as to why
>the reconstruction is better than prior published reports on such
>reconstructions. Please heed the detailed comments and carefully
>address each of the comments with appropriate revisions and clear
>responses. I will be obliged to reject the manuscript if you do not
>address these concerns since the main claim of an improved
>reconstruction of historic temperatures is not scientifically
>rigorous enough for publication in JGR-Oceans.

>Please submit your revised manuscript by March 28, 2006. If you do
>not plan to submit a revision, or if you cannot do so in the time
>allotted, I would be grateful if you could let me know as soon as
>possible.

>Please review the Important Links to JGR Information attached below
>before uploading your revised manuscript.

>When you are ready to submit your revision, please use the link
>below.

><<[10]http://jgr-oceans-submit.agu.org/cgi-bin/main.plex?el=A7D3BjvY2B7CcrO6I3A9KGXg2FZ

afNJvsZyA2JF0mAZ>http://jgr-oceans-submit.agu.org/cgi-bin/main.plex?el=A7D3BjvY2B7CcrO6I

3A9KGXg2FZafNJvsZyA2JF0mAZ>

>
>
>Sincerely,

>
>Raghu Murtugudde
>Editor, Journal of Geophysical Research - Oceans

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>Adobe Acrobat Reader is available, free, on the internet at the
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>

>
>*****END*****

>
>
>Reviewer Comments

>
>Associate Editor(Comments):

>
>The authors adequately addressed many of the reviewers'
>remarks and requests for revisions.

>
>However, there are significant outstanding issues detailed
>below. The paper needs a thorough revision to become
>acceptable.

>
>1. The paper lacks a clear description of the reconstruction
>technique. From the text, figures, tables, and the authors'
>responses, one can guess that the following approach was
>used, in order to produce the main ("full period")
>reconstruction that the authors use for model comparison and
>interpretation: (1) for each year before 1870 the subset of
>coral records for which this year's value is available
>("nest") is identified; (2) standardized values of the
>"nest" records are averaged together for each year for which
>the entire nest is available; (3) a linear regression of the
>nest values is performed on the instrumental annual tropical
>SST averages for the period 1897-1981 (or its subperiod for
>which the nest values are available); (4) the obtained
>linear regression formula for that nest is tested on the
>period 1870-1896, and the verification statistics is
>derived; (5) the reconstruction of the target year is
>performed using the same linear regression for this nest,
>and the "verification" statistics is attributed to this
>year.

>
>Very small percentage of the readers will be able to
>understand this procedure from the paper in its current
>form. There are a few reasons for that: (a) the paper lacks
>an explicit coherent description of this procedure, (b) the
>additional "inflation" of the reconstruction (p.9, lines
>2-3) is performed, but neither the explicit formula for it
>is given, nor how this inflation affects the reconstruction
>error in verification is discussed, (c) it would seem
>natural to use the verification error for the error bars,
>but it appears that the authors are using the calibration
>error, although no adequate description is given, (d) the
>authors are taking a lot of liberty with using verification
>statistics - unlike error bar estimates these are not
>supposed to be attributed to the periods other than those
>for which they were computed, or at least it is highly
>unusual to do that, (e) what values are given as coral
>reconstructions for the instrumental period is not
>explained: calibration values for corresponding nests? (f)
>why "verification" statistics in Fig 2C,D cover the entire
>calibration period is unclear, (g) the presence of the
>specific calibration formula in the upper right corner of
>Fig 2 is very confusing in the context of this work, but the
>authors failed to take any action despite the hint from
>Reviewer 2 (remark 3.3).

>
>The authors have to provide an unambiguous description of all
>aspects of their reconstruction procedure. But all
>additional information they provide about their
>reconstruction should help the reader to understand the main
>message, rather than to get confused or completely drowned
>under the confusing information flow. Therefore the
>"split-period" calibrations need to be reported only if they
>help to deliver the main message, which is not the case in
>the present version. Same with statistics: a lot of it is
>reported, but what purpose it serves is unclear. All
>statistics more complicated than correlation coefficient
>needs to be explicitly defined, to make the presentation
>unambiguous. In their reply, the authors call Durbin-watson
>statistic "standard". Well it's not for JGR-Oceans, where at
>least since 1994 it's never been used (in the entire body of
>all AGU journals it was only about 15 times). Same with sign
>test: the readers of JGR-Oceans should not be expected to
>have dendroclimatological textbooks by Cook and Kairiukstis
>or by Fritts in their possession in order to look up and
>interpret the authors' results. Some of these statistics
>are only introduced in table captions, and in a puzzling
>way, e.g. Table 2A, lines 3-4: LIN r = correlation of linear
>trend in residual series. What is meant here is probably the
>correlation coefficient of residual with the time variable,
>but in any case, LIN r is not a good notation.

>
>2. The authors resisted the gentle insistence of Reviewer 2
>(remark 5.1) on quantifying the role of trends in the
>model-reconstruction intercomparison. To put it more
>bluntly, the significant correlations reported on p.11 and
>Table 3 are only significant because of the long term
>trends. If the 50- or 100-year trends were subtracted,
>no significant correlation of residuals would be
>left. Trends themselves have such a small number of degrees
>of freedom (6, if separate trends are computed for 50 yr
>periods), that reported correlations are not significant for
>them. Therefore the authors' claim in conclusions of "a

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>strong mutual agreement between the reconstruction and two
>global coupled-climate models" (p.14, lines 21-22) is not
>properly supported by the presented results and most likely
>incorrect. The authors have to change somehow their line of
>argument about model-data consistency to make it correct and
>acceptable for publication.

>
>3. The authors claim to develop "first coral-based, large
>scale temperature reconstruction, exclusive to the tropics,
>that represents past SST variability at all time-scales."
>First, how can it possibly do this at "all" time-scales and
>what scales other reconstructions of similar length exclude?
>Second, why Evans et al 2002 reconstruction doesn't count?
>In general, the authors seem to operate with understanding
>that their reconstruction is superior to that by Evans et al
>2002 (e.g. their reply to remark 3.4 by Reviewer 2). The
>basis for that is unclear, since they use a simpler
>technique, a similar coral data set, and they only try to
>reconstruct the tropical mean, rather than the entire
>field. The actual advantages of their product compared with
>earlier works need to be made clear in the paper.

>
>4. The revision seems to have been made in a great haste, so
>that the changes the authors made often result in
>inconsistencies with the surrounding text.

>
>Abstract, lines 14-16: this sentence is grammatically
>incorrect.

>
>p.4, line 15: raw records are not data transforms

>
>p.4 lines 18-19 and p.5 lines 11-12 are in conflict. Logical
>way to present the material is to say that 16 records passed
>the screening, but then 2 of them were excluded for that and
>this reason.

>
>p.6, line 7: MTA is mentioned here, but it is only in the
>captions to Table 2 that it is explained that MTA is a
>combined mean of MAI and TAR. This is inappropriate use of
>caption, not to mention that (1) TAR is called MaiTar in the
>Table header, (2) the number of records is reduced to 13
>now, to confuse the reader further.

>
>p. 7, line 6: add "here" after "was used" to break the false
>attribution of this sentence to Evans et al 1998 work.

>
>p.8, line 5. ST abbreviation introduced earlier is not used
>here.

>
>p.8 lines 9-11: "calculated" used twice.

>
>p.8 line 20 - p.9 line 5. Ambiguous, confusing description of
>the crucial part of the procedure.

>
>
>p.9, lines 6-18. (1) attribution of the statistics to the
>entire nest record creates very bad effects here: "prior to
>1840, the explained calibration variance is quite low". For
>a reader who hasn't internalize the authors approach, the
>reference to calibration before 1840 will be shocking. (2)
>Strictly speaking, for the entire period before 1850 the
>reconstruction has less skill than climatology, according to
>CE in the Figure 2B. The authors have to deal with a

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JvsZyA2JF0mAZ>http://jgr-oceans-submit.agu.org/cgi-bin/main.plex?el=A7D3BjvY2B7Ccr06
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11. http://www.agu.org/pubs/inf4aus.html>http://www.agu.org/pubs/inf4aus.html
12.

http://www.agu.org/cgi-bin/ms_status/ms_status.cgi>http://www.agu.org/cgi-bin/ms_status/ms_status.cgi

13.

http://www.adobe.com/prodindex/acrobat/readstep.html>http://www.adobe.com/prodindex/acrobat/readstep.html

14. mailto:t.osborn@uea.ac.uk

15. http://www.cru.uea.ac.uk/~timo/

16. http://www.cru.uea.ac.uk/~timo/sunclock.htm

646. 1140567354.txt

#####

From: Stefan Rahmstorf <rahmstorf@ozean-klima.de>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: latest draft of 2000-year section text
Date: Tue, 21 Feb 2006 19:15:54 +0100
Cc: jto@u.arizona.edu, eystein.jansen@geo.uib.no, Fortunat Joos <joos@climate.unibe.ch>, Tim Osborn <t.osborn@uea.ac.uk>, drind@giss.nasa.gov, Henry Pollack <hpollack@umich.edu>

<x-flowed>
Hi Keith,

will try to look at your text asap. Concerning the issue of the drift in the von Storch run: they now have at least one paper plus one submitted comment where they redid their model run without the drift, they call this ECHO-G II, the version with drift is now ECHO-G I. I think this argues for leaving the ECHO-G I curve out of the graphs, and just having one sentence in the text stating this is not shown as it was found to drift, and has been superseded. It is an outlier that messes up the graph, and if it is known and even acknowledged by its authors that it is a model artifact, why show it in IPCC?

Stefan

</x-flowed>

647. 1140568004.txt

#####

From: "Wahl, Eugene R" <wahl@alfred.edu>
To: "Jonathan Overpeck" <jto@u.arizona.edu>
Subject: RE: Wahl and Ammann Climatic Change article on MBH
Date: Tue, 21 Feb 2006 19:26:44 -0500
Cc: "Keith Briffa" <k.briffa@uea.ac.uk>, "Eystein Jansen" <eystein.jansen@geo.uib.no>

OK:

Here is the mss. Yes, fingers crossed. Note, this is not for general dissemination until actually "in press".

The article is quite long, due to all the MM issues we address and the extensive discussions concerning use of validation measures we get into.

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As a first pass, the Abstract, Discussion, and Summary would be good places to start.

Peace, Gene

Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

1 Saxon Drive
Alfred NY, 14802

607.871.2604

-----Original Message-----

From: Jonathan Overpeck [mailto:jto@u.arizona.edu]
Sent: Tuesday, February 21, 2006 3:59 PM
To: Wahl, Eugene R
Cc: Keith Briffa; Eystein Jansen
Subject: Re: Wahl and Ammann Climatic Change article on MBH

Hi Gene - might be better to send the ms now - at least to Keith, since final text is being worked out now. Fingers crossed, thanks, peck

>Hello all:

>
>The re-revised mss. of the wahl-Ammann article on the MBH-MM controversy
>is now to Stephen Schneider of Climatic Change for his approval.
>
>It is possible that we might hear from him within days. If so, and the
>decision is full approval of "in press" status, I will let you all know
>immediately. At that time I also will send the mss. itself.
>
>Peace, Gene
>

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Attachment Converted: "c:\eudora\attach\wahl_Ammann_3321_Final_21Feb.doc"

648. 1140616435.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: "wahl, Eugene R" <wahl@alfred.edu>, "Jonathan Overpeck" <jto@u.arizona.edu>
Subject: RE: Wahl and Ammann Climatic Change article on MBH
Date: Wed Feb 22 08:53:55 2006
Cc: "Eystein Jansen" <eystein.jansen@geo.uib.no>

Thanks for this Eugene. It has been very difficult in drafting the 2000-year section text for us to get the balance between too much concentration on the controversy as you call it and the need to describe subsequent work. Sounds like your paper is an important

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one to
signpost in the text.
best wishes
Keith

At 00:26 22/02/2006, Wahl, Eugene R wrote:

OK:
Here is the mss. Yes, fingers crossed. Note, this is not for general dissemination until actually "in press". The article is quite long, due to all the MM issues we address and the extensive discussions concerning use of validation measures we get into. As a first pass, the Abstract, Discussion, and Summary would be good places to start.

Peace, Gene

Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University
1 Saxon Drive
Alfred NY, 14802
607.871.2604

-----Original Message-----

From: Jonathan Overpeck [[1]mailto:jto@u.arizona.edu]
Sent: Tuesday, February 21, 2006 3:59 PM
To: Wahl, Eugene R
Cc: Keith Briffa; Eystein Jansen

Subject: Re: Wahl and Ammann Climatic Change article on MBH
Hi Gene - might be better to send the ms now - at least to Keith, since final text is being worked out now. Fingers crossed, thanks,
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>
>Peace, Gene

--
Professor Keith Briffa,
Climatic Research Unit
University of East Anglia
Norwich, NR4 7TJ, U.K.

Phone: +44-1603-593909
Fax: +44-1603-507784
[2]http://www.cru.uea.ac.uk/cru/people/briffa/

References

- 1. mailto:jto@u.arizona.edu
- 2. http://www.cru.uea.ac.uk/cru/people/briffa/

649. 1140707670.txt

#####

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From: Keith Briffa <k.briffa@uea.ac.uk>
To: Valerie.Masson@cea.fr, Henry Pollack <hpollack@umich.edu>
Subject: Re: latest draft of 2000-year section text
Date: Thu Feb 23 10:14:30 2006
Cc: jto@u.arizona.edu, Eystein Jansen <Eystein.Jansen@geo.uib.no>

Valerie and Henry
these are really great and useful comments - I am going to try to get these incorporated, in the time allowed, though today again I am busy with exam question scrutiny board meeting and teaching. Thanks a lot for your help
Keith
At 10:02 23/02/2006, you wrote:

Dear Keith,
A few rapid comments on the section 6.6 revised text. I have enjoyed reading it, more concise, less defensive and key conclusions appear more solid. Sometimes the text is written in the past tense, sometimes in the present tense : it could be homogenised.
Please remove the sentence page 6-15 "The paleohydrologic record of North America is the most complete and diverse of any of the world in part due to the proximity to many well equipped labs but also due to the concern of the frequent change in drought, flood...".
This has nothing to do in a scientific assesment (equipment versus motivation). The same motivation should hold true for all tropical areas!
It would be worth to discuss in one paragraph somewhere (possibly together with the text page 6-6 about the proxies) the methods of tree ring standardisation which seem to have changed over time and lead to larger low frequency signals in the tree ring width based reconstructions.
Comments on the structure :
6.6.1 I think that the italic question for the section does not work. I suggest to add sub questions such as :
what do early instrumental records tell us? (p6-2, lines 7 to 39)
what new reconstruction efforts have been conducted since TAR for NH temperatures (6-2 lines 41 to 6-6 25)
what are the main sources of uncertainties in large scale climate reconstructions (6-6 lines 27 to 49) - should refer to the section introduction / description of proxies
what do NH temperature reconstructions tell us (6-6 lines 51 to 6-8 line 5)
Regarding climate forcings and simulations (6.6.3 and 6.6.4) there must be a cross verification with chapter 9, have you looked at their revised text? The title 6.6.3 includes too much refereence to modelling. They have been also statistical efforts to relate forcings and respondes (not only physical models) which have to be mentioned.
Then modelling should be in 6.6.4 only. Another way could be to combine both in one section : 6.6.3 would be model-data comparisons with 1) forcings and 2) simulations

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versus reconstructions. Section 6.6.5 is too long compared to the # of studies conducted here.

Minor comments :

6-3 2 line 20 add "North European records"
line 27 and onwards I think that Boehm reconstruction should be cited around the Alps back to 1780 (it really deserves to be cited).
line 33 Chuine et al puts the French heat wave in a 700 perspective with grape harvest dates, which could be mentioned.
line 36 shorten to "detailed changes in various climate forcings"
line 44 : what are the documentary sources incorporated by Mann? I understand essentially early instrumental records.
6-3 line 49 : this paragraph is a bit vague. Maybe mention more clearly areas where no data are available. Goose et al GRL 2004 used a synthesis of Antarctica data + simulations to discuss the pb of phase with Antarctica and could be mentioned.

I suggest to replace "assimilated" which has a special meaning for meteorologists by "combined"

6-4 line 9 change "are" to "is"
line 16 : how many such long records are available (= what are "very few"?)
6-3 line 39 : is it the rapidity of the 20th c warming or the level of late 20th c temperatures that have to be discussed?

6-5 line 8 use reconstruction, not "series". I understand that one series is one proxy record and a mixture of records with various statistical methods is a reconstruction.
Line 31 : add "many of the individual annually resolved proxy series".
6-6 line 30 change "over a fixed calendar based time window such as J-A or J-D" to "over a specific season"

6-8 line 29 : I propose to change the text about tropical ice cores.
There are few strongly temperature-sensitive proxies from tropical latitudes.

Water stable isotope records from high latitude tropical glaciers where first used as temperature proxies but recent calibration and modelling studies have confirmed that tropical precipitation isotopic composition is mostly sensitive to precipitation changes ("amount effect") at seasonal to decadal time scales both in south America and south Tibet.

References :
Hoffmann G, *Ramirez E*, Taupin JD, et al.
Coherent isotope history of Andean ice cores over the last century

<[1]<http://wos.isiknowledge.com/?SID=w1hPnja@D7cM8l86jFa&Func=Abstract&doc=17/3>>
GEOPHYSICAL RESEARCH LETTERS 30 (4): Art. No. 1179 FEB 25 2003
Vuille M, Werner M, Bradley RS, et al.
Stable isotopes in precipitation in the Asian monsoon region

<[2]<http://wos.isiknowledge.com/?SID=w1hPnja@D7cM8l86jFa&Func=Abstract&doc=19/1>>
JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES 110 (D23): Art. No. D23108 DEC 8 2005

By the way, in the same paragraph, you cite tropical glacier retreat as caused by temperature changes. I suggest to refer to chapter 3 on this topic because many studies have also shown that precipitation / relative humidity / albedo effects can be very

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important for tropical glacier mass balance (see for instance Vincent et al, Comptes Rendus Geosciences 2005).
Page 6-8, ground surface temperatures : are there tropical records available that could be explicitly discussed?
The problem of calibration mentioned line 29 (lack of the last decades of the 20th century) also holds true for many of the long tree ring records... should it be explicitly highlighted here?
6-9 : line 9-10, what is a "much longer warm period", I do not understand. I think that this could be shortened. I still suffer that Antarctica is not mentioned at all. In Goosse et al 2004 I made a stack of 6 records from East Antarctica. There is also one good borehole record from Law Dome (Dahl Jensen Annals of Glacio 1998) showing the same features.
6-10 line 28 : I do not think that it is appropriate to discuss the Solanki paper here.
6-10 and 11 : why mix volcanic and anthropogenic surface aerosols rather than 2 sections? why not discuss changes in surface occupation (land use) in the forcings for the last millenium at least in one sentence?
6-12, lines 38 and onwards : it seems that this is attribution and detection and should be a summary of chapter 9 or just a cross reference to chapter 9.
Section 6.6.5 (6-12 and 13) is too long compared to the studies cited. Maybe Fortunat could help to make this section more punchy. Should the PhD thesis of MacFarling Meure be cited in this assessment?
Remove "the best known aspects of the records"
Refer to chapter XX for biogeochemical cycles
The last paragraph is probably redondant with respect to the carbon cycle climate feedback discussed in that chapter.
Page 6-14 line 43 : redundancy in this paragraph. Does the coldest European winter have to be discussed in such detail? I would skip this (remove line mid 42 to beg of 45 and keep the last sentence of the paragraph which basically says the same thing.
The section on Asian monsoon variability is not focused on the last 2000 years but on millenial variability => mix with 6.4? Why not cite the Tibet ice core records here (ex Dasuopu 180 which should be a local precip record). There are also high res speleothem records with high resolution. Ramesh should help on this paragraph.
I hope that you find this useful, congratulations for the large improvements of this section and taking into account a record number of comments...
Valérie.

--

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[3]http://www.cru.uea.ac.uk/cru/people/briffa/

References

1. <http://wos.isiknowledge.com/?SID=w1hPnja@D7cM8l86jFa&Func=Abstract&doc=17/3>
2. <http://wos.isiknowledge.com/?SID=w1hPnja@D7cM8l86jFa&Func=Abstract&doc=19/1>
3. <http://www.cru.uea.ac.uk/cru/people/briffa/>

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#####

From: "Wahl, Eugene R" <wahl@alfred.edu>
 To: "Caspar Ammann" <ammann@ucar.edu>
 Subject: Wahl and Ammann ms 3321
 Date: Fri, 24 Feb 2006 22:33:22 -0500
 Cc: <kivel@stanford.edu>, "Jonathan Overpeck" <jto@u.arizona.edu>,
 <k.briffa@uea.ac.uk>, <eystein.jansen@geo.uib.no>

Hello all:

Here is a slightly revised update of the Wahl-Ammann final submission to Climatic Change. It is entirely unaltered in substance, design, methods, results, and conclusions.

The alterations are concentrated in Appendix 1 (the entire rest of the text is unaffected except for three words on p. 17)--focused on eliminating a small gap in logic in our description of the performance of the CE statistic (and to streamline the statements about the sign test and the product means test).

Stephen Schneider has these corrections and is still reviewing the manuscript.

Please replace the version sent earlier this week with this one.

Peace, Gene
 Dr. Eugene R. Wahl
 Asst. Professor of Environmental Studies
 Alfred University

607-871-2604
 1 Saxon Drive
 Alfred, NY 14802

Attachment Converted: "c:\eudora\attach\Wahl_Ammann_3321_Final_21Feb-Revision1.doc"

651. 1141068509.txt

#####

From: "Rob Wilson" <rob.wilson@ed.ac.uk>
 To: "Tim Osborn" <t.osborn@uea.ac.uk>
 Subject: Re: Emailing: Wilson et al. technical comment
 Date: Mon, 27 Feb 2006 14:28:29 -0000
 Reply-to: "Rob Wilson" <rob.wilson@ed.ac.uk>
 Cc: "rosanne" <rdd@ldeo.columbia.edu>, <k.briffa@uea.ac.uk>

Hi Tim,

mail.2006

yes, we processed our own RCS chronology using Jan's Jaemtland data.

I also agree that using Jaemtland or not would make little difference to the results.

Rosanne is presenting at this NAS meeting on Thursday which McIntyre is obviously going to use as a forum to muddy the waters even further. He has given us a hard time about the use of Gaspé and the Polar Urals chronologies and their influence on the 'hockey stick' trend over the past 2 centuries. However, removing these series makes little difference to our results in the past few centuries.

am just going through your e-mails w.r.t. the coral paper - it is a huge help
thanks

Rob

----- Original Message -----

From: [1]Tim Osborn

To: [2]Rob Wilson

Cc: [3]rosanne ; [4]k.briffa@uea.ac.uk

Sent: Monday, February 27, 2006 2:23 PM

Subject: Re: Emailing: Wilson et al. technical comment

Thanks for the very clear answers Rob.
We didn't use Jaemtland and you did, that is why McIntyre suggested that we disagreed. But in fact our reason for excluding it was not that it didn't correlate with temperature positively, but that we didn't even calculate a correlation because the RCS chronology series we received stopped in 1827 rather than 1978.
It is true that the full set of core data from Jan Esper span the range 1107-1978, but the RCS chronology we received spanned the range 1316-1827 only - and this matches the replication diagram in Esper et al.

([5]http://www.sciencemag.org/content/vol295/issue5563/images/data/2250/DC1/1066208S2_me

d.gif)
which stops then for Jaemtland.
Presumably you obtained the set of core data and did your own RCS processing etc., rather than using the Esper et al. RCS chronologies? Anyway, I think that clears up our supposed "differences" over Jaemtland, though do let me know if you have any more points to add. Our results would have been very little affected by including Jaemtland anyway!

Cheers

Tim

At 09:58 25/02/2006, Rob Wilson wrote:

>Moring Tim,

>answers in red.

>

>

>on a related matter, Science have forwarded me some
>questions/requests from McIntyre about our paper that they'd like our
>response to. One of them states that "D'Arrigo et al. (2006) have
>reported directly opposite findings in respect to the correlation
>between their RCS chronology and gridcell temperature for Jaemtland
>and the two foxtail series."

>I am not sure where he got that from.

>We used Jaemtland - it is a good site.

>We did not use the foxtail data for similar reasons for us not using
>the Bristlecone pine data (see below) .

>

>We didn't give a correlation for Jaemtland so it is hard for you to
>have obtained the "opposite of nothing"! But anyway, I wanted to ask
>whether in fact your Jaemtland differed from the one we used. The
>one we used should be the same as Esper et al., with data provided by
>Ed Cook. You seem to be citing Naurzbaev and Vaganov (1999) for your
>Jaemtland record which seems odd. And its start and finish years
>differ from the series I got, so I'm guessing that the data are
>different and thus there's no reason why different data would have
>consistent correlations. Also, do you know what correlation and for
>what season (annual-mean?) you got for Jaemtland?

>We also used the Esper data.

>The N+V reference is completely wrong. I checked with Rosanne. Not

>sure how that got in. The N+V reference is actually for Taymir.

>Apologies for that - hopefully there are no more mistakes like that.

>Anyway, to clarify what we did to the data, here is an exert from

>the report I wrote for Rosanne 2 years ago.

>

>"The data from this site were those utilised by Jan Esper for his
>Science paper. After removing a few low correlated series, the final
>data-set consists of 156 radii over the period 1106-1978.
>Unfortunately however, the period 1292-1315 is represented by only
>one radius and replication is only reasonable from the mid 14th century. "

>

>In the end, I used the period represented by 10 or more series - 1340-1978.

>This should agree with the data you have.

>

>As for correlations with temperature, Jaemtland is OK.

>Against the relevant local 5x5 Land CRU (version 1) grid, the STD

>and RCS chrons correlate with the Jun-Sep season at 0.48 over the

>1956-1970 period. No residual problems were found with this

>relationship. All screening was done up to 1970 so that potential

>divergence would not effect the screening process. In this situation

>though, there was no divergence for the 1971-1978 period.

>

>

>On your (D'Arrigo et al.) exclusion of the Boreal/Upperwright series,
>it wasn't clear which (one or more) of the 3 reasons listed applied
>to these: (1) no significant temperature correlation, (2) significant
>precip correlation, (3) too far south.

>I know that the temperature signal is debatable in such records, but

>I seem to recall you saying that on the longer time scales they (and

>I think you were referring to Boreal/Upperwright, but I may have been

>mistaken) showed some agreement with the N. American series from this

>recent paper, giving some support at least for a temperature

>signal. Is my recollection correct?

>As I said earlier, I did not look at the Foxtail data.

>However, I have played with the BP data.

>The sites I utilised are described in this extract.

>

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>"Of the 10 Bristlecone pine chronologies sent to me, 3 chronologies
>were identified to express a significant summer temperature signal
>using correlation analysis against local gridded data. These three
>sites also load upon the same principal component in a PCA using all
>10 chronologies. These three sites are: Hermit Hill (N = 38;
>1048-1983) and Windy Ridge (N = 29; 1050-1985) from Colorado and
>Sheep Mountain (N = 71; 0 - 1990) from California (Figure 1)."
>
>The correlation of the STD and RCS chronologies against local
>gridded July-Sep mean temperatures is 0.38 and 0.34 respectively.
>
>I have also showed you a comparative plot of the RCS chronology with
>my North American average series and the comparison is pretty good
>for most of the record and certainly there does not seem to be any
>obvious inflation of index values in the 20th century.
>
>So - why did we not use this site:
>well
>(1) Steve Macintyre was kicking up a fuss about these data and we
>felt that perhaps it might be opening us to criticism if we used them
>(2) These data are have been reported to also show a precipitation
>signal. I did some analysis on a site basis, but cannot find the
>results. However, the precipitation signal in the 3 chrons used was
>also weak. The temperature signal is stronger. This agrees with the
>BP vs NA chronology comparison.
>(3) As this was a low latitude site, then we would also need to
>include other low latitude sites - e.g. from the Himalayas. Jan
>would not let me use his data for this region, so in the end, we
>decided to keep the data-set as high latitude as possible. Quebec,
>Alps and Mongolia being the most southerly sites.
>
>I hope this answers your queries. Rosanne is presenting at the NAS
>meeting next week, and we have been trying to address many of the
>criticisms of Macintyre that he is posting on his blog. I think Jan
>making his data available was probably bad timing.
>
>Rob
Dr Timothy J Osborn
Climatic Research Unit
School of Environmental Sciences, University of East Anglia
Norwich NR4 7TJ, UK
e-mail: [6]t.osborn@uea.ac.uk
phone: +44 1603 592089
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sunclock: [8]http://www.cru.uea.ac.uk/~timo/sunclock.htm

References

1. <mailto:t.osborn@uea.ac.uk>
2. <mailto:rob.wilson@ed.ac.uk>
3. <mailto:rdd@ldeo.columbia.edu>
4. <mailto:K.briffa@uea.ac.uk>
5. http://www.sciencemag.org/content/vol295/issue5563/images/data/2250/DC1/1066208S2_me d.gif
6. <mailto:t.osborn@uea.ac.uk>
7. <http://www.cru.uea.ac.uk/~timo/>
8. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

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#####

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Øyvind Paasche <oyvind.paasche@bjerknes.uib.no>
Subject: Re: latest (as of time and date)draft of 2000 bit
Date: Mon, 27 Feb 2006 15:34:31 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

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Hi Keith and Øyvind - I agree, this is great, and your priorities are on target. I'll prepare to help on those non-temp subsections after you take a look at the (especially the North Atlantic/NAO one - which is closer to your strength than mine, I suspect).

As for captions, they're in the Figs/Captions worddoc that Øyvind sent on the 24th.

Thanks to Øyvind for doing the references job as suggested by Keith.

Best, peck

>Keith - I'll see what I can do. Nice going with 6.6.

>

>Cheers,

>Øyvind

>

>>Peck and all

>>here is version containing all Fortunat,

>>Valerie and Henry comments that are feasible to

>>do. PLEASE NOTE (at Valerie's suggestion) the

>>renaming of sections - which need to be

>>reproduced on contents page.

>>As for Figure captions , I am lost as I tried

>>to follow Fortunat , but do not think he has it

>>right - and our printer here has died (til

>>tomorrow) so can not see definitive list.

>>Tomorrow , with the full version and look at

>>the Figures I will sort this - do we have a

>>full list of Figure captions as a separate file?

>>I will look at the regional stuff tomorrow Peck

>>- but I suspect it is all weak and I can not

>>really help it much now.Please look also

>>yourself but I think at this stage we need to

>>go with what we have.

>>More important tomorrow , is for me to go

>>through what Gabi sent and check for

>>consistency.

>>

>>As for overall things not done - as I said

>>before , we have not really covered issue of

>>possible CO2 fertilization and "decline " issue

>>in trees , but this can not get done without a

>>early section rewrite , and I have to think

>>about where to say that lots of proxies do not

>>come up to the present - but again - more

>>important now to get all figures correctly

>>called out ,cross references to other Chapters

>>consistently called out, and especially

>>references sorted.

>>

>>How about Oyvind gets everyone now to check

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>>that all refs in their sections are included in
>>list - and mark in our colour , on the list,
>>which are called out in these sections (just by
>>shading them . Then we can check what is not
>>needed and what is still missing.
>>I have to go home now but will work on final
>>consolidated draft when it returns asap
>>tomorrow from Oyvind (with most up to date
>>reference list if you can Oyvind - (thank
>>goodness you are helping)
>>cheers
>>Keith

>>
>>
>>
>>--

>>Professor Keith Briffa,
>>Climatic Research Unit
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>>
>>Phone: +44-1603-593909
>>Fax: +44-1603-507784

>>
>><http://www.cru.uea.ac.uk/cru/people/briffa/>

>>Attachment converted: øyvind:keith2000section.doc (WDBN/«IC») (003B260C)

>
>
>--

>Dr. Øyvind Paasche
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>Department of Earth Science
>University of Bergen
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>Phone direct: +47 55583297
>Cell phone: +47 93048919
>E-mail: oyvind.paasche@bjerknes.uib.no

--
Jonathan T. Overpeck
Director, Institute for the Study of Planet Earth
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<http://www.ispe.arizona.edu/>
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#####

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: latest draft of 2000-year section text
Date: Tue, 28 Feb 2006 11:21:28 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, rahmstorf@ozean-klima.de,
cddhr@giss.nasa.gov, joos <joos@climate.unibe.ch>, Eystein Jansen
<eystein.jansen@geo.uib.no>

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Hi Tim, Keith and Stefan - we certainly can't get into the details of the debate, both for space reasons, and because K & T have gotten us away from the more "defensive" impression our FOD gave reviewers and others. Although I share Stefan's concern that we almost have to hammer the misinformation to death, I think we'll be ok dealing with it succinctly, and focusing on the bigger picture - Mann et al., and all the controversy is history - we know much more now, and it makes for stronger statements. Keith and Tim have done a nice job balancing all this, and we have to hope that all the Mann et al controversy will start sounding as dated as it is. I know I make that point pretty clearly when I talk to the media.

BUT, I leave it to Keith and Tim to tweak the discussion to reflect Stefan's concern as appropriate.

thanks, Peck

>Hi Stefan,

>

>our (Keith and mine) understanding of this issue is that Burger et al. (2006, Tellus, already published and therefore citable) already point out the von Storch et al. (2004) mistake in implementing the Mann et al. (1998) method. But we haven't stated this (or cited the Science in press comment) because Burger et al. also demonstrate that when they implement the method without the detrending step (i.e., following the Mann et al. approach more accurately than von Storch et al. did) then the bias is still there, though of smaller magnitude than von Storch et al. (2004) suggested. Given that we already say that the extent of any bias is uncertain, it does not seem necessary to go into the details any further by discussing the implementation by von Storch et al. of the Mann et al. method.

>

>Finally, I think (though here it is less clear from their paper and I am relying on my recollection of talking to Gerd Burger) that Burger et al. also show that the amount of noise von Storch et al. added to create the pseudo-proxies yields a pseudo-reconstruction that has much better verification skill than obtained by Mann et al. (1998) for their real reconstruction. If they increase the noise added (deteriorating the "skill" of the pseudo-proxies) until they get similar verification statistics as Mann et al. report, then the size of the bias gets bigger. In fact, the bias they obtain with the higher noise but "correct" no-detrending method is actually very similar to the bias von Storch et al. reported with lower noise but incorrect detrending method! So where does that leave us? I don't think there's room to put all this in. Of course the magnitude of the bias cannot be determined from any pseudo-proxy simulation anyway, and will be different for different models.

>

>we'd be interested to know if your (or others on the cc list) interpretation of Burger et al. (2006) is significantly different to this.

>

mail.2006

>Cheers

>

>Tim

>

>At 16:42 28/02/2006, Stefan Rahmstorf wrote:

>>Hi Keith and others,

>>

>>attached is the draft Keith sent on 21 Feb of the 2000-year
>>section, with comments and edits (grey) from me.

>>

>>I note that von Storch et al. 2004 is cited without it being
>>mentioned that they did not implement the Mann et al. method
>>correctly - by detrending before calibration, the performance of
>>the method was greatly degraded in their model. I guess you left
>>this out because the comment to Science showing this is still in
>>press? Will it be added once this has been published? I think it is
>>a major point, as it was such a high-profile paper - von Storch's
>>contention that the "hockey stick" is "nonsense" (cited in the US
>>Senate) is based on a mistake.

>>

>>Cheers, Stefan

>>

>>--

>>To reach me directly please use: rahmstorf@ozean-klima.de

>>(My former addresses @pik-potsdam.de are read by my assistant Brigitta.)

>>

>>Stefan Rahmstorf

>>www.ozean-klima.de

>>www.realclimate.org

>>

>>

>

>Dr Timothy J Osborn

>Climatic Research Unit

>School of Environmental Sciences, University of East Anglia

>Norwich NR4 7TJ, UK

>

>e-mail: t.osborn@uea.ac.uk

>phone: +44 1603 592089

>fax: +44 1603 507784

>web: <http://www.cru.uea.ac.uk/~timo/>

>sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

--

Jonathan T. Overpeck

Director, Institute for the Study of Planet Earth

Professor, Department of Geosciences

Professor, Department of Atmospheric Sciences

Mail and Fedex Address:

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Tucson, AZ 85721

direct tel: +1 520 622-9065

fax: +1 520 792-8795

<http://www.geo.arizona.edu/>

<http://www.ispe.arizona.edu/>

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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: "Wahl, Eugene R" <wahl@alfred.edu>
Subject: Fwd: RE: Wahl Ritson Ammann Science article on vonStorch 04
Date: Tue, 28 Feb 2006 11:50:28 -0700
Cc: "Keith Briffa" <k.briffa@uea.ac.uk>, "Eystein Jansen"
<eystein.jansen@geo.uib.no>, "Caspar Ammann" <ammann@ucar.edu>,
rahmstorf@ozean-klima.de, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Eugene - quite timely. Keith and Tim are doing the final revision tomorrow, and we've actually been debating if the vonStorch issue was handled just right.

thx, peck

>X-Sieve: CMU Sieve 2.2
>Subject: RE: Wahl Ritson Ammann Science article on vonStorch 04
>Date: Tue, 28 Feb 2006 13:38:06 -0500
>Thread-Topic: Wahl Ritson Ammann Science article on vonStorch 04
>Thread-Index: ACY3ZrwjPf6A8R9VTWeSE3GvqmgKLAFLDCogAACcoIA=
>From: "Wahl, Eugene R" <wahl@alfred.edu>
>To: "Jonathan Overpeck" <jto@u.arizona.edu>
>Cc: "Keith Briffa" <k.briffa@uea.ac.uk>,
> "Eystein Jansen" <eystein.jansen@geo.uib.no>,
> "Caspar Ammann" <ammann@ucar.edu>
>
>Sorry, I sent the message without the text. [The "send" button is next
>to the "insert" button on my software!!] Here it is.

>-----Original Message-----

>From: Wahl, Eugene R
>Sent: Tuesday, February 28, 2006 1:32 PM
>To: 'Jonathan Overpeck'
>Cc: Keith Briffa; Eystein Jansen; 'Caspar Ammann'
>Subject: RE: Wahl Ritson Ammann Science article on vonStorch 04

>Hello Jonathan, Keith, and Eystein:

>I don't yet have any word from Steve Schneider concerning the
>Wahl-Ammann article on the MBH/MM issues...

>...HOWEVER, here is something that slipped under my radar screen, about
>which I should have made you aware previously. I've attached the
>ACCEPTED version of the Wahl-Ritson-Ammann comment article on the
>vonStorch et al. 2004 Science paper. This the article that criticizes
>MBH for very large low-frequency amplitude losses. The final acceptance
>from Science just came TODAY, and is copied below.

>In this comment article (specifically requested to be expanded to 1000
>words by the Science editors), we note that the calibration and
>verification performance of the MBH method as implemented in VS04 show
>really poor LF fidelity--which cannot happen if the MBH method is
>implemented according to its original form. We note this, which is
>explained by a significant omission on the part of VS04 in implementing
>the MBH methodology (a detrending step that was only disclosed later
>last year in a conference proceedings paper). We also comment on
>physical and statistical reasons why detrending is not appropriate in
>this context. We conclude that the large amplitude losses VS04 claims
>are simply not correct.

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>
>I am imagining that this contextualization of the VS04 critique would
>also be relevant for your chapter, and it can now be considered "in
>press" as the from our Science correspondent notes below. I would think
>this acceptance makes it "citable". If not, I understand.
>
>
>NOTE THAT THIS ARTICLE IS SUBJECT TO THE USUAL SCIENCE EMBARGO RULES. I
>DO NOT BELIEVE THAT THIS MEANS CITATION IS EMBARGOED. (Cf. 5th
>paragraph in copied message below, which supports citation.)
>
>
>Peace, Gene
>
>*****
>
>Dr. Eugene R. Wahl
>Asst. Professor of Environmental Studies
>Alfred University
>
>607.871.2604
>
>
>***** copied message below *****
>
>
>February 28, 2006 received 10:31 am EST
>
>Dear Dr. Wahl,
>
>Below is the formal acceptance of your manuscript. The paper is
>technically not "in press" yet, though I assume that either "accepted"
>or "in press" would be acceptable.
>
>
>Dear Dr. Wahl,
>
>We are pleased to accept your revised Technical Comment on the paper by
>von Storch et al. for publication.
>
>The text of your comment will be edited to conform to *Science* style
>guidelines. Before publication you will receive galley proofs for
>author corrections. Please return the marked and corrected proofs, by
>fax or overnight express, within 48 hours of receipt.
>
>For authors with NIH grants intending to deposit the accepted version of
>their paper on PubMed Central, the following text must be displayed as a
>footnote with an asterisk to the manuscript title:
>
>"This manuscript has been accepted for publication in Science. This
>version has not undergone final editing. Please refer to the complete
>version of record at <http://www.sciencemag.org/>. This manuscript may
>not be reproduced or used in any manner that does not fall within the
>fair use provisions of the Copyright Act without the prior, written
>permission of AAAS."
>
>As noted in our License for Publication, the manuscript cannot be posted
>sooner than 6 months after final publication of the paper in Science.
>
>As you know, the full text of technical comments and responses appears
>on our website, Science Online, with abstracts published in the Letters
>section of the print *Science*.
>

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>Thanks for your patience during this long process, and thanks for
>publishing in *Science*.

>
>Sincerely,

>
>Tara S. Marathe
>Associate Online Editor, Science
>tmarathe@aaas.org

>
>***** end copied message *****

>
>Content-Type: application/msword;
> name="1120866RevisedText.doc"
>Content-Description: 1120866RevisedText.doc
>Content-Disposition: attachment;
> filename="1120866RevisedText.doc"

>
>Content-Type: image/jpeg;
> name="1120866Fig.jpg"
>Content-Description: 1120866Fig.jpg
>Content-Disposition: attachment;
> filename="1120866Fig.jpg"

--
Jonathan T. Overpeck
Director, Institute for the Study of Planet Earth
Professor, Department of Geosciences
Professor, Department of Atmospheric Sciences

Mail and Fedex Address:

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direct tel: +1 520 622-9065
fax: +1 520 792-8795
<http://www.geo.arizona.edu/>
<http://www.ispe.arizona.edu/>
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Attachment Converted: "c:\eudora\attach\1120866Fig1.jpg"

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#####

From: "Wahl, Eugene R" <wahl@alfred.edu>
To: "Jonathan Overpeck" <jto@u.arizona.edu>
Subject: RE: Wahl Ritson Ammann Science article on vonStorch 04
Date: Tue, 28 Feb 2006 13:32:19 -0500
Cc: "Keith Briffa" <k.briffa@uea.ac.uk>, "Eystein Jansen"
<eystein.jansen@geo.uib.no>, "Caspar Ammann" <ammann@ucar.edu>

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I don't yet have any word from Steve Schneider concerning the

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Wahl-Ammann article on the MBH/MM issues...

...HOWEVER, here is something that slipped under my radar screen, about which I should have made you aware previously. I've attached the ACCEPTED version of the Wahl-Ritson-Ammann comment article on the vonStorch et al. 2004 Science paper. This the article that criticizes MBH for very large low-frequency amplitude losses. The final acceptance from Science just came today, and is copied below.

In this comment article (specifically requested to be expanded to 1000 words by the Science editors), we note that the calibration and verification performance of the MBH method as implemented in VS04 show really poor LF fidelity--which cannot happen if the MBH method is implemented according to its original form. We note this, which is explained by a significant omission on the part of VS04 in implementing the MBH methodology (a detrending step that was only disclosed later last year in a conference proceedings paper). We also comment on physical and statistical reasons why detrending is not appropriate in this context. We conclude that the large amplitude losses VS04 claims are simply not correct.

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Peace, Gene

Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

607.871.2604

***** copied message below *****

Dear Dr. Wahl,

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The text of your comment will be edited to conform to *Science* style guidelines. Before publication you will receive galley proofs for author corrections. Please return the marked and corrected proofs, by fax or overnight express, within 48 hours of receipt.

For authors with NIH grants intending to deposit the accepted version of

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their paper on PubMed Central, the following text must be displayed as a footnote with an asterisk to the manuscript title:

"This manuscript has been accepted for publication in Science. This version has not undergone final editing. Please refer to the complete version of record at <http://www.sciencemag.org/>. This manuscript may not be reproduced or used in any manner that does not fall within the fair use provisions of the Copyright Act without the prior, written permission of AAAS."

As noted in our License for Publication, the manuscript cannot be posted sooner than 6 months after final publication of the paper in Science.

As you know, the full text of technical comments and responses appears on our website, Science Online, with abstracts published in the Letters section of the print *Science*.

Thanks for your patience during this long process, and thanks for publishing in *Science*.

Sincerely,

Tara S. Marathe
Associate Online Editor, Science
tmarathe@aaas.org

***** end copied message *****

656. 1141164645.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Stefan Rahmstorf <rahmstorf@ozean-klima.de>, Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: latest draft of 2000-year section text
Date: Tue, 28 Feb 2006 17:10:45 +0000
Cc: jto@u.arizona.edu, eystein.jansen@geo.uib.no, Fortunat Joos <joos@climate.unibe.ch>, drind@giss.nasa.gov

<x-flowed>
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Cheers

Tim

At 16:42 28/02/2006, Stefan Rahmstorf wrote:

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>--
>To reach me directly please use: rahmstorf@ozean-klima.de
>(My former addresses @pik-potsdam.de are read by my assistant Brigitta.)
>
>Stefan Rahmstorf
>www.ozean-klima.de
>www.realclimate.org
>
>
>

Dr Timothy J Osborn
Climatic Research Unit
School of Environmental Sciences, University of East Anglia
Norwich NR4 7TJ, UK

e-mail: t.osborn@uea.ac.uk
phone: +44 1603 592089
fax: +44 1603 507784
web: http://www.cru.uea.ac.uk/~timo/
sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm

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#####

mail.2006

From: Stefan Rahmstorf <rahmstorf@ozean-klima.de>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: latest draft of 2000-year section text
Date: Tue, 28 Feb 2006 18:32:25 +0100
Cc: Keith Briffa <k.briffa@uea.ac.uk>, jto@u.arizona.edu, eystein.jansen@geo.uib.no, Fortunat Joos <joos@climate.unibe.ch>, drind@giss.nasa.gov

Hi Tim,
my simplistic interpretation as an outside observer of this field is:
VS04 published a high-profile analysis in science concluding that the performance of the MBH method is disastrously bad. Subsequently, VS in the media called the MBH result "nonsense", accused Nature of putting their sales interests above peer review when publishing MBH, and called the IPCC "stupid" and "irresponsible" for highlighting the results of MBH. This had *major* political impact - I know this e.g. from EU negotiators who were confronted with this stuff by their US colleagues.
Then it turns out that they implemented the method incorrectly. If it is done as MBH did, variance is still somewhat underestimated in the same pseudoproxy test, but only a little, within the error bars given by MBH and shown by IPCC. Certainly nothing dramatic - one could conclude that the method works reasonably well but needs improvement. This would have been a technical discussion with not much political impact.
What VS and their colleagues are doing now, rather than publishing a correction of their mistake, is saying: "well, but if we add a lot more noise, or use red noise, then the MBH method is still quite bad..."
The question here is: should our IPCC chapter say something to correct the wrong impression which had the political impact, namely that the MBH method is disastrously bad? This is not the same as the legitimate discussion about the real errors in proxy reconstructions, which accepts that these reconstructions have some errors but are still quite useful, rather than being "nonsense".
Cheers, Stefan

--
To reach me directly please use: [1]rahmstorf@ozean-klima.de
(My former addresses @pik-potsdam.de are read by my assistant Brigitta.)

Stefan Rahmstorf
[2]www.ozean-klima.de
[3]www.realclimate.org

References

- 1. mailto:rahmstorf@ozean-klima.de
- 2. http://www.ozean-klima.de/
- 3. http://www.realclimate.org/

658. 1141180962.txt

#####

mail.2006

From: "Wahl, Eugene R" <wahl@alfred.edu>
To: "Jonathan Overpeck" <jto@u.arizona.edu>
Subject: RE: Wahl Ammann Climatic Change article on MBH/MM
Date: Tue, 28 Feb 2006 21:42:42 -0500
Cc: "Keith Briffa" <k.briffa@uea.ac.uk>, "Eystein Jansen"
<eystein.jansen@geo.uib.no>, "Caspar Ammann" <ammann@ucar.edu>

Hello all:

Good news this day. The Wahl-Ammann paper also has been given fully accepted status today by Stephen Schneider. I copy his affirmation of this below, and after that his remark from earlier this month regarding this status being equivalent to "in press". I hope this meets the deadline of before March 1 for citation.

Peace, Gene

***** first copied message

RE: provision of Wahl and Ammann ms 3321 to NAS committee
Stephen H Schneider [shs@stanford.edu]
You replied on 2/28/2006 9:33 PM.
Follow up
To: Wahl, Eugene R
Cc: katarina kivel

Hello from Sydney. I have now read your responses the the rereviewer and am satisfied you have done more than an adequate job. The paper is now accepted and you can post it where you wish with that designation. Let me know if there is anything else to do. Congratulations, Steve

***** second copied message

RE: Wahl and Ammann ms 3321
Stephen H Schneider [shs@stanford.edu]
You replied on 2/28/2006 7:06 PM.
Follow up
To: Wahl, Eugene R
Cc: katarina kivel

your interpretation is fine--get me the revision soon so I have time to assess your responses in light of reviews in time! Look forward to receiving it, Steve

On Sat, 11 Feb 2006, Wahl, Eugene R wrote:

> Hello Steve:

>

> Caspar and I expect to have the final manuscript to you in 7-10 days with all the revisions you requested in December. I have recently had some correspondence with Jonathan Overpeck about this, in his IPCC role. He says that the paper needs to be in press by the end of February to be acceptable to be cited in the SOD. [I had thought that we had passed all chance for citation in the next IPCC report back in December, but Peck has made it known to me this is not so.]

>

> He and I have communicated re: what "in press" means for Climatic Change, and I agreed to contact you to have a clear definition. What I have understood from our conversations before is that if you receive the mss and move it from "provisionally accepted" status to "accepted", then this can be considered in press, in light of CC

being a journal of record.

>
> Peace, Gene
> Dr. Eugene R. Wahl
> Asst. Professor of Environmental Studies
> Alfred University
>

***** end of copied messages *****

Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

607-871-2604
1 Saxon Drive
Alfred, NY 14802

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#####

From: "Wahl, Eugene R" <wahl@alfred.edu>
To: "Jonathan Overpeck" <jto@u.arizona.edu>
Subject: RE: Wahl Ritson Ammann Science article on vonStorch 04
Date: Tue, 28 Feb 2006 23:23:25 -0500
Cc: "Keith Briffa" <k.briffa@uea.ac.uk>, "Eystein Jansen"
<eystein.jansen@geo.uib.no>

Hello Jonathan, Keith, and Eystein:

I want to make a reminder about the embargo for release of the WRA Science comment article. Please do not disseminate this article to anyone else, or discuss it publically until it is actually published, which I know Science wants to do soon. I still believe citation is appropriate, and I have asked for clarification on this from the editors. I will let you know what/if I hear from them.

FYI, this issue is also related to the NAS committee looking into last millenium surface temperature reconstructions this week, as I think you are aware. Today, the NAS staff person working with this committee said he talked to Jesse Smith of Science about this article, who mentioned he could say nothing, but referred the staff person to me. I was not really sure what this meant, and so I did not say anything specific on this myself, to ensure that I would not be in conflict with the embargo. That is where it stands in that arena for now.

As you saw in the message from Steve Schneider that I copied to you, however, there is no embargo of any kind on use of the Climatic Change article.

Peace, Gene
Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

607-871-2604
1 Saxon Drive
Alfred, NY 14802

660. 1141226255.txt

#####

From: Susan Solomon <ssolomon@al.noaa.gov>
To: <wg1-ar4-las@joss.ucar.edu>, wg1-ar4-las@joss.ucar.edu,
<wg1-ar4-re@joss.ucar.edu>, wg1-ar4-re@joss.ucar.edu
Subject: [wg1-ar4-las] Inappropriate Press Reports
Date: wed, 1 Mar 2006 10:17:35 -0700
Cc: renete christ <RChrist@wmo.int>, bubu jallow2 <dwr@gamtel.gm>, bubu jallow1
<bubujallow@hotmail.com>, Jian Liu <Jianliu@wmo.int>, jouzel
<jouzel@dsm-mail.saclay.cea.fr>, IPCC Chair <chairipcc@teri.res.in>

Dear Colleagues,

It has come to our attention that certain preliminary results of the WG1 draft report may have been provided inappropriately to the press, particularly the Guardian and the BBC.

Due to the nature of some of the specific material now appearing in the press (i.e., specific numbers discussed in our last LA meeting but not yet presented to others; see

<http://www.guardian.co.uk/frontpage/story/0,,1719608,00.html>), and the nature in which it is being cited (i.e., a 'source' as indicated in <http://news.bbc.co.uk/1/hi/sci/tech/4761804.stm>), there may be a connection to someone inside our team, and this is both extremely disappointing and concerning to us.

As you will all be well aware, all of our findings are currently under development and cannot be quoted or cited until the report is officially finalized at the end of January, 2007. Please do not give anyone the impression that you can currently represent information on behalf of the IPCC, or provide information about the draft material in the report. To do so would be not only a great discourtesy to your colleagues but may allow others to question the credibility of the IPCC process.

We have previously circulated the attached LAGuide.pdf and are recirculating that here. We would like to emphasize here that this applies to everyone involved in the report, including review editors as well as authors, co-chairs, and bureau members. Please let us know immediately at ipcc-wg1@al.noaa.gov if you find any aspect of this document unacceptable to you.

We cannot overstate the importance of our all paying scrupulous attention to ensuring that IPCC draft results are not revealed in any way that could lead to their appearing in a press venue prior to formal approval. Please redouble your efforts to avoid being misquoted, or misidentified as representing the IPCC's draft fourth assessment report.

Best regards,

Susan Solomon, Martin Manning and Qin Dahe

Attachment Converted: "c:\eudora\attach\LAGuide1.pdf"

661. 1141246541.txt

#####

From: Stefan Rahmstorf <rahmstorf@ozean-klima.de>
To: Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: latest draft of 2000-year section text
Date: Wed, 01 Mar 2006 15:55:41 +0100
Cc: Jonathan Overpeck <jto@u.arizona.edu>, Tim Osborn <t.osborn@uea.ac.uk>, Keith Briffa <k.briffa@uea.ac.uk>, cddhr@giss.nasa.gov, Eystein Jansen <eystein.jansen@geo.uib.no>

Hi all,
let me add to Fortunat that I feel Keith and Tim have done a tremendous job in very thorny terrain. And I agree with Peck - science has moved way past the "hockey stick" debate, and it is great how our chapter shows that. Nevertheless, we should remember that the Von Storch et al. (2004) critique was a fundamental methodological critique that applies to *all* (or at least most) proxy reconstructions - it is not just a Storch vs. Mann quarrel (although it is that as well, of course). Hence it is worth mentioning their error, else this could still call the entirety of our conclusions from that section into question. Currently, our draft just says:

At present, the extent of any such bias in specific reconstructions is uncertain

This is true, but leaves in my view slightly too much room for interpretation - like, it would still encompass the interpretation that the bias of all reconstructions is disastrous, so they are all "nonsense" in von Storch's words. What about saying something along the lines: "At present, the extent of any such bias in specific reconstructions is uncertain, although probably not as large as suggested by von Storch et al. (2004), whose work was affected by a calibration error (Wahl, Ritson and Amman, 2006)."

Regards, Stefan
p.s. Tim: Are you convinced the more recent papers by the VS group use the correct calibration? In those curves that are intended to show the pseudoproxies perform poorly even when calibrated correctly, as long as you add a lot more noise, I wonder why the pseudoproxies perform poorly even within the calibration interval, where they now should be calibrated to properly reproduce the 20th C warming trend, and they don't?

662. 1141250377.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Stefan Rahmstorf <rahmstorf@ozean-klima.de>, Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: latest draft of 2000-year section text

mail.2006

Date: wed, 01 Mar 2006 16:59:37 +0000
Cc: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>, cddhr@giss.nasa.gov, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>
Hi again Stefan,

At 14:55 01/03/2006, Stefan Rahmstorf wrote:
What about saying something along the lines:

>"At present, the extent of any such bias in specific reconstructions
>is uncertain, although probably not as large as suggested by Von
>Storch et al. (2004), whose work was affected by a calibration error
>(Wahl, Ritson and Amman, 2006)."

This sounds good and Keith is currently working your suggested
wording into the paragraph in question.

>p.s. Tim: Are you convinced the more recent papers by the VS group
>use the correct calibration? In those curves that are intended to
>show the pseudoproxies perform poorly even when calibrated
>correctly, as long as you add a lot more noise, I wonder why the
>pseudoproxies perform poorly even within the calibration interval,
>where they now should be calibrated to properly reproduce the 20th C
>warming trend, and they don't?

I am not certain, of course. And yes, there is a link between the
degree to which the trend over the calibration period is captured and
the amplitude of long-term fluctuations in the reconstruction. That
many of Burger's multitude of methods do not obtain the full warming
trend, while Mann et al. do, is certainly a concern here. But it is
also true (and I have myself analysed this one year before von Storch
et al. was published - if only I'd realised the implications I could
have had another Science paper! :-)) that correct implementation of a
regression method, keeping the trend in, can still lead to a massive
underestimation of that trend. So there's still more work to be done
on this topic!

Cheers

Tim

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phone: +44 1603 592089
fax: +44 1603 507784
web: http://www.cru.uea.ac.uk/~timo/
sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm

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663. 1141267802.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: oyvind.paasche@bjerknes.uib.no

mail.2006

Subject: Text here for 6.6 BUT not references -help
Date: Wed Mar 1 21:50:02 2006
Cc: jto@u.arizona.edu,Eystein Jansen
<eystein.jansen@geo.uib.no>,t.m.melvin@uea.ac.uk

Peck

here is a version you can look at. The text in blue , I suggest deleting.
please also see my message to Oyvind below

Oyvind

here is a word file that is very near to the final version for this stage, of the
6.6 section.

NOTE that we (really Tom Melvin here) have had a nightmare with trying to get
references in

endnote and keeping the text as I wrote it . We need to work on finding and
sorting a few

references - but in working today , Tom found endnote reordering the references
being

called out in the text - actually moving them into incorrect places! To meet
todays

deadline I am sending this word file version of my text , which except for
possible minor

typos , is the version that I consider done (with the exception of changes Peck
may wish to

make to the Regional section).

Tomorrow , could you please liaise with Tom here (see his email cc'd) to discuss
how to

get the same text associated with the correct references in the way you want.Tom,
as far as

I understand is mostly there - but whether his version of this text corresponds
with what

it should say now - is beyond my comprehension. I have had enough of this system
and I

think we should have simply used word. I am sure there will be minor formatting
problems

and inconsistencies in the way cross referencing is done in what I am sending . I
am also

sure that knowing which reference was meant and which is now cited will take some
sorting .

Please let Tom know how you wish to proceed with this as soon as you know and he
may be

able to comply. Thanks - now I am going home
Keith

--

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[1]<http://www.cru.uea.ac.uk/cru/people/briffa/>

References

1. <http://www.cru.uea.ac.uk/cru/people/briffa/>

664. 1141393414.txt

#####

mail.2006

From: Jonathan Overpeck <jto@u.arizona.edu>
To: <oyvind.paasche@bjerknes.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: last minute changes.
Date: Fri, 3 Mar 2006 08:43:34 -0700

<x-flowed>

Hi Keith - pls cc everything regarding change to Øyvind, as there is basically no time left for changes now. thanks

Ø - can you remove ref to wilson et al in 6.6 at the end? Keith is going to tell us more about the cited Tett et al submitted..

thanks, peck

>X-Sieve: CMU Sieve 2.2
>Date: Fri, 03 Mar 2006 09:30:41 +0000
>To: Jonathan Overpeck <jto@u.arizona.edu>,
> Eystein Jansen <eystein.jansen@geo.uib.no>
>From: Keith Briffa <k.briffa@uea.ac.uk>
>Subject: Re: Fwd: gabi's 1500-year reconstruction
>Cc: "Susan Solomon" <Susan.Solomon@noaa.gov>
>X-UEA-Spam-Score: -102.8
>X-UEA-Spam-Level: -----
>X-UEA-Spam-Flag: NO

>
>Let us stay with Gabi as it is in Figure etc.
>and as you say in the Nature paper anyway. We
>may have more problem with Tett et al. - need to
>check status , and wilson et al is not as it
>turns out accepted yet - awaiting corrections.
>So this will definitely NOT make it and will
>have to come out - so wondered if Peck Julie
>could just look at the coral bits where this is
>cited and see if it can be removed easily. Will
>be in touch re Tett et al.

>Keith
>
>At 06:51 03/03/2006, Jonathan Overpeck wrote:
>>Hi guys - great timing here for this message
>>from Francis, and I don't think we can (or
>>should) do anything. It seems Gabi's recon is
>>in press, and that's the way it is. I suspect
>>Gabi's J Clim paper will come out before the
>>TOD too, but since it's in press in Nature,
>>it's published.

>>
>>I don't think the IPCC has to provide anything
>>beyond the report - in fact, I'm almost sure
>>Susan made this point to me/a bigger group
>>already. I'll cc this to her, just so she
>>know's what might be coming, but I think we're
>>fine. M&M can get Congress to ask the FBI to
>>secret Gabi away forever for doing her science
>>the accepted way. Seriously, it's up to her to
>>make things available as appropriate.

>>
>>Of course, I could be too sleep-deprived too.
>>Am I correct in my assessment? I don't feel
>>like calling Gabi at 2am (her time) to discuss
>>making changes (e.g., to text, let along figs)

mail.2006

>>that it's too late to make anyhow. I'll respond
>>to Francis after I hear from you.

>>

>>Anyhow, I'm just about to send the full SOD
>>text back to Norway for final minor editing. It
>>looks good.

>>

>>Best, peck

>>

>>>X-Sieve: CMU Sieve 2.2
>>>Date: Thu, 02 Mar 2006 17:11:24 -0800
>>>From: Francis Zwiers <francis.zwiers@ec.gc.ca>
>>>To: Jonathan Overpeck <jto@u.arizona.edu>
>>>Cc: Gabi Hegerl <hegerl@duke.edu>
>>>Subject: gabi's 1500-year reconstruction
>>>Hi Peck,

>>>

>>>I just got a call from Gabi, who spent the day
>>>in Washington at that NAS panel on the hockey
>>>stick. She doesn't have access to e-mail
>>>today, and so asked me to convey a message.

>>>

>>>McIntyre and McKittrick were there, and seem
>>>to have left Gabi with the strong impression
>>>that they will be insisting on having access
>>>to supporting data, etc., used to build
>>>reconstructions. Gabi says that this is
>>>making her nervous, wants to make sure that
>>>you are aware of the status of her
>>>reconstruction, and wants to be sure that you
>>>are comfortable with continuing to use it in
>>>Ch 6. She says that if you feel it necessary
>>>to exclude her reconstruction from your SOD of
>>>Ch 6, you should do so. The reconstruction is
>>>used in her Nature paper on sensitivity, which
>>>has been accepted, but the Nature paper does
>>>not describe the reconstruction or the
>>>supporting data in any detail. There is a
>>>paper under review at J. Climate that does do
>>>that (which is cited in the Nature paper), but
>>>unfortunately, an editorial decision is still
>>>pending.

>>>

>>>I hope that I've conveyed her message
>>>correctly. If you have a few minutes, it
>>>might be a good idea to give Gabi a call on
>>>her cell at bit later this evening (919 451
>>>2773).

>>>

>>>Cheers, Francis

>>>

>>>PS - hope things are progressing with your
>>>chapter. Things are a bit hectic here!

>>>--

>>>Francis Zwiers, Chief
>>>Canadian Ctr for Climate Modelling and Analysis
>>>Climate Research Division, Environment Canada
>>>c/o University of Victoria
>>>PO Box 1700, STN CSC
>>>Victoria, BC V8W 2Y2

>>>

>>>Phone: (250)363-8229
>>>Fax: (250)363-8247

mail.2006

>>>web: <http://www.cccma.bc.ec.gc.ca>http://www.cccma.bc.ec.gc.ca

>>

>>

>>

>>--

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>>Director, Institute for the Study of Planet Earth
>>Professor, Department of Geosciences
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>--

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--

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665. 1141398437.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: photographs and other visuals for science
Date: Fri, 3 Mar 2006 10:07:17 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>

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mail.2006

Hi Keith - thanks. Plan sounds good, and I will use this email to start the "do for next draft" file. Thanks, peck

>Peck

>
>we do need to say something , but as I said in an earlier message ,
>not without more consideration. We should not write something curt
>on this - ditto the Co2 possible fertilisation . In the push to do
>all this other stuff , we have had to leave it - to discuss later
>how to include an uncertainty issues bit about recent environmental
>mess ups . The D'arrigo paper is not convincing , but we have to do
>some work to show why , instead of just saying this . The divergence
>issue is NOT universal , and not unrelated to very recent period
>bias arising from processing methods . It is VERY LIKELY not the
>threshold problem D'Arrigo thinks it is. We need money here to work
>on this and losing our last application to Europe has messed us up.
>For now we can not include anything. I will work on text for the
>next iteration.

>
>At 16:05 03/03/2006, you wrote:

>>Hi Richard - this issue is one that we refer to in our key
>>uncertainty table. I believe Keith Briffa was one of the first to
>>write about it, and it is an important issue. I haven't seen R's
>>paper or results myself, but I bet Keith has. I'm cc'ing this to
>>him to see what he thinks.

>>
>>thanks, peck

>>
>>>>Know anything about the "divergence problem" in tree rings? R D'arrigo
>>>>talked to the NRC yesterday. I didn't get to talk to her afterward, but
>>>>it looked to me that they have redrilled a bunch of the high-latitude tree
>>>>rings that underlie almost all of the high-res reconstructions, and the
>>>>tree rings are simply missing the post-1970s warming, with reasonably high
>>>>confidence. She didn't seem too worried, but she apparently has a paper
>>>>just out in JGR. It looked to me like she had pretty well killed the
>>>>hockey stick in public forum--they go out and look for the most-sensitive
>>>>trees at the edge of the treeline, flying over lots and lots of
>>>>trees that are
>>>>less sensitive but quite nearby, and when things get a little warmer, the
>>>>most-sensitive trees aren't anymore, and so the trees miss the extreme
>>>>warming of the recent times, and can't reliably be counted as catching
>>>>the extreme warmth of the MWP if there was extreme warmth then.
>>>>Because as far as I can tell the hockey stick really was a
>>>>tree-ring
>>>>record, regardless of how it was labelled as multiproxy, this looks to me
>>>>to be a really big deal. And, a big deal that may bite your chapter...
>>>>--Richard

>>
>>
>>--

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>>Professor, Department of Geosciences
>>Professor, Department of Atmospheric Sciences

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--
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666. 1141737742.txt

#####

From: "Tim Osborn" <t.osborn@uea.ac.uk>
To: k.briffa@uea.ac.uk
Subject: [Fwd: Re: data request to SCIENCE for 1120514]
Date: Tue, 7 Mar 2006 08:22:22 -0000 (GMT)
Reply-to: t.osborn@uea.ac.uk
Cc: t.osborn@uea.ac.uk

Keith - see below. I bet it won't be the end of the episode! - Tim

----- Original Message -----
Subject: Re: data request to SCIENCE for 1120514
From: "Jesse Smith" <hjsmith@aaaas.org>
Date: Mon, March 6, 2006 8:03 pm
To: t.osborn@uea.ac.uk

Dear Dr. Osborn,

Thank you for your clear and careful response to the requests made by Dr. McIntyre, which we forwarded to you: it was quite satisfactory, we believe, and will greatly help Brooks (Hanson) in crafting his reply to Dr. McIntyre. I hope that this will be the end of this episode, but if it is not, we will be in touch again.

Best regards,

Jesse Smith

=====
Dr. Jesse Smith
Senior Editor

Science
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Washington, DC 20005
USA

(202) 326-6556
(202) 408-1256 (FAX)
hjsmith@aaas.org
=====

>>> Tim Osborn <t.osborn@uea.ac.uk> 3/3/2006 11:22:17 AM >>>

Dear Jesse Smith and Brooks Hanson,

thank you for your patience while waiting for our reply. Before responding to the specific data requests, we would like to say that it is our view that we should provide sufficient data to enable all the main elements of our analysis to be checked, but that we are not obliged to provide the data that would enable the research reported in other papers to be checked, even if we cite those other papers or use results reported in those other papers. You will see how this view has determined our response to some of the requests.

Now to the requests themselves, numbered according to the numbering system of Steve McIntyre's email.

(1) As you know, we provided (in advance of publication) the 14 smoothed and normalised proxy records to WDC-Paleo that enable the main parts of our analysis to be replicated. The only part of our analysis for which the unsmoothed data are required is to calculate the correlations against temperature that we reported for some of the series (not those that had already been reported by Mann and Jones, as indicated in our Table S1). These unsmoothed data for all 14 series are now also archived at WDC-Paleo, which will enable those correlations that we reported in Table S1 to be checked. These unsmoothed data were archived on Thursday 23rd February, in response to a request by a different colleague. This should cover this request in full.

(2) Our Table S1 provides the full citation to the source of our data, funnily enough given in the column labelled "Data source". Some of these may or may not have publicly archived their data, but our WDC-Paleo entry now contains the series that we were originally provided with (i.e., the unsmoothed data that we refer to in item (1) above). The "Orig source" column in our table was our effort to ensure that original work on collecting/processing these data is acknowledged, because it is important for us to acknowledge that work even when we obtained the data from a secondary study. We did not intend to imply that the data that we had used would match the data in these original sources, because various different versions might exist (due, e.g., to different methods of processing the data, or due to updated measurements, etc.). That is why we made the source of our data clear.

(a-c) We have not yet had time to double check the ITRDB citations that we provided for these three records, but we will do so as soon

mail.2006

as we have time. Our data source was in fact Esper et al. (2002) and this is correct, so the concern over the accuracy of these ITRDB citations does not limit the ability for others to check our work.

(d-f) The original studies that we cite are definitely correct for these two records. We have provided sufficient data for our analysis of these records to be checked. We have not provided extra data to enable other people's studies to be checked, nor do we feel obliged to do so.

(g) These series from Esper et al. (2002) were considered by us and then rejected. As we understand it, Esper et al. have made available their site RCS records and therefore these four records could be obtained from Esper et al. If this is not the case, we could provide these four rejected series.

(3) D'Arrigo et al. (2006) do *not* report directly opposite findings in respect to the correlations we obtain for Jaemtland and Boreal/Upperwright. Neither paper reports any correlations involving these series versus temperature. Both papers list more than one reason why series might be rejected. For example, our reasons were "we removed series from (S1) that did not correlate positively with their local annual or summer temperatures (Table S1), or which did not extend into the period with instrumental temperature to allow a correlation to be calculated." The latter is our reason for excluding Jaemtland, not the former: the Jaemtland series that we obtained from Esper et al. (2002) has no data after 1827 and so no correlation was calculated. The Jaemtland series used by D'Arrigo et al. continues through to 1978 due to the inclusion of additional data. Similarly, D'Arrigo et al. list a number of reasons for excluding series, but they do not state which one(s) were used to exclude Boreal and Upperwright, though in fact none disagreed with our criteria anyway!

We have not separately stored the temperature time series used to obtain the correlations reported in our Table S1 and to do so requires some changes to our program, which we have not done because there does not appear to be a need to do so (given our explanation above of the situation regarding our paper versus D'Arrigo et al., 2006).

Because Steve McIntyre has explicitly stated that he is unable to verify our results for the Boreal/Upperwright case, we have extracted the temperatures we used for that case only and attach them here as a text file. We hope that he can use them to reassure himself about the correlations that we obtained.

(4)

(a) We explicitly state that we did not use the Esper et al. (2002) Jasper series, so there is no expectation that they should be identical. Esper et al. (2002) have, we believe, made their version available and we have made available the series that we used via WDC-Paleo.

(b) Similarly, we explicitly state that we did not use the Esper et al. (2002) Tornetrask series and data are available as for (a).

(c) We are not obliged to confirm anything that Esper et al. (2002) did.

(5) This request is not relevant to our paper, as discussed at the start of this email.

(6) Same as (5).

We hope that we have dealt with these requests to a more than satisfactory extent, but please let us know if you feel that we should do more.

Best regards

Tim Osborn and Keith Briffa

At 19:30 23/02/2006, you wrote:

>Dear Dr. Osborn,

>

>We have just received an email from Steve McIntyre (pasted below),
>with a long and very specific list of alleged deficiencies in the
>availability of data by which to evaluate your recent paper, "The
>Spatial Extent of 20th-Century Warmth in the Context of the Past
>1200 Years," and others. Wishing to deal with this issue in a
>conscientious and reasonable way, we are passing the email along to
>you as a request for data, without taking a position on the validity
>of any particular point. We would like to have your confidential
>response to this request, keeping in mind the stated policy of
>SCIENCE that "Any reasonable request for materials, methods, or data
>necessary to verify the conclusions of the experiments reported must
>be honored." Please return your response by email directly to me,
>and CC: Brooks Hanson, our Deputy Editor
>(<<mailto:bhanson@aaas.org>>bhanson@aaas.org). We appreciate your
>cooperation, as well as the time and effort that a reply may
>take. Feel free to contact me if you have any questions about this
>issue.

>

>

>Sincerely,

>

>Jesse Smith

>

>*****START OF EMAIL FROM S. MCINTYRE*****

>Dear Dr Hanson,

>

>Thank you for your prompt response to my letter in respect to Osborn
>and Briffa [2006], Esper et al [2002] and Thompson et al [1989;
>1997]. I appreciate your efforts in this and realize that you are
>frustrated at being criticized. However, if you reflect on the
>matter, I'm sure that you will agree that the problem stems entirely
>from the original authors failing to comply with Science's data
>archiving policy.

>

>It will come as no surprise to you that I do not believe that the
>additional data, useful as it is, comes anywhere near discharging
>Science's obligations under its data policies for reasons that I
>will set out in detail below. I will discuss the shortfalls in
>connection with what I understand to be one of Science's governing
>policies

><http://www.sciencemag.org/feature/contribinfo/prep/gen_info.dtl#datadep>http://www.sciencemag.org/feature/contribinfo/prep/gen_info.dtl#datadep

>:

>

>Science supports the efforts of databases that aggregate published
>data for the use of the scientific community. Therefore, before
>publication, large data sets must be deposited in an approved
>database and an accession number provided for inclusion in the

published paper.

>
>Since the issue pertains to how Science discharges its policies, it
>is my position that you, rather than the original authors, are the
>appropriate arbiter of that. (Additionally, the authors have refused
>all requests in the past and I see no reason why their behavior
>would now differ.)

>
>Status of Each Request:

>
> 1. Digital versions of all 14 series as used in their
> final compilations;

>
>I have inspected the archive at
><ftp://ftp.ncdc.noaa.gov/pub/data/paleo/contributions_by_author/osborn2006/osborn2006.txt>ftp://ftp.ncdc.noaa.gov/pub/data/paleo/contributions_by_author/osborn2006/osborn2006.txt,

>to which you directed me. This consists of smoothed (and re-scaled)
>versions of the 14 series and is relevant to the request, but does
>not satisfy it. The authors specifically discuss correlations of
>these series to temperature, which requires consideration of the
>pre-smoothed series. Accordingly, I re-iterate my original request
>for digital versions of the 14 series.

>
>2. For each of the tree ring sites analysed (both the 11
>retained and Esper site not used, including Gotland, Jaemtland,
>Mackenzie Mts and Zhaschiviersk), an exact data citation to a public
>archive (e.g. WDCP) for the data set used; or, in the alternative,
>an archive of the data set at the Science website. In cases, where
>the publicly archive dataset for a site is related to but different
>from the version used by Osborn and Briffa, please archive the data
>set as used.

>
>I was able to reasonably reconcile the smoothed series to original
>sources in public archives and accordingly have no issue with data
>provenance for the following Osborn and Briffa series: the Mann PC1
>(#1); #5 Chesapeake; - #6 - Fisher's Greenland O18 stack; #7 -
>Netherlands documentary; #14 - Yang's China composite (although
>there are problems in the Thompson series used in this composite).
>For other users less familiar with nuances of series versions, I
>recommend that the SI be modified to provide accurate data citations
>for these 5 series.

>
>The problems mostly pertain to tree ring data, which make up the
>other 9 series. In three cases, Osborn and Briffa provided data
> Citations for sites in public archives (#4 - Quebec- cana169; #8 -
>Tirol - germ21; #11 - Mangazeja - russ067, russ068). In each of
>these 3 cases, the Esper version reconciles to the Osborn version
>(up to re-scaling). However, they do not reconcile to the original
>data sets.

>
>a) the dataset germ21, cited by Osborn-Briffa for series #8-
>Tirol, has values from 1466 to 1837, while the archived version goes
>from 1324 to 1975. Obviously the data set has not been cited
>accurately or is incomplete.

>
>b) the series cana169 goes from 1352 to 1989, while the Osborn
>version (#4 - Quebec) goes from 1352 to 1947. Again, it appears
>that the data set has not been cited accurately or is incomplete.
>Additionally, while I have been able to substantially replicate the
>features of other RCS chronologies, my efforts to reproduce the
>archived result from cana169 lead to a series with a significantly

>different shape.

>
>c) one of the two cited data sets (russ067) does not contain
>measurements at WDCP. However, the versions "mangazla" and
>"mangazpc" in the Schweingruber section of WDCP appear to have the
>data for russ067 and russ068. However, these data sets only yield
>values from 1246 to 1969, while the archived Osborn version (#11 -
>Mangazeja) goes from 1246 to 1990. Some additional data must exist
>somewhere, but has not been archived at WDCP to date.

>
>Two sites (#9 - Tornetrask; #13 - Mongolia) have WDCP measurement
>archives (swed019; mong003 respectively), but there are
>inconsistencies between the data as archived and the length of the
>Osborn and Briffa versions.

>
>d) the WDCP archive for Tornetrask ends in 1990, which is
>inconsistent with the Osborn version which ends in 1993. This
>indicates that the data sets are not the same.

>
>e) similarly, the WDCP archive for Sol Dav, Mongolia begins in
>900, while the Osborn version begins in 800.

>
>For the following 5 sites, no archive of the measurements exists at
>all - a direct breach of Science's archiving policy:

>
>f) Jasper/Icefields, Boreal, Upper Wright, Taimyr, Yamal,

>
>Accordingly, I re-iterate my request that the measurement data
>consistent with the archived site chronologies be archived for each
>of the above items 2(a)- 2(f), as well as corresponding information
>for the following 4 sites considered in Osborn and Briffa:

>
>g) Gotland, Jaemtland, Mackenzie; Zhaschiviersk

>
>3. Digital versions of the specific gridcell temperature series
>used in each of the reported temperature correlations together with
>version date.

>
>As noted in my previous request, D'Arrigo et al [2006] have reported
>directly opposite findings in respect to the correlation between
>their RCS chronology and gridcell temperature for: Jaemtland and the
>two foxtail series. I have specifically been unable to verify their
>claim in respect to bristlecones. Accordingly, I re-iterate the
>request for the digital versions of the temperature data used in
>these calculations. (In connection with a similar request, Nature
>required Mann et al. to archive the exact temperature data used in
MBH98.)

>
>4. Exact data citations to a public archive for all datasets
>used, or, if such do not exist, an archive of the data set at the
>Science website.

>
>while most Osborn versions match Esper versions up to re-scaling,
>they differ in three cases, and a separate Esper version is required
>in two of them:

>
>a) the Esper version for the Jasper data is different than the
>Osborn and Briffa version (as noted in Osborn and Briffa) and both
>data sets need to be made available;

>
>b) similarly, there are differences between the version of the
>Tornetrask series archived by Esper and the one archived by Osborn,
>again requiring examination of both data sets;

>
>c) the Polar Urals version of Esper differs from the Yamal
>version of Briffa. It is possible that the Esper version used a
>combination of data sets russ021 and russ176 (if so, would you
>please confirm this.)
>
>5. A clear and operational definition distinguishing "linear"
>and "nonlinear" trees, preferably with source code showing any
>differences in methodology.
>
>while the provision of site chronologies for 13 Esper sites is
>appreciated, one site (Mongolia) was unaccountably omitted. The
>corresponding information is requested.
>
>while the provision of the site chronologies was interesting and
>appreciated, according to my reading of Esper et al [2002], these
>site chronologies were not used in the calculations in the article,
>which distinguished between "linear" and "nonlinear". No operational
>definition is provided. combined with the unavailability of the bulk
>of the data, the calculations of "linear" and "nonlinear"
>chronologies cannot be replicated even from the recent information
>regarding Esper et al [2002] and this remains unresolved.
>
>6. Thompson provides a complete archive of both Dundee and
>Guliya ice cores, including both isotope and chemical data.
>
>while I appreciate that Thompson has provided sample information on
>(only) 2 Kilimanjaro cores, he did not provide the requested
>accompanying chemical information necessary for their
>interpretation. The Kilimanjaro data is obviously of little help
>with the Dundee and Guliya data.
>
>The U.S. Global Change Research Program required archiving of data
>commencing in 1991 and the World Data Center for Paleoclimatology
>has been in existence since then and has been online since 1994.
>Accordingly there was an adequate facility for the archiving of the
>Guliya core when it was published in 1997.
>
>I realize that the Dundee core was published in 1989, at a time when
>your present archiving policies were not in effect. However,
>Thompson has published versions of this series in other journals
>which are inconsistent with the version published in Science. I
>cannot imagine that you are content with such a situation. Even if
>you did not have policies at the time, I am sure that you can give a
>very firm request to Thompson and I find it difficult to believe
>that Thompson would refuse a direct request from Science to provide
>this data. If he has refused a direct request, then that too is
>relevant information, upon which I would appreciate confirmation.
>
>Again, I apologize for putting you in the middle of this and for the
>public nature of the exchange. However, some of this has been going
>on far too long with minimal results, leaving no alternative.
>However, I assure you that I will be equally public in commending
>you if and when you resolve matters. In my opinion, you should
>simply do the following:
>
>(1) send a copy of your data archiving policy to each
>of the authors: Osborn-Briffa; Esper et al. and Thompson;
>
>(2) tell Osborn-Briffa and Esper et al. that you
>expect them to comply with the policy which was in effect at the
>time of publication or else you will retract the article.
>

mail.2006

>(3) tell Thompson that, if he wants to publish at
>Science in the future, he should immediately clean up his archive
>for the earlier articles.
>
>Obviously there has been some inadequate housekeeping in the past. I
>can understand this and my concern is not with the past. My concern
>is with the present. You have an opportunity to remedy the situation
>now and no one will criticize Science for ensuring that paleoclimate
>authors meet Science's data archiving policies. On the other hand,
>you will be justly criticized both by me and others if you don't do
so.
>
>
>
>Regards,
>
>Stephen McIntyre
>
>*****END OF EMAIL FROM S. MCINTYRE*****
>*****
>
>=====

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To: cddhr@giss.nasa.gov, Eystein Jansen <eystein.jansen@geo.uib.no>, rahmstorf@ozean-klima.de, Bette Otto-Bleisner <ottobli@ncar.ucar.edu>, joos <joos@climate.unibe.ch>, Dominique Raynaud <raynaud@lgge.obs.ujf-grenoble.fr>, "James Zachos" <jzachos@emerald.ucsc.edu>, Valerie Masson-Delmotte <Valerie.Masson@cea.fr>, Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk
Subject: Fwd: Re: [Wg1-ar4-ch06] Chapter 6 glossary edited version
Date: Tue, 7 Mar 2006 12:02:12 -0700

Hi folks - seems the listserv is down again. Please take a look at the attached draft chap 6 glossary and send comments to me and David Rind today if you have any (Jim Z - hope you can look at the way we've butchered the preQ defns). Eystein and I would like to send to TSU tonight if we can.

mail.2006

Thanks, Peck

Date: Tue, 7 Mar 2006 11:45:06 -0700
To: David Rind <drind@giss.nasa.gov>
From: Jonathan Overpeck <jto@u.arizona.edu>
Subject: Re: [wg1-ar4-ch06] Chapter 6 glossary edited version
Cc:
Bcc: wg1-ar4-ch06@joss.ucar.edu, fons_baede@hetnet.nl
X-Attachments: :Macintosh HD:329718:Chapter 6 glossaryJTO.doc:

Hi David (and those who have contributed) - thanks!
I've attached a revised version, with my edited sections highlighted in yellow.

I've
way,
were
significantly
final
no
the yellow

tried to update some definitions to be more accurate (agree w/ Stefan, by the way, regarding D/O events), and also to standardize mention of time intervals. Also, I don't think we want to cite the sources you have cited, since these were only the sources used to get going. I think many of the definitions are updated significantly by our team.
If you get any other feedback today, great. Please forward me and Eystein your final version at the end of the day, and we'll send to the TSU (and Fons). If you get no additional input, just let us know and we can send in the attached version w/ the yellow shading removed.

Thanks again, Peck

--

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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Fwd: divergence
Date: wed, 8 Mar 2006 15:18:54 -0700
Cc: ralley@geosc.psu.edu, Eystein Jansen <eystein.jansen@geo.uib.no>, Bette Otto-Bleisner <ottobli@ncar.ucar.edu>, joos <joos@climate.unibe.ch>, t.osborn@uea.ac.uk, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>

<x-flowed>

Hi gang - Richard is raising important issues, and Keith is going to respond in some detail on Friday when he gets back. I am cc'ing this to a broader group of IPCC Chap 6 folks so that we make sure we (chap 6) deal with the issues correctly. I'm hoping that Keith will cc to us all, and we'll go from there.

For those just in on the issue raised by Richard. There is a paper written by Rosanne D'Arrigo that apparently casts serious doubt on the ability of tree ring data to reconstruct the full range of past temperature change - particularly temperatures above mid-20th century levels. Chap 6 obviously has to deal with this more in the next draft, so Eystein and I would like to get on top of it starting this week.

Keith or Richard - do you have a copy of this paper? Is it accepted?

Thanks, Peck

>X-Sieve: CMU Sieve 2.2
>Date: wed, 8 Mar 2006 11:55:46 -0500 (EST)
>From: <ralley@geosc.psu.edu>
>To: jto@u.arizona.edu
>Cc: k.briffa@uea.ac.uk
>Subject: divergence
>

>Peck--Thanks. The big issue may be that you don't just have to convince me >now; if the NRC committee comes out as being strongly negative on the >hockey stick owing to RD'A's talk, then the divergence between IPCC and NRC >will be a big deal in the future regardless. The NRC committee is accepting >comments now (I don't know for how long)... As I noted, my observations >of the NRC committee members suggest rather strongly to me that they now >have serious doubts about tree-rings as paleothermometers (and I do, >too...at least until someone shows me why this divergence problem really >doesn't matter). --Richard

--
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#####

From: Phil Jones <p.jones@uea.ac.uk>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>, Jonathan Overpeck
<jto@u.arizona.edu>
Subject: Re: Climate Audit
Date: Thu, 09 Mar 2006 13:48:31 +0000
Cc: Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Dear All,

A lot of good points raised by the horizontal Eystein. Keith is hoping to do something on the recent tree growth issue.

What this sad crowd (nice words - I'll use the phrase again) don't realise is that the satellite data now agree with the surface. This is said in Ch 3 and will come home more forcefully once the CCSP report on vertical temperature trends comes out. This should be April or May according to Tom Karl who is overseeing it all. I say should as it apparently has to be approved by the White House! Peck will know why this is and the expertise of the people doing the approval!

I can say for certain (100% - not any probable word that IPCC would use) is that the surface temperature data are correct.

McIntyre is determined and the blog does influence people, unfortunately the media. As you say as issues are partially closed, they will move on to others.

Cheers
Phil

At 12:50 09/03/2006, Eystein Jansen wrote:

>Hi Phil, thanks for the greetings. The back is status quo-like, so today
>the neurosurgeons concluded I need a surgery to take care of the hernia
>that creates the pains. Will take place in a week or two, and I will be
>out of work for a month afterwards, but should be up and going in good
>time for Wengen and for LA4.

>
>One side effect of being stranded and in horizontal working mode is more
>time to browse the net, thus I have monitored the Climate Audit page.
>Looking at the discussions after the NAS panel meeting we should expect
>focus now to be sidetracked from PC-analyses and over to the issue of bad
>proxies and divergence from temperature in the last 50 years. Thus this
>last aspect needs to be tackled more candidly in AR4 than in the SOD, and
>we need to discuss how to do this, soon. The key expert here is Keith and
>I guess we should be able to assess the situation based on his and
>D'Arrigo's work and the expertise at hand.

mail.2006

>The rather sad crowd of followers who put their confused ideas onto the
>blog is one thing - they can't make up their mind if tree-rings are
>correct over the past 50 years and the Instrumental data wrong (UHI story)
>or vice versa. The more important aspect is that the blog is now used a
>lot by media and McIntyre has immediate access to the international media
>in the form of being one of the key players in terms of paleoclimate,
>ironocally enough. He is extremely determined, has his skewed viewpoints
>and is of course very pompous, but the blog is effective for his goals.

>
>Cheers,
>Eystein

>At 08:39 +0000 09-03-06, Phil Jones wrote:

>> Peck,

>> I should stop looking at these sites. Was just looking during a
>> break yesterday pm.

>>
>> Spent part of yesterday going through the TS and SPM and
>> sent some comments in, only to be told they weren't specific
>> enough by Susan. Probably the last time I waste my time
>> doing that. I knew she had an agenda, but I hadn't fully
>> realised how extensive it was.

>>
>> We need to revisit AR4 at some stage. Let's talk about this
>> over some beers at the Wengen meeting - to decide if we do
>> anything at the Bergen one. I'm sure Susan is aware of most
>> of the issues..... well, I'd like to believe that. The trouble is
>> that the blog sites keep promoting the same arguments, it just
>> doesn't seem to matter how we try and respond - they are oblivious
>> to it. One issue we could discuss is data availability. Keith says
>> you're going to make all your series (in the plots available). This
>> should be across all chapters if done. This is a load of work, but
>> they'll just say it isn't enough. So, impossible to win, or even get a
>> draw.

>>
>> Keith is hoping to do something re Rosanne, but like all
>> of us we're not finding the time. There are a load of things
>> we want to write, but responding (even reading) all this
>> rubbish takes time.

>>
>> Hope you're better Eystein ! Looking forward to Bergen - partly
>> as we're closer then to seeing the back of IPCC!

>>
>> Cheers
>> Phil

>>>At 23:15 08/03/2006, Jonathan Overpeck wrote:

>>>Hi Phil - I'm not a big blog guy - not enough time, nor good enough
>>>internet here. So, I'm not following the audit junk. Am I nuts?

>>>And, I'm not sure I understand what's going to happen when the AR4 comes
>>>out. Should we have some discussion on this - as a broader group w/
>>>Susan - in Norway? Or is some other strategy advised?

>>>What fun...

>>>I'm hearing about D'Arrigo's splash from other sources (Richard Alley) -
>>>hope Keith et al., have good counter arguments.

>>>best, peck

mail.2006

>>>
>>>>>> Caspar,
>>>> I guess you've seen the site in the last day or so.
>>>> Did you give them your CC paper to post up and attack?
>>>> They clearly shouldn't have it.
>>>>
>>>> There are some funny things (#32 on the verification r*r revealed),
>>>> but much has gone beyond that.
>>>>
>>>> D'Arrigo's Cherry Pie - where did Briffa graduate from!
>>>> Keith's web page isn't up-to-date as he's a professor now!
>>>>
>>>> I'm the greatest hoarder of climate information!
>>>>
>>>> It's the pages on Mike that are no longer funny.
>>>>
>>>> Peck - do you think Susan really understands what will
>>>> happen when the AR4 comes out?
>>>>
>>>> I heard from Jerry North thinks they will have a report
>>>> from the NAS meeting by April.
>>>>
>>>> Cheers
>>>> Phil

>>>>
>>>>
>>>>
>>>>
>>>>
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>>>>School of Environmental Sciences Fax +44 (0) 1603 507784
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ricardo@lab.cricyt.edu.ar
Subject: NRC and IPCC millennial temperatures
Date: Sat, 11 Mar 2006 15:27:19 -0500 (EST)
Cc: mmanning@al.noaa.gov, ssolomon@al.noaa.gov

Friends in the IPCC WG1 AR4--

My impression is that, for good reasons, the US NRC panel looking at the record of temperatures over the last millennium or two is not going to strongly endorse the ability of proxies to detect warming above the level of a millennium ago, and that a careful re-examination of the Chapter 6 wording and its representation in the TS and SPM would be wise. Some of you have seen some of the discussion that follows, in some of the rapid-fire emails over the last day or two, but I'd like to clarify a little.

Please note that I am NOT on the NRC committee, do not speak for them, and have no "inside" knowledge of what they are doing. I was asked to testify to them, and I heard remarks from some other speakers and questions from the committee in public forum. I did NOT represent the IPCC to the committee, either; I stated that although I was proud to be participating with the IPCC, I absolutely was not speaking for, representing, or presaging anything in the IPCC. (I was, however, favorably quite impressed with the NRC committee and their efforts.) Someone else may have a different impression of what went on; this is mine.

mail.2006

Among the presentations, involving borehole temperatures, corals, glaciers and ice cores, and historical records, that which to me seemed to interest the committee most was from Rosanne d'Arrigo, who reported (among many other things) on a just-published study in which northern tree-ring sites were revisited and updated, and in which many of those sites failed to track the recent warming documented instrumentally. She did not make a big deal out of this, but several of the questions afterward from the committee focused on this "divergence" problem. (And to note, Rosanne did not discover the divergence problem, which has been around and discussed for a while; her testimony, including the recent large effort to update some tree-ring records, stirred interest from some committee members.)

I would also note that one of the committee members was asking each presenter whether the presenter believed that temperatures could be reconstructed for 1000 years ago within 0.5 C, and that the presenters were answering with some qualified version of "no".

My guess is that the NRC committee will put these things together, find some papers on ozone damage and CO2 fertilization, consider Rosanne's statement that the preferred temperature-sensitive trees are rare and in restricted places (and thus that a prolonged warming could easily move those trees out of the sensitive band), and conclude that tree-ring reconstructions include larger errors than are returned by any of the formal statistics from calibration or aggregation of records, and thus that there is less confidence than previously believed in the relative warmth of recent versus Medieval times. I also consider it possible that they will point out the difficulty of using a composite temperature history consisting of proxy and instrumental data if some of the proxy data do not track the more-recent part of the instrumental data.

The IPCC must be the IPCC, not the NRC. But, if the IPCC and NRC look very different, there will be much comment, and we will have to be very sure. More importantly, I believe that real issues are raised here, and that better discussion of this should be included in chapter 6, and probably brought forward at least into the TS. I know I'm not in chapter 6, I know I'm not a tree-ring expert, and I know I'm sticking my nose in where it might not belong or be welcome. But the flurry of emails in the last couple of days has not convinced me that this one can be ignored; indeed, I am more convinced that there exist issues that the IPCC must discuss more thoroughly.

My impression of the status (and my thoughts about what chapter 6 might say) from a whole lot of quick reading, your emails, and the testimony and questions I heard, is along the lines of:

--> The TAR highlighted a temperature history composited from multi-proxy paleoclimatic indicators plus the instrumental record, showing anomalous recent warmth, with the recent warmth emerging well above the 95% confidence interval for the last millennium.

--> The multi-proxy paleoclimatic indicators reflect tree-ring results more than any other source.

--> Tree-ring records are responsive to many factors, and great care and effort go into isolating the temperature signal from other signals.

--> Tree-ring data, in common with essentially all paleoclimatic data, are not collected in a continually updated "operational" fashion analogous to that used for meteorological data, so the data sets end at different times; data used in the multi-proxy reconstructions cited in the TAR ended between the 1990s and the 1940s. This difficulty motivated the need to include instrumental as well as proxy data in the reconstructions.

mail.2006

--> In those data, there was some suggestion of non-temperature influences on the tree-ring reconstructions; in particular, some of the most-recent records did not record the full amplitude of the instrumental warming. This has come to be known as the "divergence" issue.

--> Much research has been conducted since the TAR, and additional evidence of divergence has emerged in some records, causing some aggregated reconstructions from proxy records to show less warming than does the instrumental record.

--> There are many hypotheses for non-temperature influences on tree-ring records, including: (i) recent damage (as by ozone); (ii) recent fertilization (as by CO₂); and (iii) decreasing sensitivity of tree-ring growth to temperature with increasing temperature (once it's warm enough, the trees are primarily responsive to other things). The nature of these and their timing relative to the interval in which tree-ring data were calibrated to instrumental records would control the effects on climate reconstructions. In general: (i) would mean that recent warmth is underestimated but warmth from a millennium ago is not; (ii) would mean that recent warmth is overestimated but warmth from a millennium ago is not; and (iii) would mean that both recent warmth and warmth from a millennium ago are underestimated.

--> Various arguments have been advanced to support (i), (ii), or (iii), with many workers in the field favoring (i). Nonetheless, further characterizing recent non-temperature influences on tree-ring growth remains an open research question, and no broad consensus has emerged on (i), (ii), (iii), or something else.

--> These considerations do not affect the conclusion that recent warmth is anomalous over the last few centuries; the strong correlations of the proxy data with temperature over the instrumental record, and the strong tree-ring signals, are evident.

--> These considerations do not affect the best estimate that recent warmth is greater than that of a millennium ago; the central estimate from proxy data of latter-twentieth-century warmth is still above that of a millennium ago, with greater spatial coherence recently in the signal.

--> These considerations do somewhat affect the confidence that can be attached to the best estimate of recent warmth versus that of a millennium ago. If the paleoclimatic data could be confidently be interpreted as paleotemperatures, then joining the paleoclimatic and instrumental records would be appropriate, and the recent warmth would clearly be anomalous over the last millennium and beyond. By demonstrating that some tree-ring series chosen for temperature sensitivity are not fully reflecting temperature changes, the divergence issue widens the error bars and so reduces confidence in the comparison between recent and earlier warmth.

--Richard

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: drdendro@ldgo.columbia.edu, Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: NRC study
Date: Mon, 13 Mar 2006 16:29:34 -0700

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Hi Ed and Keith - I hate to say it, but Richard's take on the political aspects of the NRC vs. IPCC reports seem worth some extra effort. Since you were both invited to speak with the NRC committee, I would suggest that you both (together or separately) submit formal comments asap. I don't know when the comment period starts or ends, but I'm guessing you have to work fast. I'm also thinking that you two might want to get out a peer-reviewed paper on the topic really soon too. I worry that the hole will continue to deepen for dendroclimate if you two don't act to clarify what we know/don't know, and when it is safe (and why) to use dendroclimate data to address the issue of long-term variation in temperature.

Please don't construe my suggestions or comments as pro/con dendro, but rather just as someone who wants the truth - whatever it is - to be communicated clearly, and as best we know it. But, I do think that if Richard is suspect, dendro has a real problem. He doesn't have a personal bias in this, and is clearly trying harder than most to understand what's really going on with climate and the proxies.

Effort now might save time later.

Also, are you both going to be at the Swiss mtg in June? We really have to get this all ironed out better before the next (last) draft of the IPCC AR4.

Thanks, Peck

--

Jonathan T. Overpeck
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Professor, Department of Atmospheric Sciences

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: edwardcook <drdendro@ldgo.columbia.edu>
Subject: Re: NRC study

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Date: Tue, 14 Mar 2006 00:32:37 -0700

Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

Hi Ed - thanks for trying to fit something in quick for the NRC group. I'm not sure about Richard's full motives, but I think he has his heart in the right place - that the NRC Committee might have gotten the impression he did, and this will be reflected in their report, perhaps in a way that is even less satisfactory to you and Keith. And, this report will likely have enormous political potential. It needs to get things as right as possible from the start. So... time well spent on the part of you and Keith. Thanks much, peck

Hi Peck,

Being in Bangkok, on to PACLIM, on to CONCORD in Mendoza, back to Bangkok, and back to NY on May 1 makes it difficult for me to do much, but I will do what I can to salvage a bad situation. The longish emails I sent out to you all contain much of what I would write. The main point to make, one that Richard seems to be totally oblivious to, is that there is no evidence for loss of sensitivity prior to the 20th century in a large-scale NH sense like that seen in the 20th century. On the other hand, there is evidence that there was not a loss of sensitivity in a large-scale NH sense in my QSR paper (Fig. 6). I acknowledge the weakness in the data prior to about 1200, but even so the regional comparisons only show divergence between north and south in the 20th century, with none indicated during the putative MWP. So why is Richard and the NRC panel apparently stating without evidence that divergence probably is a problem in the past and, therefore, tree rings cannot be trusted to reconstruct past temperatures? It is honestly unscientific when the only evidence that I have seen refutes that premise, and it plays unfairly into McIntyre's hand. I almost admit to being very irritated that Richard should anoint himself as the arbitrator of this debate. He knows nothing substantive about tree rings. In that sense, he is just like Ray Bradley.

Cheers,

Ed

On Mar 14, 2006, at 6:29 AM, Jonathan Overpeck wrote:

Hi Ed and Keith - I hate to say it, but Richard's take on the political aspects of the NRC vs. IPCC reports seem worth some extra effort. Since you were both invited to speak with the NRC committee, I would suggest that you both (together or separately) submit formal comments asap. I don't know when the comment period starts or ends, but

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Also, are you both going to be at the Swiss mtg in June? We really have to get this all ironed out better before the next (last) draft of the IPCC AR4.

Thanks, Peck

--

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References

- 1. <http://www.geo.arizona.edu/>
- 2. <http://www.ispe.arizona.edu/>

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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: edwardcook <drdendro@ideo.columbia.edu>
Subject: Re: NRC Committee on Surface Temperature Reconstructions
Date: Tue, 14 Mar 2006 21:29:28 -0700
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>

Hi Ed (and Keith) - this looks good. For what it's worth, here are some comments:

- 1. I agree Keith should send in an independent letter by email too (I'd put both on letterhead or at least include as pdf attachments, so email forwarding wouldn't have the chance of messing it up) .
- 2. I would say right up front - first line that you'd like your letter (s) to go to all committee members, if possible with a cc to you. Don't leave any wriggle room.
- 3. cc to G. North and B. Otto-Bliesner - again, so there is no doubt that this gets to everyone
- 4. no need to mention IPCC. Focus on the science and the NRC review. Don't want to introduce extra politics.

Thanks both for doing this - I agree there is a real need to ensure that the panel has the science from the experts.

Best, peck

Hi everyone,
Here is a draft of what I want to quickly send to Ian Kraucunas, Ph.D.
Board on Atmospheric Sciences and Climate
National Research Council of The National Academies
500 Fifth Street NW, Keck 705
Washington, DC 20001
Email: ikraucunas@nas.edu
Phone: (202) 334-2546
Fax: (202) 334-3825
He originally invited me to talk before the NRC. I do not have any other

information on who to send it too. Please let me know what you think, but don't be too pedantic or critical at this stage. I get the feeling we have very little time to make an impact on the NRC committee and its report. I personally think that I am correct as far as I can take the argument. Let me know if I should send this on to Richard as well.

Ed
Dear Ian,
I have heard via emails and telephone conversations about some rather serious developments that could have an unfairly negative impact on the use of tree rings for reconstructing past climate and the upcoming IPCC assessment, especially that related to surface temperatures. Apparently as part of her talk Rosanne D'Arrigo mentioned the phenomenon of "divergence" between instrumental temperatures and tree growth in the latter few decades of the 20th century. The large-scale nature of this phenomenon was first described in Nature by Keith Briffa back in 1998 (Briffa et al., 1998) and to this day its cause is not well understood at all. A number of hypotheses have been mentioned, which range from natural (climatic change) to anthropogenic (i.e. pollution related), but the actual cause is still unknown.

Somewhat alarmingly, it is my impression now that the NRC committee members and other influential participants of the meeting have come to the conclusion that the observed 20th century "divergence" calls into serious question the value of the tree-ring reconstructions of temperatures over the past millennium. The implicit assumption being made is that the "divergence" is being caused by climatic change related to 20th century warming, conditions that could have also prevailed back during the Medieval Warm Period (MWP) some 800-1000 years in the past. If this were the case, then the concerns of the committee would be justified. However, the available evidence does not support such a conclusion. In a paper I published in Quaternary Science Reviews in 2004 (Cook et al., 2004), I reviewed the properties and interpretation of the tree-ring data used in the Esper et al. (2002) paper published in Science. The reasonably well distributed set of tree-ring data in both boreal and more temperate latitude sites around the Northern Hemisphere allowed me to split up the data into sub-regional ensembles, including 8 sites in the 55-70° north band and 6 sites in the 30-55° south band. The purpose was to show the overall robustness of the multi-centennial temperature signal in the tree-ring data. This plot from the QSR paper is attached below as is the paper itself. In his 1998 paper, Briffa showed that the divergence was largely restricted to the region covered by the north band described in Cook et al. (2004). Consistent with that

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finding, the north ensemble mean shown below reveals a serious downturn in growth after about 1950. This is an expression of the "divergence" that has been described first by Briffa and also by D'Arrigo in her NRC talk. In contrast, the south ensemble mean shows the opposite, i.e. a substantial growth increase which is much more consistent with 20th century warming. If one then follows the plots back in time, all of the sub-region ensemble means track each other remarkably well at multi-centennial time scales even when they enter the putative MWP 800-1000 years ago. In fact, at no time prior to the 20th century is there separation between north and south that is remotely comparable to that found after ca. 1950. This result suggests that no large-scale "divergence" of the order found during the 20th century occurred during the MWP even though that period is suggested to have been somewhat warmer than average overall. This result clearly refutes the argument that "divergence" of the kind noted in the 20th century happened in the past. It also suggests a unique anthropogenic cause to the 20th century divergence.

I am not aware of ANY evidence that demonstrates the occurrence of large-scale "divergence" in the past. It is therefore unjustified to call into question the use of tree rings for reconstructing temperatures over the past millennium based on a naive extrapolation of growth "divergence" into the past when it appears to be unique to the 20th century. The NRC committee members must be made aware of this if their report is to have the necessary scientific credibility that is expected of it.

Sincerely,
Edward R. Cook

References

Briffa, K.R., Schweingruber, F.H., Jones, P.D., Osborn, T.J., Shiyatov, S.G., Vaganov, E.A. 1998. Reduced sensitivity of recent tree-growth to temperature at high northern latitudes. *Nature* 391: 678-682.
Esper, J., Cook, E.R., Schweingruber, F.H. 2002. Low-frequency signals in long tree-ring chronologies for reconstructing past temperature variability. *Science* 295: 2250-2253.
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?
?

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Ian Kraucunas, Ph.D.

mail.2006

Board on Atmospheric Sciences and Climate
National Research Council of The National Academies
500 Fifth Street NW, Keck 705
Washington, DC 20001
Email: [1]ikraucunas@nas.edu
Phone: (202) 334-2546
Fax: (202) 334-3825

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References

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Cook, E.R., Esper, J., D'Arrigo, R.D. 2004. Extra-tropical Northern Hemisphere land temperature variability over the past 1000 years. Quaternary Science Reviews 23(20-22): 2063-2074.

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Attachment converted: Macintosh HD:Cook_QSR_Fig6.gif (GIF/«IC») (0011FEF5)

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References

1. <mailto:ikraucunas@nas.edu>

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From: Tim Osborn <t.osborn@uea.ac.uk>
To: oyvind.paasche@geo.uib.no, Eystein Jansen <Eystein.Jansen@geo.uib.no>
Subject: Re: Fwd: Re: Fwd: Ch06 Figure Check
Date: Wed, 15 Mar 2006 16:16:25 +0000
Cc: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>

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Here's the next one

Dear Oyvind,

sorry for the delay, I've been off work for a couple of days due to unexpected family illness.

here are the EPS format figures. I'll send in separate emails due to

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their size. I've tried to number them correctly according to the new numbering, though please open them to check they look ok.

One thing to note is that I have separate files for the two panels of the MWP box figure, and also the forcings/models figure is also in two files. They are all labelled appropriately, with the panel part in the filename, so I hope this is no problem!?

You should get these files:

ipccar4_fig6.10.eps
ipccar4_fig6.11.eps
ipccar4_fig6.12.eps
ipccar4_fig6.13abcd.eps & ipccar4_fig6.13e.eps
ipccar4_box6.4_fig1a.eps & ipccar4_box6.4_fig1b.eps

Please let me know if they don't all arrive!

Cheers

Tim

At 09:00 08/03/2006, Eystein Jansen wrote:

>Dear Tim and Bette,
>first I wish to thank you again for your particularly outstanding
>and hard work for the SOD. Your work in particular really has made
>the new draft a lot better than the FOD.
>There is one small remaining issue, however, as noted by the TSU in
>the message posted below. We need high res version, i.e. eps. files
>of your figures. At present we only have the ones sent in word files.
>Could you send the eps. files to us and Øyvind asap so we can get
>the whole delivery uploaded in a finished state to the TSU server.
>Best wishes,
>Eystein

>
>
>

>>Envelope-to: eystein.jansen@geo.uib.no
>>Date: Tue, 07 Mar 2006 19:00:19 -0700
>>From: IPCC-WG1 <ipcc-wg1@al.noaa.gov>
>>To: Jonathan Overpeck <jto@u.arizona.edu>, eystein.jansen@geo.uib.no
>>Subject: Ch06 Figure Check
>>X-checked-clean: by exiscan on noralf
>>X-UiB-SpamFlag: NO UIB: 0 hits, 8.0 required
>>X-UiB-SpamReport: spamassassin found;

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>>

>>Greetings Peck and Eystein!

>>

>>I have gone through the Chapter 6 figure files submitted to the ftp
>>site. Problems with any of the Chapter 6 figures are noted in the
>>attached spreadsheet. Luckily, none of your figures need revision
>>prior to the SOD.

>>

>>However, you will need to provide the TSU with information about
>>the spacing of figures... i.e. one or two columns. Please input
>>that information into the attached spreadsheet and forward that
>>information to the TSU as soon as possible.

>>

>>Another small item: some of your figures were submitted as .pdf
>>files rather than in .eps format. Please note that these files will
>>need to be resubmitted as .eps files in the near future. Although
>>replacing these figures is not urgent, I wanted to let you know now

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>>since I know how long it can take to generate high-resolution
>>images. When you do resubmit these files, please be sure to send an
>>email to the TSU to let us know to check the ftp site.

>>
>>If you have any questions, please let me know. Thanks!

>>Regards, Kristen

>>
>>+++++
>>Kristen Averyt, Ph.D.
>>Project Scientist
>>Intergovernmental Panel on Climate Change
>>Working Group I TSU
>>325 Broadway SDRC CSD08
>>Boulder, CO 80305 USA
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>>Tel: 1.303.497.4885
>>Fax: 1.303.497.5686
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>Professor/Director
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>Dep. of Earth Science, Univ. of Bergen
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>N-5007 Bergen
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>e-mail: eystein.jansen@geo.uib.no
>Phone: +47-55-583491 - Home: +47-55-910661
>Fax: +47-55-584330

>#Attachment converted: øyvind:Ch06_Figure_Check.xls (XLS8/XCEL) (003D0E85)

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>N-5007, Bergen
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School of Environmental Sciences, University of East Anglia
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sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm
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From: edwardcook <drdendro@ldeo.columbia.edu>
To: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: Fwd: Comment on NRC Workshop
Date: wed, 15 Mar 2006 19:33:48 +0700
Cc: edwardcook <drdendro@ldeo.columbia.edu>

Hi Gents, Here is what I just sent off to NRC, cc'd to Gerry North and Bette Otto-Bliesner.

Ed Begin forwarded message: > From: edwardcook > Date: March 15, 2006 7:23:23 PM GMT+07:00

> To: "Kraucunas, Ian" > Cc: edwardcook , g-north@tamu.edu, > ottobli@ucar.edu > Subject:

Comment on NRC Workshop > > Ian Kraucunas, Ph.D. > Board on Atmospheric Sciences and

mail.2006

Climate > National Research Council of The National Academies > 500 Fifth Street
NW, Keck
705 > Washington, DC 20001 > > Dear Dr. Kraucunas, > > I request that this
document (also
attached as Cook_NRC.pdf) and > the attached scientific paper (2001_Cook_QSR.pdf)
be
forwarded to > all NRC committee members who participated in the recent NRC >
workshop
"Surface Temperature Reconstructions for the Past 2,000 > Years: Synthesis of
Current
Understanding and Challenges for the > Future", ideally with a cc to me when this
is done.
I have heard > via emails and telephone conversations about a serious concern >
raised
about tree rings by some committee members and invited > participants at the NRC
workshop.
This concern could have an > unfairly negative impact on the use of tree rings
for >
reconstructing past climate, especially that related to surface air >
temperatures, hence
my letter to you and the committee. As part of > her talk, Dr. Rosanne D'Arrigo
mentioned
the discovery of > "divergence" between instrumental temperatures and tree growth
> during
the last few decades of the 20th century at selected boreal > sites in the
Northern
Hemisphere. The affected trees > systematically under-responded to increasing
temperatures,
i.e. > they grew more slowly than they should have based on a well-fitted >
linear response
model applied to the data prior to the onset of > "divergence". The large-scale
occurrence
of this change in > responsiveness has also been described by Keith Briffa
(Briffa et >
al., 1998) in Nature. A number of hypotheses have been proposed to > explain it,
which
range from natural (climatic change) to > anthropogenic (pollution related), but
the actual
cause is still > unknown. This phenomenon needed to be mentioned by Dr. D'Arrigo,
> but it
appears to have taken on a level of specious importance that > is not justified
by the
evidence. > > Perhaps not surprisingly, but also somewhat alarmingly, it is my >
understanding that some NRC committee members and other influential >
participants have
come to the conclusion that the observed 20th > century "divergence" calls into
serious
question the value of the > tree-ring reconstructions of temperatures over the
past >
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"divergence" being
caused by environmental conditions in the > 20th century could have also
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 overall robustness of the multi- > centennial temperature signal in the tree-ring data.
 This plot > from the QSR paper is embedded below and the paper is sent being > sent as an
 attachment. The importance of this plot to the > "divergence" debate follows next. > > In
 their paper, Briffa et al. (1998) showed that the "divergence" > between tree growth and
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 Cook et al. (2004). > Consistent with that finding, the north ensemble mean shown below >
 (blue curve) reveals a serious downturn in growth after about > 1950. This is an expression of
 the large-scale "divergence" > described by Briffa et al. (1998) and also by Dr.
 D'Arrigo in her > NRC talk. In contrast, the south ensemble mean (red curve) shows > the
 opposite growth trajectory after 1950, i.e. a substantial > growth increase that is much
 more consistent with 20th century > warming. If one then follows the plots back in
 time, all sub- > region ensemble means track each other remarkably well at multi- >
 centennial time scales even when they enter the putative MWP > 800-1000 years ago. In fact, at no
 time prior to the 20th century > is there a separation between north and south that is
 at all > comparable to that found after 1950. This result indicates that no > large-scale
 "divergence" of the order found during the 20th century > occurred during the MWP
 even though that period is suggested to > have been somewhat warmer than average
 overall. It thus refutes > the argument that "divergence" of the kind found in the 20th >
 century could very well have happened in the past, thus implying > that tree rings cannot
 produce reliable reconstructions of past > temperatures. It also supports the existence
 of an admittedly > unknown anthropogenic cause of the 20th century "divergence". The >
 lack of any known cause is unfortunate, but this would be true > regardless of how the
 importance of "divergence" is interpreted. > > I am not aware of ANY evidence that
 demonstrates the occurrence of > large-scale "divergence" between tree growth and climate prior to
 > the 20th century. Indeed, the available evidence indicates just > the opposite. In my
 opinion it is therefore unjustified to call > into question the use of tree rings for
 reconstructing temperatures > over the past millennium based on a naÃve and
 inappropriate > extrapolation of the growth "divergence" problem into the past when > it
 appears to be unique to the 20th century. The NRC committee > members must consider this in

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their report

if it is to have the > necessary scientific credibility that is expected of it. >
>

References > > Briffa, K.R., Schweingruber, F.H., Jones, P.D., Osborn, T.J., >
Shiyatov,

S.G., Vaganov, E.A. 1998. Reduced sensitivity of recent > tree-growth to
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high northern latitudes. Nature 391: > 678-682. > > Esper, J., Cook, E.R.,
Schweingruber,

F.H. 2002. Low-frequency > signals in long tree-ring chronologies for
reconstructing past >

temperature variability. Science 295: 2250-2253. > > Cook, E.R., Esper, J.,
D'Arrigo, R.D.

2004. Extra-tropical Northern > Hemisphere land temperature variability over the
past 1000

years. > Quaternary Science Reviews 23(20-22): 2063-2074. > > Sincerely, > >
Edward R. Cook

> > ===== > Dr. Edward R. Cook > Doherty Senior
Scholar and >

Director, Tree-Ring Laboratory > Lamont-Doherty Earth Observatory > Palisades,
New York

10964 USA > Email: drdendro@ldeo.columbia.edu > Phone: 845-365-8618 > Fax:
845-365-8152 >

===== > ï¿¼ ï¿¼ ï¿¼ Hi Gents,

Here is what I just sent off to NRC, cc'd to Gerry North and Bette Otto-Bliesner.

Ed
Begin forwarded message:

From: edwardcook <[1]drdendro@ldeo.columbia.edu>

Date: March 15, 2006 7:23:23 PM GMT+07:00

To: "Kraucunas, Ian" <[2]IKraucunas@nas.edu>

Cc: edwardcook <[3]drdendro@ldeo.columbia.edu>, [4]g-north@tamu.edu,
[5]ottobli@ucar.edu

Subject: Comment on NRC Workshop

Ian Kraucunas, Ph.D.

Board on Atmospheric Sciences and Climate

National Research Council of The National Academies

500 Fifth Street NW, Keck 705

Washington, DC 20001

Dear Dr. Kraucunas,

I request that this document (also attached as Cook_NRC.pdf) and the attached
scientific

paper (2001_Cook_QSR.pdf) be forwarded to all NRC committee members who
participated in the

recent NRC workshop "Surface Temperature Reconstructions for the Past 2,000
Years:

Synthesis of Current Understanding and Challenges for the Future", ideally with a
cc to me

when this is done. I have heard via emails and telephone conversations about a
serious

mail.2006

concern raised about tree rings by some committee members and invited participants at the NRC workshop. This concern could have an unfairly negative impact on the use of tree rings for reconstructing past climate, especially that related to surface air temperatures, hence my letter to you and the committee. As part of her talk, Dr. Rosanne D'Arrigo mentioned the discovery of "divergence" between instrumental temperatures and tree growth during the last few decades of the 20th century at selected boreal sites in the Northern Hemisphere. The affected trees systematically under-responded to increasing temperatures, i.e. they grew more slowly than they should have based on a well-fitted linear response model applied to the data prior to the onset of "divergence". The large-scale occurrence of this change in responsiveness has also been described by Keith Briffa (Briffa et al., 1998) in Nature. A number of hypotheses have been proposed to explain it, which range from natural (climatic change) to anthropogenic (pollution related), but the actual cause is still unknown. This phenomenon needed to be mentioned by Dr. D'Arrigo, but it appears to have taken on a level of specious importance that is not justified by the evidence.

Perhaps not surprisingly, but also somewhat alarmingly, it is my understanding that some NRC committee members and other influential participants have come to the conclusion that the observed 20th century "divergence" calls into serious question the value of the tree-ring reconstructions of temperatures over the past millennium. The implicit assumption apparently being made is that the "divergence" being caused by environmental conditions in the 20th century could have also prevailed back during times like the Medieval Warm Period (MWP) some 800-1000 years in the past. If this were the case, then the concern raised by some at the workshop would be justified. However, the available evidence does not support such a conclusion. In a paper I published in Quaternary Science Reviews in 2004 (Cook et al., 2004), I reviewed the properties and interpretation of the tree-ring data used in the Esper et al. (2002) paper published in Science. The reasonably well distributed set of tree-ring data in both boreal and more temperate latitude sites around the Northern Hemisphere allowed me to split up the data into sub-regional ensembles, including 8 sites in the 55-70° north band and 6 sites in the 30-55° south band. The purpose was to demonstrate the overall robustness of the multi-centennial temperature signal in the tree-ring data. This plot from the QSR paper is embedded below and the paper is sent being sent as an attachment. The importance of this plot to the "divergence" debate follows next.

In their paper, Briffa et al. (1998) showed that the "divergence" between tree growth and temperatures was largely restricted to the region covered by the north band described in Cook et al. (2004). Consistent with that finding, the north ensemble mean shown below (blue curve) reveals a serious downturn in growth after about 1950. This is an expression of the large-scale "divergence" described by Briffa et al. (1998) and also by Dr. D'Arrigo in her NRC talk. In contrast, the south ensemble mean (red curve) shows the opposite growth trajectory after 1950, i.e. a substantial growth increase that is much more consistent with 20th century warming. If one then follows the plots back in time, all sub-region ensemble means track each other remarkably well at multi-centennial time scales even when they enter the putative MWP 800-1000 years ago. In fact, at no time prior to the 20th century is there a separation between north and south that is at all comparable to that found after 1950. This result indicates that no large-scale "divergence" of the order found during the 20th century occurred during the MWP even though that period is suggested to have been somewhat warmer than average overall. It thus refutes the argument that "divergence" of the kind found in the 20th century could very well have happened in the past, thus implying that tree rings cannot produce reliable reconstructions of past temperatures. It also supports the existence of an admittedly unknown anthropogenic cause of the 20th century "divergence". The lack of any known cause is unfortunate, but this would be true regardless of how the importance of "divergence" is interpreted.

I am not aware of ANY evidence that demonstrates the occurrence of large-scale "divergence" between tree growth and climate prior to the 20th century. Indeed, the available evidence indicates just the opposite. In my opinion it is therefore unjustified to call into question the use of tree rings for reconstructing temperatures over the past millennium based on a naïve and inappropriate extrapolation of the growth "divergence" problem into the past when it appears to be unique to the 20th century. The NRC committee members must consider this in their report if it is to have the necessary scientific credibility that is expected of it.

References

Briffa, K.R., Schweingruber, F.H., Jones, P.D., Osborn, T.J., Shiyatov, S.G., Vaganov, E.A.
1998. Reduced sensitivity of recent tree-growth to temperature at high northern latitudes.
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Esper, J., Cook, E.R., Schweingruber, F.H. 2002. Low-frequency signals in long tree-ring

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Cook, E.R., Esper, J., D'Arrigo, R.D. 2004. Extra-tropical Northern Hemisphere land temperature variability over the past 1000 years. Quaternary Science Reviews 23(20-22): 2063-2074.

Sincerely,

Edward R. Cook

=====

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Email: [6]drdendro@ldeo.columbia.edu
Phone: 845-365-8618
Fax: 845-365-8152

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Attachment Converted: "c:\eudora\attach\Cook_NRC.pdf"

Attachment Converted: "c:\eudora\attach\Cook_QSR_Fig61.gif"

References

1. mailto:drdendro@ldeo.columbia.edu
2. mailto:IKraucunas@nas.edu
3. mailto:drdendro@ldeo.columbia.edu
4. mailto:g-north@tamu.edu
5. mailto:ottobli@ucar.edu
6. mailto:drdendro@ldeo.columbia.edu

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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Martin Manning <mmanning@al.noaa.gov>
Subject: SUPER URGENT IPCC help needed
Date: Thu, 23 Mar 2006 13:17:44 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk, Eystein Jansen <eystein.jansen@geo.uib.no>, <oyvind.paasche@bjerknes.uib.no>, Bette Otto-Bleisner <ottobli@ncar.ucar.edu>, Melinda Marquis <Marquis@ucar.edu>, averyt@ucar.edu, ssolomon@al.noaa.gov

Sounds good Martin. Keith, Tim - are you out there? Please help by ensuring we're doing the right thing w Fig 6.13 and table 6.2

Hi Peck
Thanks for the provisional "go ahead" - we can (and so will) wait till Monday before changing the master copy of the chapter here.

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Regards
Martin

At 11:16 AM 3/23/2006, Jonathan Overpeck wrote:

Hi Martin - this seems ok to me. I hope we hear from Tim and Keith - they are the key folks on this one. If we don't hear from them, then we go with what you have done. Seems quite reasonable to me, and I'm sorry we caused the TSU this extra work. Thanks again, Peck

X-Sieve: CMU Sieve 2.2

Date: Wed, 22 Mar 2006 19:11:36 -0700

To: Jonathan Overpeck <jto@u.arizona.edu>,
Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk,
Eystein Jansen <eystein.jansen@geo.uib.no>,
<oyvind.paasche@bjerknes.uib.no>,
Bette Otto-Bleisner <ottobli@ncar.ucar.edu>,
Melinda Marquis <Marquis@ucar.edu>

From: Martin Manning <mmanning@al.noaa.gov>

Subject: Re: SUPER URGENT IPCC help needed

Cc: ssolomon@al.noaa.gov, averyt@ucar.edu

Dear Jonathan

Thanks for trying to sort this out quickly for us and for the information that the

Ammann et al paper is not available.

Susan and I have discussed your two options and have to say that we can not agree to

option 1 in the circumstances. Although the Jones and Mann (2004) paper shows the NCAR

simulation, the key point is that it cites it as "C. Ammann et al private communication

2003". So in effect option 1 would be bringing in material that was not peer reviewed

and not even separately documented. Anyone wanting to discredit your chapter would

highlight the fact that you appear to be depending on work done in 2003 that had still

not been peer-reviewed.

Option 2 is the only way to meet the standard that we have set all along of basing the

assessment very firmly on peer reviewed literature.

Kristen Averyt found that she could edit the EPS files that you had sent us earlier for

Fig 6.13 and take out the curves in question labelled AJS2006. The result is attached.

If you can confirm that this edited figure looks correct we are now proposing to drop

that into your chapter in place of the original one. We would also remove the [S4] row

in Table 6.2 referring to this study. We would also of course use the edited version of

the figure in the TS (Fig TS-26 in current draft).

If you can see any other implications of this approach to resolving the problem that we

need to be aware of please let me know. If the author team wants to provide a redrawn

figure that might be an improvement on the attached version we can still wait until

Monday morning for that.

Best regards

Martin

At 04:25 PM 3/22/2006, Jonathan Overpeck wrote:

Page 330

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Hi Keith and Tim - need FAST help. Figure 6.13, and Table 6.2 cite Amman et al., for the CSM curve. Since this paper doesn't yet exist in "in press" form (I checked w/ Bette, who is a co-author), we have two choices. I think choice one below could be ok, but want to have confirmation from Keith or Tim, and if it's not ok, (NOTE) Tim and Keith need to get new Fig and Table to Melinda and Martin at the TSU by Monday.

Option 1: we can cite Jones, P.D., and M.E. Mann, 2004: Climate over past millennia. Reviews of Geophysics, 42(2) - this paper (already in references - there is hope!) has the CSM simulation in its Fig 8, but of course it's not the idea original reference describing the simulation.

Option 2: we (Tim) creates new fig 6.13, and Table 6.2 without any reference to this simulation.

PLEASE NOTE - if Keith and Tim (or Martin) feels we must go w/ option 2, Tim has to send the new fig and table to TSU (Melinda Marguis and Martin) by Monday AM at the absolute latest.

Thanks for your quick help, Peck

--

Jonathan T. Overpeck
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Professor, Department of Geosciences
Professor, Department of Atmospheric Sciences
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<http://www.ispe.arizona.edu/>

--

Recommended Email address: mmanning@al.noaa.gov
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Dr Martin R Manning, Director, IPCC WG I Support Unit
NOAA Aeronomy Laboratory Phone: +1 303 497 4479
325 Broadway, DSRC R/AL8 Fax: +1 303 497 5628
Boulder, CO 80305, USA

--

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Boulder, CO 80305, USA

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#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Martin Manning <mmanning@al.noaa.gov>, Jonathan Overpeck
<jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen
<eystein.jansen@geo.uib.no>, <oyvind.paasche@bjerknes.uib.no>, Bette Otto-Bleisner
<ottobli@ncar.ucar.edu>, Melinda Marquis <Marquis@ucar.edu>
Subject: Re: SUPER URGENT IPCC help needed
Date: Fri, 24 Mar 2006 14:16:19 +0000
Cc: ssolomon@al.noaa.gov, averyt@ucar.edu

<x-flowed>
Dear all,

we (Keith and I) agree that it isn't appropriate to cite only Jones and Mann (2004) as a reference for the NCAR CSM curves in figure 6.13.

Another alternative to deleting the curves, however, would be to reference Mann, Rutherford, Wahl and Ammann (2005), which should already be in the reference list. This might be an appropriate reference because it includes Ammann as a co-author and provides a more information about the simulation than Jones and Mann (2004). However it still relies upon the submitted Ammann et al. paper as the main reference -- so maybe still not good enough? I've attached a PDF of Mann et al. (2005) for you to consider.

From earlier discussions (and perhaps also in relation to chapters using new model runs of future climate), I thought that a new unpublished run with an existing published model under published forcing might be allowed (in the same way that updated 2005 or 2006 instrumental temperatures could be included, even if not published, providing they were compiled following the procedures described in an earlier paper). For instance, the EMIC runs we included as an extra

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panel probably fall in this category. Maybe the CSM run falls in this category too? Have other runs with this model been published? And the forcing used in this run was presented in Goosse et al. (2005; GRL 32, L06710, again it includes Ammann as a co-author) as well as in Jones and Mann (2004). So, maybe CSM can be included under this reasoning?

I don't want to sound as if we are arguing strenuously to keep the CSM curves in the figure -- if the preferred decision is to drop it, then so be it. If so, then the modified figure looks ok.

Cheers

Tim

At 02:11 23/03/2006, Martin Manning wrote:

>Dear Jonathan

>

>Thanks for trying to sort this out quickly for us and for the information that the Ammann et al paper is not available.

>

>Susan and I have discussed your two options and have to say that we can not agree to option 1 in the circumstances. Although the Jones and Mann (2004) paper shows the NCAR simulation, the key point is that it cites it as "C. Ammann et al private communication 2003". So in effect option 1 would be bringing in material that was not peer reviewed and not even separately documented. Anyone wanting to discredit your chapter would highlight the fact that you appear to be depending on work done in 2003 that had still not been peer-reviewed.

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>If you can see any other implications of this approach to resolving the problem that we need to be aware of please let me know. If the author team wants to provide a redrawn figure that might be an improvement on the attached version we can still wait until Monday morning for that.

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>Best regards

>Martin

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>At 04:25 PM 3/22/2006, Jonathan Overpeck wrote:

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>>Option 1: we can cite Jones, P.D., and M.E. Mann, 2004: Climate over past millennia. Reviews of Geophysics, 42(2) - this paper

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>>(already in references - there is hope!) has the CSM simulation in
>>its Fig 8, but of course it's not the idea original reference
>>describing the simulation.

>>
>>Option 2: we (Tim) creates new fig 6.13, and Table 6.2 without any
>>reference to this simulation.

>>
>>PLEASE NOTE - if Keith and Tim (or Martin) feels we must go w/
>>option 2, Tim has to send the new fig and table to TSU (Melinda
>>Marguis and Martin) by Monday AM at the absolute latest.

>>
>>Thanks for your quick help, Peck

>>
>>
>>--

>>
>>Jonathan T. Overpeck
>>Director, Institute for the Study of Planet Earth
>>Professor, Department of Geosciences
>>Professor, Department of Atmospheric Sciences

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>>fax: +1 520 792-8795<http://www.geo.arizona.edu/>
>><http://www.ispe.arizona.edu/>

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>--
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>** Please note that problems may occur with my @noaa.gov address
>Dr Martin R Manning, Director, IPCC WG I Support Unit
>NOAA Aeronomy Laboratory Phone: +1 303 497 4479
>325 Broadway, DSRC R/AL8 Fax: +1 303 497 5628
>Boulder, CO 80305, USA

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e-mail: t.osborn@uea.ac.uk
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sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
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#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: "Gustafson, Diane" <DGustafs@nas.edu>
Subject: Re: Proxy time series

mail.2006

Date: Wed, 29 Mar 2006 14:36:50 +0100
Cc: Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Dear Diane / Mike / NRC Committee,

At 22:18 28/03/2006, Gustafson, Diane wrote:

>Dear Tim:

>

>Our National Research Council Committee on Surface Temperature
>Reconstructions has been considering your paper with Keith Briffa
>published in a recent issue of Science. Could you please elaborate
>on your criterion for selecting the proxy time series included in
>the analysis. We are interested in how you computed the correlation
>between the proxy time series and local temperature time series. Is
>the correlation based on filtered or detrended time series? How
>would you counter the potential criticism that your selection method
>tends to favor proxy time series that show a strong 20th century warming?

>

>It would be most helpful for us if you could reply in time for us to
>consider your response at our meeting tomorrow morning. Thanks in
>advance for your help.

>

>Mike wallace

We (Tim Osborn and Keith Briffa) will first respond to these specific questions about our recent Science paper. In addition, copied below are some further comments by Keith Briffa on issues related to tree-ring proxy records, that may be of interest to the committee.

The primary purpose of our paper was to implement an alternative, and possibly complementary, method of proxy-data analysis to the methods used in most previously published reconstructions of past NH temperature variations. We did not want to introduce an entirely new selection of proxy records (even if this were possible), because that would obscure whether differences in our conclusions, compared with published work, arose from our method or a different selection of proxy records.

We decided, therefore, to make use of as many of the individual records used in almost all the previously published NH temperature reconstructions, excluding any records for which an indication of at least partial temperature sensitivity was lacking. So, very low resolution records for which comparison with instrumental temperatures is problematic were excluded.

We used records specifically from Mann and Jones (2003) and Esper et al. (2002). In addition we included records from Mann et al. (2003), which I think just adds the van Engelen documentary record from the Low Countries in Europe, because the others were already in the Mann and Jones set. We excluded duplicates, and our paper explains which series we used where duplicates were present. We did not average the Tornetrask, Yamal and Taimyr tree-ring records as done by Mann and Jones, because we could see no reason not to use them as individual series.

The series used by Mann and Jones had already been correlated with their local instrumental temperatures -- using decadal-smoothed, non-detrended, values -- so we accepted this as an indication of some temperature sensitivity. For the other series, we calculated our own correlations against local instrumental temperatures, trying both annual-mean or summer-mean temperatures. In our paper's supplementary information, we state that we used the HadCRUT2 temperatures for this purpose, which combines land air temperatures

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with SST observations. In fact, we used the CRUTEM2 land-only temperature data set for this purpose. These should be identical where the proxy locations are not coastal. For these correlations, we did not filter the data, nor did we detrend it, and we used the *full* period of overlap between the proxy record and the available instrumental record.

We excluded records that did not show a *positive* correlation with their local temperatures. The remaining set includes most of the long, high resolution records used by others, such as Moberg et al., Crowley and Lowery, Hegerl et al., Mann, Bradley and Hughes, etc. as well as by Mann and Jones and Esper et al.

The final question, regarding the selection method favouring records that show a strong 20th century warming trend, is a more philosophical issue. As stated above, we did not actually use strongly selective criteria, preferring to use those records that others had previously used and only eliminating those that were clearly lacking in temperature sensitivity. To some extent, therefore, the question is then directed towards the studies whose selection of data we used. Certainly we did not look through a whole host of possibilities and just pick those with a strong upward trend in the last century! And we don't think the scientists whose work we selected from would have done this either. There are very few series to choose from that are >500 years long and are from proxy types/locations where temperature sensitivity might be expected. It would be entirely the wrong impression to think that there are 140 such a priori suitable possible series, and that we picked (either explicitly or implicitly) just those 10% that happened by chance to exhibit upward 20th century trends.

The correlation with local temperature is an entirely appropriate factor to consider when selecting data; these could be computed using detrended data, though for those that we calculated, our use of unfiltered data means that the trend is unlikely to dominate the correlation. One would need to inspect the trend in the temperature data at each location to evaluate how much influence it would have on the results; but in locations where a strong upward trend is present, it would be right to exclude proxy records that did not reproduce it, though also correct that a proxy shouldn't be included solely on the basis of it having the trend, especially where the proxy resolution is sufficient to test its ability to capture shorter term fluctuations.

Finally, note that our method has not selected only those records with a strong 20th century warming trend. Of the 14 proxies selected (see our figure 1), 7(!) do not have strong upward 20th century trends: Quebec, Chesapeake Bay, W Greenland, Tirol, Tornetrask, Mangazeya, and Taimyr. Our method gives equal weight to all records, so it should not be biased towards a single record, or a small number of records, that do show strong upward trends.

Here are the additional comments on tree-ring issues:

I would also like to take the opportunity, if you will allow, to comment briefly on some reports that have reached me concerning the contribution made by Rosanne D'Arrigo to your Committee. Apparently, this is being interpreted by some as reflecting adversely on the validity of numerous temperature reconstructions that involve significant dependence on tree-ring data. This is related to Rosanne's focus in her presentation on the apparent difference between measured temperatures and tree growth in recent decades - a so-called "divergence" problem.

First let me make it clear that as I did not attend the Committee

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meeting I am not able to comment specifically on the details of Rosanne D'Arrigo's actual presentation, though I am aware of her papers with various co-authors related to this "divergence" in the recent (circa post 1970) trends in tree-growth and temperature changes as recorded in instrumental data, at near tree-line sites in the Canadian Arctic. There are also other papers dealing with 'changing growth responses' to climate in North American trees.

I have co-authored a paper in Nature on the reduced response to warming as seen in tree-ring densitometric data at high-latitude sites around the Northern Hemisphere, increasingly apparent in the last 30 years or so.

First, it is important to note that the phenomena is complicated because it is not clearly identifiable as a ubiquitous problem. Rather it is a mix of possible regionally distinct indications, a possible mix of phenomena that is almost certainly in part due to the methodological aspects of the way tree-ring series are produced. This applies to my own work, but also very likely to other work.

The implications at this stage for the 'hockey stick' and other reconstructions are not great. That is because virtually all long tree-ring reconstructions that contribute to the various reconstructions, are NOT affected by this. Most show good coherence with temperature at local levels in recent decades. This is not true for one series (based on the density data). As these are our data, I am able to say that initial unpublished work will show that the "problem" can be mitigated with the use of new, and again unpublished, chronology construction methods.

In the case of the work by Rosanne and colleagues, I offer my educated opinion that the phenomenon they describe is likely also, at least in part, a chronology construction issue. I am not saying that this is a full explanation, and certainly there is the possibility of increased moisture stress on these trees, but at present the issue is still being defined and explored. As the issue needs more work, this is only an opinion, and until there is peer-reviewed and published evidence as to the degree of methodological uncertainty , it is not appropriate to criticize this or other work . For my part, I have been very busy, lately with teaching and IPCC commitments, but we will do some work on this now, though again lack of funds to support a research assistant do not help.

The matter is important but I do not believe that the facts yet support Rosanne's contention, in her Global Biogeochemical Cycles paper (Vol. 18, GB3021, doi:10.1029/2004GB002249, 2004) that an optimum physiological threshold has been consistently exceeded at a site in the Yukon. This conclusion should certainly not be taken as indicating a widespread threshold exceedence.

It was my call not to "overplay" the importance of the divergence issue, knowing the subtlety of the issues, in the forthcoming IPCC Chapter 6 draft. We did always intend to have a brief section about the assumption of uniformitarianism in proxy interpretation , including mention of the possible direct carbon dioxide fertilization effect on tree growth (equally controversial), but it is likely to conclude that here as well , there is no strong evidence of any major real-world effect. This and the divergence problem are not well defined, sufficiently studied, or quantified to be worthy of too much concern at this point. The uncertainty estimates we calibrate when interpreting many tree-ring series will likely incorporate the possibility of some bias in our estimates of past warmth, but these

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are wide anyway. This does not mean that temperatures were necessarily at the upper extreme of the reconstruction uncertainty range 1000 years ago, any more than they may have been at the bottom. The real problem is a lack of widespread (and non-terrestrial) proxies for defining the level of early warmth, and the vital need to up-date and study the responses of proxies in very recent times.

Best regards,

Tim Osborn and Keith Briffa

--
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web: <http://www.cru.uea.ac.uk/~timo/>
sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

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679. 1143753480.txt

#####

From: Eduardo Zorita <Eduardo.Zorita@gkss.de>
To: t.osborn@uea.ac.uk (Tim Osborn)
Subject: Re: Response to Wahl et al in Science
Date: Thu, 30 Mar 2006 16:18:00 +0200 (MET DST)
Cc: Eduardo.Zorita@gkss.de, k.briffa@uea.ac.uk

Tim,

yes, I also found it strange. We noticed that Amman and Wahl cited their Science comment as accepted in their manuscript that is now in press in Climatic Change.

Personally I think it is convenient that this clarification gets published but I am somewhat disapointed by the fact that a very similar content was submitted by Buerger and Cubasch about one year ago and it was not even sent to reviewers (it is the paper that finally appeared in Tellus). I think that comment was of much higher quality than wahl's.

Science knew of the Tellus paper, since we cite it in our response. So actually

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there is scientifically nothing new in this exchange, but it will be published in Science...

Anyway, I am happy to have more time now for more productive work and hope that Ritson
doe not bomb me with more mails in the future

eduardo

> Thanks for letting us know, Eduardo. It is strange that Science
> accepted the wahl et al. comment before yours; we were told of this
> on 28-Feb and that is why you will notice, if you get to see the
> latest IPCC draft, that wahl et al. is cited but your response is not
> cited! This will look strange, given that they will be published
> together. Maybe it can be changed later?

> Cheers

> Tim

> At 11:31 29/03/2006, Eduardo Zorita wrote:

> >Dear Tim,

> >

> >the comment by wahl, Ritson and Amman and our response have been now
> >accepted for

> >publication in Science

> >

> >eduardo

> Dr Timothy J Osborn

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> web: <http://www.cru.uea.ac.uk/~timo/>

> sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

>

680. 1143819006.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>

To: "Brooks Hanson" <bhanson@aaaas.org>

Subject: Re: data request to SCIENCE for 1120514

Date: Fri, 31 Mar 2006 10:30:06 +0100

Cc: "Jesse Smith" <hjsmith@aaaas.org>, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Dear Brooks Hanson,

of the two additional questions/requests, the first one is quick to
respond to and so I can do that immediately.

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In fact my previous reply answers the first question already, as does our paper itself in a very clear way. It is something of a waste of time, therefore, to have to write another answer, but here goes anyway...

We clearly state (in the SOM to our paper) what the data sources were, and Esper et al. was not the source for the four series in question. There is, therefore, no need for anyone to "surmise" that this is the case, because we explicitly state it!

Further, we state in our paragraph (d) that we replaced Athabasca with a new, "better-replicated series" from Luckman and Wilson. "Better-replicated" clearly indicates that there are more data in the new series than were available to Esper et al., as is also clear from even a cursory read of the Luckman and Wilson paper. So it should be obvious that you cannot expect to reproduce the results using the fuller data set by using only the more limited data available from Esper et al. -- otherwise what would be the point of going out and collecting all that new data?

The other three series are covered in our paragraph (c), "The data sets contain some non-identical tree-ring series derived from the same sites; we have favoured series from (S3) because they are based on a greater number of tree core measurements than the series generated by (S1)". So we clearly did not use the Esper et al. data (S1) and it should also be clear that the series we did use can not be reproduced using the Esper et al. data because they are "non-identical" and there are fewer tree cores in the Esper et al. data. The source we gave for these three series is Briffa (2000).

We did not use tree-core measurement data in our paper, only chronologies that had previously been assembled by others from core measurement data. I don't have any core measurement data and therefore have none to give out! And in my first reply I explained why I didn't think that this was appropriate anyway, since I consider that our obligation is limited to providing data to allow the replication of the steps reported in our paper, none of which involved any processing of core measurement data.

I will reply next week regarding the second question/request.

Best regards

Tim

At 20:35 30/03/2006, Brooks Hanson wrote:

> Dear Dr. Osborn:

>

>Thank you for your assistance in resolving the request for data for
>your recent paper. I have passed along the relevant information you
>have provided (I assure you not your email). In response, i've received
>two additional questions. I'm wondering if it would be possible to
>clarify these.

>

>In 4 cases, the Osborn site chronology differs from the Esper site
>chronology, although in the other cases the versions are identical. In
>some cases, the date ranges do not match. I do not believe that it is
>possible to replicate the Osborn version from the Esper measurement data
>in these 4 cases and surmise that Osborn used a different measurement
>data set. I therefore request measurement data used by Osborn for the
>following sites: Polar Urals, Tornetrask, Taymir and Athabaska.

>

>The HadCRU2 data set contains temperature data for the gridcell 37.5N,

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>117.5W commencing in 1870. However, the gridcell information provided
>by Osborn commenced only in 1888 and the differences are material to
>the final result (0.045 versus 0.18 reported). What is the reason for
>commencing this comparison in 1888 rather than the available 1870? Since
>there is a material difference in this example, could you please provide
>the gridcell temperature sets in a comparable format for the other 13
>Osborn and Briffa series
>
>I appreciate that the latter request may take some additional effort as
>you noted. I'm hopeful that this will provide a resolution to this
>matter.
>
>Sincerely,
>Brooks Hanson

Dr Timothy J Osborn
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681. 1144427398.txt

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From: Rainer Zahn <rainer.zahn@uab.es>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>, "k.briffa-uea.ac.uk"
<k.briffa@uea.ac.uk>
Subject: Re:
Date: Fri, 07 Apr 2006 12:29:58 +0200

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At 18:17 03/04/2006, you wrote:

>Hi Rainer, we drafted a complaint, which Keith Briffa still sits on, and
>I don't think it will be sent. Some of our partners, e.g. Hadley Centre,
>MPI and CNRS were reluctant as they thought complaining might backfire.
>If there was foul play, we had no proof of it. We did some checks with
>commission representatives, but did not learn much. I think the problem
>was that the review panel was biased against us, and that the commission
>did not follow up with instructions that was coherent with their own policies.
>
>Best wishes,
>Eystein

Hi Eystein,

not sure if I comprehend the mentality of not sending a statement, keeping
a low profile I do not perceive a good strategy. I am mentioning this as I
have become increasingly weary of FWP programmes and proposals. Over the
past four years I was involved in 4 initiatives none of which came through.
Beyond the immediate frustration on the basis of the individual failures I
do note in all these instances is an unfavourable degree of ambiguity in
the reviewing process such that it appears the reviewers are being kept in
the dark about the vision of the call beyond what the call says in
printing. I can see the challenge from the programme managerial side that

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one wishes not to interfere with the reviewing progress and yet I feel that the reviews offered, perhaps the reviewing process at large, do not live up to the standards set for proposals. Quite frankly, from my few conversations I had with the programme managers and their assistants I have come to the conclusion that they are helpful in providing assistance with logistics and proposal structuring, yet on a managerial front they are not up to speed with what I would perceive professionalism in handling their tasks. So to me it seems there are various levels involved in the issue that in the end mount to the impression that FWPs are not an immediate option for proposals much longer. This view is shared by quite a number of colleagues and it is for this reason that I am convince we must respond to the Imprint failing.

If Keith doesn't mind perhaps forward the statement so I can glance through it.

Best, Rainer

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682. 1145388731.txt

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: Henry Pollack <hpollack@umich.edu>
Subject: Re: IPCC FAR draft
Date: Tue, 18 Apr 2006 15:32:11 -0600
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk

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Hi Henry - thanks for the email. Just earlier today, Eystein and I were soliciting approval from our team on how to best get feedback from chapter authors - Lead Authors and Contributing Authors alike. Since we're all authors, it isn't appropriate to comment officially as expert reviewers, but rather to work as a team to take expert reviews - AND chapter 6 author feedback - and use them to create a better finalo draft. One key, as promised earlier, is to have a process that makes sure we get all comments and are able to respond to them. The other key is that we ensure time to allow the needed debate. Eystein and I are going to ask LAS (including Keith) to do there work sooner in the draft cycle than before so that we have the time for this.

So... I would suggest you keep these comments in a safe place for a bit longer, and then send them in to the Eystein and I when we ask (should be in the next week). Note that the current draft has only officially been available for a bit over a week (indeed, I didn't see it until today since the IPCC TSU had to check for all sorts of things after we submitted it over a month ago), and we won't be working on the new draft until June. So we have time to be thoughtful and complete in the feedback gathering process.

Is this ok? Seems more suitable than giving

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review via the gov process on your own work (you are an author of our chapter).

Also, I can anticipate one thing that is going to come up again, and that I don't think we had your feedback on (nor Keith's). What about the borehole recons that you and colleagues have done extending back beyond the last couple centuries. I don't have my paper pdf collection here, but I believe you have some recons going back many centuries. Does this need more attention in the chapter?

Thanks for being proactive and quick to send feedback. We'll be sending our email to all CA's soon, if you're willing to wait a couple more days.

Thanks, peck

>Hi Keith (and Peck and Eystein),

>

>I have recently been sent the current draft of the IPCC FAR by the US
>Global Change Research Program, asking for comments on the draft. This
>is the first time I have seen this product since we were feverishly
>exchanging e-mails in February. Let me call to your attention some
>small but not insignificant corrections to be made to the next draft.

>

>Page 6-33, Section 6.6.1.2, line 22. The title of this section (in
>italics) should be changed to "What do ground surface temperature
>reconstructions derived from subsurface temperature measurements tell
>us?"

>

>Page 6-33, lines 49 and 52, there is a reference (Smerdon et al., in press).
>This paper has now been published, so substitute "2006" for "in press",
>and in the list of references the citation should include the following:

>

>J. Geophys. Res. 111, D07101, doi:10.1029/2004JD005578

>

>Page 6-34, lines 43 and 44. This section is dealing with the southern
>hemisphere. The sentence "...these both indicate unusually warm
>conditions prevailing in the 20th century (Pollack and Smerdon, 2004)"
>, and the reference therein, are both incorrect.

>

>The ground surface temperature changes over the last 500 years DO NOT
>indicate unusually warm conditions prevailing in the 20th century in
>Australia and southern Africa. This is because the unusually warm
>conditions developed late in the century, after most of the boreholes
>had already been logged. What the borehole reconstruction for
>Australia does show is very good correspondence with the Cook et al
>(2000) reconstruction for Tasmania and the Cook et al. (2002) recon for
>New Zealand. The Australia work is described in a manuscript "Five
>centuries of Climate Change in Australia: The View from Underground" by
>Pollack, Huang and Smerdon now under review in the Journal of
>Quaternary Science. The Africa work is unpublished.

>

>Is this e-mail to you sufficient to activate these changes? Or should I
>submit these comments to the US Government Review Panel? If I am to
>submit to the latter, they require all comments to be filed by May 9.

>

>Cheers,

>Henry

>

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>
>
> [\ /] Henry N. Pollack
> | \ / | Professor of Geophysics
> | MICHIGAN | Department of Geological Sciences
> [] \ / [] University of Michigan
> [] \ / [] Ann Arbor, Michigan 48109-1005, U.S.A.
>
> Phone: 734-763-0084 FAX: 734-763-4690
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> URL: www-personal.umich.edu/~hpollack/book.html

--
Jonathan T. Overpeck
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683. 1146062963.txt

#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: Fwd: Re: Ruherford et al 2005
Date: Wed, 26 Apr 2006 10:49:23 -0400
Reply-to: mann@psu.edu
Cc: Scott Rutherford <srutherford@rwu.edu>, Keith Briffa <k.briffa@uea.ac.uk>, Phil Jones <p.jones@uea.ac.uk>

<x-flowed>
thanks Tim,

I'm saddened to hear that this bozo is bothering you too, in addition to NCAR, NSF, NAS, IPCC and everyone else. Rest assured that I won't ever respond to McIntyre should he ever contact me, but I will forward you any email he sends related to this. I assume Scott feels the same way...

I hope you're having as nice a spring as we are here. See you in June?

mike

p.s. we have some interesting new reconstruction based on RegEM using a greatly expanded multiproxy network (which includes the MXD data). I hope to send you guys shortly. It is our hope that you'll consider being co-authors. This to come soon...

Tim Osborn wrote:

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> Hi Scott and Mike,
>
> as lead author and co-author on the Rutherford et al. paper, I thought
> I'd let you know that we are dealing with some requests for the MXD
> data set used in this paper, including the one copied below from
> McIntyre. We should have got this organised a bit quicker but we will
> (eventually!) get the data and its description available for
> interested parties. So if you get any more requests for the MXD data
> that were used in our joint paper, please pass them on to me.

> Hope everything's well with you,

> Tim

>> Date: wed, 26 Apr 2006 15:08:39 +0100
>> To: "Steve McIntyre" <stephen.mcintyre@utoronto.ca>
>> From: Tim Osborn <t.osborn@uea.ac.uk>
>> Subject: Re: Rutherford et al 2005
>> Cc: "Andrew Weaver" <jclim@uvic.ca>, Keith Briffa <k.briffa@uea.ac.uk>

>> Dear Steve,

>> I have just finished responding to Science about your latest request
>> to them concerning our recent paper, so I can now turn to your
>> request copied below.

>> I can answer your first request immediately:

>> The MXD data used in Rutherford et al. were *derived* from the
>> Schweingruber network, but aren't actually the raw site-by-site data
>> values. The reason why we didn't use the latter is that the
>> site-by-site MXD chronologies have only been processed using a
>> "traditional" approach to standardization that removes low-frequency
>> climate variations. Our age-band decomposition approach (Briffa et
>> al., 2001, JGR), which retains more low-frequency variability, had
>> only been applied at the regional-average level. So we gridded the
>> site-by-site chronologies onto a 5x5 grid and added to each grid box
>> the "missing" regional-scale low-frequency information identified by
>> comparing the age-band and traditionally-standardized results at a
>> regional scale.

>> I will respond with information and/or data to your requests (2)-(4)
>> soon.

>> Regards

>> Tim

>> At 19:37 18/04/2006, Steve McIntyre wrote:

>>> Dear Tim, I presume that the sites used in the MXD network in
>>> Rutherford et al., Journal of Climate 2005 came from the
>>> Schweingruber network. Could you provide me with (1) confirmation as
>>> to whether this is the case; (2) identification of the sites; (3)
>>> the protocol for site selection from the larger Schweingruber
>>> network; (4) a URL for any data or dataversions not available in the
>>> Schweingruber network at WDCP. Regards, Steve McIntyre

> Dr Timothy J Osborn
> Climatic Research Unit

mail.2006

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>

--
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University Park, PA 16802-5013

<http://www.met.psu.edu/dept/faculty/mann.htm>

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684. 1146252894.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: t.m.melvin@uea.ac.uk
Subject: Fwd: Re: Standardisation uncertainty for tree-ring series
Date: Fri Apr 28 15:34:54 2006

X-Mailer: QUALCOMM Windows Eudora Version 7.0.0.16
Date: Fri, 28 Apr 2006 15:08:05 +0100
To: philip.brohan@metoffice.gov.uk
From: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: Standardisation uncertainty for tree-ring series
Cc: Keith Briffa <k.briffa@uea.ac.uk>, simon.tett@metoffice.gov.uk

Hi Philip,
we have three "groups" of trees:
"SCAND" (which includes the Tornetrask and Finland multi-millennial
chronologies, but
also some shorter chronologies from the same region). These trees fall mainly
within
the 3 boxes centred at:
17.5E, 67.5N
22.5E, 67.5N
27.5E, 67.5N
"URALS" (which includes the Yamal and Polar Urals long chronologies, plus other
shorter
ones). These fall mainly within these 3 boxes:
52.5E, 67.5N
62.5E, 62.5N (note this is the only one not at 67.5N)
67.5E, 67.5N
"TAIMYR" (which includes the Taimyr long chronology, plus other shorter ones).
These
fall mainly within these 4 boxes:
87.5E, 67.5N
102.5E, 67.5N

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112.5E, 67.5N

122.5E, 67.5N

We do some analysis at the group scale, and for this we take the JJA temperatures from each box and average to the group scale to obtain a single series from each of SCAND,

URALS and TAIMY.

We do some analysis at the overall scale, and for this we take these three group

temperature series and average them to get an overall NW Eurasia temperature for boxes

with tree chronologies in them.

We did also try using a wider average for the region, including all LAND temperatures

from grid boxes within a rectangular region from 12.5E to 127.5E and from 57.5N to

72.5N, but I don't think it correlated so well against the tree-ring width data (I can't

remember the exact correlations), so we didn't pursue that.

Does that give you enough information to be going on with? I'd recommend using CRUTEM3

rather than HadCRUT3, because the correlations seem to deteriorate with the inclusion of

SST data in some cases -- though of course you can look into this yourself.

Cheers

Tim

At 16:35 27/04/2006, philip.brohan@metoffice.gov.uk wrote:

Thanks Tim.

I need to extract from the instrumental and model data the appropriate data to calibrate the tree-rings against. Presumably this is the June-July-August average land surface temperature for a particular region in NW Eurasia. Could you send me the lat and long ranges of the region?

Cheers,

Philip

On Thu, 2006-04-27 at 16:01, Tim Osborn wrote:

> Thanks for the nice precise description of methodology, Philip. It's
> good that we are all clear exactly what procedure is to be applied.

>

> On the train after our meeting last week, Keith and I discussed this
> a bit more. In the NW Eurasian case study, n is quite high and
> therefore it is likely that the bootstrap estimates will show
> relatively little variation and probably will underestimate the true
> error (due to additional errors in the assumptions underlying RCS, as
> discussed in London). We will do the calculations anyway, and then
> we will know for sure how large/small they are, rather than just speculating.

>

> It looks likely that Tom Melvin will have time to devote directly to
> this issue as he will probably be funded by our (that includes you,
> Simon) NERC RAPID project for a while. Once/if this is confirmed,
> then we'll get Tom to do the calculations outlined below and
> communicate directly with Philip over any implementation issues etc.

>

> Cheers

>

> Tim

>

> At 16:02 26/04/2006, philip.brohan@metoffice.gov.uk wrote:

> >Keith, Tim.

> >

> > At our meeting last wednesday I agreed to specify exactly what needed
> >to be done to make uncertainty estimates for standardisation of the

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> >tree-ring data.
> >
> > Suppose we are making a proxy series from n cores. From those n cores
> >we can make an RCS age correction curve, and a mean proxy series (the
> >average of the cores after applying the age correction curve to each
> >one?). These are the best-estimate values for the age-correction curve
> >and the proxy series.
> >
> > We also need bootstrap estimates of the age correction curve and the
> >mean proxy series. To make a bootstrap estimate: sample, with
> >replacement, from the n cores until you have a set of n samples. (Some
> >of the cores will be in this sample once, some several times, and some
> >not at all). From this set of n samples, make an age correction curve
> >and a mean proxy series as before. These are the bootstrap estimates.
> >
> > we need a lot of bootstrap estimates. I'd like 1000 - 100 will probably
> >do at a pinch. So please can you make these and send me the 1001 age
> >correction curves and 1001 mean proxy series.
> >
> > I will do something similar with the instrumental series, and we can
> >then make bootstrap estimates of the regression uncertainty and the
> >uncertainty in the reconstructed temperatures.
> >
> >Cheers,
> >
> > Philip
> >
> >--
> >Philip Brohan, Climate Scientist
> >Met Office Hadley Centre for Climate Prediction and Research
> >Tel: +44 (0)1392 884574 Fax: +44 (0)1392 885681
> >Global climate data sets are available from [1]<http://www.hadobs.org>
> >
> >Dr Timothy J Osborn
> >Climatic Research Unit
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> >web: [2]<http://www.cru.uea.ac.uk/~timo/>
> >sunclock: [3]<http://www.cru.uea.ac.uk/~timo/sunclock.htm>

--
Philip Brohan, Climate Scientist
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Global climate data sets are available from [4]<http://www.hadobs.org>

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web: [5]<http://www.cru.uea.ac.uk/~timo/>
sunclock: [6]<http://www.cru.uea.ac.uk/~timo/sunclock.htm>

--
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[7]http://www.cru.uea.ac.uk/cru/people/briffa/

References

1. <http://www.hadobs.org/>
2. <http://www.cru.uea.ac.uk/~timo/>
3. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
4. <http://www.hadobs.org/>
5. <http://www.cru.uea.ac.uk/~timo/>
6. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
7. <http://www.cru.uea.ac.uk/cru/people/briffa/>

685. 1146713460.txt

#####

From: Eduardo Zorita <Eduardo.Zorita@gkss.de>
 To: t.osborn@uea.ac.uk (Tim Osborn), k.briffa@uea.ac.uk (Keith Briffa)
 Subject: Wengen meeting
 Date: Wed, 03 May 2006 23:31:00 +0200 (MET DST)

Dear Tim, dear Keith,

I am writing to inform you that I have reconsidered my acceptance to attend the wengen meeting. In the last days I have convinced myself that under the present circumstances a constructive discussion on reconstruction methods is unfortunately not possible. We have another exchange on the last Journal of Climate paper by Mann et al, which is now under review. Even the editor of J. of Climate found adequate to tell us that all inflammatory comments in their response would have to be eventually deleted. Even considering the considerable pressure that he has is exposed to in American politics, I think Michael Mann is unable of any constructive discussion.

I am very grateful for your invitation to this meeting and I hope that we can continue our collaboration in other ocasion.

Best wishes

eduardo

686. 1147435800.txt

#####

From: <mann@meteo.psu.edu>
 To: Tim Osborn <t.osborn@uea.ac.uk>, Keith Briffa <k.briffa@uea.ac.uk>, "Phil Jones" <p.jones@uea.ac.uk>, "Michael E. Mann" <mann@psu.edu>, Scott Rutherford <srutherford@rwu.edu>
 Subject: Re: FW: Ruherford et al 2005
 Date: Fri, 12 May 2006 8:10:00 -0600

hi tim. personally, I don't see why you should make any concessions for this moron. By the way, our supplementary site (now on scott's computer) doesn't block any ip#s.

another lie.. Mike

-----Original Message-----

From: Tim Osborn <t.osborn@uea.ac.uk>
Subj: FW: Rutherford et al 2005
Date: Fri May 12, 2006 8:10 am
Size: 4K
To: Keith Briffa <k.briffa@uea.ac.uk>, "Phil Jones" <p.jones@uea.ac.uk>,
"Michael E. Mann" <mann@psu.edu>, Scott Rutherford <srutherford@rwu.edu>

Thought you might be interested in the following. I *am* going to provide the list of MXD sites requested, but honestly haven't had time to put it together this his request. Clearly the 2-week delay was too long for him! Still, at least I'm not (yet) described as "juvenile"! :-)

Tim

>From: "Steve McIntyre" <stephen.mcintyre@utoronto.ca>
>To: "Andrew Weaver" <jclim@uvic.ca>
>Cc: "Tim Osborn" <t.osborn@uea.ac.uk>
>Subject: FW: Rutherford et al 2005
>Date: Fri, 12 May 2006 09:54:37 -0400
>
>Dear Andrew,
>Rutherford et al 2005 states that supplementary information is available at
><http://fox.rwu.edu/~rutherford/supplements/jclim2003a>.
>
>First, in passing, Scott Rutherford has blocked the IP address of the
>computer that I regularly use from access to that site (I had previously
>been blocked from Mann's FTP site.) while I have been able to have someone
>else send me the data, I'm sure that such petty behavior is inconsistent
>with Journal of Climate access policies and I request that you ask your
>authors to stop such juvenile behavior insofar as it affects the Journal of
>Climate.
>
>Second, the referenced website does NOT contain the MXD data, but only
>includes a link to "Ask Tim Osborn". As you can see from the attached
>correspondence, Osborn has undertaken to provide the requested information,
>but the article certainly implies - and I am sure that that this was your
>understanding as editor - that the data would be readily available. In this
>case, even a simple listing of the sites has not been provided after nearly
>2 weeks. (I might add that I initially requested a listing of the sites from
>a coauthor nearly 2 years ago.)
>
>In order to comply with the apparent undertakings of Rutherford et al, I
>think that you should arrange for a less ad hoc method of providing the
>supplementary information.
>
>Regards,
>
>Steve McIntyre
>
>
>
>
>
>-----Original Message-----
>From: Tim Osborn [mailto:t.osborn@uea.ac.uk]
>Sent: April 26, 2006 10:09 AM
>To: Steve McIntyre
>Cc: Andrew Weaver; Keith Briffa

mail.2006

>Subject: Re: Rutherford et al 2005

>

>

>Dear Steve,

>

>I have just finished responding to Science about your latest request
>to them concerning our recent paper, so I can now turn to your
>request copied below.

>

>I can answer your first request immediately:

>

>The MXD data used in Rutherford et al. were *derived* from the
>Schweingruber network, but aren't actually the raw site-by-site data
>values. The reason why we didn't use the latter is that the
>site-by-site MXD chronologies have only been processed using a
>"traditional" approach to standardization that removes low-frequency
>climate variations. Our age-band decomposition approach (Briffa et
>al., 2001, JGR), which retains more low-frequency variability, had
>only been applied at the regional-average level. So we gridded the
>site-by-site chronologies onto a 5x5 grid and added to each grid box
>the "missing" regional-scale low-frequency information identified by
>comparing the age-band and traditionally-standardized results at a
>regional scale.

>

>I will respond with information and/or data to your requests (2)-(4) soon.

>

>Regards

>

>Tim

>

>At 19:37 18/04/2006, Steve McIntyre wrote:

> >Dear Tim, I presume that the sites used in the MXD network in
> >Rutherford et al., Journal of Climate 2005 came from the
> >Schweingruber network. Could you provide me with (1) confirmation as
> >to whether this is the case; (2) identification of the sites; (3)
> >the protocol for site selection from the larger Schweingruber
> >network; (4) a URL for any data or dataversions not available in the
> >Schweingruber network at WDCP. Regards, Steve McIntyre

>

>Dr Timothy J Osborn
>Climatic Research Unit
>School of Environmental Sciences, University of East Anglia
>Norwich NR4 7TJ, UK

>

>e-mail: t.osborn@uea.ac.uk
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687. 1147982305.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: "Neil Roberts" <C.N.Roberts@plymouth.ac.uk>
Subject: Re: ipcc chapter 6 draft
Date: Thu, 18 May 2006 15:58:25 -0600
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Hi Neil - Thanks for your interest in providing feedback on the draft chap 6 Second Order Draft. Since the IPCC has very strict rules about all this, I'm going to ask them (the IPCC) to send you an official invitation to review, along with the process - formal, but highly efficient - to follow. If you could send your comments in that way it would be a great help. We've been asked to keep everything squeaky clean, and not to get comments informally.

Thanks! Peck

>Dear Jonathan

>

>Please excuse me for writing direct, but Keith Briffa suggested it >would be simplest. I have looked through the draft chapter 6 and >find it an impressive document. However, bullet 4 on page 6.2, >starting "global mean cooling and warming....." strikes me as >incorrect and misleading.

>

>whereas the mean rate of temperature change over the Pleistocene may >have been >10 times slower than that projected for the next century, >there is clear evidence that for specific major climatic >transitions, global (or at least hemispheric) temperature changes in >the past have been at least as rapid as those projected by climate >model simulations and incorporated in the last IPCC report. The >most obvious case in point is the global warming at the start of the >Holocene, ca. 11.5 ka BP. Russell Coope, more than 20 years ago, >showed from beetles that UK temperatures rose faster than could be >dated within the errors of 14C dating. Subsequently this was >confirmed by Greenland ice cores based on layer counting (full >glacial to interglacial in less than 100 years), and by the Cariacos >basin marine record. I have worked on varved lake records from both >the tropics (Roberts et al Nature 1993 366, 146-148) and the >Mediterranean (Roberts et al The Holocene, 2001, 11, 719-734) where >this climate transition was accomplished in substantially less than >a century. In short, several independent lines of evidence show >that the climate system has been capable of flipping from one >meta-stable state to another, very different one over timescales >that could be experienced by a single human lifetime. This is not >an unimportant conclusion in terms of the potential for non-linear >responses of future climate to GHG forcing.

>

>I also looked for supporting argument for bullet 4 later in chapter >6, but found nothing of substance.

>

>In short, this particular bullet seems in need of critical >reassessment before the definitive version of the next IPCC report >emerges.

>

>Thanks in anticipation and best regards

>

>Neil

--

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Professor, Department of Atmospheric Sciences

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<http://www.ispe.arizona.edu/>
</x-flowed>

688. 1148266730.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: "Wahl, Eugene R" <wahl@alfred.edu>
Subject: RE: Wahl & Amman paper
Date: Sun, 21 May 2006 22:58:50 -0600
Cc: "Bette Otto-Bleisner" <ottobli@ncar.ucar.edu>, "Eystein Jansen" <eystein.jansen@geo.uib.no>, "Caspar Ammann" <ammann@ucar.edu>, t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Hi Gene - thanks for the update. If Tim/Keith/Caspar want to add anything (or Martin ask for more clarification), please cc to the entire list on this email. Sounds like the UCAR version is the one to consider "official" (right everyone?).

Thanks again, Peck

>Hello Peck, Martin, Bette, Eystein, Caspar:

>

>I just double checked the UCAR website version with the pdf version
>I have, and they are identical with the exception that the
>supplemental tables (Tables 1S and 2S), and supplemental figure
>caption and figure (Figure 1S) are placed at the very end of the
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>include updated versions of unpublished papers as well. If you have
>any thoughts on that please let me know.

>
> Best regards
> Martin

>
> --
> Recommended Email address: mmanning@al.noaa.gov
> ** Please note that problems may occur with my @noaa.gov address
> Dr Martin R Manning, Director, IPCC WG I Support Unit
> NOAA Aeronomy Laboratory Phone: +1 303 497 4479
> 325 Broadway, DSRC R/CSD8 Fax: +1 303 497 5628
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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Caspar Ammann <ammann@ucar.edu>
Subject: Re: Wahl & Amman paper

mail.2006

Date: Mon, 22 May 2006 07:58:44 -0600

Cc: "Bette Otto-Bleisner" <ottobli@ncar.ucar.edu>, "Eystein Jansen" <eystein.jansen@geo.uib.no>, "Wahl, Eugene R" <wahl@alfred.edu>, Martin Manning <mmanning@al.noaa.gov>, t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Thanks all who have commented. Below is the likely final word unless Martin needs more clarification. Seem ok, Martin? Sorry for the confusion. Guess some reviewers are running out of substantive issues, so that might be a sign that we're getting close to the final draft...

Best, Peck

From Caspar:

>Dear all, yes the UCAR version can be considered the "official" one.
>I changed the order of pages because I needed to separate the
>"primary content" of the paper from its "supplement"; thus I moved
>tables XS, figure 1S and its caption to the end. Everything else is
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"the differences are as I understand , insubstantial and not pertinent to the interpretation used in preparing the draft."

and Gene:

>

>Wahl, Eugene R wrote:

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>>acceptance from Stephen Schneider at Climatic Change came on
>>February 28. The article is still in this status.

>> Let me know if I can help clarify things futher. Please note that
>>I will be in Boulder starting May 27, to be a visiting scholar at
>>NCAR for a month. I will be keeping up with email from there.

>> Peace, Gene Dr. Eugene R. Wahl

>>Asst. Professor of Environmental Studies

>>Alfred University

>> 607-871-2604

>>1 Saxon Drive

mail.2006

>>Alfred, NY 14802 _____

>>

>>From: Jonathan Overpeck [mailto:jto@u.arizona.edu]

>>Sent: Sat 5/20/2006 8:39 PM

>>To: Martin Manning

>>Cc: Bette Otto-Bleisner; Eystein Jansen; Caspar Ammann; Wahl, Eugene R

>>Subject: Re: Wahl & Amman paper

>>

>>Hi Martin - we'll look into this asap. I'll cc to Caspar and Gene
>>to see if they can clarify the situation and make sure we have the
>>correct version. I'll also cc Bette since she may see Caspar around
>>NCAR and make sure he know's we are trying to clarify things with
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>>

>>More soon, thx, Peck

>>

>>

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>>

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>>of the Wahl and Amman paper (accepted by Climatic Change) on our
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>>]

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>>any thoughts on that please let me know.

>>

>> Best regards

>> Martin

>>

>>

>>

>>

>> --
>> Recommended Email address: mmanning@al.noaa.gov

>> ** Please note that problems may occur with my @noaa.gov address

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>> NOAA Aeronomy Laboratory Phone: +1 303 497 4479

>> 325 Broadway, DSRC R/CSD8 Fax: +1 303 497 5628

>> Boulder, CO 80305, USA

>>

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>
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>Climate and Global Dynamics Division - Paleoclimatology
>1850 Table Mesa Drive
>Boulder, CO 80307-3000
>email: ammann@ucar.edu tel: 303-497-1705 fax: 303-497-1348

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</x-flowed>

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#####

From: Martin Manning <mmanning@al.noaa.gov>
To: Jonathan Overpeck <jto@u.arizona.edu>, Caspar Ammann <ammann@ucar.edu>
Subject: Re: wahl & Amman paper
Date: Mon, 22 May 2006 10:18:44 -0600
Cc: "Bette Otto-Bleisner" <ottobli@ncar.ucar.edu>, "Eystein Jansen"
<eystein.jansen@geo.uib.no>, "Wahl, Eugene R" <wahl@alfred.edu>,
t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>

Dear Peck et al
Thanks for clearing this up. The bottom line is that the version of this paper on the UCAR site is fine. Unfortunately though, the one we have on the IPCC WG1 web site is not!
I am attaching a copy of that for clarity. The metadata in this PDF file indicate that it was created by Oyvind Paasche from a word document in early March when we were asking the chapter teams to provide copies of the unpublished literature. It seems that Oyvind worked from an earlier and significantly shorter version - less text, fewer tables and the figures are different - as you can see in the attached. Although to repeat my earlier statement the conclusions of this earlier draft do not appear to me to be substantially different.
Based on what we now know, the TSU should add the NCAR version of the paper to our review web site and we will do that today.
Thanks

mail.2006

Martin

At 07:58 AM 5/22/2006, Jonathan Overpeck wrote:

Thanks all who have commented. Below is the likely final word unless Martin needs more clarification. Seem ok, Martin? Sorry for the confusion. Guess some reviewers are running out of substantive issues, so that might be a sign that we're getting close to the final draft...
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mail.2006

Peace, Gene Dr. Eugene R. Wahl
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Martin

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Boulder, CO 80305, USA

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Climate and Global Dynamics Division - Paleoclimatology
1850 Table Mesa Drive
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email: ammann@ucar.edu tel: 303-497-1705 fax: 303-497-1348

--

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Boulder, CO 80305, USA
Attachment Converted: "c:\documents and settings\tim osborn\my
documents\eudora\attach\Wahl_&_Ammann.pdf"

References

1. mailto:jto@u.arizona.edu
2. http://www.cgd.ucar.edu/ccr/ammann/millennium/refs/WahlAmmann_ClimaticChange_inPress.pdf
3. http://www.cgd.ucar.edu/ccr/ammann/millennium/refs/WahlAmmann_ClimaticChange_inPress.pdf
4. http://www.geo.arizona.edu/
5. http://www.ispe.arizona.edu/

691. 1148339153.txt

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From: "Wahl, Eugene R" <wahl@alfred.edu>
To: "Martin Manning" <mmanning@al.noaa.gov>, "Jonathan Overpeck" <jto@u.arizona.edu>, "Caspar Ammann" <ammann@ucar.edu>
Subject: RE: Wahl & Amman paper -- NCAR pdf is correct version
Date: Mon, 22 May 2006 19:05:53 -0400
Cc: "Bette Otto-Bleisner" <ottobli@ncar.ucar.edu>, "Eystein Jansen" <eystein.jansen@geo.uib.no>, <t.osborn@uea.ac.uk>, "Keith Briffa" <k.briffa@uea.ac.uk>

Hello all:

Yes, Martin, the paper you sent today is indeed an old version, and should be
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replaced by
the NCAR pdf version.

This old version sent today is actually older than the Feb 21 version I mentioned yesterday (see below), and has no relevance in terms of the text that is accepted/in press with Climatic Change as of February 28, 2006.

As I mentioned yesterday (see below), the text of the UCAR pdf is identical to the WORD version I sent to Peck, Keith, and Eyestein on February 24.

Peace, Gene

Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

From: Wahl, Eugene R
Sent: Monday, May 22, 2006 6:49 PM
To: Wahl, Eugene R
Subject: Sent by Martin Manning -- Wahl & Amman paper --with old version

From: Martin Manning [mailto:mmanning@al.noaa.gov]
Sent: Monday, May 22, 2006 12:19 PM
To: Jonathan Overpeck; Caspar Ammann
Cc: Bette Otto-Bleisner; Eysteine Jansen; Wahl, Eugene R; t.osborn@uea.ac.uk;
Keith Briffa
Subject: Re: Wahl & Amman paper

Dear Peck et al
Thanks for clearing this up. The bottom line is that the version of this paper on the UCAR site is fine. Unfortunately though, the one we have on the IPCC WG1 web site is not!
I am attaching a copy of that for clarity. The metadata in this PDF file indicate that it was created by Oyvind Paasche from a word document in early March when we were asking the chapter teams to provide copies of the unpublished literature. It seems that Oyvind worked from an earlier and significantly shorter version - less text, fewer tables and the figures are different - as you can see in the attached. Although to repeat my earlier

mail.2006

statement the conclusions of this earlier draft do not appear to me to be substantially different.

Based on what we now know, the TSU should add the NCAR version of the paper to our review web site and we will do that today.

Thanks
Martin

At 07:58 AM 5/22/2006, Jonathan Overpeck wrote:

Thanks all who have commented. Below is the likely final word unless Martin needs more

clarification. Seem ok, Martin? Sorry for the confusion. Guess some reviewers are running

out of substantive issues, so that might be a sign that we're getting close to the final draft...

Best, Peck
>From Caspar:

Dear all, yes the UCAR version can be considered the "official" one. I changed the order of

pages because I needed to separate the "primary content" of the paper from its "supplement"; thus I moved tables xS, figure 1S and its caption to the end.

Everything else is identical.

>From Keith:

"the differences are as I understand, insubstantial and not pertinent to the interpretation used in preparing the draft."

and Gene:

Wahl, Eugene R wrote:

Hello Peck, Martin, Bette, Eystein, Caspar:

I just double checked the UCAR website version with the pdf version I have, and they are

identical with the exception that the supplemental tables (Tables 1S and 2S), and supplemental figure caption and figure (Figure 1S) are placed at the very end of the

document in the UCAR version. The content is identical in both versions.

The text (including tables and figure captions) of the UCAR pdf is also identical to the

WORD text that I sent to Peck, Keith Briffa, and Eystein Jansen on February 24. There was

a version sent on February 21, which the February 24 version superceded. There were 3

words changed on p. 17, and some changes made to Appendix 1 in the February 24 version.

Perhaps this difference between the 2/21 and 2/24 versions is the cause of the differences that Martin has seen.

[Note: I would have sent the graphics separately with these versions, and I did not keep

copies of the sent files in my email account -- to deal with memory limits in the system

here. Thus, I cannot confirm exactly which graphic files are associated with the February

24 version. My apologies.]

In summary, the UCAR website pdf document should be considered the official one that is

mail.2006
"accepted/in press". Formal notification of acceptance from Stephen Schneider at Climatic Change came on February 28. The article is still in this status.

Let me know if I can help clarify things further. Please note that I will be in Boulder starting May 27, to be a visiting scholar at NCAR for a month. I will be keeping up with email from there.

Peace, Gene Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University
607-871-2604
1 Saxon Drive
Alfred, NY 14802

From: Jonathan Overpeck [[1] mailto:jto@u.arizona.edu]

Sent: Sat 5/20/2006 8:39 PM

To: Martin Manning

Cc: Bette Otto-Bleisner; Eystein Jansen; Caspar Ammann; Wahl, Eugene R

Subject: Re: Wahl & Amman paper

Hi Martin - we'll look into this asap. I'll cc to Caspar and Gene to see if they can

clarify the situation and make sure we have the correct version. I'll also cc Bette since

she may see Caspar around NCAR and make sure he know's we are trying to clarify things with his paper.

More soon, thx, Peck

Dear Eystein and Jonathan

It has been pointed out to us by a reviewer that the version of the Wahl and Amman

paper (accepted by Climatic Change) on our review web site differs from the version that is available publicly from the NCAR web site at:

[

[2]http://www.cgd.ucar.edu/ccr/ammann/millennium/refs/wahlAmmann_ClimaticChange_inPress.pdf

<[3]http://www.cgd.ucar.edu/ccr/ammann/millennium/refs/wahlAmmann_ClimaticChange_inPress.pdf
f>]

Although the differences are not (in my view) substantial, the paper on the NCAR web site is apparently dated Feb 24th (i.e. before the date of final submission of the SOD), it has additional figures and data, and the running header says "Feb 24, in press".

Could you please clarify which of the two versions of this paper would reflect most accurately the status of the paper as used by the Chapter 6 team when preparing the SOD.

That has been our basis for deciding on which version to include on our reviewer web pages up until now, but we are now reconsidering whether to also include updated versions of

unpublished papers as well. If you have any thoughts on that please let me know.

Best regards

Martin

--

mail.2006

Recommended Email address: mmanning@al.noaa.gov
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NOAA Aeronomy Laboratory Phone: +1 303 497 4479
325 Broadway, DSRC R/CSD8 Fax: +1 303 497 5628
Boulder, CO 80305, USA

--

Caspar M. Ammann
National Center for Atmospheric Research
Climate and Global Dynamics Division - Paleoclimatology
1850 Table Mesa Drive
Boulder, CO 80307-3000
email: ammann@ucar.edu tel: 303-497-1705 fax: 303-497-1348

--

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--

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References

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4. <http://www.geo.arizona.edu/>
5. <http://www.ispe.arizona.edu/>

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#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: expert review comments on AR4
Date: Thu, 25 May 2006 13:16:21 -0400
Reply-to: mann@psu.edu

<x-flowed>
Hi Keith,

mail.2006

here is the submitted comment by Tapio Schneider, attached. Please do not pass along or show to others. Thanks in advance,

mike

Keith Briffa wrote:

> Hi Mike
> thanks for these comments and especially thanks for your remarks on
> the effort of trying to produce a balanced picture of the current
> state of things in the IPCC Chapter 6. In fact , I know that it is
> already out of date and I am going to get particularly lambasted for
> not discussing problems with recent tree responses to warming and
> potential problems wit CO2 fertilization - I may have to add even more
> text yet .You are absolutely correct that we had unreasonable trouble
> from Susan , who was not as "hands off" as she might have been. I will
> certainly study your comments carefully - as I always do . I would
> rather reserve comment on the Crowley reconstruction til I speak
> personally to you. I really hope that we can get an atmosphere of
> constructive discussion that , I believe, must include some discussion
> of the sceptics . Look forward to those drinks and some time away from
> the mad house of teaching/exam marking etc. See you soon

>
> best wishes
> Keith

>
> At 18:08 24/05/2006, you wrote:

>
>> Hi Keith,

>>
>> I wanted you to have an advance copy of the comments I'll be
>> submitting on the final draft of the AR4. I commend you for the
>> excellent work you've done and the tough battle I know you have had
>> to fight. I don't envy it, and you know the tough battles I've been
>> through.

>>
>> Confidentially, I do have a number of specific concerns mostly in
>> the area of discussions of where things actually now stand in terms
>> of some of the earlier criticisms. I believe that the discussion is
>> still out of date, given what has been shown in recent publications,
>> including wahl and Ammann (Science). Also, and I don't think this is
>> the only place you're going to hear this from, there are deep
>> problems w/ Hegerl et al '06, particularly the claims of what TLS can
>> do, which are egregiously incorrect. There is a comment in review in
>> Nature (not me, but I can promise you, by someone who understands the
>> statistical issues involved better than anyone else in our community)
>> that is very critical. I think its unwise for the TAR to
>> uncritically accept the claims made, particularly given that the
>> actual J. Climate paper was in limbo at least at the time the most
>> recent draft was finalized. I believe that disqualifies it for
>> consideration for AR4, no?

>>
>> Also, I think it is an absolute travesty that figure 6.10 isn't being
>> shown in the SPM. I think that is unforgiveable, and there should be
>> an effort to over-ride that decision (I would suspect that is Susan
>> Solomon's doing?),

>>
>> I hope we can discuss these things (and much else) over a few beers
>> in Switzerland. Looking forward to seeing you soon,

>>
>> mike

>>

mail.2006

>> --
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 >> Director, Earth System Science Center (ESSC)
 >>
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> --
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 > http://www.cru.uea.ac.uk/cru/people/briffa/

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From: Keith Briffa <k.briffa@uea.ac.uk>
 To: mann@psu.edu
 Subject: Re: expert review comments on AR4
 Date: Thu May 25 17:34:59 2006

Hi Mike
 thanks for these comments and especially thanks for your remarks on the effort of trying to produce a balanced picture of the current state of things in the IPCC Chapter 6. In fact ,

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I know that it is already out of date and I am going to get particularly lambasted for not discussing problems with recent tree responses to warming and potential problems with CO2 fertilization - I may have to add even more text yet .You are absolutely correct that we had unreasonable trouble from Susan , who was not as "hands off" as she might have been. I will certainly study your comments carefully - as I always do . I would rather reserve comment on the Crowley reconstruction til I speak personally to you. I really hope that we can get an atmosphere of constructive discussion that , I believe, must include some discussion of the sceptics . Look forward to those drinks and some time away from the mad house of teaching/exam marking etc. See you soon
best wishes
Keith
At 18:08 24/05/2006, you wrote:

Hi Keith,
I wanted you to have an advance copy of the comments I'll be submitting on the final draft of the AR4. I commend you for the excellent work you've done and the tough battle I've been through. I know you have had to fight. I don't envy it, and you know the tough battles through. Confidentially, I do have a number of specific concerns mostly in the area of discussions of where things actually now stand in terms of some of the earlier criticisms. I believe that the discussion is still out of date, given what has been shown in recent publications, including Wahl and Ammann (Science). Also, and I don't think this is the only place you're going to hear this from, there are deep problems w/ Hegerl et al '06, particularly the claims of what TLS can do, which are egregiously incorrect. There is a comment in review in Nature (not me, but I can promise you, by someone who understands the statistical issues involved better than anyone else in our community) that is very critical. I think its unwise for the TAR to uncritically accept the claims made, particularly given that the actual J. Climate paper was in limbo at least at the time the most recent draft was finalized. I believe that disqualifies it for consideration for AR4, no?
Also, I think it is an absolute travesty that figure 6.10 isn't being shown in the SPM. I think that is unforgiveable, and there should be an effort to over-ride that decision (I would suspect that is Susan Solomon's doing?), I hope we can discuss these things (and much else) over a few beers in Switzerland.
Looking forward to seeing you soon,
mike

--
Michael E. Mann
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Page 368

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References

1. <mailto:mann@psu.edu>
2. <http://www.met.psu.edu/dept/faculty/mann.htm>
3. <http://www.cru.uea.ac.uk/cru/people/briffa/>

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: john mitchell <jfbmitchell@yahoo.co.uk>
Subject: Re: Review comments
Date: wed, 21 Jun 2006 16:57:03 -0600
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Jouzel@lsce.saclay.cea.fr, Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk

Hi John - thanks. I'll cc to Keith and Tim too, and we'll be sure to discuss these in Bergen. I'll be on my normal email to the extent we have time to be check email - experience suggests it's tough. But... we'll try to keep an eye on email.

See you soon, best, peck

Hi Eystein, Jon,

I am in Geneva at the WMO EC meeting,so I have not had a lot of time to look at the SOD comments. I can not get to Bergen before Tuesday. I had a quick look at the comments on the hockey stick and include below the questions I think need to be addressed which I hope will help the discussions. I do tbelieve we need a clear answer to the skeptics . I have also copied these comments to Jean. Please let me know that you have received this, and what email address I can contact you at in Bergen`.

with best wishes

John

1. There needs to be a clear statement of why the instrumental and proxy data are shown on the same graph. The issue of why we don't show the proxy data for the last few decades (they don't show continued warming) but assume that they are valid for early warm periods needs to be explained.

2. There are a number of methodological issues which need a clear response. There are two aspects to this. First, in relation to the TAR and MBA which seems to be the obsession of certain reviewers. Secondly (and this I believe this is the main priority for us) in relation to conclusions we make in the chapter we should make it clear where our comments apply to only MBH (if that is appropriate), and where they apply to the overall findings of the chapter. Our response should consider all the issues for both MBH and the overall chapter conclusions

a. The role of bristlecone pine data

Is it reliable?

Is it necessary to include this data to arrive at the conclusion that recent warmth is unprecedented?

b. Is the PCA approach robust? Are the results statistically significant? It seems to me that in the case of MBH the answer in each is no. It is not clear how robust and significant the more recent approaches are.

3. The chapter notes that new data has been included, but we don't say how much or is this substantial or minor. The impression I have that the amount added is minor, but I can't tell.

4. The Esper et al and Moburg et al data both show increased variance, but the temporal patterns are quite different. We need to say why the discrepancy does not undermine our conclusions of greater cooling in the Little Ice Age.

5. I have not had time to check the original chapter, but the comments give the

mail.2006
impression that the recent 50 yr warming is unprecedented over the last
500years (seems reasonable) and elsewhere over the last 1000years (less clear)

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1.

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From: Tim Osborn <t.osborn@uea.ac.uk>
To: simon.tett@metoffice.gov.uk, philip.brohan@metoffice.gov.uk, Eduardo Zorita <Eduardo.Zorita@gkss.de>, Gerd Bürger <gerd.buerger@met.fu-berlin.de>
Subject: report back from PAGES/CLIVAR Wengen meeting
Date: Fri Jun 23 16:35:28 2006
Cc: Keith Briffa <k.briffa@uea.ac.uk>

Hi Simon, Philip, Eduardo & Gerd (cc Keith),

I thought you might be interested in a brief report back from the recent Wengen meeting, specifically about how SO&P-funded work on pseudo-proxies was covered and related hockey-stick issues.

****Please don't circulate this further, because it is just my personal viewpoint****

Thanks for letting me show some of your material. I skipped over some graphs I took from Philip's regression presentation at the SO&P meeting because Francis Zwiers covered forward/inverse/total least squares before me. I did show some results from Eduardo, including pseudo-proxy results from Erik-II. And I showed a figure from Gerd's "many flavours" pseudo-proxy paper.

The meeting included fairly intensive discussions about many issues, and this included some discussion of von Storch et al. (2004, 2006), wahl et al. (2006), Mann et al. (2005), Burger and Cubasch (2005) and Burger et al. (2006). Generally the discussion was quite open, with only a few disdainful remarks made about the work of people not there -- certainly not enough to distract from useful discussions.

In general, most people accepted that the MBH method could, in some situations, result in biased reconstructions with too little low-frequency. I'm not sure how much Mike Mann accepted this, but it was reinforced by findings shown by Eugene wahl that indicated some bias in their CSM pseudo-proxy studies, and particularly by Francis Zwiers who looked to have almost completely replicated the von Storch et al. results with respect to the MBH method (though he emphasised the preliminary nature of his work and he may not have implemented the MBH method correctly... we'll have to wait and see).

Mike showed many detailed psuedo-proxy tests of the RegEM method and these seemed quite convincing in showing little problem with that method... it does assume equal error in both instrumental and proxies, so it should show less bias than other methods that wrongly put all the error in the instrumental record (i.e., "typical" regression).

So... there was some confusion about how the MBH method can be biased but the RegEM not be biased (in pseudo-proxy tests) yet they give the same results for the real proxies.

Mike thought it might be the ECHO-G vs CSM differences, but I argued against this and was supported by Caspar Ammann and Eugene wahl who did not think that the character of the model runs was a big factor in explaining different results.

There was limited discussion of trend/detrend and white/red noise pseudo-proxy issues. Many seemed to think that if pseudo-proxy studies showed that detrending definitely caused a problem, then this was a reason not to detrend. The alternative of finding a method that worked with detrended data was not really discussed.

The discussion was fairly constructive and for the most part friendly. Eugene wahl in particular seemed keen to "build bridges" within the community.

I should also mention two of the workshop outcomes.

The first is that a paper is being planned based on the things discussed at the workshop and covering many issues from proxy data, forcings, model simulations and reconstructions. I hope that the authorship of this might be wider than just the participants of the workshop, but we will have to wait and see who else is asked to contribute.

The second is that we should set up a "climate reconstruction challenge". The idea would be to use a simulation (*not* of the last 1000 years, so none of us know the expected answer) and provide some data from a "calibration period" and some "pseudo-proxies" from the full period and make these public so that anyone could attempt to make a reconstruction using their favoured method(s). The true model NH temperature series would be kept secret for 6 months or so. Thus it would be a "blind" test and after attempts had been submitted they would be evaluated against the true result to assess which methods were most successful.

Caspar Ammann will probably provide the simulation, so he wouldn't take part in

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making any reconstructions. He would keep the details secret from all others so that any one, including MBH, you and us, could enter the challenge.

Finally, it was asked whether the model runs that have so far been used for pseudo-proxy studies (NCAR CSM, ECHO-G Erik-I, HadCM3, maybe ECHO-G Erik-II?) might be made publicly available for shared use, so results are less model dependent. This would just be the surface air temperature fields from the runs, not all the other variables. What do you think, Simon and Eduardo? If you are happy with this then they could get them from the SO&P website, so no need for data extraction on your part.

Hope you find this summary interesting. It's just my opinions. I've cc'd this to Keith in case he wants to say anything different!

Cheers

Tim

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From: Caspar Ammann <ammann@ucar.edu>
To: Christoph Kull <christoph.kull@pages.unibe.ch>
Subject: Re: climate reconstruction challenge
Date: Thu, 29 Jun 2006 06:43:40 -0600
Cc: Tim Osborn <t.osborn@uea.ac.uk>, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Hi Christoph,
sounds excellent. 20th is a good target with three weeks left. Let me launch one full round to solicit comments and ideas, and then I can send you what we have to build the web site. I'll check with Mike about having him fold this into the report.
Cheers
Caspar

Christoph Kull wrote:

> Dear Caspar and Tim,
> Thanks for putting this issue forward!!
> PAGES/CLIVAR may help communicating this challenge to the community.
>
> we will be able to setup the website with the data sets and the call etc.:
> - let me know what you need! It would be best for us to have first a simple
> "word document with the structure, headings and text. We will then produce a
> "hidden site" that can be updated and finalized before it will go public
> online.
>
> we will be able to announce the challenge to the community via the
> Newsletter and e-news:
> - we need a respective experiment description.
> - the next Newsletter is going to be published by end of July. Can you
> provide me this information by the 20th? This would also fit with the
> planned announcement in the workshop report for EOS...Mike will draft this
> report.
> I suggest to directly contact him for an incorporation of this call.
>
> All the best, thanks a lot and greetings from Bern,
> Christoph

>
>
> On 23.06.2006 19:23, "Caspar Ammann" <ammann@ucar.edu> wrote:
>
>
>> Hi Tim,
>>
>> just back from the various trips and meetings, most recently
>> Breckenridge and the CCSM workshop until yesterday. This coincided with
>> the release of the NRC report...
>>
>> Thanks Tim for getting in touch with Simon and Eduardo. And I would
>> think it would be excellent if you would be on the reconstruction side
>> of things here. We really need to make sure that all the reconstruction
>> groups (the ones that show up in the spaghetti-graph) also provide
>> reconstructions for the Challenge. By the way, Mike Mann is fine with
>> the participation of the German group in this as he has spoken now
>> favorably on the project.
>>
>> I think the separation you point at is absolutely crucial. So, as I
>> indicated in Wengen, I would suggest that we could organize a small
>> group of modelers to define the concepts of the experiments, and then
>> make these happen completely disconnected from standard data-centers. A
>> Pseudo-Proxy group should then develop concepts of how to generate
>> pseudo-proxy series and tell the modelers where they need what data. But
>> what they do is not communicated to the modelers. Based
>>
>> The underlying concept as well as the technical procedure of how we
>> approach the pseudo-proxies should be made public, so that everybody
>> knows what we are dealing with. We could do this under the PAGES-CLIVAR
>> intersection umbrella to better ensure that the groups are held separate
>> and to give this a more official touch. Below a quick draft, we should
>> iterate on this and then contact people for the various groups.
>>
>> So long and have a good trip to Norway,
>> Caspar
>>
>>
>>
>> Here a very quick and simple structural draft we can work from: (all
>> comments welcome, no hesitations to shoot hard!)
>>
>>
>> Primary Goals:
>>
>> - cross-verification of various emulations of same reconstruction
>> technique using same input data
>> - comparison of skill at various time scales of different techniques if
>> fed with identical pseudo-proxy data
>> - sensitivities of hemispheric estimates to noise, network density
>> - identify skill of resolving regional climate anomalies
>> - isolate forced from unforced signal
>> - identify questionable, non-consistent proxies
>> - modelers try to identify climate parameters and noise structure over
>> calibration period from pseudo-proxies
>>
>>
>> Number of experiments:
>>
>> - available published runs
>> - available unpublished, or available reordered runs
>> - CORE EXPERIMENTS OF CHALLENGE: 1-3 brand new experiments

mail.2006

```
>> ^one experiment should look technically realistic: trend in
>> calibration, and relatively reasonable past (very different phasing)
>> ^one experiment should have no trend in calibration at all, but
>> quite accentuated variations before
>> ^...one could have relatively realistic structure but contains a
>> large landuse component (we could actually do some science here...)
>>
>>
>> Pseudo-Proxies and "instrumental-data":
>>
>> - provide CRU-equivalent instrumental data (incl. some noise) that is
>> degrading in time
>> - provide annually resolved network of pseudo proxies ((we could even
>> provide a small set of ~5 very low resolution records with some
>> additional uncertainty in time))
>> - 2 networks: one "high" resolution (100 records), one "low" resolution
>> (20), though only one network available for any single model experiment
>> to avoid "knowledge-tuning", or through time separation: first 500-years
>> only low-res, then second 500-years with both.
>> - pseudo-proxies vary in representation in climate (temperature, precip,
>> combination), time (annual, seasonal) and space (grid-point, small region)
>>
>>
>> Organization of three separate and isolated groups, and first steps:
>>
>> - Modeler group to decide on concept of target climates, forcing series.
>> Provide only network information to Proxy-Group (People? Ammann, Zorita,
>> Tett, Schmidt, Graham, Cobb, Goosse...).
>> - Pseudo-proxy group to decide on selection of networks, and
>> representation of individual proxies to mimic somewhat real world
>> situation, but develop significant noise (blue-white-red) concepts,
>> non-stationarity, and potential "human disturbance" (People? Brohan,
>> Schweingruber, Wolff, Thompson, Overpeck/Cole, Huybers, Anderson, ...).
>> - Reconstruction group getting ready for input file structures: netCDF
>> for "instrumental", ascii-raw series for pseudo-proxy series. Decide
>> common metrics and reconstruction targets given theoretical pseudo-proxy
>> network information. (People: everybody else)
>>
>>
>> Direct science from this: (important!)
>>
>> - Forced versus internal variations in climate simulations (Modelers)
>> - Review and catalog of pseudo-proxy generation: Noise and stationarity
>> in climate proxy records, problems with potential human/land use
>> influence (Proxy Group)
>> - Detection methods and systematic uncertainty estimates (Reconstruction
>> Group)
>>
>>
>>
>>
>> Tim Osborn wrote:
>>
>>> Hi Caspar and Christoph,
>>>
>>> I just wanted to let you know that:
>>>
```

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>>> (1) I have emailed Simon Tett (for HadCM3) and Eduardo Zorita (for
>>> ECHO-G Erik-I, not sure about Erik-II) to ask if they would be
>>> prepared for surface temperature fields to be made available from
>>> their model runs and placed on a pseudo-proxy website for use in
>>> pseudo-proxy studies. I'll let you know their response.
>>>
>>> (2) In wengen I suggested that Philip Brohan, a colleague of Simon
>>> Tett, might be interested in creating pseduo-proxies from the output
>>> of Caspar's secret model simulation, because of Philip's interest in
>>> statistical error models (e.g. in the error model he just published of
>>> the instrumental temperature record, HadCRUT3). I have emailed Philip
>>> to ask him if he would be interested. Again, I'll let you know his
>>> response.
>>>
>>> with regard to the "climate reconstruction challenge", Keith and I
>>> were wondering how it is going to be run. Obviously some kind of
>>> organising group would be useful to ensure it is designed to be as
>>> scientifically useful an experiment as possible. Yet there needs to
>>> be a clear distinction between provided experimental design advice
>>> (and things like convening EGU sessions) and having too much knowledge
>>> of the setup that would prevent such people from taking part in the
>>> challenge. Keith and I would be interested in the former, but would
>>> also like to keep our distance and take part in the challenge. I'm
>>> not sure that it was clear in wengen exactly who is to organise this all.
>>>
>>> Cheers
>>>
>>> Tim
>>>
>>> Dr Timothy J Osborn, Academic Fellow
>>> Climatic Research Unit
>>> School of Environmental Sciences, University of East Anglia
>>> Norwich NR4 7TJ, UK
>>>
>>> e-mail: t.osborn@uea.ac.uk
>>> phone: +44 1603 592089
>>> fax: +44 1603 507784
>>> web: http://www.cru.uea.ac.uk/~timo/
>>> sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm
>>>
>>> **Norwich -- City for Science:
>>> **Hosting the BA Festival 2-9 September 2006
>>>
>>>
>>>
>
>

--
Caspar M. Ammann
National Center for Atmospheric Research
Climate and Global Dynamics Division - Paleoclimatology
1850 Table Mesa Drive
Boulder, CO 80307-3000
email: ammann@ucar.edu tel: 303-497-1705 fax: 303-497-1348

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697. 1151689605.txt

#####

mail.2006
From: Valérie Masson-Delmotte <Valerie.Masson@cea.fr>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: warning - more reviews for you
Date: Fri, 30 Jun 2006 13:46:45 +0200
Reply-to: Valerie.Masson@cea.fr

<x-flowed>
Dear Keith,

I hope that you had a good trip back from Bergen.

Some of the review comments which appeared to be relevant for the Holocene section are yours. I copy them here so that you can take there of them.

All the best,

Valérie.

6-687

A

26:18

28:19

Replace "limiting the vallue" on line 18 to "review as a" on line 19 by "which means there is no legitimate"

[VINCENT GRAY (Reviewer's comment ID #: 88-774)]

FOR KEITH

6-694

A

27:0

33:

Section 6.6.1.1 (on 2000-yr proxy reconstructions) is a little too long. It can be either shortened or reorganized into 2 or more shorter

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sections, say on reconstruction history, debate, and new development.

[Govt. of United States of America (Reviewer's comment ID #: 2023-407)]

6-695

A

27:0

Fig. 6.10a. Rather than showing the average of 4 European stations I suggest to plot the available averaged European mean land temperature (using much more than just 4 stations) from Luterbacher et al. 2004 and Xoplaki et al. 2005. This continental scale average would provide a more appropriate overview for the last 250 years. The first lead author has the data or they can be obtained prepared from xoplaki@giub.unibe.ch or juerg@giub.unibe.ch. Xoplaki, E., Luterbacher, J., Paeth, H., Dietrich, D., Steiner N., Grosjean, M., and Wanner, H., 2005: European spring and autumn temperature variability and change of extremes over the last half millennium, *Geophys. Res. Lett.*, 32, L15713. Luterbacher, J., Dietrich, D., Xoplaki, E., Grosjean, M., and H. Wanner, 2004: European seasonal and annual temperature variability, trends and extremes since 1500, *Science*, 303, 1499-1503.

[Jürg Luterbacher (Reviewer's comment ID #: 151-8)]

6-696

A

27:0

Fig 6.10. I here repeat a point made in my comments on the FOD. It is statistically invalid and visually misleading to overlay the black instrumental line on this diagram. The coloured graph lines show proxy records that end at 1980. If you want a line that continues up to more recent years that then you must use the proxy records that continue past 1980, not switch to a different type of series. There are up to date proxy records available, but as I'm sure the authors of this chapter are aware, they depart from the surface instrumental record, many of them declining after 1980. By failing to show this, and including the surface temperature data in black, it constitutes a misrepresentation, since the black line is an invalid forward extrapolation of the proxy data. If the reason for not showing the updated proxies is that they are not considered to be good representatives of temperature anymore, then by what right does the Figure insinuate that they were good proxies 8-10 centuries ago? It is no defence to claim that MBH99 established a

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statistically skillful relationship between the proxy network and the instrumental data, since that claim has been refuted, as discussed above. McIntyre and Mckitrick (2005a,d) showed that the pre-1450 RE statistic was incorrectly benchmarked, yielding a spurious inference, and the r2 stat calculated by MB&H themselves, which showed the lack of skill, was simply not reported. The failure of the r2 and CE stats is confirmed by wahl and Ammann. The squared correlation between the MBH long proxies and the instrumental record is nearly zero (MM05a,c). The mean correlation between the long NOAMER proxies and gridcell temperatures in the MBH98 data set (which dominate the pre-AD1450 portion) is -0.08 (McIntyre and Mckitrick 2005c), and the RE significance benchmark is above the MBH98 RE score, using all available implementation of the Mann code (McIntyre and Mckitrick 2005d). The surface instrumental record cannot be used as a statistically valid extrapolation for the proxies after 1980.

[Ross Mckitrick (Reviewer's comment ID #: 174-35)]

</x-flowed>

698. 1152563768.txt

#####

From: Henry Pollack <hpollack@umich.edu>
To: Jonathan Overpeck <jto@u.arizona.edu>
Subject: Re: Borehole in the Southern Hemisphere
Date: Mon, 10 Jul 2006 16:36:08 -0400
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, Ricardo Villalba <ricardo@lab.cricyt.edu.ar>, Jason Smerdon <jsmerdon@ldeo.columbia.edu>

<x-flowed>

Hi Peck et al,

Thanks for your note about the Africa borehole reconstructions, along with the correspondence with Jason Smerdon. In my e-mail to you on April 18,2006 I had indicated that the African work was unpublished. However, I had forgotten that the Nature paper by Huang, Pollack and Shen (Temperature trends over the past five centuries reconstructed from borehole temperatures, Nature 403, pp 756-758, 2000) actually showed the reconstructions for both southern Africa and Australia as bar graphs of century-long changes in Figure 3 of that paper. The figure displaying both the Africa and Australia borehole reconstructions that appears in the FAR draft (Figure 6.12? or was it 6.11?) shows temperature vs. time for five centuries, a display that differs from the bar-graphs in the Nature paper only in format, not data.

Inasmuch as there have been no additions to the datasets since that paper, it seems that we can correctly say that the reconstructions for southern Africa and Australia have both been published in the Nature (2000) paper. There is nothing "wrong" or outdated with either of those reconstructions. We have, in addition, a newer and more expansive paper about Australia alone (discussing the same reconstruction as appeared in the Nature paper), now in press in the Journal of Quaternary Science. This paper was already mentioned in the e-mail of April 18, 2006, which I will paste at the end of this message.

Other questions?

mail.2006

Cheers,
Henry

[] Henry N. Pollack
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Phone: 734-763-0084 FAX: 734-763-4690
e-mail: hpollack@umich.edu
URL: www.geo.lsa.umich.edu/~hpollack/
URL: www-personal.umich.edu/~hpollack/book.html

e-mail of April 18, 2006:

Date: Tue, 18 Apr 2006 16:26:27 -0400 [04/18/2006 04:26:27 PM EDT]
From: Henry Pollack <hpollack@umich.edu> Add to Address book
(hpollack@umich.edu) United States
To: Keith Briffa <k.briffa@uea.ac.uk>
Cc: jto@u.arizona.edu, eystein.jansen@geo.uib.no
Subject: IPCC FAR draft
Headers: Show All Headers
Hi Keith (and Peck and Eystein),

I have recently been sent the current draft of the IPCC FAR by the US Global Change Research Program, asking for comments on the draft. This is the first time I have seen this product since we were feverishly exchanging e-mails in February. Let me call to your attention some small but not insignificant corrections to be made to the next draft.

Page 6-33, Section 6.6.1.2, line 22. The title of this section (in italics) should be changed to "what do ground surface temperature reconstructions derived from subsurface temperature measurements tell us?"

Page 6-33, lines 49 and 52, there is a reference (Smerdon et al., in press). This paper has now been published, so substitute "2006" for "in press", and in the list of references the citation should include the following:

J. Geophys. Res. 111, D07101, doi:10.1029/2004JD005578

Page 6-34, lines 43 and 44. This section is dealing with the southern hemisphere. The sentence "...these both indicate unusually warm conditions prevailing in the 20th century (Pollack and Smerdon, 2004)" , and the reference therein, are both incorrect.

The ground surface temperature changes over the last 500 years DO NOT indicate unusually warm conditions prevailing in the 20th century in Australia and southern Africa. This is because the unusually warm conditions developed late in the century, after most of the boreholes had already been logged. what the borehole reconstruction for Australia does show is very good correspondence with the Cook et al (2000)

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reconstruction for Tasmania and the Cook et al. (2002) recon for New Zealand. The Australia work is described in a manuscript "Five centuries of Climate Change in Australia: The View from Underground" by Pollack, Huang and Smerdon now under review in the Journal of Quaternary Science. The Africa work is unpublished.

Is this e-mail to you sufficient to activate these changes? Or should I submit these comments to the US Government Review Panel? If I am to submit to the latter, they require all comments to be filed by May 9.

Cheers,
Henry

Quoting Jonathan Overpeck <jto@u.arizona.edu>:

> Hi Henry - hope you're having a nice summer. I just got back from the
> IPCC mtg where we made plans for generating the final draft of our
> paleo chapter. One question that came up is whether we can show (in
> Fig 6.12 - southern hemisphere climate records of the last
> millennium) your borehole recon for southern Africa. As you can see
> below, Jason Smerdon has told our SH lead, Ricardo Villalba that the
> recon we've used is not yet published. The question for you is
> whether we can/should use a version that IS published, we feel your
> recon is an important one to show as it represents a region not
> represented by other good reconstructions. But, we don't want to use
> something that has proven to be wrong.
>
> We appreciate your input on this issue. Also, if there is a published
> recon that we can use, would you pls send the recon (guess it's only
> one value per century, right?) and the ref we should cite?
>
> As you can imagine, we're under a tough time constraint, so if you
> can let us know as soon as you can, that would be great.
>
> Many thanks, Peck
>
>
>> X-Sieve: CMU Sieve 2.2
>> From: "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>
>> To: "Keith R. Briffa" <k.briffa@uea.ac.uk>,
>> "Jonathan Overpeck" <jto@u.arizona.edu>
>> Subject: Borehole in the Southern Hemisphere
>> Date: Thu, 29 Jun 2006 06:00:20 -0300
>>
>> Hi Keith and Peck,
>> Please, find below a copy of the message that I got from Jason Smerdon,
>> regarding the South African borehole record. It looks that the record as it
>> is shown in Figure 6.12 has not been published, however former versions of
>> the South African reconstruction have been included in at least two papers.
>> Please, let me know your impressions to proceed with this matter. Cheers,
>> Ricardo
>>
>> ----- Original Message -----
>> From: "Jason Smerdon" <jsmerdon@ldeo.columbia.edu>
>> To: "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>
>> Sent: Wednesday, June 28, 2006 8:09 PM

>> Subject: Re: Publication in JQR

>>

>>

>>> Hi Ricardo,

>>>

>>> I believe that you are referring to the reconstruction from the Southern Africa holes that we provided to Tim Osborn. That reconstruction has not been published as a time series as it is shown in Tim's figure. I believe, however, that the same reconstruction was published as a histogram in the following reference:

>>>

>>> Huang S, Pollack HN, Shen PY. 2000. Temperature trends over the last five centuries reconstructed from borehole temperatures. Nature 403: 756-758.

>>>

>>> The only thing that might be different is the number of holes that were used, but I don't think that part of the dataset has been updated since Huang's 2000 paper. To confirm this I would encourage you to contact > Henry Pollack at hpollack@umich.edu. He will know for sure. A similar reconstruction using a subset of the Southern Africa holes is referenced in the Australian paper:

>>>

>>> Tyson PD, Mason SJ, Jones MQW, Cooper GRJ. 1998. Global warming and geothermal profiles: The surface rock temperature response in South Africa. Geophysical Research Letters 25: 2711-2714.

>>>

>>> But the reconstruction will of course not be exactly equal to the larger Southern African reconstruction that we provided for Tim. I hope this helps and let me know if I can be of any further assistance.

>>>

>>> Jason

>>>

>>> On wed, 28 Jun 2006, Ricardo Villalba wrote:

>>>

>>> > Dear Jason,

>>> > Thanks for the preprint. Do you know if the South African borehole records

>>> > has been published? Thanks,

>>> > RICARDO

>>> >

>>>

>>>

>

>

> --

> Jonathan T. Overpeck

> Director, Institute for the Study of Planet Earth

> Professor, Department of Geosciences

> Professor, Department of Atmospheric Sciences

>

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>

>

>

</x-flowed>

699. 1152909980.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Henry Pollack <hpollack@umich.edu>
Subject: Re: Borehole in the Southern Hemisphere
Date: Fri, 14 Jul 2006 16:46:20 -0600
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Valerie Masson-Delmotte <Valerie.Masson@cea.fr>, t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Hi again Henry - I've attached an 1997 paper of your's and wonder if you could shed some up-to-date insights on how to best interpret. In particular:

1) it has been pointed out to us that the result in this paper argue for a globally warm period during the middle Holocene that was warmer than today. Our assessment (i.e., Figure 6.9) indicates that there was likely no period during the Holocene that was warmer around the global than the late 20th century. Especially outside of the tropics, there were periods warmer than today during the Holocene, but these regionally warm periods were not synchronous - at least at the centennial scale we can examine with proxy data. Thus, although Huang et al. 1997, indicates greater mean annual global warmth, it was unlike the synchronous global warming of the late 20th century.

Plus, we believe the warmth of the Holocene was driven by orbital forcing, and that what we see makes sense in that regard. Huang et al, 1997 can be explained perhaps (this is a question) by the heavy borehole coverage in the Northern mid- to high-latitudes? We also know that proxy data shown in Fig 6.9 also indicate more warming (again, not synchronous) in Southern Hem mid-latitudes - where there are also many boreholes.

Obviously, another issue is that the boreholes don't give the same temporal resolution as the other proxy records we synthesized/assessed, and at least in your paper, there isn't regional information either.

So - the point is not (unless you suggest otherwise) that Huang et al 97 is wrong, but rather than within the limits of the data, it is compatible with what the higher-resolution, regionally-specific, multi-proxy data are showing in Fig 6.9, and that there was likely no period during the Holocene that was warmer synchronously around the global than the during the late 20th century. Do you agree with this, and is our reasoning accurate and complete?

2) Huang et al 1997 also shows evidence for warmth within the last 500-1000 years that was greater than during the 20th century AND a cool minima 200 years ago. Both of these are highlighted in your abstract, and both seem incompatible with other evidence. For example, your own more recent work has shown the coolest temperatures

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to be about 500 years ago.

We didn't think it was within our focus to comment on these issues, but we are being asked to by reviewers, and it would be good to have your help in addressing these issues - hopefully in our responses to review comments rather than in our main text (which has to be shortened).

Many thanks for your help with this paper and the issues it raises.

Best, Peck

--
Jonathan T. Overpeck
Director, Institute for the Study of Planet Earth
Professor, Department of Geosciences
Professor, Department of Atmospheric Sciences

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Attachment Converted: "c:\documents and settings\tim osborn\my documents\eudora\attach\huang1997GRLHoloceneBoreholes.pdf"

700. 1152912026.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: figure issues
Date: Fri, 14 Jul 2006 17:20:26 -0600
Cc: Valerie Masson-Delmotte <Valerie.Masson@cea.fr>

<x-flowed>

Hi all - including Eystein, whom I haven't been able to talk with on these issues yet:

1) I'd like to get your status report on Fig. 6.12 - based on feedback from Henry Pollack, we will keep the borehole curves and corresponding instrumental data. I believe we are also going to add the new recon from Law Dome - Valerie was going to send. Do you have everything needed for this figure revision?

2) Since we met in Bergen, I have received feedback from many about our MWP box, and would like to float the idea that we delete the bottom (Osborn and Briffa) panel. I know this is shocking coming from me (I think O&B, 2006 is a paper of the year contender!), but I have become convinced that it will be too much of a lightening rod for what it gives us. We still show the data in the top panel, which

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conveys the same thing (although in a much less sophisticated way!), and we still back up with citations to O&B2006. BUT, we hopefully avoid a possible intense focus on methodological focus on the fig, and the criticism that it's LA work that hasn't been thoroughly vetted. This focus (i.e., from skeptics and those inclined to listen to them for political reasons) is stupid, but we want to keep readers focused on the science and not on the politically-generated flak. I think we can do this just as well without the O&B06 figure, assuming we still cite the findings of the O&B06 paper, but just don't show the figure. We also save space - not the reason for my suggestion, but a good thing given what Keith and Tim need to add in response to issue like divergence etc.

Obviously, was the biggest fan and pusher for the figure to be included, and I'm sorry to be suggesting otherwise now.

Does this make sense?

Thanks, Peck

--

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701. 1152974217.txt

#####

From: "Smith, G. (Geoff) (SG)" <Geoff.Smith@AKZONOBEL-CHEMICALS.COM>
To: ITRDBFOR@LISTSERV.ARIZONA.EDU
Subject: Re: [ITRDBFOR] Joe Barton's hockey stick hearing coming up
Date: Sat, 15 Jul 2006 10:36:57 +0800
Reply-to: ITRDB Dendrochronology Forum <ITRDBFOR@LISTSERV.ARIZONA.EDU>

Dr. Solomon,

It is not clear what makes the Wegman Committee Report in your opinion a "new low". In scientific study, one part is clearly physical (growth rates of trees, IR absorption, etc.) and a separate part is the statistical treatment of the data.

Dr. Wegman's report is clearly focused on the latter. He is well qualified to analyze statistical methods, as chair of the National Academy of Sciences' (NAS) Committee on Applied and Theoretical Statistics, and a board member of the American Statistical Association.

The conclusion of the Committee headed by Dr. Wegman is clear - the statistical methods of MBH 98/99 cannot be relied upon to support the claim that the 90's were the hottest decade of the past millennium. If

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one wants to argue with Dr. Wegman's conclusion, it will be necessary to show how he has misunderstood or misrepresented the statistical methods used in those studies.

Obviously this does not prove that the 90's were not the hottest decade of the past millennium, only that the MBH 98/99 analyses cannot be used to support that claim, nothing more and nothing less.

Anyone interested in paleoclimatology in general, and dendrochronology in particular, should read the recent NAS report and the Wegman Committee Report (or in fact anyone interested in the use of statistics in climatology).

Your last comment seems to reflect a belief that it is scurrilous to "question unquestioned science". Wouldn't there seem to be a long honored history of exactly this type of action, both before and after Einstein? Or perhaps I'm misinterpreting your remarks.

Geoff Smith
Singapore

-----Original Message-----

From: ITRDB Dendrochronology Forum
[mailto:ITRDBFOR@LISTSERV.ARIZONA.EDU] On Behalf Of Allen M. Solomon
Sent: Saturday, July 15, 2006 6:53 AM
To: ITRDBFOR@LISTSERV.ARIZONA.EDU
Subject: Re: Joe Barton's hockey stick hearing coming up

You also may want to look at a new "report" prepared for Barton by a group of statisticians regarding the hockey stick - this is going to be the focus of the hearing, in order to advertise it. It seems (to me) to be a new low in politics to have a "congressional report" generated specifically to question unquestioned science.

-A1
Allen M Solomon, Ph.D.
National Program Leader, Global Change Research
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703 605 5251

E&ENews PM
Friday, July 14, 2006

CLIMATE: New House report sets stage for another 'hockey stick' brawl
Lauren Morello, E&ENews PM reporter
Flawed statistics underlie the controversial "hockey stick" climate analysis, according to a report released today by an ad hoc panel of scientists assembled by the House Energy and Commerce Committee.

The report contradicts a recent National Academy of Sciences study that
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found the hockey stick analysis -- which concluded Earth has been warmer over the last millennium than at any other point -- is largely correct.

Published in 1998 by the journal Nature, the hockey stick reconstructs past global average temperatures using data from corals, tree rings, ice cores and bore holes deep within the Earth -- the first to draw on multiple sources of "proxy data" to sketch a picture of past climate.

The study includes a graph that shows Earth's average temperature increasing sharply during the 20th century, with an upward curve that resembles the blade of a hockey stick. Often cited as evidence that human emissions are the dominant cause of rising global temperatures, the graph became controversial after it appeared in a 2001 Intergovernmental Panel on Climate Change report.

But the House Committee's ad hoc panel says the hockey stick's authors relied on statistics that are pre-disposed to produce the hockey-stick shape.

Claims by the hockey stick paper's authors of unprecedented global warming during the 20th century "cannot be supported by [the] analysis," the panel concluded.

The Energy and Commerce Committee -- whose chairman, Rep. Joe Barton (R-Texas), is a leading Capitol Hill critic of the hockey-stick study -- has scheduled a hearing next week on the ad hoc panel's conclusions.

In June 2005, Barton and Oversight and Investigations Subcommittee Chairman Ed Whitfield (R-Ky.) launched a probe into scientific and financial records of climatologists who created the graph -- Michael Mann of Pennsylvania State University, Raymond Bradley of the University of Massachusetts and Malcolm Hughes of the University of Arizona (Greenwire, July 18, 2005).

That prompted a rare show of public infighting between Barton and Whitfield and House Science Committee Chairman Sherwood Boehlert (R-N.Y.), who asked the National Academy of Sciences to examine the validity of the hockey stick and similar climate reconstructions (Greenwire, June 23).

[Click here to view the House panel report.](#)

[Click here to view the National Academy of Sciences report.](#)

[Click here to view the hockey stick paper \[Nature subscription required\].](#)

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----- Original Message -----

From: "David M. Lawrence" <dave@FUZZO.COM>
To: <ITRDBFOR@LISTSERV.ARIZONA.EDU>
Sent: Friday, July 14, 2006 3:13 PM
Subject: Joe Barton's hockey stick hearing coming up

>I thought I'd pass this on since tree-ring data and their use in
> reconstructing past climates are central to the controversy. I wonder
> if
> any attention will be paid to the recently released NRC report on
> climate
> over the past 2,000 years, or in a forthcoming paper in Climate Change
> that
> finds the method used to obtain the hockey stick reasonably robust.
>
> Dave
>
> -- here's my note posted to two journalism lists --
>
> It looks like Joe Barton will get all the climate uncertainty sorted
> out
> on
> Wednesday, June 19, at 10 a.m. He will be holding a hearing called
> "Questions Surrounding the 'Hockey Stick' Temperature Studies:
> Implications
> for Climate Change Assessments." The hearing will focus on the
> notorious
> "hockey stick" graph indicating that the temperatures in the latter
> part
> of
> the 20th century were higher than at any time in the last millennium.
>
> I doubt there will be more light than heat, but the hearing will be
> interesting to watch, if anything. The hearing can be watched live
> via
> the
> Internet.
>
> For more information:
>
> http://energycommerce.house.gov/108/News/07142006_1989.htm

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>
>
> <http://energycommerce.house.gov/108/Hearings/07192006hearing1987/hearing.htm>

> Dave

>
> -----
> David M. Lawrence | Home: (804) 559-9786
> 7471 Brook Way Court | Fax: (804) 559-9787
> Mechanicsville, VA 23111 | Email: dave@fuzzo.com
> USA | http: http://fuzzo.com
> -----

> "We have met the enemy and he is us." -- Pogo

> "No trespassing
> 4/17 of a haiku" -- Richard Brautigan

702. 1153139501.txt

#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: draft of EOS piece
Date: Mon, 17 Jul 2006 08:31:41 -0400
Reply-to: mann@psu.edu

<x-flowed>
Hi Keith,

Thanks, please comment on the attached version which incorporated all other comments received.

thanks,

mike

Keith Briffa wrote:

> Mike
> just back from holiday - can you send me latest draft and I will
> comment asap on it - somewhat confused re where we are with others -
> or should I just comment immediately on the one you sent?

> Keith

> At 16:36 12/07/2006, you wrote:

>> thanks very much Guys,

>> will await comments from Keith and Heinz (?), prepare one last
>> version, and then submit...

>> mike

>> Caspar Ammann wrote:

>>> Mike,

>>> here also a few thoughts and edits from me (in-between kids waking
>>> up, dressing, feeding, etc.)

>>> Caspar
>>>
>>>
>>>
>>> On Jul 12, 2006, at 6:18 AM, Michael E. Mann wrote:
>>>
>>>> Thanks Christoph,
>>>> Awaiting comments from others.
>>>>
>>>> Caspar: any comments on our discussion of the challenge?
>>>>
>>>> thanks,
>>>>
>>>> mike
>>>>
>>>> Christoph Kull wrote:
>>>>
>>>>>
>>>>> Dear all,
>>>>> Thanks Mike for this report.
>>>>> I made a few edits / suggestions - it's up to you to decide on them.
>>>>> Hopefully Caspar can also provide some input.
>>>>> We will be ready to communicate the weblink for the challenge by
>>>>> end of this
>>>>> week. I will let you know....
>>>>>
>>>>> All the best, thanks a lot and greetings from Bern,
>>>>> Christoph
>>>>>
>>>>>
>>>>> On 10.07.2006 19:57, "Michael E. Mann"
>>>>> <mailto:mann@meteo.psu.edu><mann@meteo.psu.edu> wrote:
>>>>>
>>>>>
>>>>>>
>>>>>> Dear Keith/Phil/Christoph/Thorsten/Heinz,
>>>>>>
>>>>>> Attached is a draft meeting report for EOS. Rather than re-invent
>>>>>> the
>>>>>> wheel, I have followed closely the PAGES newsletter piece, but have
>>>>>> expanded on certain points as appropriate for the broader EOS
>>>>>> audience.
>>>>>> I've also included Caspar. Though not a member of the PAGES/CLIVAR
>>>>>> intersection working group, I want to get his feedback too,
>>>>>> particularly
>>>>>> on the discussion of the "PR Challenge".
>>>>>>
>>>>>> The word limit for an Eos meeting piece is 1500 words, we're
>>>>>> currently
>>>>>> about 200 words under. So there is room for small additions or
>>>>>> expansions of key points.
>>>>>>
>>>>>> Please send me any suggested changes/additions/etc. or, if you
>>>>>> have none
>>>>>> simply indicate that you are happy with it as is, and happy to
>>>>>> lend your
>>>>>> name to it.
>>>>>>
>>>>>> Thanks in advance,
>>>>>>
>>>>>> mike
>>>>>>

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>>>>

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>>>>

>>>> --

>>>> Michael E. Mann

>>>> Associate Professor

>>>> Director, Earth System Science Center (ESSC)

>>>>

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<<http://www.met.psu.edu/dept/faculty/mann.htm>><http://www.met.psu.edu/dept/faculty/mann.htm>

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>

> --

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> Climatic Research Unit

> University of East Anglia

> Norwich, NR4 7TJ, U.K.

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> Phone: +44-1603-593909

> Fax: +44-1603-507784

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Page 391

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email: mann@psu.edu
<http://www.met.psu.edu/dept/faculty/mann.htm>

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703. 1153163328.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>
Subject: new fig 6.14
Date: Mon, 17 Jul 2006 15:08:48 +0100
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, joos <joos@climate.unibe.ch>

<x-flowed>

Hi Peck, Eystein and Fortunat,

I've drafted two versions of the new fig 6.14, comprising a new panel showing the forcing used in the EMIC runs, plus the old fig 6.13e panel showing the EMIC simulated NH temperatures. Keith has seen them already.

First you should know what I did, so that you (especially Fortunat) can check that what I did was appropriate:

(1) For the volcanic forcing, I simply took the volcanic RF forcing from Fortunat's file and applied the 30-year smoothing before plotting it.

(2) For the solar forcing there are 2 curves. For the first, I took the Bard 0.25% column from Fortunat's RF file. For the second, I took the Bard 0.08% column from Fortunat's RF file from 1001 to 1609, and then appended the WLS RF forcing from 1610 to 1998. Then I smoothed the combined record. NOTE that for the Bard0.25%, the line is flat from 1961 onwards which probably isn't realistic, even though that is what was used in the model runs.

(3) For the "all other forcings" there are 2 curves. For the first, I took the CO2 concentrations provided by Fortunat, then used the "standard" IPCC formula from the TAR (in fact the first of the three options for CO2 in IPCC TAR Table 6.2) to convert this to a radiative forcing. I then added this to the non-CO2 radiative forcings data from Fortunat's file, to get the total radiative forcing. For the second, I replaced all values after 1765 with the 1765 value (for the natural forcings case). Then I smoothed the combined record (as in fig 6.13c, I only applied a 10-year smoothing when plotting the "all other forcings", because it is fairly smooth anyway and using a high smoothing results in lower final values when there is a strong trend at the end of a time series).

Now, some comments on the figures themselves (please print them and refer to them when reading this):

(1) File 'chap6_f6.14_option1.pdf' is strongly preferred by Keith and me. This shows the three forcing components separately, which helps with understanding the individual causes of specific warming and cooling periods. I have managed to reduce the size of this

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considerably, compared to the equivalent panel in fig 6.13, because with only a few series on it I could squeeze them together more and also reduce the range of the vertical axes.

(2) Although we don't prefer it, I have also made 'chap6_f6.14_option2.pdf' which is even smaller by only showing the sum of all the forcings in the top panel.

which version do you prefer? Please let me know so I can make final changes only to the preferred version.

Some more comments:

(1) Fig 6.14b was originally Fig 6.13e. When it was part of that figure, the colour bar showing the shades of grey used to depict the overlapping ranges of the published temperature reconstructions was only on Fig 6.13d. Do you think I should now also add it to the EMIC panel (6.14b), now that it is in a separate figure? It will be a bit of a squeeze because of the legend that is already in 6.14b.

(2) Another carry over from when 6.14b was part of 6.13, is that the time range of all panels had to match (900-2010). Now that the EMICs are in a separate figure, I could start them in year 1000, which is when the forcing and simulations begin. Unless you want 6.13 and 6.14 to remain comparable? Again please comment/decide.

(3) I wasn't sure what colours to use for the forcing series. In option 1, the volcanic and other forcings apply to all runs, so I chose black (with thick/thin used to distinguish the "all" forcings from the "natural-only" forcings (basically the thin flat line in "all other forcings). The cyan-green-blue runs used strong solar forcing, so I used blue for that forcing. The red-orange-brown runs used weak solar forcing, so I used brown for that forcing. Sound ok?

Sorry for the long email, but I wanted to get everything explained to avoid too many iterations.

Please let me know your decisions/comments on these questions, or on any other aspects of the new figure.

Cheers

Tim

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Attachment Converted: "c:\eudora\attach\chap6_f6.14_option2.pdf"

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Dr Timothy J Osborn, Academic Fellow
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sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

**Norwich -- City for Science:
**Hosting the BA Festival 2-9 September 2006

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704. 1153167959.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: Special instructions/timing adjustment
Date: Mon Jul 17 16:25:59 2006
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, "Ricardo Villalba"
<ricardo@lab.cricyt.edu.ar>, joos <joos@climate.unibe.ch>

Hi all,
I'm halfway through these changes and will get the revised figures out to you probably tomorrow, except maybe the SH one, because:
I'm not sure if the van Ommen (pers. comm.) data shown by Jones & Mann and suggested by Riccardo are the data to use or not. Is it published properly? I've seen the last 700 years of the Law Dome 180 record published, so perhaps we should show just the period since 1300 AD? That period appears in:
Mayewski PA, Maasch KA, White JWC, et al.
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Mid latitude winter climate variability in the South Indian and southwest Pacific regions since 1300 AD
CLIMATE DYNAMICS 22 (8): 783-794 JUL 2004
See below for some more comments in respect to individual figures.
At 21:36 30/06/2006, Jonathan Overpeck wrote:

Figure 6.10.

1. shade the connection between the top and middle panels

yes

2. remove the dotted (long instrumental) curve from the middle panel

yes

3. replace the red shaded region in the bottom panel with the grey-scale one used in Fig 6.13

yes

4. label only every increment of 10 in the grey-scale bar (formally color) in the bottom panel

yes

5. Increase font sizes for axis numbering and axis labeling - all are too small. You can figure out the best size by reducing figs to likely page size minus margins. We guess

the captions need to be bigger by a couple increments at least.

yes

Figure 6.11.

1. This one is in pretty good shape except that Ricardo has to determine if S. African boreholes need to be removed.

I think Henry said they were published and could stay

Figure 6.12

1. again, please delete S. African borehole if Ricardo indicates it's still not published.

I think Henry said they could stay.

2. consider adding Law Dome temperature record - Ricardo is investigating, but perhaps Keith/Tim can help figure out if it's valid to include. Feel free to check with Valerie on this too, as she seems to know these data at least a little

Already discussed above.

3. also, please increase font sizes and make sure they match 6.10 - probably better to use bold fonts

You are right that I've mixed bold and non-bold. When reduced to small size, the non-bold actually read more clearly than the bold, I think, so I'll standardise on non-bold. It's not possible to completely standardise on the size, because each figure I provide might be scaled by different amounts. I don't know final figure size, so will make a good guess. Should be ok.

Figure 6.13

1. we are going to split the existing 6.13 into two figure. The first is 100% Tim's fig., and is just an upgrade of the existing 6.13 a-d, with the only changes being:

1a. delete the old ECHO-G red dashed line curve in panel d, and

Keith says this was discussed and rejected, so I should keep old ECHO-G in?

1b. please also increase font sizes and make sure they match 6.10 and 12 - please use bold fonts.

ok, as discussed above.

2. The existing 6.13e is going to become a new 6.14, with the addition of a new forcings panel "a" on top of the existing panel e (which becomes 6.14b). To make this happen, Tim and Fortunat have to coordinate, as Tim has the forcing data (and knows what we what) and Tim has the existing figure. We suspect it will be easier for Fortunat to give Tim data and layout advice, and for Tim to make a figure that matches the other

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figs he's doing. PLEASE NOTE that this fig can't be as large as the existing 6.13a-d, but needs to be more compact to permit its inclusion.

done.
Cheers
Tim

705. 1153172761.txt

#####

From: "Cooke, Barry" <bcooke@NRCAN.GC.CA>
To: ITRDBFOR@LISTSERV.ARIZONA.EDU
Subject: Re: [ITRDBFOR] Joe Barton's hockey stick hearing coming up
Date: Mon, 17 Jul 2006 17:46:01 -0400
Reply-to: ITRDB Dendrochronology Forum <ITRDBFOR@LISTSERV.ARIZONA.EDU>

"Non-independence" of reconstructions and "worthlessness" of the hockey stick model were raised as separate issues.

If the worth of a model is measured by its ability to predict, then a model that explains 0.5% of the variation in some variable is fairly (but not necessarily completely) "worthless". Surely, one hopes for better. Especially where consensus is required.

The proxy data on which multi-proxy reconstructions are based may be statistically independent, but the reconstructions themselves are not. This is not because of any lack of "independence" (i.e. objectivity) among networked researchers, but a measurable fact of arithmetic. To the extent that multi-proxy reconstructions are built on the same proxy data, they are statistically non-independent (i.e. correlated).

i.e. It's not the non-independence that make the model worthless. It's the uncertainty.

On your last point of social networks, try a Google search of 'Exxon Secrets'. The difference between a ruling orthodoxy and a scientific network is not the degree of connectivity, but the mode of governance: coercion & inculcation vs. facts & reason (including statistical inference). Be wary of any science that loathes statistics or resents external investigation. That's the start of rot.

If Wegman et al. are suggesting that statisticians should be put to work to serve the interests of paleoclimatologists (which they are), then who on this list is going to argue that? I say let's put them to work!

Barry Cooke

-----Original Message-----

From: ITRDB Dendrochronology Forum
[mailto:ITRDBFOR@LISTSERV.ARIZONA.EDU]
Sent: Monday, July 17, 2006 6:43 AM
To: ITRDBFOR@LISTSERV.ARIZONA.EDU
Subject: Re: Joe Barton's hockey stick hearing coming up

>Marianne's message further claims that the "characterization of the
>hockey stick as 'worthless' underscores what appears to be a basic lack

>of understanding of how scientific consensus is formed". Yet if a
>consensus is based on invalid statistical analysis, then the consensus

>is wrong.

To explain my point (and my apologies to those to whom this is obvious): it would not be unprecedented for a scientific consensus to be wrong. However, there is also ample precedent for papers containing flaws (which virtually all do, if somebody looks hard enough, or has the misfortune of having the resources of Congress devoted to finding them) to have constructive influence on debate. To take an example from history, many of Charles Darwin's observations are pure amateurish nonsense by the standards of even the late 19th century, but no one would doubt their value in building the consensus for evolution. The question is not always strict veracity, but whether work provokes fruitful questions, or leads research in a constructive direction. (By the way, this is not to take a position on the Wegman judgement on the MBH papers).

>Dave's message further claims that there are multiple "independent >lines of evidence" for the hockey stick. The Wegman report discusses >this claim. See especially p.46-47, which cite twelve different >studies and concludes that those studies "cannot really claim to be >independent".

This part of the report is more precious than useful. In most empirical fields, leading primary investigators have linkages--nothing unusual about that. We could construct similar matrices of social networks in physics, biology, statistics. That doesn't mean the works produced in physics, biology or statistical theory are "worthless". A similar point can be made about different investigators using the same proxy data. In fact, isn't it one of the recommendations of the Wegman report that the paleoclimate community share data more effectively? Seems that if that recommendation was followed, certain statisticians would have even more occasion to complain of a lack of true independence. Seems these poor climate experts can't win!

Wouldn't it be interesting to see a "social network" matrix--or a funding matrix--between those the scientists, statisticians, Congressional Republicans, and oil companies most passionate about "debunking" global climate change?

Dr. Maryanne W. Newton
Research Associate
Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern
Dendrochronology Cornell University

706. 1153186426.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: Special instructions/timing adjustment
Date: Mon, 17 Jul 2006 21:33:46 -0600
Cc: "Ricardo Villalba" <ricardo@lab.criicyt.edu.ar>, Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>, Valerie Masson-Delmotte <Valerie.Masson@cea.fr>

<x-flowed>
Hi Tim et al (especially Valerie) - again, sorry for the confusion, but hopefully the emails sent and forwarded from Valerie and me this evening helps figure this out. I think we're going with borehole for Law Dome, but you guys need to confirm it's the way to go. I'm cc'ing

mail.2006

to Valerie in the hope she can try to provide more guidance in this - with a confirmation that it's the best way to go and will stand up to criticism. If we have multiple conflicting temp recons from Law Dome, and one can't be shown from the literature as being the best, then we should state that, and show neither - just an idea. BUT, I think Valerie was pretty sure the borehole was best. She should be more available in a day or so.

Thanks all, cheers, Peck

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>

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>
>Tim
>
>
>Dr Timothy J Osborn, Academic Fellow
>Climatic Research Unit
>School of Environmental Sciences, University of East Anglia

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>sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm
>
>**Norwich -- City for Science:
>**Hosting the BA Festival 2-9 September 2006

--

Jonathan T. Overpeck
Director, Institute for the Study of Planet Earth
Professor, Department of Geosciences
Professor, Department of Atmospheric Sciences

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<http://www.ispe.arizona.edu/>
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707. 1153232546.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: new fig 6.14
Date: Tue, 18 Jul 2006 10:22:26 -0600
Cc: t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Hi all - Thanks for all the Euro-dialog before I even got to my computer - lots of good issues raised, and glad the misunderstanding got cleared up.

Eystein and I can't connect easily today, so I'm going to take a stab at the CLA compromise, guessing that he'll concur. If not, he can clarify.

1) We really do need to see the original forcing (spikes for volc, higher freq for solar), so that should be a given. If Tim can do his usual graphical magic and get a smoothed version in there too, that's ok, but I think Fortunat is correct that this new 6.14 gives us a chance to show data differently (and in a way that the TS team really would like). BUT, to show a smoothed curve, perhaps behind? (or whatever looks best and makes it easy to see the more raw data) the more raw data, would be a nice way to connect 6.14 with 6.13, and also make the points that Tim points out - especially highlighting the obvious link between forcing and response prior to 1900. This last point is key for the TS too. BUT, please don't make the more raw data hard to see - they are a KEY part of this fig, especially in the

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TS. So... go for it Tim - I suggest some annotation for those peaks that are too large to plot - perhaps an asterisk with a note in the caption that "*volcanic forcing peaks larger than XXX are truncated for plotting purposes" or something like that.

2) the normalisation reference period should be consistent between all of the associated figs, so I'd stick with with you've been doing Tim. Otherwise, it will be too confusing.

3) as to whether forcing should be proportional. As long as the scaling (y-axis labeling) is explicit we can be flexible here in order to make sure viewers can see all of the smoothed and unsmoothed forcing data clearly. That is the key, and we can relax the need to have them all proportional in this fig.

Bottom line is that the forcing data we present should have the ability to see the differences in solar clearly - as Fortunat's mock-up plot does. This is driven more from the TS, but that's ok - we get serious play in the TS.

Hope this provides enough for Tim to go with, and as always, if you want to provide some options, that's fine.

Fortunat - you'll need write the caption - hopefully keeping it as brief as possible by citing the earlier captions in the report.

thanks all! best, Peck

--

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</x-flowed>

708. 1153232841.txt

#####

From: "Cooke, Barry" <bcooke@NRCAN.GC.CA>
To: ITRDBFOR@LISTSERV.ARIZONA.EDU
Subject: [ITRDBFOR] wegman on calibrating response functions
Date: Tue, 18 Jul 2006 10:27:21 -0400
Reply-to: ITRDB Dendrochronology Forum <ITRDBFOR@LISTSERV.ARIZONA.EDU>

That may be "the point" that you're choosing to focus on. My point, quite apart from yours, is that (1) there were oversights in MBH98, (2) that paper appears to have been rushed to publication, (3) M&M03 appear to have been shunned by the scientific review process, (4) wegman et al. have got a couple of good points on the statistics of tree-ring calibration worthy of discussion, (5) the issue of calibration error cuts to the core of the debate, as it is what underlies the breadth of

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the confidence envelope around the hockey stick during the MWP. You criticize their analysis of the MBH98 social network, but what do you make of their more substantive argument regarding errors in calibration response functions?

Barry

-----Original Message-----

From: ITRDB Dendrochronology Forum [mailto:ITRDBFOR@LISTSERV.ARIZONA.EDU]
Sent: Tuesday, July 18, 2006 6:28 AM
To: ITRDBFOR@LISTSERV.ARIZONA.EDU
Subject: Re: Joe Barton's hockey stick hearing coming up

At 05:46 PM 7/17/2006 -0400, Barry Cooke wrote:
>The proxy data on which multi-proxy reconstructions are based may be
>statistically independent, but the reconstructions themselves are not.
>This is not because of any lack of "independence" (i.e. objectivity)
>among networked researchers, but a measurable fact of arithmetic. To
>the extent that multi-proxy reconstructions are built on the same proxy
>data, they are statistically non-independent (i.e. correlated).

Fair enough. But I believe the point (or at least the implication) is being made that these networked researchers are failing to adequately review the work of their peers. It would also be naive not to expect that Mr. Barton and the political wing of the "Climate science is bunk" crowd will use those connects to argue for the "worthlessness" of most everything produced by the network. (Note the recent public comments by Senator Inhofe).

Dr. Maryanne W. Newton
Research Associate
Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern
Dendrochronology Cornell University

709. 1153233036.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: Law Dome figure
Date: Tue, 18 Jul 2006 10:30:36 -0600
Cc: Ricardo Villalba <ricardo@lab.cricyt.edu.ar>, Keith Briffa <k.briffa@uea.ac.uk>, Valerie Masson-Delmotte <Valerie.Masson@cea.fr>, Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>
Hi Tim, Ricardo and friends - your suggestion to leave the figure unchanged makes sense to me. Of course, we need to discuss the Law Dome ambiguity clearly and BRIEFLY in the text, and also in the response to "expert" review comments (sometimes, it is hard to use that term "expert"...).

Ricardo, Tim and Keith - can you take care of this please. Nice resolution, thanks.

best, Peck

>Hi all,

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>
>(1) Jones/Mann showed (and Mann/Jones used in
>their reconstruction) an isotope record from Law
>Dome that is probably O18 (they say "oxygen
>isotopes"). This has a "cold" present-day and
>"warm" MWP (indeed relatively "warm" throughout
>the 1000-1750 period). The review comments from
>sceptics wanted us to show this for obvious
>reasons. But its interpretation is ambiguous
>and I think (though I'm not certain) that it has
>been used to indicate atmospheric circulation
>changes rather than temperature changes by some
>authors (Souney et al., JGR, 2002).

>
>(2) Goosse et al. showed Deuterium excess as an
>indicator of Southern Ocean SST (rather than
>local temperature). Goosse et al. also showed a
>composite of 4 Antarctic ice core records (3
>deuterium, 1 O18). Neither of these comes up to
>the 20th century making plotting on the same
>scale as observed temperature rather tricky!

>
>(3) Dahl-Jensen showed the temperatures obtained
>by inverting the borehole temperature profiles.
>This has a colder MWP relative to the recent
>period, which shows strong recent warming.

>
>I have data from (1) and now from (3) too, but
>not from (2) though I could ask Hugues Goosse
>for (2). Anyway, (1) and (2) aren't calibrated
>reconstructions like the others in the Southern
>Hemisphere figure, so plotting them would alter
>the nature of the figure.

>
>But if we show only (3) then we will be accused
>of (cherry-)picking that (and not showing (1) as
>used by Mann/Jones) because it showed what we
>>wanted/expected.

>
>Can I, therefore, leave the SH figure unchanged
>and can we just discuss the Law Dome ambiguities
>in the text?

>
>Cheers

>
>Tim

>
>At 02:41 18/07/2006, Jonathan Overpeck wrote:
>>Hi Tim, Ricardo and Keith - Valerie just
>>reminded me that she sent this to us all (minus
>>Tim) back in June. There is plenty below for
>>discussion in the text, and the Law Dome
>>borehole data can be obtained at the site below
>>(http://www.nbi.ku.dk/side95613.htm). This is
>>the record that should be added to the SH
>>figure.

>>
>>Thanks, Peck

>>
>>>X-Sieve: CMU Sieve 2.2

>>>Date: Wed, 28 Jun 2006 12:44:50 +0200

>>>From: Valérie Masson-Delmotte <Valerie.Masson@cea.fr>

>>>Reply-To: Valerie.Masson@cea.fr

mail.2006

>>>Organization: LSCE
>>>To: Jonathan Overpeck <jto@u.arizona.edu>,
>>> Ricardo Villalba <ricardo@lab.cricyt.edu.ar>,
>>> Keith Briffa <k.briffa@uea.ac.uk>
>>>Subject: (pas de sujet)
>>>
>>>Dear Ricardo and Peck,
>>>
>>>Here are the references for the Law Dome temperature discussion :
>>>
>>>* stack of Antarctic ice cores and Law Dome
>>>deuterium excess profile (showing large
>>>changes in moisture source)
>>>
>>>Title: *A late medieval warm period in the
>>>Southern Ocean as a delayed response to
>>>external forcing?*>>>Author(s): *Goosse H*
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Goosse+H&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>*Masson-Delmotte V*
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Masson-Delmotte+V&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>Renssen H
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Renssen+H&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>Delmotte M
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Delmotte+M&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>Fichefet T
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Fichefet+T&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>Morgan V
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Morgan+V&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>van Ommen T
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=van+Ommen+T&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>Khim BK
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Khim+BK&curr_doc=1/3&Form=FullRecordPage&doc=1/3>,
>>>Stenni B
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Stenni+B&curr_doc=1/3&Form=FullRecordPage&doc=1/3>
>>>Source: GEOPHYSICAL RESEARCH LETTERS 31 (6): Art. No. L06203 MAR 17 2004
>>>Document Type: Article
>>>Language: English
>>>Abstract: On the basis of long simulations
>>>performed with a three-dimensional climate
>>>model, we propose an interhemispheric climate
>>>lag mechanism, involving the long-term memory
>>>of deepwater masses. Warm anomalies, formed in
>>>the North Atlantic when warm conditions
>>>prevail at surface, are transported by the
>>>deep ocean circulation towards the Southern
>>>Ocean. There, the heat is released because of
>>>large scale upwelling, maintaining warm
>>>conditions and inducing a lagged response of
>>>about 150 years compared to the Northern
>>>Hemisphere. Model results and observations
>>>covering the first half of the second
>>>millenium suggest a delay between the
>>>temperature evolution in the Northern

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>>>Hemisphere and in the Southern Ocean. The
>>>mechanism described here provides a reasonable
>>>hypothesis to explain such an interhemipsheric
>>>lag.
>>>Keywords Plus: CLIMATE-CHANGE; ICE CORE; LAW
>>>DOME; TEMPERATURES; ANTARCTICA; PALEOCLIMATE;
>>>CIRCULATION; MILLENNIUM; RECORDS; SIGNAL
>>>
>>>* borehole temperature profile from Law Dome :
>>>Title: *Monte Carlo inverse modelling of the
>>>Law Dome (Antarctica) temperature profile*
>>>Author(s): *DahlJensen D*
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=DahlJensen+D&curr_doc=4/15&Form=FullRecordPage&doc=4/15>,
>>>Morgan VI
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Morgan+VI&curr_doc=4/15&Form=FullRecordPage&doc=4/15>,
>>>Elcheikh A
>>><http://wos.isiknowledge.com/CIW.cgi?SID=X1EEf2907C03d9dPA24&Func=OneClickSearch&field=AU&val=Elcheikh+A&curr_doc=4/15&Form=FullRecordPage&doc=4/15>
>>>Source: ANNALS OF GLACIOLOGY, VOL 29, 1999
>>>ANNALS OF GLACIOLOGY 29: 145-150 1999
>>>Document Type: Article
>>>Language: English
>>>
>>>Abstract: The temperature profile in the 1200
>>>m deep Dome Summit South (DSS) borehole near
>>>the summit of Law Dome, Antarctica, was
>>>measured in 1996, 3 years after the
>>>termination of the deep drilling.
>>>
>>>The temperature profile contains information
>>>on past surface temperature over the last 4
>>>ka. This temperature history is determined by
>>>the use of a Monte Carlo inverse method in
>>>which no constraints are placed on the unknown
>>>temperature history and no solution is assumed
>>>to be unique. The temperature history is
>>>obtained from a selection of equally
>>>well-fitting solutions by a statistical
>>>treatment.
>>>
>>>The results show that solutions covering the
>>>last 4 ka have a well-developed central value,
>>>a most likely temperature history. The
>>>temperature record has two well-developed
>>>minima at: AD 1250 and 1850. From 1850 to the
>>>present, temperatures have gradually increased
>>>by 0.7 K. The reconstructed temperatures are
>>>compared with the stable oxygen isotope
>>>(delta(18)O) from the DSS ice core.
>>>
>>>=> The inversed temperature data are available on the GFY web site at :
>>><http://www.nbi.ku.dk/side95613.htm>, go to "Dye
>>>3, GRIP, Law Dome temperature reconstructed
>>>from borehole measurements"
>>>
>>>* Regarding the calibration issue there are several publications :
>>>- seasonal calibration between 180 and T :
>>>
>>>[van Ommen and Morgan, 1997a]
>>><<http://staff.acecrc.org.au/%7Eetas/home/reprints/1997%20-%20JGR%20-%20van%20Ommen%20-%20delT.pdf>>

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>>>
>>>Tas D. van Ommen and Vin Morgan. Calibrating
>>>the ice core paleothermometer using
>>>seasonality. J. Geophys. Res.,
>>>102(D8):9351-9357, 1997, [AAD Cat. Ref. 7488].
>>>
>>>[van Ommen and Morgan, 1997b]
>>><<http://staff.acecrc.org.au/%7Eetas/home/reprints/1997%20-%20JGR%20-%20van%20Ommen%20-%20delTcorr.pdf>>
>>>
>>>Tas D. van Ommen and Vin Morgan. Correction to
>>>"Calibrating the ice core paleothermometer
>>>using seasonality". J. Geophys. Res.,
>>>102(D25):30,165, 1997, [AAD Cat. Ref. 8236].
>>>
>>>- decadal calibration from a high resolution
>>>ice core (using deuterium excess)
>>>
>>>*Recent southern Indian Ocean climate
>>>variability inferred from a Law Dome ice core:
>>>new insights for the interpretation of coastal
>>>Antarctic isotopic records*
>>>V. Masson-Delmotte ^{^A1}, M. Delmotte ^{^A1} ^{A4} ,
>>>V. Morgan ^{^A2} , D. Etheridge ^{^A3} , T. van
>>>Ommen ^{^A2} , S. Tartarin ^{^A1} , G. Hoffmann
>>>
>>>Stable isotopes in water have been measured
>>>along a very high accumulation ice core from
>>>Law Dome on the east Antarctic coast. These
>>>enable a detailed comparison of the isotopic
>>>records over sixty years (1934-1992) with
>>>local (Antarctic station data) and remote
>>>meteorological observations (atmospheric
>>>reanalyses and sea-surface temperature
>>>estimates) on a seasonal to inter-annual time
>>>scale. Using both observations and isotopic
>>>atmospheric general circulation model (GCM)
>>>results, we quantify the relationships between
>>>stable isotopes ($d^{18}O$, dD and deuterium
>>>excess; $dD = dD - 8 \times d^{18}O$) with site and
>>>source temperature at seasonal and decadal
>>>time scales, showing the large imprint of
>>>source conditions on Law Dome isotopes. These
>>>calibrations provide new insights for the
>>>quantitative interpretation of temporal
>>>isotopic fluctuations from coastal Antarctic
>>>ice cores. An abrupt change in the local
>>>meridional atmospheric circulation is clearly
>>>identified from Law Dome deuterium excess
>>>during the 1970s and analysed using GCM
>>>simulations.
>>>
>>>
>>>
>>>Valérie.
>>
>>
>>--
>>Jonathan T. Overpeck
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>

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>sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm

>

>**Norwich -- City for Science:

>**Hosting the BA Festival 2-9 September 2006

--

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From: Fortunat Joos <joos@climate.unibe.ch>

To: Keith Briffa <k.briffa@uea.ac.uk>

Subject: Re: new fig 6.14

Date: Tue, 18 Jul 2006 16:20:16 +0200

Cc: Tim Osborn <t.osborn@uea.ac.uk>, Jonathan Overpeck <jto@u.arizona.edu>, Eystein Jansen <eystein.jansen@geo.uib.no>

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Hi Keith,

Thanks.

My concerns comes from the following. I am not convinced that one gets the same response when forcing a model with smoothed volcanic forcing

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instead with the spikes. I suspect that the ocean will gain more heat in the later case due to the longer time to respond to the forcing. However, this remains to be tested, but nobody has done this as far as I know. In other words, postprocessing the output of a model forced with high resolution data does not necessarily give the same results as forcing the model with smoothed input. There is a chance to get different results. That is why I prefer to show the real forcing, i.e. the volcanic spikes. As long as nobody has done such tests run I would prefer to be scientifically on the safe side with the figure. Sorry, but this is my modellers view on this.

Forcings do not need to be on the same scale here. We know that temporarily volcanic forcing, albeit negative, is much larger than anthropogenic forcing. Why should we hide this well-known fact? Sceptics may call on this. Readers of our chapter are hopefully able to interpret the y-axis.

The TS-team (in this case neither me nor Peck) asked us to show the volcanic spikes.

A point of the figure is to show the implication of low solar forcing (WLS versus Bard) that is why I prefer to blow the solar panel somewhat up. We have varied solar forcing between the different runs. Of course the point about the natural forcing only simulation not able to get the 20th century warming is very important. Indeed, I believe that this important conclusion is underscored if we make it very clear that we have varied solar forcing over a wide range (by a factor of 3).

It would also be nice to show the 11-yr solar cycle that is in the data (sun spots, but also 14C).

As far as normalisation of the forcing is concerned. I have no strong opinion. There is a consistency issue with chapter 2 where radiative forcing is always defined relative to 1750 (1750==0). This point may especially be important for the TS. There is also the issue about agreement over recent decades. This is why I slightly prefer to normalize the forcing to be zero around 1750.

The sulfur figure will show volcanic spikes. We have agreed in Bergen that we add a sentence to the caption to point out that sulfate deposition may strongly vary regionally.

I think we have with fig 13 and 14 now the opportunity to convey to the readers the same information in two different ways. Perhaps, we should not miss this opportunity. In any case, we will find a solution and then go forward.

Cheers, Fortunat

Keith Briffa wrote:

> Fortunat et al
> My opinions were consistent with Tim's expression - we discussed his
> response. The importance of consistency between different modelling
> figures (time response of filters and in the absolute magnitude of
> forcing scale) are the most important aspects. To start showing
> apparently different volcanic spikes (in the sulphate and EMIC Figure)
> will lead to confusion also. Ultimately we should remember that the
> point of this Figure is to show that you can not get simulated
> temperatures to match observations without anthropogenic forcing - not
> to show proportional responses to different solar or volcanic events.
> cheers
> Keith

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>
> At 13:45 18/07/2006, Fortunat Joos wrote:
>
>> Dear Tim,
>>
>> Sorry, that was a very careless and a totally inappropriate choice of
>> words. I seriously apologize. Of course smoothing is not dishonest (I
>> do it also all the time). To the contrary, I very much appreciate all
>> your hard work to do these figures. I know that it is very time
>> consuming from own experience ... (that is perhaps why I did not
>> reflect on my wording when writing the e-mail). What I wanted to say
>> is that if one has the opportunity to show directly what forcing was
>> used by the model than I very much prefer to do so. I hope there
>> remains no misunderstanding. I realize now that I should have used
>> more modest wording at various places.
>>
>> Let us see what Eystein, Peck and Keith are thinking about it.
>>
>> With best wishes, Fortunat
>>
>> Tim Osborn wrote:
>>
>>> Hi all,
>>> thanks for the responses, Peck and Fortunat.
>>> I drafted the new figure 6.14 following as closely as possible the
>>> approach used for the original forcing/simulation figure (now 6.13).
>>> This is why I smoothed all series and used a common anomalisation
>>> period for all curves across all panels. It can greatly help to
>>> interpret why the simulated temperature responds in the way it does,
>>> because the zero (or "normal" level) is comparable across plots and
>>> because the strengths of different forcings can be compared *on the
>>> same timescale* as the simulated temperatures are shown. And, for
>>> 6.13, with so many different forcings and models shown, it would have
>>> been impossible to use unsmoothed series without making the
>>> individual curves indistinguishable (or indeed fitting them into such
>>> a compact figure).
>>> Now that the EMIC panels are separate from the original 6.13, we do
>>> have the opportunity to make different presentational choices. But I
>>> think, nevertheless, that some of the reasons for (i) proportional
>>> scaling, (ii) common anomalisation period; and (iii) smoothing to
>>> achieve presentation on comparable time scales, that held for 6.13
>>> probably also hold in 6.14.
>>> However, I also appreciate the points raised by Fortunat,
>>> specifically that (i) it is nice to be able to compare the magnitude
>>> of the 11-yr solar cycles with the magnitude of the low-frequency
>>> solar variations; and (ii) that using a modern reference period
>>> removes the interpretation that we don't even know the forcing today.
>>> So we have various advantages and disadvantages of different
>>> presentational choices, and no set of choices will satisfy all these
>>> competing demands.
>>> One thing that I am particularly perturbed about is Fortunat's
>>> implication that to show smoothed forcings would be scientifically
>>> dishonest. I disagree (and I was also upset by your choice of
>>> wording). If it were dishonest to show smoothed data, then
>>> presumably the same holds for 6.13 (but its impossible to distinguish
>>> all the different volcanic forcings if shown unsmoothed), but also to
>>> every other graphic... should I be showing the EMIC simulated
>>> temperatures without smoothing too, so you can see the individual
>>> yearly responses to the volcanic spikes? But annual means are formed
>>> from the temperatures simulated on the model timesteps, so we still
>>> wouldn't be showing results that had not been post-processed. Most
>>> climate models, even GCMs, respond in a quasi-linear way, such that
>>> the smoothed response to unsmooth forcing is very similar to the

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>>> response to smooth forcing. So if we are interested in the
>>> temperature response on time scales of 30 years and longer, it seems
>>> entirely appropriate (and better for interpretation/comparison of
>>> forcings) to show the forcings on this time scale too, because the
>>> forcing variations on those time scales are the ones that are driving
>>> the temperature response (even though the forcing may be intermittent
>>> like volcanoes or have 11-yr cycles like solar).
>>> The choice of smoothing / no smoothing is not, therefore, anything to
>>> do with honesty/dishonesty, but is purely a presentational choice
>>> that can be made accordingly to what the purpose of the figure is. Here
>>> our purpose seems to be long-term climate changes, rather than
>>> response to individual volcanoes or to the 11-yr solar cycle.

>>> So the position is:

>>> (1) smoothing or no smoothing: there are arguments for both choices,
>>> though clearly I prefer smoothing and Fortunat prefers no smoothing.
>>> I could make a figure which kept the smooth lines but put the raw
>>> annual histogram volcanic spikes underneath in pale grey, as Peck
>>> requested anyway (and possibly put the 11-yr solar cycles in pale
>>> brown underneath the smoothed brown solar series). This would be a
>>> compromise but the main problem is that the scale of the largest
>>> volcanic spikes would far exceed the scale I am using to show the
>>> smoothed series (so the panel is not large enough to do this)!
>>> (2) pre-industrial or present-day anomalisation reference period:
>>> again there are arguments for both choices. Whatever we choose, I
>>> firmly believe it should be the same for *all* curves in this figure
>>> (which can make a dramatic difference).
>>> (3) exaggeration of solar scale or proportional vertical scales: this
>>> is the one that I have the firmest opinion about. I see no reason to
>>> exaggerate the scale of the solar forcings relative to volcanic or
>>> anthropogenic forcings. The difference between the forcings looks
>>> clear enough in the version of the figure that I made. Exaggerating
>>> it will wrongly make the Bard 2.5% case look (at first glance) bigger
>>> than the anthropogenic forcing, and make it look more important than
>>> volcanic forcing.
>>> I'll hold off from making any more versions till decisions are made
>>> on these issues.

>>> Cheers

>>> Tim

>>> At 09:01 18/07/2006, Fortunat Joos wrote:

>>>>

>>>> Hi Tim and co,

>>>>

>>>> Thanks for the figure. I like the figure showing the model results
>>>> and the general outline/graphic style.

>>>>

>>>> However, I am concerned about what is shown in the forcing figure.

>>>>

>>>> 1) volcanic panel: I strongly believe that we should show what was
>>>> used by the model and not some 40 year smoothed curves for volcanic
>>>> forcing or any other forcing. So please use the original data file.
>>>> Scientific honesty demands to show what was used and not something
>>>> post-processed.

>>>>

>>>> 2) solar panel:

>>>> 2a) We must show the Wang-Lean-Shirley data on the original
>>>> resolution as used to drive the models. In this way, we also
>>>> illustrate the magnitude of the 11-yr annual cycle in comparison
>>>> with the background trend. The record being flat, apart from the
>>>> 11-yr cycle, during the last decades is a reality.

>>>> 2b) Do not apply any smoothing to the Bard data. Just use them as
>>>> they are and how they were published by Bard and used in the model.

>>>> 2c) It is fine to suppress the Bard 0.08 case after 1610 (not done in
>>>> my figure version)

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>>>> 2d) the emphasis of the figure is on the solar forcing differences.
>>>> So, please show solar somewhat overproportional in comparison to
>>>> volcanic and other forcings.
>>>>
>>>> 3) other forcings: again no smoothing needed here. It would be hard
>>>> to defend a double smoothing.
>>>>
>>>> 4)- normalisation of solar forcing to some period mean. If the
>>>> different solar forcings disagree for today as in your option, we
>>>> may send the signal that we do not even know solar forcing today.
>>>> Thus, I slightly prefer to have the same mean forcing values for all
>>>> solar records during the last few decades as shown in the attached
>>>> version. However, I also can see some arguments for other
>>>> normalisations.
>>>>
>>>> To illustrate points 1 to 4, I have prepared and attached a version
>>>> of the forcing panel.
>>>>
>>>> other points
>>>>
>>>> - Your choice of colors is fine
>>>> - time range 1000-2000 AD is fine
>>>> - suggest to remove the text from the y-labels except the units w/m2.
>>>>
>>>> Sorry for this additional comments coming a bit late. However, I did
>>>> not realise that you planned to smoothed the model input data in any
>>>> way.
>>>>
>>>> With best wishes,
>>>>
>>>> Fortunat
>>>>
>>>> Tim Osborn wrote:
>>>>
>>>>> Hi Peck, Eystein and Fortunat,
>>>>> I've drafted two versions of the new fig 6.14, comprising a new
>>>>> panel showing the forcing used in the EMIC runs, plus the old fig
>>>>> 6.13e panel showing the EMIC simulated NH temperatures. Keith has
>>>>> seen them already.
>>>>> First you should know what I did, so that you (especially Fortunat)
>>>>> can check that what I did was appropriate:
>>>>> (1) For the volcanic forcing, I simply took the volcanic RF forcing
>>>>> from Fortunat's file and applied the 30-year smoothing before
>>>>> plotting it.
>>>>> (2) For the solar forcing there are 2 curves. For the first, I
>>>>> took the Bard 0.25% column from Fortunat's RF file. For the
>>>>> second, I took the Bard 0.08% column from Fortunat's RF file from
>>>>> 1001 to 1609, and then appended the WLS RF forcing from 1610 to
>>>>> 1998. Then I smoothed the combined record. NOTE that for the
>>>>> Bard0.25%, the line is flat from 1961 onwards which probably isn't
>>>>> realistic, even though that is what was used in the model runs.
>>>>> (3) For the "all other forcings" there are 2 curves. For the
>>>>> first, I took the CO2 concentrations provided by Fortunat, then
>>>>> used the "standard" IPCC formula from the TAR (in fact the first of
>>>>> the three options for CO2 in IPCC TAR Table 6.2) to convert this to
>>>>> a radiative forcing. I then added this to the non-CO2 radiative
>>>>> forcings data from Fortunat's file, to get the total radiative
>>>>> forcing. For the second, I replaced all values after 1765 with the
>>>>> 1765 value (for the natural forcings case). Then I smoothed the
>>>>> combined record (as in fig 6.13c, I only applied a 10-year
>>>>> smoothing when plotting the "all other forcings", because it is
>>>>> fairly smooth anyway and using a high smoothing results in lower
>>>>> final values when there is a strong trend at the end of a time

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>>>> series).
>>>> Now, some comments on the figures themselves (please print them and
>>>> refer to them when reading this):
>>>> (1) File 'chap6_f6.14_option1.pdf' is strongly preferred by Keith
>>>> and me. This shows the three forcing components separately, which
>>>> helps with understanding the individual causes of specific warming
>>>> and cooling periods. I have managed to reduce the size of this
>>>> considerably, compared to the equivalent panel in fig 6.13, because
>>>> with only a few series on it I could squeeze them together more and
>>>> also reduce the range of the vertical axes.
>>>> (2) Although we don't prefer it, I have also made
>>>> 'chap6_f6.14_option2.pdf' which is even smaller by only showing the
>>>> sum of all the forcings in the top panel.
>>>> which version do you prefer? Please let me know so I can make
>>>> final changes only to the preferred version.
>>>> Some more comments:
>>>> (1) Fig 6.14b was originally Fig 6.13e. When it was part of that
>>>> figure, the colour bar showing the shades of grey used to depict
>>>> the overlapping ranges of the published temperature reconstructions
>>>> was only on Fig 6.13d. Do you think I should now also add it to
>>>> the EMIC panel (6.14b), now that it is in a separate figure? It
>>>> will be a bit of a squeeze because of the legend that is already in
>>>> 6.14b.
>>>> (2) Another carry over from when 6.14b was part of 6.13, is that
>>>> the time range of all panels had to match (900-2010). Now that the
>>>> EMICs are in a separate figure, I could start them in year 1000,
>>>> which is when the forcing and simulations begin. Unless you want
>>>> 6.13 and 6.14 to remain comparable? Again please comment/decide.
>>>> (3) I wasn't sure what colours to use for the forcing series. In
>>>> option 1, the volcanic and other forcings apply to all runs, so I
>>>> chose black (with thick/thin used to distinguish the "all" forcings
>>>> from the "natural-only" forcings (basically the thin flat line in
>>>> "all other forcings). The cyan-green-blue runs used strong solar
>>>> forcing, so I used blue for that forcing. The red-orange-brown
>>>> runs used weak solar forcing, so I used brown for that forcing.
>>>> Sound ok?
>>>> Sorry for the long email, but I wanted to get everything explained
>>>> to avoid too many iterations.
>>>> Please let me know your decisions/comments on these questions, or
>>>> on any other aspects of the new figure.
>>>> Cheers
>>>> Tim

>>>

>>>

>>>

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>>> **Norwich -- City for Science:
>>> **Hosting the BA Festival 2-9 September 2006

>>>

>>>

>>> --

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#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Henry Pollack <hpollack@umich.edu>
Subject: Re: Huang, et al GRL 24, 1997
Date: Tue, 18 Jul 2006 21:50:19 -0600
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Valerie Masson-Delmotte <Valerie.Masson@cea.fr>, t.osborn@uea.ac.uk, Keith Briffa <k.briffa@uea.ac.uk>, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>

<x-flowed>

Hi Henry - excellent feedback, thanks. I think it should be easy for Valerie (Holocene issues in 6.5) and Keith/Tim.Ricardo (last 2k, section 6.6) to deal with the 'expert' review issues regarding this paper. It sounds to me like that is the place for discussion of this paper, rather than in the text itself. BUT, it is important that the responses to review comments be thorough and convincing - Valerie and Keith - please update your responses in this respect.

thanks all, Peck

>Hi Peck and others,
>
>Attached is a brief discussion of the subject
>paper and the questions you have asked me to
>address. Let me know if you need additional
>clarification.
>
>Cheers,
>Henry
>

mail.2006

>  Henry N. Pollack
> Professor of Geophysics
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> Ann Arbor, Michigan 48109-1005, U.S.A.

> Phone: 734-763-0084 FAX: 734-763-4690
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> URL: www-personal.umich.edu/~hpollack/book.html

>Quoting Jonathan Overpeck <jto@u.arizona.edu>:

>>Hi again Henry - I've attached an 1997 paper of
>>your's and wonder if you could shed some
>>up-to-date insights on how to best interpret.
>>In particular:

>>1) it has been pointed out to us that the
>>result in this paper argue for a globally warm
>>period during the middle Holocene that was
>>warmer than today. Our assessment (i.e., Figure
>>6.9) indicates that there was likely no period
>>during the Holocene that was warmer around the
>>global than the late 20th century. Especially
>>outside of the tropics, there were periods
>>warmer than today during the Holocene, but
>>these regionally warm periods were not
>>synchronous - at least at the centennial scale
>>we can examine with proxy data. Thus, although
>>Huang et al. 1997, indicates greater mean
>>annual global warmth, it was unlike the
>>synchronous global warming of the late 20th
>>century.

>>Plus, we believe the warmth of the Holocene was
>>driven by orbital forcing, and that what we see
>>makes sense in that regard. Huang et al, 1997
>>can be explained perhaps (this is a question)
>>by the heavy borehole coverage in the Northern
>>mid- to high-latitudes? We also know that proxy
>>data shown in Fig 6.9 also indicate more
>>warming (again, not synchronous) in Southern
>>Hem mid-latitudes - where there are also many
>>boreholes.

>>Obviously, another issue is that the boreholes
>>don't give the same temporal resolution as the
>>other proxy records we synthesized/assessed,
>>and at least in your paper, there isn't
>>regional information either.

>>So - the point is not (unless you suggest
>>otherwise) that Huang et al 97 is wrong, but
>>rather than within the limits of the data, it
>>is compatible with what the higher-resolution,
>>regionally-specific, multi-proxy data are
>>showing in Fig 6.9, and that there was likely
>>no period during the Holocene that was warmer
>>synchronously around the global than the during
>>the late 20th century. Do you agree with this,
>>and is our reasoning accurate and complete?

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>>
>>2) Huang et al 1997 also shows evidence for
>>warmth within the last 500-1000 years that was
>>greater than during the 20th century AND a cool
>>minima 200 years ago. Both of these are
>>highlighted in your abstract, and both seem
>>incompatible with other evidence. For example,
>>your own more recent work has shown the coolest
>>temperatures to be about 500 years ago.
>>
>>We didn't think it was within our focus to
>>comment on these issues, but we are being asked
>>to by reviewers, and it would be good to have
>>your help in addressing these issues -
>>hopefully in our responses to review comments
>>rather than in our main text (which has to be
>>shortened).
>>
>>Many thanks for your help with this paper and the issues it raises.
>>
>>Best, Peck
>>
>>
>>
>>--
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>
>
>Attachment converted: Macintosh HD:GRL 1997.doc (WDBN/«IC») (00141CBF)

--
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712. 1153314389.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: cddhr@giss.nasa.gov
Subject: Fwd: Re: Gavin Smchmidt'comment
Date: wed, 19 Jul 2006 09:06:29 -0600
Cc: joos <joos@climate.unibe.ch>, Ricardo Villalba <ricardo@lab.cricyt.edu.ar>, Eystein Jansen <eystein.jansen@geo.uib.no>, cddhr@giss.nasa.gov, Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk

<x-flowed>

David - can you comment, help? thx, Peck

>X-Sieve: CMU Sieve 2.2
>X-Virus-checked: by University of Berne
>Date: wed, 19 Jul 2006 16:51:05 +0200
>From: Fortunat Joos <joos@climate.unibe.ch>
>Organization: University of Bern
>X-Accept-Language: en-us, en
>To: Jonathan Overpeck <jto@u.arizona.edu>
>Cc: Ricardo Villalba <ricardo@lab.cricyt.edu.ar>, Eystein Jansen <eystein.jansen@geo.uib.no>, cddhr@giss.nasa.gov, Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk
>Subject: Re: Gavin Smchmidt'comment
>
>
>

>Jonathan Overpeck wrote:

>>Hi Fortunat - Glad you're on this, and thanks for helping us get it >>right. I agree we need assurance from Chap 2 (David, can you make >>sure we've got it) that the deleted issues are, indeed, covered in >>Chap 2.

>In particular, I am not sure that chap 2 covers the Solanki et al. issue

>>thanks again, Peck

>>>Hi,

>>>what we agreed was actually to keep line 25 to line 34 on p 6-35 >>>and not just until line 30. (As well line 50, p-36 line 2-7).

>>>The sentence on line 32/33 that there is general agreement in the >>>evolution of the different proxies is important as there is in >>>general much confusion about this and this is a chapter 6 >>>statement covering the whole millennium. The sentence also links >>>nicey to the next sentence on line 50. Yes, as agreed in Bergen >>>delete the other parts if chapter 2 indeed is going to cover it. I >>>have not done so in my revision as I wanted to hear what chap 2 is >>>doing before deleting.

>>>Peck, in total we will delete 22 line. Note that I have also >>>squeezed out a few line in the sulfur section. Making progress!

>>>Regards, Fortunat

>>>David Rind wrote:

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>>>
>>>>Jonathan,
>>>>
>>>>
>>>>Keith and I discussed this at the meeting; basically what we need
>>>>to keep is:
>>>>
>>>>P. 6-25, lines 25-30, first sentence on line 50, and P. 6-26 the
>>>>first paragraph (lines 2-7).
>>>>
>>>>
>>>>All the rest is discussed in one form or another in Chapter 2, pp. 55-56.
>>>>
>>>>Concerning the volcanic forcing, there isn't nearly as much
>>>>overlap, and Chapter 6 did not have very much anyway - I think it
>>>>would be useful to keep what's there, adding just a reference to
>>>>Chapter 2 (add: "see also Chapter 2", at the end of line 26).
>>>>(I'm assuming that Fig. 6-13a still includes the solar and
>>>>volcanic forcing).
>>>>
>>>>David
>>>>
>>>>
>>>>At 11:40 AM -0600 7/18/06, Jonathan Overpeck wrote:
>>>>
>>>>>Hi David - it's good to know you can get to work before someone,
>>>>>even if they live in Europe.
>>>>>
>>>>>Your plan sounds good, and is it safe to assume that you will be
>>>>>making sure Chap 2 gets the right material from chap 6, and that
>>>>>we can thus pare our discussion of past solar and volcanic
>>>>>forcing down to a minimum? Can you give us an update of what
>>>>>they will not cover that we should (i.e., looking at section
>>>>>6.6)?
>>>>>
>>>>>Many thanks, Peck
>>>>>
>>>>>Hi All,
>>>>>
>>>>>[It's a sad state of affairs if I'm the one who gets to work
>>>>>sooner! (regardless of the time difference).]
>>>>>
>>>>>What is discussed below is basically what we thought in
>>>>>response to Gavin's comment - that we would basically
>>>>>cross-reference chap 2, where the primary discussion would
>>>>>occur. It's consistent with chapter 2's general discussion of
>>>>>how forcings have changed over time, and would seem odd if
>>>>>chapter 2 left out past solar and volcanic forcing. Chapter 2
>>>>>should feel free to utilize anything that existed in Chapter 6
>>>>>on these issues to complement their discussion, if the need
>>>>>arises. Once that is finalized, Chapter 6 can then make the
>>>>>proper cross-references.
>>>>>
>>>>>David
>>>>>
>>>>>
>>>>>At 10:26 AM -0600 7/18/06, Jonathan Overpeck wrote:
>>>>>
>>>>>>Hi Ricardo - good points. We did discuss this in Bergen, and
>>>>>>David Rind (as a Chap 2 CA) was going to help make sure we
>>>>>>kept things covered in chap 2, while cutting our solar and
>>>>>>volcanic discussions in chap 6. The key will be
>>>>>>cross-referencing chap 2 carefully. So, Keith, Ricardo and

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>>>>>>David - please interact to figure out how to work this
>>>>>>efficiently. Perhaps David could comment first since he's at
>>>>>>work sooner.
>>>>>>
>>>>>>Thanks... Best, Peck
>>>>>>
>>>>>>Hi all!
>>>>>>
>>>>>>In comment 6-811, Gavin Schmidt points out that our sections
>>>>>>
>>>>>>6.6.3.1 solar forcing
>>>>>>
>>>>>>6.6.3.2 volcanic forcing
>>>>>>
>>>>>>largely replicate the discussion in Chap. 2 on the same
>>>>>>topics. I checked
>>>>>>Chap. 2, and they provide a large (almost 8 pages in the SOD)
>>>>>>discussion
>>>>>>mainly on solar and but also on volcanic forcings. Gavin
>>>>>>suggests that only
>>>>>>the implementation issues should be discussed in our chapter
>>>>>>and leave the
>>>>>>most general information in Chapter 2. We can substantially shorten our
>>>>>>section following his advice. Please, find below the outline of the
>>>>>>sections in Chap. 2 dealing with solar and volcanic forcings. Cheers,
>>>>>>
>>>>>>Ricardo
>>>>>>
>>>>>>
>>>>>>
>>>>>>2.7 Natural Forcings
>>>>>>
>>>>>>
>>>>>>
>>>>>>2.7.1 Solar Variability
>>>>>>
>>>>>>2.7.1.1 Direct observations of solar irradiance
>>>>>>
>>>>>>2.7.1.1.1 Satellite measurements of total solar irradiance
>>>>>>
>>>>>>2.7.1.1.2 Observed decadal trends and variability
>>>>>>
>>>>>>2.7.1.1.3 Measurements of solar spectral irradiance
>>>>>>
>>>>>>2.7.1.2 Estimating past solar radiative forcing
>>>>>>
>>>>>>2.7.1.2.1 Reconstructions of past variations in solar irradiance
>>>>>>
>>>>>>2.7.1.2.2 Implications for solar radiative forcing
>>>>>>
>>>>>>2.7.1.3 Indirect effects of solar variability
>>>>>>
>>>>>>
>>>>>>
>>>>>>2.7.2 Explosive Volcanic Activity
>>>>>>
>>>>>>2.7.2.1 Radiative effects of volcanic aerosols
>>>>>>
>>>>>>2.7.2.2 Thermal, dynamic and chemistry perturbations forced by volcanic
>>>>>>aerosols
>>>>>>
>>>>>>
>>>>>>

>>>>>>>
>>>>>>>
>>>>>>>----- Original Message -----
>>>>>>>From: "Tim Osborn" <t.osborn@uea.ac.uk>
>>>>>>>To: "Jonathan Overpeck" <jto@u.arizona.edu>; "Keith Briffa"
>>>>>>><k.briffa@uea.ac.uk>
>>>>>>>Cc: "Eystein Jansen" <eystein.jansen@geo.uib.no>; "Ricardo Villalba"
>>>>>>><ricardo@lab.cricyt.edu.ar>; "joos" <joos@climate.unibe.ch>
>>>>>>>Sent: Monday, July 17, 2006 12:25 PM
>>>>>>>Subject: Re: Special instructions/timing adjustment
>>>>>>>
>>>>>>> Hi all,
>>>>>>>
>>>>>>> I'm halfway through these changes and will get the revised figures
>>>>>>> out to you probably tomorrow, except maybe the SH one, because:
>>>>>>>
>>>>>>> I'm not sure if the van Ommen (pers. comm.) data shown by Jones &
>>>>>>> Mann and suggested by Riccardo are the data to use or not. Is it
>>>>>>> published properly? I've seen the last 700 years of the Law Dome 180
>>>>>>> record published, so perhaps we should show just the period since
>>>>>>> 1300 AD? That period appears in:
>>>>>>>
>>>>>>> Mayewski PA, Maasch KA, White JWC, et al.
>>>>>>> A 700 year record of Southern Hemisphere extratropical
>>>>>>> climate variability
>>>>>>> ANNALS OF GLACIOLOGY 39: 127-132 2004
>>>>>>>
>>>>>>> and
>>>>>>>
>>>>>>> Goodwin ID, van Ommen TD, Curran MAJ, et al.
>>>>>>> Mid latitude winter climate variability in the South Indian and
>>>>>>> southwest Pacific regions since 1300 AD
>>>>>>> CLIMATE DYNAMICS 22 (8): 783-794 JUL 2004
>>>>>>>
>>>>>>> See below for some more comments in respect to individual figures.
>>>>>>>
>>>>>>> At 21:36 30/06/2006, Jonathan Overpeck wrote:
>>>>>>> >Figure 6.10.
>>>>>>> >1. shade the connection between the top and middle panels
>>>>>>>
>>>>>>> yes
>>>>>>>
>>>>>>> >2. remove the dotted (long instrumental) curve from the middle panel
>>>>>>>
>>>>>>> yes
>>>>>>>
>>>>>>> >3. replace the red shaded region in the bottom panel with the
>>>>>>> >grey-scale one used in Fig 6.13
>>>>>>>
>>>>>>> yes
>>>>>>>
>>>>>>> >4. label only every increment of 10 in the grey-scale bar (formally
>>>>>>> >color) in the bottom panel
>>>>>>>
>>>>>>> yes
>>>>>>>
>>>>>>> >5. Increase font sizes for axis numbering and axis labeling - all
>>>>>>> >are too small. You can figure out the best size by reducing figs to
>>>>>>> >likely page size minus margins. We guess the captions need to be
>>>>>>> >bigger by a couple increments at least.
>>>>>>>
>>>>>>> yes
>>>>>>>

>>>>>>>>
>>>>>>>> >Figure 6.11.
>>>>>>>> >
>>>>>>>> >1. This one is in pretty good shape except that Ricardo has to
>>>>>>>> >determine if S. African boreholes need to be removed.
>>>>>>>>
>>>>>>>> I think Henry said they were published and could stay
>>>>>>>>
>>>>>>>>
>>>>>>>> >
>>>>>>>>
>>>>>>>> >Figure 6.12
>>>>>>>> >
>>>>>>>> >1. again, please delete S. African borehole if Ricardo indicates
>>>>>>>> >it's still not published.
>>>>>>>>
>>>>>>>> I think Henry said they could stay.
>>>>>>>>
>>>>>>>> >2. consider adding Law Dome temperature record - Ricardo is
>>>>>>>> >investigating, but perhaps Keith/Tim can help figure out if it's
>>>>>>>> >valid to include. Feel free to check with Valerie on this too, as
>>>>>>>> >she seems to know these data at least a little
>>>>>>>>
>>>>>>>> Already discussed above.
>>>>>>>>
>>>>>>>> >3. also, please increase font sizes and make sure they match 6.10 -
>>>>>>>> >probably better to use bold fonts
>>>>>>>>
>>>>>>>> You are right that I've mixed bold and non-bold. When reduced to
>>>>>>>> small size, the non-bold actually read more clearly than the bold, I
>>>>>>>> think, so I'll standardise on non-bold. It's not possible to
>>>>>>>> completely standardise on the size, because each figure I provide
>>>>>>>> might be scaled by different amounts. I don't know final figure
>>>>>>>> size, so will make a good guess. Should be ok.
>>>>>>>>
>>>>>>>> >Figure 6.13
>>>>>>>> >
>>>>>>>> >1. we are going to split the existing 6.13 into two figure. The
>>>>>>>> >first is 100% Tim's fig., and is just an upgrade of the existing
>>>>>>>> >6.13 a-d, with the only changes being:
>>>>>>>> >1a. delete the old ECHO-G red dashed line curve in panel d, and
>>>>>>>>
>>>>>>>> Keith says this was discussed and rejected, so I should
>>>>>>>> keep old ECHO-G
>>>>>>>>
>>>>>>>>
>>>>>>>> in?
>>>>>>>>
>>>>>>>>
>>>>>>>> >1b. please also increase font sizes and make sure they match 6.10
>>>>>>>> >and 12 - please use bold fonts.
>>>>>>>>
>>>>>>>> ok, as discussed above.
>>>>>>>>
>>>>>>>> >2. The existing 6.13e is going to become a new 6.14, with the
>>>>>>>> >addition of a new forcings panel "a" on top of the existing panel e
>>>>>>>> >(which becomes 6.14b). To make this happen, Tim and Fortunat have to
>>>>>>>> >coordinate, as Tim has the forcing data (and knows what we what) and
>>>>>>>> >Tim has the existing figure. We suspect it will be easier for
>>>>>>>> >Fortunat to give Tim data and layout advice, and for Tim to make a
>>>>>>>> >figure that matches the other figs he's doing. PLEASE NOTE that this
>>>>>>>> >fig can't be as large as the existing 6.13a-d, but needs to be more
>>>>>>>> >compact to permit its inclusion.

>>>>>>>>

done.

>>>>>>>>

Cheers

>>>>>>>>

Tim

>>>>>>>>

>>>>>>>>

Dr Timothy J Osborn, Academic Fellow
Climatic Research Unit
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>>>>>>>>

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>>>>>>>>

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**Hosting the BA Festival 2-9 September 2006

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--
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713. 1153339440.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Keith Briffa <k.briffa@uea.ac.uk>
Subject: new figs 6.11 and 6.12
Date: wed Jul 19 16:04:00 2006
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, "Ricardo Villalba"
<ricardo@lab.cricyt.edu.ar>, joos <joos@climate.unibe.ch>

Here's the new 6.11 and 6.12. Very few changes necessary.
At 21:36 30/06/2006, Jonathan Overpeck wrote:

mail.2006

Figure 6.11.

1. This one is in pretty good shape except that Ricardo has to determine if S. African boreholes need to be removed.

It turned out that these could stay. All I've done is to add some white latitude/longitude lines.

Figure 6.12

1. again, please delete S. African borehole if Ricardo indicates it's still not published.

Not necessary.

2. consider adding Law Dome temperature record - Ricardo is investigating, but perhaps Keith/Tim can help figure out if it's valid to include. Feel free to check with Valerie on this too, as she seems to know these data at least a little

We decided not to do this, but to discuss in the text instead.

3. also, please increase font sizes and make sure they match 6.10 - probably better to use bold fonts

Fonts are bigger. Decided to standardise on non-bold fonts for all these plots.

Cheers

Tim

714. 1153406000.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>

To: Tim Osborn <t.osborn@uea.ac.uk>

Subject: Re: Special instructions/timing adjustment

Date: Thu, 20 Jul 2006 10:33:20 -0600

Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>

<x-flowed>

Hi Tim - Thanks. If you don't mind, let's see what the new grey in panel c, and also the 5-95% range on a. Also, another alternative to the grey and red could be some other color that is just less bright - perhaps blue?

Agree there is no reason to switch the reviewed panel c uncertainty approach. It argues a bit that we leave panel a as is too. I'm unsure what is best, so maybe see what Keith thinks too - and discuss more with Phil - he is right that most are trying to go with 5-95 where possible.

Thanks again.

>Hi again,

>

>I still have the red option built into the program, so can easily revert to it. Of course

mail.2006

>the grey has the advantage of consistency with
>the model and EMIC panels, which really must be
>grey so that all the coloured lines indicating
>the simulated temperatures will show up (red
>isn't really an option for the reconstruction
>shading in those figures). I'll see if I can
>make it clearer yet keep it in grey.

>
>On a different note, Phil Jones just popped in
>and said why are we using "+-2SE" shading in the
>top instrumental panel when it has apparently
>been decided to show the smaller 5-95% range (he
>says this is only 0.8225 times the +-2SE range)
>in all IPCC WG1 figures. Shall I change this?
>If I do, then the brown and orange curves will
>fall outside this narrower range more often than
>they fall outside the current wider SE range.

>
>The grey shading in panel (c) is also computed
>from the overlap of the +-1 SE and +-2 SE ranges
>of individual reconstructions, but I guess this
>can stay unchanged, rather than needing to be
>recalculated using the overlap of the ?-?% and
>5-95% ranges?

>
>Cheers

>
>Tim

>
>At 16:05 19/07/2006, Jonathan Overpeck wrote:
>>Hi Tim - thanks! Now I can see why you went
>>with the red rather than grey in the bottom
>>panel - it's hard to see. I'd like to float the
>>idea with everyone on the email that we
>>consider going back to red, or try something
>>else. All else is good (thanks) perhaps make
>>the bottom/top axis labels bigger still? (both
>>numbers and "Year").

>>
>>Thx again, Peck

>>
>>>Hi Peck et al.,

>>>
>>>revised fig 6.10 is attached.

>>>
>>>At 21:36 30/06/2006, Jonathan Overpeck wrote:
>>>>Figure 6.10.

>>>>
>>>>1. shade the connection between the top and middle panels

>>>>
>>>>It was already shaded. Your poor old eyes must be failing you ;-)

>>>>
>>>>Ok, so it *was* rather pale! I've made it a bit darker.

>>>>
>>>>2. remove the dotted (long instrumental) curve from the middle panel

>>>>
>>>>Done

>>>>
>>>>3. replace the red shaded region in the
>>>>bottom panel with the grey-scale one used in
>>>>Fig 6.13

>>>>
>>>>Done - how does it look now? I had to outline

mail.2006

>>>the instrumental series with a narrow white
>>>band to ensure it could be seen against the
>>>very dark grey shading.
>>>
>>>>4. label only every increment of 10 in the
>>>>grey-scale bar (formally color) in the bottom
>>>>panel
>>>
>>>Done
>>>
>>>>5. Increase font sizes for axis numbering and
>>>>axis labeling - all are too small. You can
>>>>figure out the best size by reducing figs to
>>>>likely page size minus margins. We guess the
>>>>captions need to be bigger by a couple
>>>>increments at least.
>>>
>>>Increased the axis numbering/labelling by a couple of points.
>>>
>>>Cheers
>>>
>>>Tim
>>>
>>>
>>>
>>>Attachment converted: Macintosh HD:chap6_f6.10.pdf (PDF /«IC») (00141E77)
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>>>
>>>**Norwich -- City for Science:
>>>**Hosting the BA Festival 2-9 September 2006
>>
>>
>>--
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mail.2006

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>
>**Norwich -- City for Science:
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--

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http://www.ispe.arizona.edu/
</x-flowed>

715. 1153424011.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Caspar Ammann <ammann@ucar.edu>
Subject: Fwd: Re: pseudo-proxies for the climate reconstruction challenge
Date: Thu Jul 20 15:33:31 2006
Cc: philip.brohan@metoffice.gov.uk

I should also say, Caspar, that I've not forwarded any documents to Philip yet with more details about the challenge. I thought that you should do that instead, because you will have (more likely) kept track of where the latest version is.

Cheers
Tim

Hi Caspar,
I forgot to forward to you Philip Brohan's positive response to my invitation for him to be involved in the production of pseudo-proxy and pseudo-instrumental data for the climate reconstruction challenge.

It is copied below and you can find his contact details below too.
Best wishes
Tim

From: philip.brohan@metoffice.gov.uk
Subject: Re: pseudo-proxies for the climate reconstruction challenge
To: Tim Osborn <t.osborn@uea.ac.uk>
Cc: simon.tett@metoffice.gov.uk, Keith Briffa <k.briffa@uea.ac.uk>
Date: Thu, 29 Jun 2006 11:08:54 +0100
Hi Tim.

mail.2006

Thanks for your notes from the workshop. It sounds both interesting and very positive - I was afraid that the relations between the participants would break down completely, but you've clearly made good progress.

I think a blind test of reconstruction methods is an excellent idea, and I'm happy to support it in any capacity. I've done this before with nuclear fuel performance models, and the results were both alarming and instructive. Doing it properly won't be easy though, I think several different stretches of model simulation will be required.

So yes - volunteer me to Caspar (or the organising committee) to make pseudo-proxy and pseudo-instrumental data.

Philip

On Fri, 2006-06-23 at 16:48, Tim Osborn wrote:

> Hi Philip (cc Simon & Keith),

>

> Please read my report-back from Wengen workshop first. You'll see
> that a "climate reconstruction challenge" was suggested and that this
> would be a "blind" test where participating groups would not know
> what the real answer is.

>

> Caspar Ammann would provide and keep secret a suitable model
> simulation. But we discussed who should make the pseudo-proxy data
> from the model output. I wondered whether you (Philip) would be
> interested in this, given your experience with the instrumental error
> model and interest in statistical models for proxy error. What do
> you think of this idea, Philip? A number of proxy people, including
> us, might liaise with you about how such an error model might be
> structured, but ultimately we would not be allowed to know precise
> details about how you generated a set of pseudo-proxies otherwise we
> wouldn't be allowed to take part in the challenge ourselves.

>

> Would you be interested in participating in this "challenge" in this
> way, and have time to do so? It would preclude you from entering the
> challenge of course.

>

> Please let me know and I will liaise with whoever else is involved in
> organising this challenge (at least Caspar, but it's not yet clear who else).

>

> Cheers

>

> Tim

>

--

Philip Brohan, Climate Scientist

Met Office Hadley Centre for Climate Prediction and Research

Tel: +44 (0)1392 884574 Fax: +44 (0)1392 885681

Global climate data sets are available from [1]<http://www.hadobs.org>

References

1. <http://www.hadobs.org/>

716. 1153470204.txt

#####

From: "Wahl, Eugene R" <wahl@alfred.edu>

To: "Keith Briffa" <k.briffa@uea.ac.uk>

Subject: RE: confidential

Date: Fri, 21 Jul 2006 04:23:24 -0400

Hi Keith:

mail.2006

I hope you are well in all this!!

I have done my best this evening to digest the issues you asked me to look at, and to give perspective on them. Here is what I can offer at this point.

1) Thoughts and perspective concerning the reviewer's comments per se. These are coded in blue and are in the "Notes" column between pages 103 and 122 inclusive. It got to the point that I could not be exhaustive, given the very lengthy set of review thoughts, so I am also attaching a review article Caspar and I plan to submit to Climatic Change in the next few days. [The idea is that this would accompany the Wahl-Ammann article, to summarize and amplify on it -- given all the proper and non-proper interpretation WA has received and the need for subsequent analysis that WA only lightly touches on. Steve Schneider is aware that it is coming.] I think a read through this, especially the part on PCs and Bristlecones, can say about all I might offer additionally. It is not lengthy.

Please note that this Ammann-wahl text is sent strictly confidentially -- it should not be cited or mentioned in any form, and MUST not be transmitted without permission. However, I am more than happy to send it for your use, because it succinctly summarizes what we have found on all the issues that have come up re: MBH. As you can see, we agree at some level with some of the criticisms raised by MM and others, but we do not find that they invalidate MBH in any substantial way.

2) I have added a brief suggested alteration to page 6-3 of the draft text you sent, to take into account the fact Wahl-Ammann decidedly settles the issue concerning how proxy PC calculations impact the MBH style reconstruction. These changes are encoded using WORD's "Track Changes" feature.

I did not get into suggesting how that paragraph might otherwise be rewritten. You can see more generally where Caspar and I have gone in the attached text, and how our work relates generally to the MM, von Storch, etc. "examinations" of MBH. Thinking further, the "Validation Thresholds and Measures of Merit" and "Amplitude Issues" sections might also be well worth a look. The former will help you see how over-strong and one-sided are the arguments Steven McIntyre puts forth in this area. (Cf. Wahl-Ammann Appendix 1 also on this topic -- McIntyre strongly avoids, or simply chastizes as ad hoc, the false negative issues at lower frequencies that we raise concerning the use of r^2 .) He has done with the IPCC just what he did in reviewing the Wahl-Ammann paper--and indeed in all his efforts--write volumes of very strongly worded, one-sided critiques, which can take a lot of time to see through and then respond to. I hope what we have written can help you in this way. I note that Mike Mann, Richard Alley, and others have written response comments, which would be useful for getting perspective also.

Finally, note also that I corrected the reference to Wahl, Ritson, Ammann (Wahl et al., 2006) on page 6-6, and put the correct publication information in the reference section.

I hope this all helps. I would be happy to do my best to answer any further questions you might have.

All the best, and Peace, Gene
Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

607-871-2604
1 Saxon Drive
Alfred, NY 14802

From: Keith Briffa [mailto:k.briffa@uea.ac.uk]
Sent: Tue 7/18/2006 10:20 AM
To: Wahl, Eugene R.
Subject: confidential

Gene

I am taking the liberty (confidentially) to send you a copy of the reviewers comments (please keep these to yourself) of the last IPCC draft chapter. I am concerned that I am not as objective as perhaps I should be and would appreciate your take on the comments from number 6-737 onwards , that relate to your reassessment of the Mann et al work. I have to consider whether the current text is fair or whether I should change things in the light of the sceptic comments. In practise this brief version has evolved and there is little scope for additional text , but I must put on record responses to these comments - any confidential help , opinions are appreciated . I have only days now to complete this revision and response. note that the sub heading 6.6 the last 2000 years

is page 27 line35 on the original (commented) draft.

Cheers
Keith

--
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Attachment Converted: "c:\eudora\attach\AW_Editorial_July15.doc"

Attachment Converted: "c:\eudora\attach\AR4SOR_BatchAB_Ch06_ERW_comments.doc"

Attachment Converted:
"c:\eudora\attach\Ch06_SOD_Text_TSU_FINAL_2000_12jul06_ERW_suggestions.doc"

717. 1153482869.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Fortunat Joos <joos@climate.unibe.ch>, David Rind <drind@giss.nasa.gov>
Subject: Re: Gavin Smchmidt'comment
Date: Fri Jul 21 07:54:29 2006
Cc: Jonathan Overpeck <jto@u.arizona.edu>, Ricardo Villalba <ricardo@lab.cricyt.edu.ar>, Eystein Jansen <eystein.jansen@geo.uib.no>, cddhr@giss.nasa.gov, t.osborn@uea.ac.uk

I suggest only one of us - Fortunat - make these changes in his version ,
Page 429

mail.2006

otherwise we are
all going to do it slightly differently.
Keith
At 08:16 19/07/2006, Fortunat Joos wrote:

Hi,
what we agreed was actually to keep line 25 to line 34 on p 6-35 and not just
until line 30. (As well line 50, p-36 line 2-7).
The sentence on line 32/33 that there is general agreement in the evolution of
the different proxies is important as there is in general much confusion about this
and this is a chapter 6 statement covering the whole millennium. The sentence also links
nicely to the next sentence on line 50. Yes, as agreed in Bergen delete the other
parts if chapter 2 indeed is going to cover it. I have not done so in my revision as I
wanted to hear what chap 2 is doing before deleting.
Peck, in total we will delete 22 line. Note that I have also squeezed out a few
line in the sulfur section. Making progress!
Regards, Fortunat
David Rind wrote:

Jonathan,
Keith and I discussed this at the meeting; basically what we need to keep is:
P. 6-25, lines 25-30, first sentence on line 50, and P. 6-26 the first
paragraph (lines 2-7).
All the rest is discussed in one form or another in Chapter 2, pp. 55-56.
Concerning the volcanic forcing, there isn't nearly as much overlap, and
Chapter 6 did not have very much anyway - I think it would be useful to keep what's there,
adding just a reference to Chapter 2 (add: "see also Chapter 2", at the end of line 26). (I'm assuming that Fig. 6-13a still
includes the solar and volcanic forcing).
David
At 11:40 AM -0600 7/18/06, Jonathan Overpeck wrote:

Hi David - it's good to know you can get to work before someone, even if they
live in Europe.
Your plan sounds good, and is it safe to assume that you will be making sure
Chap 2 gets the right material from chap 6, and that we can thus pare our discussion of
past solar and volcanic forcing down to a minimum? Can you give us an update of what they
will not cover that we should (i.e., looking at section 6.6)?
Many thanks, Peck

Hi All,
[It's a sad state of affairs if I'm the one who gets to work sooner!
(regardless of the time difference).]
what is discussed below is basically what we thought in response to Gavin's
comment - that we would basically cross-reference chap 2, where the primary discussion
would

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occur. It's consistent with chapter 2's general discussion of how forcings have changed over time, and would seem odd if chapter 2 left out past solar and volcanic forcing.

Chapter 2 should feel free to utilize anything that existed in Chapter 6 on these issues

to complement their discussion, if the need arises. Once that is finalized, chapter 6

can then make the proper cross-references.

David

At 10:26 AM -0600 7/18/06, Jonathan Overpeck wrote:

Hi Ricardo - good points. We did discuss this in Bergen, and David Rind (as a Chap 2 CA) was going to help make sure we kept things covered in chap 2, while cutting our solar

and volcanic discussions in chap 6. The key will be cross-referencing chap 2 carefully.

So, Keith, Ricardo and David - please interact to figure out how to work this efficiently. Perhaps David could comment first since he's at work sooner.

Thanks... Best, Peck

Hi all!

In comment 6-811, Gavin Schmidt points out that our sections

6.6.3.1 Solar forcing

6.6.3.2 Volcanic forcing

largely replicate the discussion in Chap. 2 on the same topics. I checked Chap. 2, and they provide a large (almost 8 pages in the SOD) discussion mainly on solar and but also on volcanic forcings. Gavin suggests that only the implementation issues should be discussed in our chapter and leave the most general information in Chapter 2. We can substantially shorten our section following his advice. Please, find below the outline of the sections in Chap. 2 dealing with solar and volcanic forcings. Cheers, Ricardo

2.7 Natural Forcings

2.7.1 Solar Variability

2.7.1.1 Direct observations of solar irradiance

2.7.1.1.1 Satellite measurements of total solar irradiance

2.7.1.1.2 Observed decadal trends and variability

2.7.1.1.3 Measurements of solar spectral irradiance

2.7.1.2 Estimating past solar radiative forcing

2.7.1.2.1 Reconstructions of past variations in solar irradiance

2.7.1.2.2 Implications for solar radiative forcing

2.7.1.3 Indirect effects of solar variability

2.7.2 Explosive Volcanic Activity

2.7.2.1 Radiative effects of volcanic aerosols

2.7.2.2 Thermal, dynamic and chemistry perturbations forced by volcanic aerosols

----- Original Message -----

From: "Tim Osborn" <t.osborn@uea.ac.uk>

To: "Jonathan Overpeck" <jto@u.arizona.edu>; "Keith Briffa" <k.briffa@uea.ac.uk>

Cc: "Eystein Jansen" <eystein.jansen@geo.uib.no>; "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>; "Joos" <joos@climate.unibe.ch>

Sent: Monday, July 17, 2006 12:25 PM

Subject: Re: Special instructions/timing adjustment

Hi all,

I'm halfway through these changes and will get the revised figures out to you probably tomorrow, except maybe the SH one, because:

I'm not sure if the van Ommen (pers. comm.) data shown by Jones &

Mann and suggested by Riccardo are the data to use or not. Is it

published properly? I've seen the last 700 years of the Law Dome 180

mail.2006

record published, so perhaps we should show just the period since 1300 AD? That period appears in:
Mayewski PA, Maasch KA, White JWC, et al.
A 700 year record of Southern Hemisphere extratropical climate variability
ANNALS OF GLACIOLOGY 39: 127-132 2004
and

Goodwin ID, van Ommen TD, Curran MAJ, et al.
Mid latitude winter climate variability in the South Indian and southwest Pacific regions since 1300 AD
CLIMATE DYNAMICS 22 (8): 783-794 JUL 2004
See below for some more comments in respect to individual figures.
At 21:36 30/06/2006, Jonathan Overpeck wrote:

>Figure 6.10.

>1. shade the connection between the top and middle panels

yes

>2. remove the dotted (long instrumental) curve from the middle panel

yes

>3. replace the red shaded region in the bottom panel with the

>grey-scale one used in Fig 6.13

yes

>4. label only every increment of 10 in the grey-scale bar (formally

>color) in the bottom panel

yes

>5. Increase font sizes for axis numbering and axis labeling - all

>are too small. You can figure out the best size by reducing figs to

>likely page size minus margins. We guess the captions need to be

>bigger by a couple increments at least.

yes

>Figure 6.11.

>

>1. This one is in pretty good shape except that Ricardo has to

>determine if S. African boreholes need to be removed.

I think Henry said they were published and could stay

>

>Figure 6.12

>

>1. again, please delete S. African borehole if Ricardo indicates

>it's still not published.

I think Henry said they could stay.

>2. consider adding Law Dome temperature record - Ricardo is

>investigating, but perhaps Keith/Tim can help figure out if it's

>valid to include. Feel free to check with Valerie on this too, as

>she seems to know these data at least a little

Already discussed above.

>3. also, please increase font sizes and make sure they match 6.10 -

>probably better to use bold fonts

You are right that I've mixed bold and non-bold. When reduced to

small size, the non-bold actually read more clearly than the bold, I

think, so I'll standardise on non-bold. It's not possible to

completely standardise on the size, because each figure I provide

might be scaled by different amounts. I don't know final figure

size, so will make a good guess. Should be ok.

>Figure 6.13

>

>1. we are going to split the existing 6.13 into two figure. The

>first is 100% Tim's fig., and is just an upgrade of the existing

>6.13 a-d, with the only changes being:

>1a. delete the old ECHO-G red dashed line curve in panel d, and

Keith says this was discussed and rejected, so I should keep old ECHO-G

in?

>1b. please also increase font sizes and make sure they match 6.10
>and 12 - please use bold fonts.
ok, as discussed above.
>2. The existing 6.13e is going to become a new 6.14, with the
>addition of a new forcings panel "a" on top of the existing panel e
>(which becomes 6.14b). To make this happen, Tim and Fortunat have to
>coordinate, as Tim has the forcing data (and knows what we what) and
>Tim has the existing figure. We suspect it will be easier for
>Fortunat to give Tim data and layout advice, and for Tim to make a
>figure that matches the other figs he's doing. PLEASE NOTE that this
>fig can't be as large as the existing 6.13a-d, but needs to be more
>compact to permit its inclusion.
done.

Cheers

Tim

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[8]http://www.cru.uea.ac.uk/cru/people/briffa/

References

1. http://www.cru.uea.ac.uk/~timo/
2. http://www.cru.uea.ac.uk/~timo/sunclock.htm
3. http://www.geo.arizona.edu/
4. http://www.ispe.arizona.edu/
5. http://www.geo.arizona.edu/
6. http://www.ispe.arizona.edu/
7. http://www.climate.unibe.ch/~joos/
8. http://www.cru.uea.ac.uk/cru/people/briffa/

718. 1153520622.txt

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From: Keith Briffa <k.briffa@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Eystein Jansen
<eystein.jansen@geo.uib.no>,
Subject: where I am up to now
Date: Fri Jul 21 18:23:42 2006
Cc: Fortunat Joos <joos@climate.unibe.ch>, drind@giss.nasa.gov

Need Fortunat to check the Gavin simplification (with David) and awaiting
comments from
Henry - though I have had a go at the relevant ones. Still needs the paragraph on
tree
rings and I have to incorporate Ricardo's bit. But this gives you a near overview
of where
we are - the inputting of the very many comment responses nearly there.
Keith
Is any body out there - any chance of call her in next half hour - or at home
later
44 1953 8510 - Peck?
Peck and Eystein
OK I am still struggling . I will not be able to get stuff to you til tuesday I
reckon -
masses of typing and having to re-read and consult with others (Henry will get
back to me
early next week) on the borehole stuff. Discussing stuff with Eugene Wahl
(confidentially)
and still need to check corrections and balance text. Tim still working on
Figures. We are
doing best to get stuff back asap - but if I have to incorporate Ricardo's stuff
and put
into version by Fortunat , it is getting more complicated. Fortunat should do
edits

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relating to the rationalising of the forcing text (as per Gavin comment - or has he already?) . Best if Oyvind puts the lot together then.
Keith

--
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[1]http://www.cru.uea.ac.uk/cru/people/briffa/

References

1. <http://www.cru.uea.ac.uk/cru/people/briffa/>

719. 1153761297.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Fortunat Joos <joos@climate.unibe.ch>
Subject: Re: solar and Law Dome GHG reference
Date: Mon, 24 Jul 2006 13:14:57 -0600
Cc: Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk, Eystein Jansen <eystein.jansen@geo.uib.no>, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>

<x-flowed>

Hi Fortunat and Keith - thanks for keeping close track of the volcanic and solar forcing aspects of 6.6, including coordination w/ Chap 2. The more you can do at this stage, Keith, the better (i.e., mystery changes), but there will be time to update re: chap 2 later.

Thanks again! Peck

>Hi,

>
>Three points:

>
>- Reference to MacFarling Meure already changed in my revision.

>
>- solar: It will probably not be a big deal to delete a few lines, when we have seen what chap 2 is doing.

>
>- Note that I am away for two weeks from July 29 to August 12, but I have time to work on remaining issues during the second half of August.

>
>With best wishes, Fortunat

>
>Jonathan Overpeck wrote:
>>Hi all - we probably have to cite this one, no? Thx, Peck

>>
>>>X-Sieve: CMU Sieve 2.2
>>>Date: Fri, 21 Jul 2006 11:07:59 -0600
>>>To: eystein.jansen@geo.uib.no, jto@u.arizona.edu
>>>From: Martin Manning <mmanning@al.noaa.gov>
>>>Subject: Fwd: Law Dome GHG reference
>>>Cc: Melinda Marquis <Marquis@ucar.edu>, ipcc-wg1@al.noaa.gov

mail.2006

>>>

>>>Hi Eystein, Peck

>>>

>>>The following from Dave Etheridge gives the citation for the
>>>published version of the MacFarling Meure et al paper. Not sure if
>>>you are switching to citing the GRL paper in preference to
>>>MacFarling Meure's thesis - but if you are here is the right
>>>reference.

>>>

>>>Cheers

>>>Martin

>>>

>>>>DomainKey-Signature: s=email; d=csiro.au; c=nofws; q=dns;
>>>>b=QFtbAVZCd84qwm9oHqL5Q+VatZDVO/wqkH4eZVeBGcwDj6LT57x2oyOdHwNvJZy8jBw0qelqAUxaZv
>>>>AcwNqCdAvbK9kTL2qq3KXA2S21EvnS2a+f7LIXMAZd11fm2vAa;
>>>>X-IronPort-AV: i="4.07,164,1151848800";
>>>> d="pdf'?scan'208,217"; a="103465294:sNHT485096344"
>>>>Subject: Law Dome GHG reference
>>>>Date: Fri, 21 Jul 2006 11:57:05 +1000
>>>>X-MS-Has-Attach: yes
>>>>X-MS-TNEF-Correlator:
>>>>Thread-Topic: Law Dome GHG reference
>>>>Thread-Index: AcasaPcmdL+xIXSPRpytweF8iOx2pg==
>>>>From: <David.Etheridge@csiro.au>
>>>>To: <mmanning@al.noaa.gov>, <d.lowe@niwa.co.nz>, <piers@env.leeds.ac.uk>
>>>>X-OriginalArrivalTime: 21 Jul 2006 01:57:05.0834 (UTC)
>>>>FILETIME=[F7AA30A0:01C6AC68]
>>>>X-Rcpt-To: <mmanning@aztec.al.noaa.gov>
>>>>X-DPOP: Version number suppressed

>>>>

>>>>Some of you were asking about this paper for IPCC AR4. It is now
>>>>published (today) in GRL. A pdf is attached.

>>>>

>>>>Regards

>>>>

>>>>David

>>>>

>>>>MacFarling Meure, C., Etheridge, D., Trudinger, C., Steele, P.,
>>>>Langenfelds, R., van Ommen, T., Smith, A. and Elkins, J. (2006).
>>>>The Law Dome CO₂, CH₄ and N₂O Ice Core Records Extended to 2000
>>>>years BP. Geophysical Research Letters, Vol. 33, No. 14, L14810
>>>>10.1029/2006GL026152.
>>>><<http://www.agu.org/journals/gl/g10614/2006GL026152/2006GL026152.pdf>>
>>>><http://www.agu.org/journals/gl/g10614/2006GL026152/2006GL026152.pdf>

>>>>

>>>><<2000yr_CO2CH4N2O_MacFarlingMeure_GRL.pdf>>

>>>>

>>>>Dr David Etheridge

>>>>CSIRO Marine and Atmospheric Research
>>>>Private Bag 1 (street address: 107-121 Station St.)
>>>>Aspendale, Victoria 3195, Australia
>>>>phone (61) 3 9239 4590 FAX (61) 3 9239 4444
>>>>email: david.etheridge@csiro.au

>>>>

>>>>website: <<http://www>><http://www.cmar.csiro.au/>

>>>>

>>>>--

>>>>Recommended Email address: mmanning@al.noaa.gov
>>>>** Please note that problems may occur with my @noaa.gov address
>>>>Dr Martin R Manning, Director, IPCC WG I Support Unit
>>>>NOAA Aeronomy Laboratory Phone: +1 303 497 4479
>>>>325 Broadway, DSRC R/CSD8 Fax: +1 303 497 5628
>>>>Boulder, CO 80305, USA

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>>>
>>
>>
>
>--

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> Climate and Environmental Physics,
> Physics Institute, University of Bern
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--
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</x-flowed>

720. 1153762381.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Tim Osborn <t.osborn@uea.ac.uk>
Subject: Re: MWP box figure
Date: Mon, 24 Jul 2006 13:33:01 -0600
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>
Hi again Tim et al - looks good to me. Obviously,
you and Keith need to nail the divergence issue
in the text, and also refer to it in the caption
for this fig, but otherwise, it's looking good.
Thanks, Peck

>Hi again,
>
>attached is the new MWP box figure.
>
>We reverted back to the figure used in the FOD
>because the decision to drop the panel from
>Osborn & Briffa (2006) meant that we were able
>to show a different selection of curves in the
>remaining panel from those we used in our paper.
>This allowed us to drop the shorter series that
>didn't span the medieval period, simplifying the
>figure and also dealing with a number of review
>comments that had been made about those series.
>

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>The only differences from the FOD figure are
>that the font is now consistent with the others
>figures, the composite mean series has been
>removed, and the figure has been shrunk
>vertically to save space.
>
>Cheers
>
>Tim
>
>
>Attachment converted: Macintosh HD:chap6_box6.4_f1.pdf (PDF /«IC») (00143489)
>Dr Timothy J Osborn, Academic Fellow
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>web: http://www.cru.uea.ac.uk/~timo/
>sunclock: http://www.cru.uea.ac.uk/~timo/sunclock.htm
>
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</x-flowed>

721. 1153771098.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>
Subject: Re: Special instructions/timing adjustment
Date: Mon Jul 24 15:58:18 2006
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, Fortunat Joos <joos@climate.unibe.ch>

Hi Peck et al.,
I've increased the axis labelling font size by another pt in all plots.
I attach two versions of 6.10, one in the grey (same as before except for bigger
axis
labelling) and one in brown. Brown looks like some old curry stain (or worse!).
Note that

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conversion from postscript to PDF or GIF tends to alter the colours, which alter again on different printers compared with the screen. So there's not much point in me playing around much more with the colours. Also attached are new versions of 6.13 and 6.14. Both have the bigger axis fonts and the matching grey shading as 6.10. 6.13 has thicker lines for all models, so they show up better on the new darker grey shading. 6.14 now has the EMIC forcing shown without any smoothing. I have used a vertical scale for the volcanoes which is half that of the solar and anthropogenic forcings. Only one spike (1258) hits the bottom of the plot with this choice of scaling, and only a couple overlap the solar forcing lines. What do you think now (Fortunat too)? Oh, and I also start now at 1000 rather than 900 AD.

Cheers

Tim

At 17:06 22/07/2006, Jonathan Overpeck wrote:

Hi Tim - this looks pretty nice, and I appreciate your chugging through to make the switch to 5-95%. I'd still be keen to see what the fig looks like in some more modest color than the old red. Grey could be the final choice, but it's not too much of a hassle, could you try a color version that is a bit more sharp? Also, it would be nice to make the x-axis labels (numbers and "Year") as large as makes sense - they still seem too small. Sorry to be nitpicky, but this figure is going to be a major one of the whole report, so it makes sense to get it as perfect as we can. Thanks! best, peck

Hi Peck and Eystein,
what do you think of the attached new version of 6.10? Keith and I have spent some time examining various options and think that this one looks clearer (less smudgy) while still being a good representation of the data and in grey. I spoke with Phil and Keith and the 5-95% range seems preferable for consistency with other chapters.
So:
(1) I now use 5-95% range in panel (a).
(2) Panel (b) has no further changes to it.
(3) Panel (c) is now also based on the overlap of the 5-95% ranges of the individual reconstructions, rather than on the ± 2 standard error ranges (extra weight is still given for temperatures that fall within the ± 1 SE range). I also applied some week smoothing prior to plotting. I also now plot using just 10 grey shades, in 10% steps, rather than the 20 shades in 5% steps that I used previously (in the last version, I changed the scale bar to have 10 steps of 10%, but I had still plotted the data using 20

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steps of 5%).
Hope you like it,
Tim

At 17:33 20/07/2006, Jonathan Overpeck wrote:

Hi Tim - Thanks. If you don't mind, let's see what the new grey in panel c, and also the 5-95% range on a. Also, another alternative to the grey and red could be some other color that is just less bright - perhaps blue?
Agree there is no reason to switch the reviewed panel c uncertainty approach. It argues a bit that we leave panel a as is too. I'm unsure what is best, so maybe see what Keith thinks too - and discuss more with Phil - he is right that most are trying to go with 5-95 where possible.
Thanks again.

Hi again,
I still have the red option built into the program, so can easily revert to it. Of course the grey has the advantage of consistency with the model and EMIC panels, which really must be grey so that all the coloured lines indicating the simulated temperatures will show up (red isn't really an option for the reconstruction shading in those figures). I'll see if I can make it clearer yet keep it in grey.
On a different note, Phil Jones just popped in and said why are we using "+-2SE" shading in the top instrumental panel when it has apparently been decided to show the smaller 5-95% range (he says this is only 0.8225 times the +-2SE range) in all IPCC WG1 figures.
Shall I change this? If I do, then the brown and orange curves will fall outside this narrower range more often than they fall outside the current wider SE range.
The grey shading in panel (c) is also computed from the overlap of the +-1 SE and +-2 SE ranges of individual reconstructions, but I guess this can stay unchanged, rather than needing to be recalculated using the overlap of the +-?% and 5-95% ranges?
Cheers
Tim

At 16:05 19/07/2006, Jonathan Overpeck wrote:

Hi Tim - thanks! Now I can see why you went with the red rather than grey in the bottom panel - it's hard to see. I'd like to float the idea with everyone on the email that we consider going back to red, or try something else. All else is good (thanks) perhaps make the bottom/top axis labels bigger still? (both numbers and "Year").
Thx again, Peck

Hi Peck et al.,
revised fig 6.10 is attached.
At 21:36 30/06/2006, Jonathan Overpeck wrote:

Figure 6.10.
1. shade the connection between the top and middle panels

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It was already shaded. Your poor old eyes must be failing you ;-)
Ok, so it *was* rather pale! I've made it a bit darker.

2. remove the dotted (long instrumental) curve from the middle panel

Done

3. replace the red shaded region in the bottom panel with the grey-scale one
used in Fig 6.13

narrow Done - how does it look now? I had to outline the instrumental series with a
white band to ensure it could be seen against the very dark grey shading.

4. label only every increment of 10 in the grey-scale bar (formally color) in
the bottom panel

Done

5. Increase font sizes for axis numbering and axis labeling - all are too
small. You can figure out the best size by reducing figs to likely page size minus margins. We
guess the captions need to be bigger by a couple increments at least.

Increased the axis numbering/labelling by a couple of points.

Cheers

Tim

Attachment converted: Macintosh HD:chap6_f6.10.pdf (PDF /«IC») (00141E77)

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**Hosting the BA Festival 2-9 September 2006

--

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[4]<http://www.ispe.arizona.edu/>

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sunclock: [6]<http://www.cru.uea.ac.uk/~timo/sunclock.htm>
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Attachment converted: Macintosh HD:chap6_f6.10 1.pdf (PDF /«IC») (001427F4)
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fax: +44 1603 507784
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sunclock: [10]<http://www.cru.uea.ac.uk/~timo/sunclock.htm>
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References

1. <http://www.cru.uea.ac.uk/~timo/>
2. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
3. <http://www.geo.arizona.edu/>
4. <http://www.ispe.arizona.edu/>
5. <http://www.cru.uea.ac.uk/~timo/>
6. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
7. <http://www.geo.arizona.edu/>
8. <http://www.ispe.arizona.edu/>
9. <http://www.cru.uea.ac.uk/~timo/>
10. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
11. <http://www.geo.arizona.edu/>

12. <http://www.ispe.arizona.edu/>

722. 1153772456.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>
Subject: MWP box figure
Date: Mon, 24 Jul 2006 16:20:56 +0100
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>
Hi again,

attached is the new MWP box figure.

We reverted back to the figure used in the FOD because the decision to drop the panel from Osborn & Briffa (2006) meant that we were able to show a different selection of curves in the remaining panel from those we used in our paper. This allowed us to drop the shorter series that didn't span the medieval period, simplifying the figure and also dealing with a number of review comments that had been made about those series.

The only differences from the FOD figure are that the font is now consistent with the others figures, the composite mean series has been removed, and the figure has been shrunk vertically to save space.

Cheers

Tim

</x-flowed>

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723. 1153866449.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: latest me, fortunat, ricardo bit
Date: Tue Jul 25 18:27:29 2006

mail.2006

Cc: Fortunat Joos <joos@climate.unibe.ch>, <oyvind.paasche@bjerknes.uib.no>, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>

Guys

here is what I understand you want from me - revised text (only up Table of Key etc) - ie

not touched refs (understand Oyvind will put them in - most are given in text)

Tim sending Table and Figure captions separately. I am sending the text with my, Fortunat's

and Ricardo's changes - with minor edits of mine added to them.

I undersatand that Oyvind will sort this ou and insert in final Chapter. I am also sendoing

my reponses to data to most of my comments (Findicates that Fortunat has answered that one

) . I will also send my edited version of Ricardo's reponses that I tweaked - ignore if

wish) . I know I have not done all comments yet but the remaining ones can be done tomorrow

I hope and any changes needed put on next draft. I do not expect many - and I was not

clearwhether Peck wanted to respond to the regional (US) precip related ones anyway?

I have added in the rather large paragraph on the tree-ring issues in response to several

comments - I know you will scream at the size butI think we need to pu it in and then get

Ricardo's

--

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Fax: +44-1603-507784

[1]<http://www.cru.uea.ac.uk/cru/people/briffa/>

References

- 1. <http://www.cru.uea.ac.uk/cru/people/briffa/>

724. 1154090231.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: issue from Susan
Date: Fri, 28 Jul 2006 08:37:11 -0600
Cc: Eystein Jansen <eystein.jansen@geo.uib.no>

<x-flowed>

Hi Keith - in our TS/SPM discussions, Susan has raised this question:

"In the TAR they spoke of 1998 being the warmest year in the millennium and the 1990s the warmest decade. I don't see that chapter 6 addresses any of these time scales. I am not saying you should do so - but are you planning to say anything about it and why you aren't doing so? and if you're not planning to say anything at all, can you please tell me what you think about it, just for my own info?"

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would you please give me your feedback on this, with enough thoughtful detail to hopefully make me/Susan fully informed (a para should be enough).

Thanks, Peck

--

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</x-flowed>

725. 1154353922.txt

#####

From: Eystein Jansen <Eystein.Jansen@geo.uib.no>
To: Valerie.Masson@cea.fr, Jonathan Overpeck <jto@u.arizona.edu>
Subject: Re: Thompson et al, 2006 paper to include
Date: Mon, 31 Jul 2006 09:52:02 +0200
Cc: Olga Solomina <olgasolomina@yandex.ru>, Keith Briffa <k.briffa@uea.ac.uk>, Ricardo Villalba <ricardo@lab.cricyt.edu.ar>, ValÈrie Masson-Delmotte <Valerie.Masson@cea.fr>, Oyvind.Paasche@bjerknes.uib.no

<x-flowed>

Hi Olga,
I agree with Valerie that the ice core evidence is ambiguous. I would personally place more weight on the alkenone data, which is a reasonable well calibrated SST proxy. Foraminifer transfer function based SSTs and some Mg/Ca results that are available suggest a similar picture as far as I know. Of course it is possible and plausible that the tropical oceans are behaving in a non consistent manner and not all areas are showing the same signal, but a sizeable portion appear to do so in order to conclude as we do in the chapter in my opinion. Some signals may be due to changes in in trade wind induced coastal upwelling strength, but there are enough cores with alkenone data outside of these areas. If we were to say more about the uncertainties it may be the fact that proxies are seasonally skewed.

My conclusion is to let the chapter say what we say at the moment.

Cheers,
Eystein

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At 09:42 +0200 31-07-06, Valérie Masson-Delmotte wrote:

>Thanks Olga.

>

>It seems to me that there is still a large
>uncertainty about the temperature versus
>precipitation effect on these tropical glaciers.
>Other indications from south America are related
>to lake levels with contrasted views in the low
>versus highlands.

>Several references suggest that there is the end
>of a wet period after the early Holocene in
>tropical south America ; this is expected to
>induce an increase of 180 signals.

>One review was conducted several years ago
>within the PEPI project

>(http://www.pazt.cn.wr.usgs.gov/pcaw/ and
>references herein).

>I think that the state of the art is that we
>have no reliable proxy record that is sensitive
>to temperature only on the tropical lands for
>the Holocene; therefore the statement that was
>written for the Holocene was based on areas of
>the tropical oceans where SST reconstructions
>were published.

>Do we have to write more explicitly about the uncertainty?

>

>Valérie.

>

>Jonathan Overpeck a écrit :

>>Hi Olga - it is not too late to ask these good
>>questions. Glaciers can, of course, be affected
>>by both temp and precip changes, so the
>>question is really for Valerie (land) and
>>Eystein (ocean) - are the land and ocean data
>>from the tropics strong enough to outweigh what
>>the glaciers are saying about tropical temps
>>earlier in the Holocene? Lonnie's Figure 8
>>(see attached) presents Hauscaran and
>>Kilimanjaro data that suggest early to mid
>>warmth in tropical South America and Africa
>>that is (if the O-isotopes are temp) greater
>>than today. Personally, I'm quite unsure that
>>these are reliable temperature records, BUT if
>>we want to make that case, we have to be
>>convincing. What do terrestrial and ocean temp
>>data say?

>>

>>Thanks Olga for sending the proposed revised
>>text - I think Eystein is putting finishing
>>touches on the next draft for LA etc. review.

>>

>>Best, Peck

>>

>>>>

>>>>Hello everybody,

>>>> I attach here a version of glacier box and
>>>>suggestions (in red) how to include there the
>>>>reference to the new Thompson et al., 2006
>>>>paper.

>>>> In this relation - I am getting more and more
>>>>concern about our statement that the Early

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>>>Holocene was cool in the tropics - this paper
>>>shows that it was, actually, warm - ice core
>>>evidences+glaciers were smaller than now in
>>>the tropical Andes. The glaciers in the
>>>Southern Hemisphere (Porter, 2000, review
>>>paper) were also smaller than at least in the
>>>Neoglacial. We do not cite Porter's paper for
>>>the reason that we actually do not know how to
>>>explain this - orbital reason does not work
>>>for the SH, but if we do cite it (which is
>>>fair) we have to say that during the Early to
>>>Mid Holocene glaciers were smaller than later
>>>in both Northern, and Southern Hemisphere,
>>>including the tropics, which would contradict
>>>to our statement in the Holocene chapter and
>>>the bullet. It is probably too late to rise
>>>these questions, but still just to draw your
>>>attention.

>>> I am going to Kamchatka tomorrow, but will be
>>>available by e-mail from time to time.

>>> All the best,

>>>olga

>>>

>>> ----- Original Message -----

>>>

>>> *From:* Jonathan Overpeck <mailto:jto@u.arizona.edu>

>>>

>>> *To:* Olga Solomina <mailto:olgasolomina@yandex.ru>

>>>

>>> *Cc:* Eystein Jansen <mailto:eystein.jansen@geo.uib.no> ;

>>> oyvind.paasche@bjerknes.uib.no

>>> <mailto:oyvind.paasche@bjerknes.uib.no>

>>>

>>> *Sent:* Sunday, July 30, 2006 3:42 AM

>>>

>>> *Subject:* Re: [Wg1-ar4-ch06] Fwd: Additional In-Press Papers

>>>

>>>

>>> Hi Olga - I agree, and hope that you and òyvind make sure you
>>> include it in the next round of edits, which will begin very
>>> soon. We have all of the new text and Eystein is assembling for
>>> authors to check. This same new draft will be the one that
>>> Eystein and I work on to achieve more consistency and the proper
>>> length. Although we've cut some text already, some received has
>>> grown too. So... think about a way to include the reference to
>>> Lonnie's work without lengthening if you can.

>>>

>>>

>>> OK? Many thanks, Peck

>>>

>>>> Hi Peck,

>>>

>>>

>>>

>>> Lonnie's paper is a very good one and suitable for the
>>> glacier box. If it is still possible I would add this reference.

>>>

>>>

>>>

>>>

>>>

>>>

>>>

>>>

>>>

----- Original Message -----

mail.2006
>>> *From:* Jonathan Overpeck <mailto:jto@u.arizona.edu>
>>>
>>> *To:* wg1-ar4-ch06@joss.ucar.edu
>>> <mailto:wg1-ar4-ch06@joss.ucar.edu>
>>>
>>> *Sent:* Friday, July 28, 2006 6:32 PM
>>>
>>> *Subject:* [wg1-ar4-ch06] Fwd: Additional In-Press Papers
>>>

>>> Hi Chap 6 LA's - here is another batch of papers from the
>>> TSU to be considered using the guidelines provided below
>>> - we don't want to add citations just to make our ref
>>> list more complete.
>>>

>>> Thanks, Peck and Eystein
>>>

>>>> X-Sieve: CMU Sieve 2.2
>>>> Date: Wed, 26 Jul 2006 11:25:25 -0600
>>>> From: IPCC-WG1 <ipcc-wg1@al.noaa.gov>
>>>> <mailto:ipcc-wg1@al.noaa.gov>
>>>> X-Accept-Language: en-us, en
>>>

>>> To: Jonathan Overpeck <jto@u.arizona.edu>,
>>> Eystein Jansen <eystein.jansen@geo.uib.no>
>>> Subject: Additional In-Press Papers
>>>

>>> Dear CLAS
>>>

>>> Please find attached additional paper(s) that are
>>> relevant to your chapter and have been submitted in
>>> response to our most recent guidelines for
>>> consideration of papers published in 2006 following
>>> the expert and government review. A separate
>>> spreadsheet file is attached listing: the submitter,
>>> file name of the paper, its acceptance date, and the
>>> chapter and section which the submitter feels is
>>> relevant.
>>>

>>> As discussed in Bergen, please note the following:
>>> * inclusion of additional papers in the final draft
>>> should not open up any substantive issues that were
>>> not in the second draft and so not previously reviewed;
>>> * additional papers should only be used where in the
>>> view of the LAs doing so provides a more balanced
>>> coverage of scientific views;
>>> * we anticipate that a quick reading of the abstract
>>> of each paper will enable a decision consistent with
>>> this and we would not encourage any lengthy
>>> consideration by the LA team.
>>>

>>> One additional point to keep in mind is that this
>>> most recent adjustment of our publication deadlines
>>> should not be perceived by others as a device for
>>> allowing the LAs to reference more of their own
>>> papers. We trust that you and your team will be both
>>> objective and vigilant when deciding to include or
>>> reject papers in this respect.
>>>

>>> Best regards,
>>> WG1 TSU
>>>

>>> --
>>>

mail.2006

>>>
>>>Attachment converted: Macintosh HD:Glaciers 30
>>>july so.doc (WDBN/«IC») (00148B9A)
>>
>>
>>--
>> Jonathan T. Overpeck
>>Director, Institute for the Study of Planet Earth
>>Professor, Department of Geosciences
>>Professor, Department of Atmospheric Sciences
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>><http://www.geo.arizona.edu/>
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--

Eystein Jansen
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N-5007 Bergen
NORWAY
e-mail: eystein.jansen@geo.uib.no
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Fax: +47-55-584330
</x-flowed>

726. 1154370684.txt

#####

From: Tim Osborn <t.osborn@uea.ac.uk>
To: Jonathan Overpeck <jto@u.arizona.edu>, Eystein Jansen
<eystein.jansen@geo.uib.no>, Keith Briffa <k.briffa@uea.ac.uk>, Øyvind Paasche
<oyvind.paasche@bjerknes.uib.no>
Subject: latest figures, captions and tables from Keith/Tim
Date: Mon Jul 31 14:31:24 2006

Dear all,

we have now updated the figure captions for our section and these are attached as a PDF together with the figures. Unfortunately I forgot to highlight the caption changes in blue... can you just completely replace the old captions with the new ones? We worked hard to make the captions as short as possible, while retaining their accuracy.

When updating the captions, we spotted minor inconsistencies in the labelling of figures 6.10 and 6.12 and so we have corrected these figures and new versions are incorporated in the attachment. The labelling change also affects table 6.1. I have attached the tables again too, with the new change highlighted in red (simply change 'CED2004' to 'ECS2002' in Table 6.1).

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Hope this is all ok and now finalised.

If you want me to send the new figures as individual files (EPS format) then please say. Also if you want the new captions/figures as word rather than PDF, please say (the word file is large and very slow to open on my PC).

Cheers

Tim & Keith

727. 1154461714.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>
Subject: Re: Urgent Re: latest version of my responses
Date: Tue Aug 1 15:48:34 2006
Cc: Tim Osborn <t.osborn@uea.ac.uk>, jto@u.arizona.edu, Fortunat Joos <joos@climate.unibe.ch>, Valerie.Masson@cea.fr, Ricardo Villalba <ricardo@lab.cricyt.edu.ar>

Dear all
attached is my latest (currently definitive) version of the responses to the "sky-blue-highlighted" comments on text and Figures.
PLEASE NOTE THAT THESE HAVE CHANGED IN VARIOUS PLACES FROM WHAT I SENT EARLIER AS WELL AS BEING UPDATED. I would suggest that they be cut and pasted into the document rather than just including the new ones. Sorry , but I had to reconsider a number of responses and edit others to remove typos etc.
Even though marked in blue - a few were not relevant to me. Two have been marked with "Valerie " - (6-1072, 6-1073) . Those marked PECK (6-862 through 6-868; ie 7 comments) are best dealt with by he. The comment 6-1110 is for Stefan. The comments marked F are those I sent from Fortunat before and I also sent the edited version of Ricardo's. The two outstanding ones he marked for me/Tim are here (6-818 and 6-819)
6-818 Noted - this issue will be reviewed , though the discussion of forcings must come before that of comparison of simulation results.
6-819 Noted - the text is intended to provide examples only and will be modified to refer to Table 6.2 , where details of all simulations used are provided.
I think that should be OK as far as my stuff goes. I will send minor changes to text (separate message) that have arisen in dealing with final comments.
Cheers
Keith

At 10:37 01/08/2006, Eystein Jansen wrote:

Hi Keith,
could you send me responses to the reviewers's comments received on the figures for 6.6?
The Batch i received only had responses for the comments to the main text. This relates to comment 1074 and onwards. Only quite few comments.

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is We need to send the comments responses file to the TSU by the week-end so this
urgent. Hope you have time..
Cheers,
Eystein
--

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--
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[1]<http://www.cru.uea.ac.uk/cru/people/briffa/>

References

1. <http://www.cru.uea.ac.uk/cru/people/briffa/>

728. 1154484340.txt

#####

From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: response to your question
Date: Tue, 1 Aug 2006 22:05:40 -0600
Cc: "Susan Solomon" <Susan.Solomon@noaa.gov>, Eystein Jansen
<eystein.jansen@geo.uib.no>

<x-flowed>
Hi Keith - thanks. This makes sense to me. I'll
cc Susan so she understands the issue better, and
also can advise on any strategy we should adopt
to make sure we communicate effectively.

thanks again

best, peck

>Peck,
>
>The TAR was, in my opinion, wrong to say
>anything about the precedence (or lack thereof)
>of the warmth of the individual year 1998.
>
>The reason is that all reconstructions have very
>wide uncertainty ranges bracketing
>individual-year estimates of part temperature.

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>Given this, it is hard to dismiss the
>possibility that individual years in the past
>did exceed the measured 1998 value. These errors
>on the individual years are so wide as to make
>any comparison with the 1998 measured value very
>problematic, especially when you consider that
>most reconstructions do not include it in their
>calibration range (curtailed predictor network
>in recent times) and the usual estimates of
>uncertainty calculated from calibration (or
>verification) residual variances would not
>provide a good estimate of the likely error
>associated with it even if data did exist.

>
>I suspect that many/most reconstructions of NH
>annual mean temperature have greater fidelity at
>decadal to multidecadal timescales (based on
>examination of the covariance spectrum of the
>actual and estimated data over the calibration
>period. This is the reason many studies
>implicitly (Hegerl et al.,) or explicitly (Esper
>et al., Cook et al.) choose to calibrate
>directly against decadal-smoothed data.

>
>The exception is the Briffa et al (tree-ring
>density network based) reconstruction back to ~
>1400. This has probably the best year-to-year
>fidelity - but for summer land only and does not
>go back anyway to the MWP.

>
>We are on much safer grounds focusing on
>decadal/multi-decadal timescales and so this is
>where we place the emphasis. As for the 'warmest
>decade' - this is likely to be the 1990s or the
>last 10 years - but again, the proxies do not
>cover this period, and we do anyway state that
>post 1980 is the warmest period - which I think
>is fair enough.

>
>
>--
>Professor Keith Briffa,
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>
>Phone: +44-1603-593909
>Fax: +44-1603-507784
>
><http://www.cru.uea.ac.uk/cru/people/briffa/>

--
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<http://www.ispe.arizona.edu/>
</x-flowed>

729. 1154697504.txt

#####

From: Anders Moberg <anders.moberg@natgeo.su.se>
To: Martin Juckes <m.n.juckes@rl.ac.uk>
Subject: McIntyre, McKittrick & MITRIE ...
Date: Fri, 04 Aug 2006 09:18:24 +0100
Cc: Anders <anders@misu.su.se>, Eduardo.Zorita@gkss.de, hegerl@duke.edu,
esper@wsl.ch, k.briffa@uea.ac.uk, m.allen1@physics.ox.ac.uk, weber@knmi.nl,
t.osborn@uea.ac.uk

<x-flowed>

Dear Martin and all others,

Having read the new manuscript, I would like to draw the attention of all of you to the section about McIntyre&McKittrick vs Mann et al. I am not entirely happy with this section. It may be that I am not fully updated about all details on their dispute, but it appears to be some mistakes in this section of our manuscript. Therefore, I ask all of you to check how this section can be improved and clarified. This is very important! If we refer incorrectly to the MM-Mann dispute, I am convinced that all of us will be involved in lengthy frustrating e-mail discussions later on. I anticipate this from personal experience! Let's do our best to avoid this.

The problematic bit of text starts on p. 16, para 4: ("The failure of MM2003 ... is partly due to a misunderstanding of the stepwise reconstruction method") and slightly below: ("MM2003 only calculate principal components for the period when all chronologies are present").

I read through the MM2003 paper yesterday. From what is written there, on p. 763-765, it appears that they were well aware of the stepwise method. On p. 763, about at the middle of the page, they write: "Following the description of MBH98 ... our construction is done piecewise for each of the periods listed in Table 8, using the roster of proxies available through the period and the selection of TPCs for each period listed in Table 8".

This is clearly at odds to what is written in our manuscript. Has it been documented somewhere else that MM2003, despite what they wrote, really understood the stepwise technique? If it is so, we need to insert a reference. If this is not the case, we need to omit the lines about the misunderstanding. We also need to explain better why the MM2003 calculations differ from MBH.

Moreover, our sentence ("MM2003 only calculate principal components for the period when all chronologies are present") imply that MM2003 only calculated PCs for the period 1820-1971, as this would be the period when all chronologies are present according to the MM2003 Table 8. Obviously, they calculated PCs beyond 1820, as their calculations actually extend back to 1400.

The problem continues in the legend to our Fig. 2. (" Each of the 212 data series is shown ... The red rectangle indicates the single block

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used by MM2003, neglecting all data prior to 1619"). The last sentence is inconsistent with the information in MM2003 in three ways; a) MM2003 clearly show in their Table 8 that they analysed the same blocks of data as MBH. b) The year 1619 as a starting point of a data block is inconsistent with MM Table 8. Where does the year 1619 come from? It is not mentioned anywhere in MM2003. c). The red block implies that MM2003 made calculations back only to 1619, but they did back to 1400.

Moreover, the numbers given in the graph of our Fig. 2 indicate that the total number of series is 211, whereas the text in the legend and also in the main text on p. 16 says 212. Which number is correct?

I suppose that some of you others will know this subject much better than I. I have just read the MM2003 paper, and find our reference to it to be inconsistent with it. I hope you all can make efforts to make this bit crystal clear. If not, I fear we will get problems!

Finally, I would like to draw your attention to the related sentence in our conclusions on p. 26: ("Papers which claim to refute ... have been reviewed and found to contain serious flaws"). Are all of you happy with this statement? Would it sound better with a somewhat less offending sentence, something like:

"Papers which claim to refute ... have been reviewed and found to essentially contribute with insignificant information that does not affect the consensus, and even to include some flaws."

I attach the MM2003 paper.

I will send some comments to the other parts of the text in a separate mail.

Cheers,
Anders

Martin Juckes wrote:

> Hello All,
>
> here is another draft. I've added a new reconstruction, using 19 independent
> proxies series from Jones et al., Mann et al., Esper et al. and Moberg et al.
> This gives a good fit to the calibration data, such that 2 recent years exceed
> the maximum pre-industrial estimate by 4 sigma levels. I've included this
> because without it I found it hard to draw precise and useful conclusions
> from the 4 partially overlapping reconstructions I had done before.

> cheers,
> Martin

> -----

> \documentclass[cpd,11pt]{egu}
>
> \input macs
> \voffset 5cm
> \hoffset 1.5cm
>
> \begin{document}
>
> \title
> {\bf Millennial Temperature Reconstruction Intercomparison and Evaluation
> }
>

```

> \runningtitle{Millennial Temperature}
> \runningauthor{M.~N.~Juckes et al}
> \author{Martin Juckes{(1)}$,
> Myles Allen{(2)}$,
> Keith Briffa{(3)}$,
> Jan Esper{(4)}$,
> Gabi Hegerl{(5)}$,
> Anders Moberg{(6)}$,
> Tim Osborn{(3)}$,
> Nanne Weber{(7)}$,
> Eduardo Zorita{(8)}$}
> \correspondence{Martin Juckes (M.N.Juckes@rl.ac.uk)}
> \affil{
> British Atmospheric Data Centre, SSTD,
> Rutherford Appleton Laboratory
> Chilton, Didcot,
> Oxfordshire, OX11 0QX,
> United Kingdom
> }
>
> \affil{1: Rutherford Appleton Laboratory,
> 2: University of Oxford,
> 3: University of East Anglia,
> 4: Swiss Federal Research Institute,
> 5: Duke University,
> 6: Stockholm University,
> 7: Royal Netherlands Meteorological Institute (KNMI),
> 8: GKSS Research Centre
> }
> \date{Manuscript version from 31 Oct 2005 }
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> \received{}
> %\pubacpd{} % ONLY applicable to ACP
> \revised{}
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> \firstpage{1}
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> \maketitle
>
> \begin{abstract}
> There has been considerable recent interest in paleoclimate reconstructions of the
temperature history of
> the last millennium. A wide variety of techniques have been used.
> The interrelation among the techniques is sometimes unclear, as different studies
often
> use distinct data sources as well as distinct methodologies.
> Recent work is reviewed with an aim to clarifying the import of
> the different approaches.
> A range of proxy data collections used by different authors are passed
> through two reconstruction algorithms: firstly, inverse regression and,
> secondly, compositing followed by variance matching.
> It is found that the first method tends to give large weighting to
> a small number of proxies and that the second approach is more robust
> to varying proxy input.
> A reconstruction using 19 proxy records extending back to 1000AD shows a
> maximum pre-industrial temperature of 0.227K (relative to the 1866 to 1970 mean).
> The standard error on this estimate, based on the residual in the calibration

```

> period is 0.149K. Two recent years (1998 and 2005) have exceeded the
 > pre-industrial
 > estimated maximum by more than 4 standard errors.
 > \end{abstract}
 >
 >
 > %%\openup 1\jot
 >
 > \introduction\label{sec:intro}
 >
 > The climate of the last millennium has been the subject of much
 > debate in recent years, both in the scientific literature
 > and in the popular media.
 > This paper reviews reconstructions of past temperature,
 > on the global, hemispheric, or near-hemispheric scale, by
 > \citet{jones_etal1998} [JBB1998],
 > \citet{mann_etal1998a} [MBH1998],
 > \citet{mann_etal1999} [MBH1999],
 > \citet{huang_etal2000} [HPS2000],
 > \citet{crowley_lowery2000} [CL2000],
 > \citet{briffa_etal2001} [BOS2001],
 > \citet{esper_etal2002b} [ECS2002],
 > \citet{mann_jones2003} [MJ2003],
 > \citet{moberg_etal2005} [MSH2005],
 > \citet{oerlemans2005} [OER2005],
 > \citet{hegerl_etal2006+} [HCA2006].
 > %%The criticism
 > %%directed at them (mainly MBH1999) by \citet{mcintyre_mckitrick2003} [MM2003] and
 > others.
 >
 >
 > Climate variability can be partitioned into contributions from
 > internal variability of the climate system and response to forcings,
 > which the forcings being further partitioned in natural and
 > anthropogenic.
 > The dominant change in forcing in the late 20th century
 > arises from human impact in the form of
 > greenhouse gases \citep[primarily carbon dioxide, methane and
 > chloro-fluoro carbons:][IPCC2001].
 > The changes in concentration of these gases in the atmosphere
 > are well documented and their radiative properties which reduce,
 > for a given temperature difference, radiative loss of heat to space
 > from the mid and lower troposphere
 > \citep[for carbon dioxide, this was first documented by][arrhenius1896]
 > are beyond dispute.
 >
 > However, there remains some uncertainty on two issues:
 > firstly, how much of the observed change is due to greenhouse forcing as
 > opposed to natural forcing and internal variability;
 > secondly, how significant, compared to past natural changes, are the
 > changes which we now observe and expect in the future?
 >
 > The first question is not answered by the IPCC conclusion cited above because
 > that conclusion only compares the anthropogenic forcing of the late 20th century
 > with the natural forcings of the same period. Further back in the past, it is
 > harder to make definitive statements about the amplitude of variability in natural
 > forcings. The second question reflects the uncertainty in the response of the
 > climate system to a given change in forcing. In the last century both the
 > variations in forcing and the variations in response have been measured with
 > some detail, yet there remains uncertainty about the contribution of
 > natural variability to the observed temperature fluctuations.
 > In both cases, investigation is hampered by the fact that
 > estimates of global mean temperature based on reliable direct measurements

> are only available from 1856 onwards \cite{jones_etal1986}.

>

> Climate models are instrumental in addressing both questions,

> but they are still burdened with

> some level of uncertainty and there is a need for more detailed knowledge

> of the behaviour of the actual climate on multi-centennial timescales

> both in order to evaluate the climate models and in order to address the

> above questions directly.

>

> The scientific basis for proxy based climate reconstructions may be stated simply:

there are

> a number of physical indicators

> which contain information about the past environmental variability.

> As these are not direct measurements, the term proxy is used.

>

>

> \cite{jones_mann2004} review evidence for climate change in

> the past millennium and conclude that there had been a

> global mean cooling since the 11th century

> until the warming period initiated in the 19th century, but the issue remains

> controversial. This paper reviews recent contributions and evaluates the impact

> of different methods and different data collections used.

>

> Section 2 discusses recent contributions, which have developed a range of new

> methods to address aspects of the problem.

> Section 3 discusses the technique used by MBH1998/9

> in more detail in the context of criticism by \cite{mcintyre_mckitrick2003}

> (hereafter MM2003).

> Section 4 presents some new results using the data collections from 5 recent

studies.

>

>

> \section{A survey of recent reconstructions}

>

> This section gives brief reviews of recent

> contributions, displayed in Fig.~1.

> Of these, 5 are estimates of the Northern Hemisphere mean temperature

> (MBH1999, HPS2000, CL2000, MSH2005, HCA2006),

> 2 of the Northern Hemisphere extra tropical mean temperature (BOS2001, ECS2002)

> and 3 of the global mean temperature (JBB1998, MJ2003, OER2005).

> All, except the inherently low resolution reconstructions of HPS2000 and OER2005,

> have been smoothed with a 40 year running mean.

> With the exception of HPS2000 and OER2005, the reconstructions

> use partly overlapping methods and data, so they

> cannot be viewed as independent from a statistical viewpoint.

> In addition to exploiting a range of different data sources,

> the above works also use a range of techniques.

> The subsections below cover different scientific themes,

> ordered according to the date of key publications.

> Some reconstructions which do not extend all the way

> back to 1000AD are included because of their

> importance in addressing specific issues.

> The extent to which the global, northern hemisphere and northern hemisphere

> extratropical reconstructions might be expected to agree

> is discussed in Sect.~2.10 below.

>

> \subsection{High-resolution paleoclimate records}

>

> \cite{jones_etal1998} [JBB1998] present the first annually resolved

> reconstructions of temperatures back to 1000AD, using

> a composite of standardised 10 proxies for the northern hemisphere and 7 for the

southern,

> with variance damped in the early part of the series to account for the

- > lower numbers of proxies present (6 series extend back to 1000AD), following
\citet{osborn_etal1997}.
- > The composites are
- > scaled by variance matching (Appendix A) against the annual mean summer
temperatures for 1931-1960.
- > Climate models are also employed to investigate the temperature coherency
> between proxy sites and it is shown that there are strong large scale
> coherencies in the proxy data which are not reproduced by
> the climate model. An evaluation of each individual
> proxy series against instrumental data from 1881 to 1980
> shows that tree-rings and historical reconstructions
> are more closely related to temperature than those
> from corals and ice-cores.
- >
- > with regard to the temperatures of the last millennium,
> the primary conclusion of JBB1998 is that
> the twentieth century was the warmest of the millennium.
- > There is clear evidence of a cool period from 1500 to 1900,
> but no strong "Medieval warm Period" [MWP] (though the second warmest
> century in the northern hemisphere reconstruction is
> the 11th). The MWP is discussed further in Sect.~2.4 below.
- >
- > JBB1998 draw attention to the limitations of some of the proxies
> on longer timescales (see Sect.~3.5 below).
- > Homogeneity of the data record and
> its relation with temperature may not be guaranteed on longer timescale.
- > This is an important issue, since
> many climate reconstructions assume a constant relationship between
> temperature anomalies and the proxy indicators
> (there are also problems associated with timescale-dependency in the
> relationship which are discussed further in Sect.~2.6 below).
- >
- > MJ2003 include some additional proxy series and extend to study period back a
> further millennium and conclude that the late 20th century warmth
> is unprecedented in the last two millennia.
- >
- > \subsection{Climate field reconstruction}
- >
- > \citet{mann_etal1999} published
> the first reconstruction of the last thousand years northern hemispheric mean
> temperature which included objective error bars,
> based on the analysis of the residuals in the calibration period.
- > The authors concluded not only
> that their estimate of the temperature over the whole period 1000AD to 1860AD
> was colder than the late twentieth century, but also that 95% certainty limits
> were below the last decade of the twentieth century.
- > The methods they used were presented in MBH1998
> which described a reconstruction back to 1400AD.
- >
- > MBH1998 use a collection of 415 proxy time indicators, many more than used in
\citet{jones_etal1998},
> but many of these are too close geographically to be considered
> as independent, so they are combined into a smaller number of representative
> series.
- > The number of proxies also decreases significantly with age:
> only 22 independent proxies extend back to 1400AD,
> and, in
> MBH1999, 12 extend back to 1000AD (7 in the Northern Hemisphere).
- > MBH1998 and MBH1999 have been the subject of much debate since the latter was
cited
> in the IPCC (2001) report, though the IPCC
> conclusions\footnote{\citet{IPCC2001} concluded that
> "The 1990s are likely to have been the warmest decade of the millennium in

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- > the Northern Hemisphere, and 1998 is likely to have been the warmest
- > year," where ``likely'' implies a greater than 66% probability.
- > Since 2001 it has been recognised that there is a need to explicitly
- > distinguish between an expression of confidence, as made by the IPCC in this
- quote,
- > which should include expert assessment of the robustness of statistical methods
- > employed, and simple citation of the results of statistical test.
- > In the language of
- > \citet{manning_etal2004} we can say that MBH1999 carried out statistical
- > tests which concluded that the 1990s have been the warmest decade of the
- > millenium with 95% likelihood, while IPCC (2001), after assessing all
- > available evidence had a 66% confidence in the same statement.}
- > were weaker than those of MBH1999.
- >
- > This work also differ from Jones et al. (1998) in using spatial patterns of
- temperature
- > variability rather than hemispheric mean temperatures. In this way the study aims
- > to exploit proxies which are related to temperature indirectly: for
- > instance, changes in temperature may be associated with changes in
- > wind and rainfall which might affect proxies more strongly than
- > temperature. Since wind and rainfall are correlated with
- > changes in temperature patterns, it is argued, there may be important non-local
- > correlations between proxies and temperature.
- >
- > Different modes of atmospheric variability are evaluated through an
- > Empirical Orthogonal Function [EOF] analysis of the time period 1902 to 1980,
- > expressing the global field as a sum of spatial patterns (the EOFs) multiplied by
- > Principal Components (PCs -- representing the temporal evolution).
- > Earlier instrumental data are too sparse to be used for this purpose:
- > instead they are used in a validation calculation to determine how
- > many EOFs should be included in the reconstruction.
- > Time series for each mode of variability are then reconstructed from the proxy
- data using
- > a optimal least squares inverse regression.
- >
- > Finally, the skill of the regression of each PC is tested using the
- > 1856 to 1901 validation data.
- > Prior to 1450AD it is determined that only
- > one PC can be reconstructed with
- > any accuracy. This means that the main advantage of the
- > Climate Field Reconstruction method does not apply at earlier dates.
- > The methodology will be discussed further in Sect.~3 below.
- >
- > The reconstructed temperature evolution (Fig.~1) is rather less variable than that
- of Jones et al. (1998),
- > but the differences are not statistically significant.
- > The overall picture is of gradual cooling until the mid 19th century,
- > followed by rapid warming matching that evaluated by the earlier work.
- >
- > \subsection{Borehole temperatures}
- >
- > \citet{huang_etal2000} [HPS2000] estimate northern hemisphere temperatures
- > back to 1500AD using
- > measurements made in 453 boreholes (their paper also presents global and
- > southern hemisphere results using an additional 163 southern hemisphere
- boreholes).
- > The reconstruction is included here, even though it does not extend back to
- 1000AD,
- > because it has the advantage of being completely
- > independent of the other reconstructions shown.
- > Temperature fluctuations at the surface propagate slowly downwards, so that
- measurements
- > made in the boreholes at depth contain a record of past surface temperature

fluctuations.

> HPS2000 used measurements down to around 300m.

> The diffuse nature of the temperature anomaly means that short time scale fluctuations

> cannot be resolved. Prior to the 20th century, the typical resolution is about 100 years.

>

> \citet{mann_etal2003} analyse the impact of changes in land use and snow cover on borehole temperature reconstructions and conclude that

> it results in significant errors.

> This conclusions has been refuted by

> \citet{pollack_smerdon2004} (on statistical grounds),

\citet{gonzalez-rouco_etal2003}

> (using climate simulations) and \citet{huang2004} (using an expanded network of 696

> boreholes in the northern hemisphere).

>

> \subsection{Medieval Warm Period}

>

> Despite much discussion

> \citep[e.g.][]{hughes_diaz1994, bradley_etal2003}, there is no clear quantitative understanding of what is meant by the "Medieval Warm Period" [MWP].

> \citet{crowley_lowery2000}

> [CL2000] discuss the evidence for a global MWP, which they interpret as

> a period of unusual warmth in the 11th century. All the reconstructions

> of the 11th century temperature shown

> in Fig.~1 estimate that century to have been warmer than most of the

> past millennium. However, the question of practical importance is not

> whether it was warmer than the 12th to 19th centuries, which is

> generally accepted, but whether it was a period of comparable

> warmth to the late 20th century. MBH1999 concluded, with 95\% confidence, that

> this was not so. CL2000 revisit the question

> using 15 proxy records, of which 9 were not used in the studies

> described above. Several of the series used have extremely low temporal resolution.

> %%CL2000 sought to select tree ring chronologies with consistent quality

> %%throughout their length, as measured by the "sample replication"

> %%\citep{cook_etal2004}.

> %%[check usage of "sample replication" -- cook etal (QSR) is available from Jan's website]]

>

> They draw attention to the spatial localization of the MWP in their proxy series:

> it is strong in North America, North Atlantic and western Europe, but not

> clearly present elsewhere. Periods of unusual warmth

> do occur in other regions, but these are short and asynchronous.

>

> Their estimate of northern hemispheric temperature over the past millennium is consistent

> with the works discussed above. They conclude that the occurrence of decades of

> temperatures similar to those of the late 20th century cannot be unequivocally ruled

> out, but that there is, on the other hand, no evidence to support the claims

> that such an extended period of large-scale warmth occurred.

>

> \citet{soon_baliunas2003} carry out an analysis of local climate reconstructions.

> They evaluate the number of such reconstructions which show (a) a sustained

``climate

> anomaly" during 800-1300AD, (b) a sustained ``climate

> anomaly" during 1300-1900AD and (c)

> their most anomalous 50 year period in the 20th century.

> Their definition of a ``sustained climate anomaly" is 50 years of warmth,

> wetness or dryness for (a) and (c) and 50 years of coolness, wetness

> or dryness in (b).

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- > It should be noted that they do not carry out evaluations which allow direct comparison between
- > the 20th century and earlier times:
- > they compare the number of extremes occurring in the 20th century with the
- > number of anomalies occurring in periods of 3 and 4 centuries in the past.
- > Both the use of sampling periods of differing length and different selection criteria make interpretation
- > of their results problematic.
- > They have also been criticised for interpreting
- > regional extremes which occur at distinct times as being indicative of a global
- > climate extremes \citep{jones_mann2004}. This issue is discussed further in
- > Sect.~2.9 below.
- > \citet{osborn_briffa2006} perform a systematic analysis along the lines of
- > \citet{soon_baliunas2003}
- > and conclude that the proxy records alone, by-passing the problem of proxy calibration
- > against instrumental temperatures, show an unprecedented anomaly in the 20th century.
- >
- > \subsection{Segment length curse}
- >
- > \citet{briffa_etal2001} and \citet{briffa_etal2002} discuss the impact of
- > the ``segment length curse'' \citep{cook_etal1995a, briffa_etal1996, briffa2000}
- > on
- > temperature reconstructions from tree rings.
- > Tree rings have been shown to have much greater sensitivity
- > than other proxies on short timescales (JBB1998), but there is a concern that this may not
- > be true on longer timescales. Tree ring chronologies are often made up of
- > composites of many trees of different ages at one site.
- > The width of the annual growth ring
- > depends not only on environmental factors but also on the age of the
- > tree. The age dependency on growth is often removed by subtracting
- > a growth curve from the tree ring data for each tree. This process,
- > done empirically, will not only remove age related trends but also any
- > environmental
- > trends which span the entire life of the tree.
- > \citet{briffa_etal2001} use a more sophisticated method
- > (Age Band Decomposition [ABD], which
- > forms separate chronologies from tree rings in different age bands,
- > and then averages all the age-band chronologies)
- > to construct northern hemisphere
- > temperatures back to 1400AD, and show that
- > a greater degree of long term variability is preserved.
- > The reconstruction lies between those
- > of MBH1999 and JBB1998, showing the cold 17th century of the former,
- > but the relatively mild 19th century of the latter.
- >
- > The potential impact of the segment length limitations is analysed further
- > by \citet{esper_etal2002b, esper_etal2003}, using 'Regional Curve Standardisation'
- > (RCS)
- > \citep{briffa_etal1992}.
- > In RCS composite growth curves (different curves reflecting
- > different categories of growth behaviour) are obtained from all the trees
- > in a region and this, rather than a fitted curve, is subtracted
- > from each individual series. Whereas ABD circumvents the need to
- > subtract a growth curve, RCS seeks to evaluate a growth curve which
- > is not contaminated by climate signals.
- > The ECS2002 analysis agrees well with that of MBH1999 on short
- > time scales, but has greater centennial variability \citep{esper_etal2004}.
- > ECS2002 suggest that this may be partly due to the lack of tropical proxies
- > in their work, which they suggest should be regarded as an extratropical
- > Northern Hemisphere estimate. The extratropics are known to have

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- > greater variability than the tropics.
- > %[check]:from eduardo:: Table 1 in MBH GRL 99 --add ref??
- > However, it has to be also noted that among the proxies used by MBH1999
- > (12 in total), just 2 of them are located in the tropics, both at one location
- > (see table 1 below).
- >
- > \citet{cook_etal2004} study the data used by ECS2002 and pay particular attention
- > to potential loss of quality in the earlier parts of tree-ring chronologies
- > when a relatively small number of tree samples are available. Their analysis
- > suggests that tree ring chronologies prior to 1200AD should be treated with
- > caution.
- >
- > \subsection{Separating timescales}
- >
- > \citet{moberg_etal2005} follow BOS2001 and ECS2002 in trying to address
- > the ``segment length curse'', but rather than trying to improve the
- > tree-ring chronologies by improving the standardizations,
- > they discard low frequency component of the tree-ring data,
- > and replace this with low-frequency information from proxies with lower temporal
- > resolution.
- > A wavelet analysis is used to filter different temporal scales.
- >
- > Each individual proxy series is first scaled to unit variance and then wavelet
- > transformed.
- > Averaging of the wavelet transforms is made separately for tree ring data
- > and the low-resolution data.
- > The average wavelet transform of tree-ring data for timescales less than 80
- > years is combined with the averaged wavelet transform of the low-resolution data
- > for
- > timescales longer than 80 years to form one single wavelet transform covering all
- > timescales.
- > This composite wavelet transform is inverted to create a dimensionless temperature
- > reconstruction, which is calibrated against the instrumental record of
- > northern hemisphere mean temperatures, AD 1856-1979, using a variance matching
- > method.
- >
- > Unfortunately, the calibration period is too short to independently calibrate the
- > low frequency component. The variance matching represents a form of
- > cross-calibration.
- > In all calibrations against instrumental data, the long period (multi-centennial)
- > response is determined by a calibration which is dominated by
- > sub-centennial variance. The MSH2005 approach makes this explicit and
- > shows a level of centennial variability which is much larger than in
- > MBH1999 reconstruction and
- > similar to that in simulations of the past millennium with two
- > different climate models, ECHO-G \citet{storck_etal2004} and NCAR CSM
- > ('Climate System Model') \citet{mann_etal2005}.
- >
- > \subsection{Glacial advance and retreat}
- >
- > \citet{oerlemans2005} provides another independent estimate of the global mean
- > temperature
- > over the last 460 years from an analysis of glacial advance and retreat.
- > As with the bore hole based estimate of HPS2000, this work uses a
- > physically based model rather than an empirical calibration.
- > The resulting curve lies within the
- > range spanned by the high-resolution proxies, roughly midway between
- > the MBH1999 Climate Field Reconstruction and the HPS2000 bore hole estimate.
- >
- > Unlike the borehole estimate, but consistent with most other works presented
- > here, this analysis shows a cooling trend prior to 1850, related to glacial
- > advances over that period.
- > It should be noted that

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- > the technique used to generate the bore hole estimate \citep{pollack_etal1998}
- > assumes a constant temperature prior to 1500AD. The
- > absence of a cooling trend after this date may be influenced by this
- > boundary condition.
- >
- > \subsection{Regression techniques}
- >
- > Many of the reconstructions listed above depend on empirical relationships
- > between proxy records and temperature. \citet{storch_etal2004} suggest
- > that the regression technique used by MBH1999
- > under-represents\footnote{This is sometimes referred to as ``underestimating'',
- > which will mean the same thing to many people, but something slightly different
- > to statisticians. Any statistical model (that is, a set of assumptions about the
- > noise characteristics of the data being examined) will deliver estimates of
- > an expected value and variability. The variability of the expected value is
- > not generally the same as the expected value of the variability.}
- > the variability of past climate.
- > This conclusion is drawn after a applying a method similar to that of MBH1999 to
- > output from a
- > climate model using a set of pseudo-proxies: time series generated from
- > the model output and degraded with noise which is intended to match the noise
- > characteristics of actual proxies.
- > \citet{mann_etal2005} use the same approach and arrive at a different conclusion:
- > namely, that their regression technique is sound.
- > \citet{mann_etal2005} show several implementations of their
- > Climate Field Reconstruction Method in the CSM simulation, using different levels
- > of white noise in their synthetic pseudo proxies.
- > For a case of pseudo-proxies with a realistic signal-to-noise ratio of 0.5, they
- > use
- > a calibration period (1856-1980) which is longer than that
- > used in MBH1998 and MBH1999 (1901-1980).
- > It turns out that the difference in the length of the calibration period is
- > critical
- > for the skill of the method (Zorita, personal communication et al., submitted).
- > % (I think you can refer to Buerger et al 2006 here. Check with Eduardo if this is
- > OK.
- > % By the way, update the reference list: Tellus, 58A, 227-235) [AM]
- >
- > There is some uncertainty about the true nature of noise on the proxies, and
- > on the instrumental record, as will be discussed further below.
- > The optimal least squares estimation technique of MBH1998 effectively
- > neglects the uncertainties in the proxy data relative to uncertainties
- > in the temperature.
- > Instead,
- > \citet{hegerl_etal2006+} use total least squares regression
- > \citep{allen_stott2003, adcock1878}.
- > This approach
- > allows the partitioning of noise between instrumental temperatures
- > and proxy records to be estimated, on the assumption that the instrumental
- > noise is known. \citet{hegerl_etal2006+} show that this approach leads to greater
- > variability in the reconstruction.
- >
- > \citet{rutherford_etal2005} take a different view. They compare reconstructions
- > from 1400AD to present using a regularised expectation maximisation technique
- > \citep{schneider2001}
- > and the MBH1998 climate field reconstruction method and find only minor
- > differences.
- > Standard regression techniques assume that we have a calibration period, in which
- > both sets of variables are measured, and a reconstruction (or prediction) period
- > in which one variable is estimated, by regression, from the other.
- > The climate reconstruction problem is more complex:
- > there are hundreds of instrumental records
- > which are all of different lengths, and similar numbers of proxy records,

- > also of varying length. The expectation maximisation technique
- > \citep{little_rubin1987}
- > is well suited to deal with this: instead of imposing an
- > artificial separation between a calibration period and a reconstruction
- > period, it fills in the gaps in a way which exploits all data present.
- > Regularised expectation maximisation is a generalisation
- > developed by \citet{schneider2001} to deal with ill posed problems.
- > Nevertheless, there is still a simple regression equation at the heart of the
- > technique.
- > That used by \citet{rutherford_etal2005} is similar to that used by
- > %new: corrected
- > MBH1998, so the issue raised by \citet{hegerl_etal2006+} is unanswered.
- >
- > \subsection{Natural variability and forcings}
- >
- > Global temperature can fluctuate through internally generated variability of
- > the climate system (as in the El Ni\~no phenomenon), through
- > variability in natural forcings (solar insolation, volcanic aerosols,
- > natural changes to greenhouse gas concentrations) and human changes.
- > Reconstructions of variations in the external forcings for the last
- > millenium have been
- > put forward \citep{crowley2000}, although recent studies have
- > suggested a lower amplitude
- > of low-frequency solar forcing \citep{lean_etal2002, foukal_etal2004}.
- >
- > Analysis of reconstructed temperatures of MBH1999 and CL2000 and
- > simulated temperatures using reconstructed solar and volcanic forcings
- > shows that changes in the forcings can explain the reconstructed long
- > term cooling through most of the millenium
- > and the warming in the late 19th century \citep{crowley2000}.
- > The relatively cool climate in the second half of the 19th century may be
- > attributable to cooling from deforestation \citep{bauer_etal2003}.
- > \citet{hegerl_etal2003} analyse the correlations between four
- > reconstructions (MBH1999, BOS2001, ECS2002, and a modified version of
- > CL2000)
- > and estimated forcings \citep{crowley2000}.
- > They find that that natural forcing, particularly by
- > volcanism, explains a substantial fraction of decadal variance.
- > Greenhouse gas forcing is detectable
- > with high significance levels in all analyzed reconstructions except
- > MSH2005, which ends in 1925.
- > \citet{weber2005b} carries out a similar analysis with a wider range
- > of reconstructions. It is shown that the regression of reconstructed
- > global temperatures on the forcings has a similar dependence on timescale
- > as regressions derived from the climate model. The role of solar forcing is
- > found to be larger for longer timescales, whereas volcanic forcing dominates
- > for decadal timescales.
- > The trend component over the period 1000 to 1850 is, however, in all
- > reconstructions larger than the trend implied by the forcings.
- >
- > The methods employed by
- > \citet{hegerl_etal2006+} attribute about a third of the early 20th
- > century warming, sometimes
- > more, in high-variance reconstructions to greenhouse gas forcing.
- > These results indicate that enhanced variability in the past does not
- > make it more difficult to detect greenhouse warming, since a large
- > fraction of the variability can be attributed to external forcing.
- > Quantifying the influence of external forcing on the proxy records is
- > therefore more relevant to understanding climate variability and its
- > causes than determining if past periods were possibly as warm as the
- > 20th century.
- >
- > \citet{goosse_etal2005} investigate the role of internal variability using

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- > an ensemble of 25 climate model simulations of the last millennium
- > and forcing estimates from \citet{crowley2000}.
- > They conclude that internal variability dominates local and regional
- > scale temperature anomalies, implying that most of the variations
- > experienced by a region such as Europe over the last millennium could
- > be caused by internal variability. On the hemispheric and global scale,
- > however, the forcing dominates.
- > This agrees with results from a long
- > solar-forced model simulation by \citet{weber_etal2004}.
- > %%similar This reinforces similar statements made by JOS1998. [where does this
- > come from?]
- > \citet{goosse_etal2005}
- > make the new point, that noise can lead to regional temperature anomalies
- > peaking at different times to the forcing, so that disagreements in
- > timing between proxy series should not necessarily be interpreted as
- > meaning there is no common forcing.
- >
- > \subsection{The long view}
- >
- > The past sections have drawn attention to the problems of calibrating
- > temperature reconstructions using a relatively short
- > period over which instrumental records are available.
- > For longer reconstructions, with lower temporal resolution,
- > other methods are available. Pollen
- > reconstructions of climate match the ecosystem types with those
- > currently occurring at different latitudes. The changes in
- > ecosystem can then be mapped to the temperatures at which
- > they now occur \citep[e.g.][]{bernabo1981, gajewski1988}.
- > These reconstructions cannot resolve decadal variability,
- > but they provide an independent estimate of local low-frequency
- > temperature variations. The results of \citet{weber_etal2004}
- > and
- > \citet{goosse_etal2005} suggest that such estimates
- > centennial mean temperatures can provide some information about
- > global mean anomalies, as they strongly reflect the external forcings on
- > centennial and longer timescales. However, there has, as yet,
- > been no detailed intercomparison between the pollen based
- > reconstructions and the higher resolution reconstructions.
- >
- >
- > \section{Critics of the IPCC consensus on millennial temperatures}
- >
- > The temperature reconstructions described in the previous section
- > represent (including their respective differences and similarities)
- > the scientific consensus, based on objective analysis
- > of proxy data sources which are sensitive to temperature.
- > Nevertheless, there are many who are strongly attached to the view that past
- > temperature variations were significantly larger and that, consequently,
- > the warming trend seen in recent decades should not be considered
- > as unusual.
- >
- >
- > The criticism has been directed mainly at the \citet{mann_etal1998a,
- > mann_etal1999}
- > work.
- > Therefore, this section focuses mainly on this criticism.
- > %new
- > Though some of the critics identify the consensus with the MBH1998 work,
- > this is not the case: the consensus rests on a broader body of work, and
- > as formulated by IPCC2001 is less strong than the conclusions of
- > MBH1998 (Sect.~3.2).
- > \citet{mcintyre_mckitrick2003} [MM2003]
- > criticize MBH1998 on many counts, some related to deficiencies

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- > in the description of the data used and possible irregularities in the data
- > themselves. These issues have been largely resolved in \citet{mann_etal2004}.
- > %%\footnote{ftp://holocene.evsc.virginia.edu/pub/MANNETAL1998}.
- >
- > As noted above, the MBH1998 analysis is considerably more complex than others,
- > and uses a greater volume of data.
- > There are 3 main stages of the algorithm: (1) sub-sampling of
- > regions with disproportionate numbers of proxies, (2) regression,
- > (3) validation and uncertainty estimates.
- >
- > Stage (1) is necessary because some parts of the globe, particularly
- > North America and Northern Europe, have a disproportionate number of
- > proxy records. Other authors have dealt with this by using only
- > a small selection of the available data or using regional
- > averages \citep[BOS2001;][{}]{hegerl_etal2006+}. MBH1998
- > use a principal component analysis to extract the common signal from the records
- in
- > densely sampled regions.
- >
- > The failure of MM2003 to replicate the MBH1998 results is partly due to
- > a misunderstanding of the stepwise reconstruction method. MBH1998 use
- > different subsets of their proxy database for different time periods.
- > This allows more data to be used for more recent periods.
- >
- > For example, Fig.~2 illustrates
- > how the stepwise approach applies to the North American tree ring network.
- > Of the total of 212 chronologies, only 66 extend back beyond 1400AD.
- > MM2003 only calculate principal components for the period when all
- > chronologies are present. Similarly, MBH1998 use one principal
- > component calculated from 6 drought sensitive tree-rings chronologies from South
- West Mexico
- > and this data is omitted in MM2003.
- > % [is this clear now?? (AM)]
- > %new
- > %%Table 7 of MM2003 indicates only 20 series for the region, as the
- > %%supplementary information provided with MBH2003 omitted 2
- > %%\citep{mann_etal2004}.
- > %endnew
- > \citet{mcintyre_mckitrick2005a} [MM2005] continue the criticism of the techniques
- > used by MBH1998 and introduce a "hockey stick index": defined in terms of the
- ratio
- > of the variance at the end of a time series
- > to the variance over the remainder of the series.
- > MM2005 argue that the way in which
- > a principal component analysis is carried out in MBH generates an artificial
- > bias towards a high "hockey-stick index" and that the statistical significance of
- > the MBH results may be lower than originally estimated.
- >
- > The issue arises because the tree ring chronologies are standardized:
- > this involves subtracting a mean and dividing by a variance.
- > MBH1998 use the mean and variance of the detrended series evaluated
- > over the calibration period. MM2005 are of the view that this is
- > incorrect.
- > They suggest that each series should be standardised with respect to the
- > mean and variance its full length.
- >
- > The code used by MM2005 is not, at the time of writing available,
- > but the code fragments included in the text imply
- > that their calculation used data which had been
- > centred (mean removed) but had not been normalized to unit variance
- (standardised).
- > Figure 3 shows the effect of the changes, applied to the
- > North American tree ring sub-network of the data used by MBH1998,

> using those chronologies which extend back to 1400AD.
 > The calculation used here does not precisely reproduce the archived MBH1998
 > result, but the differences may be due to small differences in
 > mathematical library routines used to do the decomposition.
 > The effect of replacing the MBH1998 approach with centering and
 > standardising on the whole time series is small, the effect of
 > omitting the standardisation as in MM2005 is much larger:
 > this omission causes the 20th century trend to be removed from the
 > first principal component.
 >
 > \citet{storch_zorita2005} look at some of the claims made in MM2005
 > and analyses them in the context of a climate simulation.
 > They find the impact of the modifications suggested by McIntyre and Mckitrick to
 > be minor.
 > \citet{mcintyre_mckitrick2005b} clarify their original claim, stating that the
 > standardisation technique used by MBH98 does not create the "hockey-stick"
 structure
 > but does "steer" the selection of this structure in principal component
 > analysis.
 >
 > \citet{mcintyre_mckitrick2005c} [MM2005c] revisit the MM2003 work and correct
 > their earlier error by taking the stepwise reconstruction technique into account.
 > They assert that the results of MM2003, which show a 15th century
 > reconstruction 0.5K warmer than found by MBH1998,
 > are reproduced with only minor changes to the MBH1998 proxy data base.
 > Examination of the relevant figures, however, shows that this is not entirely
 > true. The MM2005c predictions for
 > the 15th century are 0.3K warmer than the MBH1998
 > result: this is still significant, but, unlike the discredited MM2003 result, it
 > would not make the 15th century the warmest on record.
 >
 > MM2005c and \citet{wahl_ammann2005} both find that
 > excluding the north American bristlecone pine data from the proxy
 > data base removes the skill from the 15th century reconstructions.
 > MM2005c justify this removal on the grounds that the first principal component
 > of the North American proxies, which is dominated by the
 > bristlecone pines, is a statistical outlier with respect to the joint distribution
 > of ΔT and the difference in mean between 1400 to 1450 and 1902 to 1980.
 > %%first ref to table 1
 > Table 1, which lists a range of proxies extending back to 1000,
 > shows that the North American first principal component ("ITRDB [pc01]" in that
 table)
 > is not an outlier
 > in terms of its coherence with northern hemispheric mean temperature from 1856 to
 1980.

```

> \begin{table}[t]
> \small
> %% output from mitrie/pylib/multi_r2.py, edited
> \begin{tabular}{|p{7.0cm}|r|r||r||}
> \hline
> Name & Lat. & Lon. & Id &  $\Delta T$  & Type \cr
> \hline
> GRIP: borehole temperature (degC) (Greenland) $\Delta 1$  & 73 & -38 & *,Mo & 0.67
> & [IC] \cr
> China: composite (degC) $\Delta 2$  & 30 & 105 & *,Mo & 0.63 & [MC]
> \cr
> Taymir (Russia) & 72 & 102 & He & 0.60 & [TR C]
> \cr
> Eastern Asia & 35 & 110 & He & 0.58 & [TR C] \cr
> Polar Urals $\Delta 3$  & 65 & 67 & Es, Ma & 0.51 &
> [TR] \cr
> Tornetraesk (Sweden) $\Delta 4$  & 58 & 21 & Mo & 0.50 & [TR]
    
```

```

\cr
> ITRDB [pc01] & 40 & -110 & Ma & 0.49 & [TR PC] \cr
> Mongolia & 50 & 100 & He & 0.46 & [TR C] \cr
> Arabian Sea: Globigerina bull$^5$ & 18 & 58 & *,Mo & 0.45 & [CL]
\cr
> Western Siberia & 60 & 60 & He & 0.44 & [TR C] \cr
> Northern Norway & 65 & 15 & He & 0.44 & [TR C] \cr
> Upper Wright (USA)$^6$ & 38 & -119 & *,Es & 0.43 & [TR]
\cr
> Shihua Cave: layer thickness (degC) (China)$^7$ & 40 & 116 & *,Mo & 0.42 &
[SP] \cr
> Western Greenland & 75 & -45 & He & 0.40 & \cr
> Quelcaya 2 [do18] (Peru)$^8$ & -14 & -71 & *,Ma & 0.37 & [IC]
\cr
> Boreal (USA)$^6$ & 35 & -118 & *,Es & 0.32 & [TR]
\cr
> Tornetraesk (Sweden)$^9$ & 58 & 21 & *,Es & 0.31 & [TR]
\cr
> Taymir (Russia)$^{10}$ & 72 & 102 & *,Es, Mo & 0.30 &
[TR] \cr
> Fennoscandia$^{11}$ & 68 & 23 & *,Jo, Ma & 0.28 &
[TR] \cr
> Yamal (Russia)$^{12}$ & 70 & 70 & *,Mo & 0.28 &
[TR] \cr
> Northern Urals (Russia)$^{13}$ & 66 & 65 & *,Jo & 0.27 &
[TR] \cr
> \hline
> \end{tabular}
> \caption{Continued overleaf.}
> \end{table}
>
> \renewcommand{\thetable}{\arabic{table}}
> \addtocounter{table}{-1}
> \begin{table}[t]
> \small
> \begin{tabular}{|p{7.0cm}|r|r||r||}
> \hline
> Name & Lat. & Lon. & Id & $R^2$ & Type \cr
> \hline
> ITRDB [pc02] & 42 & -108 & Ma & 0.21 & [TR PC] \cr
> Lenca (Chile)$^{14}$ & -41 & -72 & Jo & 0.18 & [TR] \cr
> Crete (Greenland)$^{15}$ & 71 & -36 & *,Jo & 0.16 &
[IC] \cr
> Methuselah walk (USA) & 37 & -118 & *,Mo & 0.14 & [TR]
\cr
> Greenland stack$^{15}$ & 77 & -60 & Ma & 0.13 &
[IC] \cr
> Morocco & 33 & -5 & *,Ma & 0.13 & [TR]
\cr
> North Patagonia$^{16}$ & -38 & -68 & Ma & 0.08 &
[TR] \cr
> Indian Garden (USA) & 39 & -115 & *,Mo & 0.04 & [TR]
\cr
> Tasmania$^{17}$ & -43 & 148 & Ma & 0.04 &
[TR] \cr
> ITRDB [pc03] & 44 & -105 & Ma & -0.03 & [TR PC] \cr
> Chesapeake Bay: Mg/Ca (degC) (USA)$^{18}$ & 38 & -76 & *,Mo & -0.07 &
[SE] \cr
> Quelcaya 2 [accum] (Peru)$^8$ & -14 & -71 & *,Ma & -0.14 &
[IC] \cr
> France & 44 & 7 & *,Ma & -0.17 & [TR]
\cr
> \hline

```

```

> \end{tabular}
> \caption{(continued)
> The primary reference for each data set is indicated by the superscript in the
first column as
> follows:
> 1: \citep{dahl-jensen_etal1998}, 2: \citet{yang_etal2002}, 3:
\citet{shiyatov1993}, 4: \citet{grudd_etal2002}, 5: \citet{gupta_etal2003},
> 6: \citet{lloyd-graumlich1997}, 7: \citet{tan_etal2003}, 8: \citet{thompson1992},
> 9: \citet{bartholin-karlen1983}, 10: \citet{naurzbaev-vaganov1999}, 11:
\citet{briffa_etal1992},
> 12: \citet{hantemirov-shiyatov2002}, 13: \citet{briffa_etal1995}, 14:
\citet{lara-villalba1993},
> 15: \citet{fisher_etal1996}, 16: \citet{boninsegna1992}, 17:
\citet{cook_etal1991}, 18: \citet{cronin_etal2003}.
> the "Id" in column 4 refers to the reconstructions in which the data were used.
> The type of proxy is indicated in column 6:: tree-ring [TR], tree-ring composite
[TR C],
> tree-ring principle component [TR PC], coral [CL], sediment [SE], ice core [IC],
> multi-proxy composite [MC]. The 19 proxy series marked with a "*" in column 4 are
used in the
> ``Union'' reconstruction.
> }
> \end{table}
>
> \citep[[]; MM2005c]{briffa-osborn1999} suggest that
> rising CO2 levels may have contributed significantly to the
> 19th and 20th century increase in growth rate in some trees,
> particularly the bristlecone pines, but such an
> effect has not been reproduced in controlled experiments with mature trees
> \citep{korner_etal2005}.
>
> Once a time series purporting to represent past temperature has been obtained,
> the final, and perhaps, most important, step is to verify its
> and estimate uncertainty limits. This is discussed further in the next section.
>
> \section{Varying methods vs. varying data}
>
> One factor which complicates the evaluation of the various reconstructions is
> that different authors have varied both method and data collections. Here we will
> run a representative set of proxy data collections through two algorithms:
> inverse regression and scaled composites. These two methods, and the different
> statistical models from which they may be derived, are explained in the
> Appendix A.
>
> Esper et al. (2005) investigated the differing calibration approaches used in the
recent literature, including
> regression and scaling techniques, and concluded that the methodological
differences in calibration result in differences
> in the reconstructed temperature amplitude/variance of about 0.5K.
> This magnitude is equivalent to the mean annual temperature change for the
Northern Hemisphere reported in the last
> IPCC report for the 1000-1998 period.
> \citet{burger_etal2006} take another approach and investigate a family of 32
different regression algorithms
> derived by adjusting 5 binary switches, using pseudo-proxy data.
> They show that these choices, which
> have all been defended in the literature, can lead to a wide variety of different
> reconstructions given the same data.
> They also point out that the uncertainty is greater when we
> attempt to estimate the climate of periods which lie outside the range experienced
> during the calibration period. The relevance of this point to the last millennium
is
> under debate: the glacier based temperature estimates of OER2005 suggest that the

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- > coldest northern hemisphere mean temperatures occurred close to the start of
- > the instrumental record, in the 19th century. The borehole reconstructions,
- > however, imply that there were colder temperatures experienced in the 16th to 18th
- > centuries.
- > For the question as to whether the warmth of the latter part of the calibration
- > period has been experienced in the past, however,
- > this particular issue is not directly relevant.
- >
- > As noted above, much of the MBH1999 algorithm is irrelevant to reconstructions
- > prior to AD 1450, because before that date the data only suffice,
- > according to estimates in that paper, to determine one degree of freedom.
- > Hence, we will only look at direct evaluation of the hemispheric mean temperature.
- >
- > Several authors have evaluated composites and calibrated those composites
- > against instrumental temperature. Many of the composites contain more samples in
- > later
- > periods, so that the calibration may be dominated by samples which do
- > not extend into the distant past. Here, we will restrict attention to
- > records which span the entire reconstruction period.
- > The data series used are listed in table 1.
- >
- > \subsection{Proxy data quality issues}
- >
- > As noted previously, there has been especially strong criticism of
- > MBH1998, 1999, partly concerning some aspects of their data collection.
- > Figures 4 and 5 show reconstructions made using the MBH1999 and MBH1998 data
- > respectively.
- > Regression against northern hemispheric mean temperature from 1856 to 1980 is used
- > instead of regression against principal components of
- > temperature from 1902 to 1980. There are differences, but key features remain.
- > MM2003 draw attention to the fact that one time series,
- > "CANA036" in the ITRDB classification, contributed
- > by Gaspard, appears twice in the MBH1998 database.
- > This error is corrected in the red dashed curve of Fig.~5,
- > which is almost identical to the green curve, which retains the duplication.
- >
- > \subsection{Reconstruction using a union of proxy collections}
- >
- > The following subsection will discuss a range of reconstructions using different
- > data collections. The first 5 of these collections are defined as those proxies
- > used by
- > JBB1998, MBH1999, ECS2002, MSH2005 and HCA2006, respectively, which extend back to
- > 1000AD.
- > These will be referred to below as the JBB, MBH, ECS, MSH, HCA composites below
- > to distinguish them from the composites used in the published articles, which
- > include
- > additional, shorter, proxy data series.
- > Finally there is a 'Union' composite made using 19 independent northern
- > hemisphere proxy series marked with "*" in table 1. Apart from the China
- > composite
- > record, all the data used are individual series. The PCs used by MBH1999 have been
- > omitted in favour of individual series used in other studies.
- > Two southern hemisphere tropical series, both from the Quelcaya glacier, Peru,
- > are included ensure adequate representation of tropical temperatures.
- > This 'Union' collection contains 11 tree-ring series, 4 ice-cores, and one each of
- >
- > coral, speleothem, lake sediment and a composite record including historical data.
- >
- > \subsection{Intercomparison of proxy collections}
- >
- > Figure 6 shows reconstructions back to 1000AD using
- > composites of proxies and variance matching [CVM] (for the proxy
- > principal components in the MBH1998, MBH1999 data collections the sign

> is arbitrary: these series have, where necessary, had the sign reversed so that
 > they have a positive correlation with the northern hemisphere
 > temperature record).
 > Surprisingly, the 'Union' does not lie in the range spanned by the other
 > reconstructions,
 > and reaches colder temperatures than any of them. It does, however, fit the
 > calibration period
 > data better than any of the sub-collections.
 >
 > The reconstructions shown in Fig.~7 use the same data is used: this time
 > using inverse regression [INVR] (Appendix A), as used by MBH1998
 > (the method used here differs from that of MBH1998 in using northern hemisphere
 > temperature to calibrate against, having a longer calibration period,
 > and reconstructing only a single variable instead of multiple EOFs).
 > The spread of values is substantially increased relative to the CVM
 > reconstruction.
 >
 > with INVR, only one reconstruction (that using the ECS2001
 > data) shows temperatures warmer than the mid 20th century.
 > The inverse regression technique applies weights to the
 > individual proxies which are proportional to the
 > correlation between the proxies and the calibration temperature
 > signature.
 > For this time series the 5 proxies are weighted as:
 > 1.7 (Boreal); 2.9 (Polar Urals); 1.7 (Taymir); 1.8 (Tornetraesk); and 2.3 (Upper
 > wright).
 > Firstly, it should be noted that this collection samples North America and the
 > Eurasian arctic only. The bias towards the arctic is strengthened by the weights
 > generated by the inverse regression algorithm, such that the reconstruction has
 > poor geographical coverage.
 >
 > The MBH1999 and HPS2000 published reconstructions are shown in Fig.~6 for
 > comparison: the MBH1999
 > reconstruction lies near the centre of the spread of estimates, while the HPS2000
 > reconstruction
 > is generally at the lower bound.
 >
 > Much of the current debate revolves around the level of
 > centennial scale variability in the past.
 > The CVM results generally suggest
 > a low variance scenario comparable to MBH1999. The inverse regression
 > results, however, suggest greater variability. It should be noted
 > that the MBH1999 inverse regression result use greater volumes of
 > data for recent centuries, so that the difference in Fig.~7 between the
 > dashed red curve and the full green curve in the 17th
 > century is mainly due to reduced proxy data input in the latter
 > (there is also a difference because MBH1999 used inverse regression
 > against temperature principle components rather than northern hemisphere
 > mean temperature as here).
 >
 > Table 2 shows the cross correlations of the reconstructions in Fig.~6,
 > for high pass (upper right) and low pass (lower left) components
 > of the series, with low pass being defined by a 40 year running mean.
 > The low pass components are highly correlated.

```

> \begin{table}[t]
> %% output from mitrie/pylib/pp.py
> \begin{tabular}{|l|c|c|c|c|c|c|}
> \hline
> & Ma & Mo & Es & Jo & He & Union\cr
> \hline
> Ma & -- & 14\% & 25\% & 60\% & 20\% & 61\% \cr
> Mo & 69\% & -- & 37\% & 11\% & 13\% & 60\% \cr

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> Es & 64\% & 77\% & -- & 14\% & 36\% & 57\% \cr
> Jo & 62\% & 51\% & 46\% & -- & 11\% & 35\% \cr
> He & 72\% & 75\% & 85\% & 53\% & -- & 26\% \cr
> Union & 67\% & 71\% & 62\% & 45\% & 84\% & -- \cr
> \hline
> \end{tabular}
> \caption{Cross correlations between reconstructions from
> different proxy data bases: Mann et al (Ma), Moberg et al (Mo),
> Esper et al (Es), Jones et al (Jo), Hegerl et al (He).
> Lower left block correspond to low pass filtered series,
> upper right to high pass filtered.}
> \end{table}
>
> The significance of the correlations between these five proxy data samples
> and the instrumental temperature data during the calibration period (1856-1980)
> has been evaluated using a Monte-Carlo simulation
> with (1) a first order Markov model and (2) random time series
> which reproduces the lag correlation structure of the data samples (see Appendix
A).
> Figure 8 shows the lag correlations. The instrumental record had a pronounced
> anti-correlation on the 40 year time-scale. This may be an artifact of the short
> data record, but it is retained in the significance calculation as the best
available
> estimate which is independent of the proxies.
> The 'Union' composite shows multi-centennial correlations which are not present in
the other data.
> The MBH and JBB composites clearly underestimate the decadal scale correlations,
while
> the HCA and 'Union' composites overestimate it.
> %%first ref to table 3
> Results are shown in table 3.
> If the full lag correlation structure of the data were known, it would be true,
> as argued by MM2005, that the first order approach generally
> leads to an overestimate of significance. Here, however, we only have a
> estimated correlation structure based on a small sample. Using this finite
> sample correlation is likely to overestimate long-term correlations and hence
> lead to an underestimate of significance. Nevertheless, results are presented here
> to provide a cautious estimate of significance.
> For the MBH and JBB composites, which have short lag-correlations, the difference
> between the two methods is minimal. For other composites there is a substantial
difference.
> In all cases the  $R^2$  values exceed the 99\% significance level. When
> detrended data are used the  $R^2$  values are lower, but still above the 95\%
> level -- with the exception of the Hegerl et al. data. This data has only decadal
> resolution, so the lower significance in high frequency variability is to be
expected.
>
>
> \begin{table}[t]
> %% output from mitrie/pylib/sum_ac.py
> \begin{tabular}{|l|c|c|c|c|c|c|c|p{1.1cm}|}
> \hline
> Source &  $R^2_{95|h}$  &  $R^2_{95|AR}$  &  $R^2$  &  $R^2_{detr}$  &  $\sigma$  & Signif.
& Signif. (detrended) \cr
> \hline
> Mann et al. & 0.205 & 0.170 & 0.463 & 0.286 & 0.186 & 99.99\% & 98.75\%\cr
> \hline
> Moberg et al., (hi+lo)/2 & 0.225 & 0.183 & 0.418 & 0.338 & 0.153 & 99.87\% & 99.25\%\cr
> \hline
> Esper et al. & 0.335 & 0.220 & 0.613 & 0.412 & 0.158 & 99.96\% & 98.11\%\cr
> \hline

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```

> Jones et al. & 0.187 & 0.180 & 0.371 & 0.274 & 0.203 & 99.93\% & 99.17\%\cr
> \hline
> Hegerl et al. & 0.440 & 0.266 & 0.618 & 0.357 & 0.133 & 99.56\% & 90.13\%\cr
> \hline
> Union & 0.337 & 0.236 & 0.655 & 0.414 & 0.149 & 99.98\% & 97.91\%\cr
> \hline
> \end{tabular}
> \caption{
>  $R^2$  values evaluated using the Northern Hemisphere mean temperature (1856 to
1980) and various
> proxy records.
> Columns 2 and 3 show  $R^2$  values for the 95\% significance
> levels, evaluated using a Monte Carlo simulation with 10,000 realisations. In
columns
> 2, 7 and 8 the full lag-correlation structure of the data is used, in column
> 3 a first order auto-regressive model is used, based on the lag one
auto-correlation.
> Column 4 shows the  $R^2$  value obtained from the data and column 5 shows the same
> using detrended data.
> Column 6 shows the standard error (root-mean-square residual) from the calibration
> period. Columns 7 and 8 show significance levels, estimated using
> Monte Carlo simulations as in column 2, for the full and detrended  $R^2$  values.
> }
> \end{table}
>
> Figure 9 plots this reconstruction,
> with the instrumental data
> in the calibration period.
> The composite tracks the changes in northern hemisphere temperature well,
> capturing the steep rise between 1910 and 1950 and much of the decadal
> scale variability. This is reflected in the significance scores (Tab.~3)
> which are high both for the full series and for the detrended series.
> The highest temperature in the reconstructed data, relative to the 1866-1970 mean
is
> 0.227K in 1091AD. This temperature was first exceeded in the instrumental record
in 1878,
> again in 1937 and frequently thereafter. The instrumental record has not gone
below this level since 1986.
> Taking  $\sigma=0.149$  as the root-mean-square residual in the calibration period
> 1990 is the first year when the 1091 maximum was exceed by  $2\sigma$ .
> This happened again in 1995 and every year since 1997.
> 1998 and every year since 2001 have exceeded the preindustrial maximum by
 $3\sigma$ .
>
> \conclusions\label{sec:end}
>
> There is general agreement that global temperatures cooled
> over the majority of the last millennium and have risen sharply
> since 1850. In this respect, the recent literature has not produced
> any change to the conclusions of JBB1998, though there remains
> substantial uncertainty about the magnitude of centennial scale variability
> superimposed over longer term trends.
>
> The IPCC 2001 conclusion that temperatures of the past millennium
> are unlikely to have been as warm, at any time prior to the 20th
> century, as the last decades of the 20th century is supported
> by subsequent research and by the results obtained here.
>
> The greatest range of disagreement among independent
> assessments occurs during the coolest centuries, from 1500 to
> 1900, when the departure from recent climate conditions
> was strongest and may have been outside the range of
> temperatures experienced during the later

```

> instrumental period.

>

> There are many areas of uncertainty and disagreement within
> the broad consensus outlined above, and also some who
> dissent from that consensus. Papers which claim to refute the
> IPCC2001 conclusion on the climate of the past millennium have been
> reviewed and found to contain serious flaws.

>

> A major area of uncertainty concerns the accuracy of the long time-scale
> variability in the reconstructions. This is particularly
> so for timescale of a century and longer. There does not appear to be any
> doubt that the proxy records would capture rapid change on
> a 10 to 50 year time scale such as we have experienced in recent decades.

>

> Using two different reconstruction methods on a range of proxy data
> collections, we have found that inverse regression
> tends to give large weighting to
> a small number of proxies and that the relatively simple
> approach of compositing all the series and using variance matching to
> calibrate the result gives more robust estimates.

>

> A new reconstruction made with a composite of 19 proxies extending back
> to 1000AD fits the instrumental record to within a standard error of 0.149K.
> This reconstruction gives a maximum pre-industrial temperature of 0.227K
> relative to the 1866 to 1970AD mean. The maximum temperature from the
> instrumental record is 0.841K, over 4 standard errors larger.

>

> The reconstructions evaluated in this study show considerable disagreement
> during the 16th century. The new 19 proxy reconstruction implies 21-year mean
> temperatures close to 0.6K below the 1866 to 1970AD mean. As this reconstruction
> only used data extending back to 1000AD, there is a considerable volume of 16th
> century
> data which has not been used. This will be a focus if future research.

>

> {\bf Acknowledgments}

>

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>

> \vfill\eject

>

> \def\thesection{A}

> {\bf Appendix A: Regression methods}

>

> Ideally, the statistical analysis method would be determined by the
> known characteristics of the problem. Unfortunately, the error
> characteristics of the proxy data are not sufficiently well
> quantified to make the choice clear.

> This appendix describes two methods and the statistical models which can be
> used to motivate them.

>

> \subsection{Inverse regression [INVR]}

>

> Suppose $x_{\{ik\}}$, $i=1, N_{\{pr\}}$, $k=1, L$ is a set of $N_{\{pr\}}$
> standardised proxy records of length L and that we are trying
> to obtain an estimate \hat{y}_i of a quantity y_i which is
> known only in a calibration period (i in C\$).

>

> Several "optimal" estimates of y_i can be obtained, depending on

> the hypothesised relation between the proxies and y_k .

> Inverse regression follows from the model

>
$$y_k = \beta_i x_{ik} + \epsilon_k$$

> where ϵ_k is a noise process, independent between proxies.

> It follows that optimal estimate for the coefficients β_i are

>
$$\hat{\beta}_i = \frac{\sum_{k \in C} x_{ik} y_k}{\sum_{k \in C} y_k^2}$$

> Given these coefficients, the optimal estimate of the y_k outside the calibration period is

>
$$\hat{y}_k = \frac{\sum_i \hat{\beta}_i x_{ik}}{\sum_i \hat{\beta}_i^2}$$
.

> **Composite plus variance matching [CVM]**

> This method is rather easier. It starts out from the hypothesis that different proxies represent different parts of the globe. A proxy for the global mean is then obtained as a simple average of the proxies:

>
$$\overline{x}_k = N_{pr}^{-1} \sum_i x_{ik}$$

> Suppose

>
$$\overline{x}_k = \beta y_k + \epsilon_k$$

> then an optimal estimate of β is easily derived as

>
$$\hat{\beta} = \frac{\sum_{k \in C} \overline{x}_k y_k}{\sum_{k \in C} y_k^2}$$
.

> However, $y_k^* = \hat{\beta}^{-1} \overline{x}_k$ is not an optimal estimate of y_k .

> Because of the added noise, \overline{x}_k is generally an overestimate of βy_k . To correct for this we should use:

>
$$y_k^* = \frac{\overline{x}_k}{\sqrt{\beta^2 \sigma_y^2 + \sigma_{\epsilon}^2}}$$

> where σ_y^2 and σ_{ϵ}^2 are the expected variance of y_k and the

> respectively.

> This leads to an estimate:

>
$$y_k^* = \frac{\overline{x}_k}{\sqrt{\sigma_y^2 + \sigma_{\epsilon}^2}}$$

> This is known as the variance matching method because it matches the variance of the reconstruction with that of observations over the calibration period.

> **Appendix B: Statistical tests**

>
>
> \subsection{Tests for linear relationships}
>
> The simplest test for a linear relationship is the anomaly correlation
> (also known as: Pearson Correlation, Pearson's product moment correlation, R^2 ,
> product mean test):
> \be
>
$$R = \frac{\overline{y^{\prime} x^{\prime}}}{\sqrt{\overline{y^{\prime 2}} \overline{x^{\prime 2}}}}$$

> \ee
> where the over-bar represents a mean over the data the test is being applied to,
> and a prime a departure from the mean
> \citep{pearson1896}.

>
> The significance of an anomaly correlation can be estimated using the
> t statistic:
> \be
>
$$t = \frac{R \sqrt{n-2}}{\sqrt{1-R^2}}$$

> \ee
> where n is the sample size (for independent variables).
> Two Gaussian variables will produce a t statistics which obeys the
> Student's t-distribution of $n-2$ degrees of freedom.

>
> Ideally, if the noise affecting all the x and y values is independent,
> n is simply the number of measurements. This is unlikely to be the case,
> so an estimate of n is needed. The Monte-Carlo approach is more
> flexible: a large sample of random sequences with specified correlation
> structures is created, and the frequency with which the specified
> R coefficient is exceeded can then be used to estimate its significance.

>
> \subsection{Lag correlations}
>
> Following \citet{hosking1984}, a random time series with a specified
> lag correlation structure is obtained from the partial correlation coefficients,
> which are generated using Levinson-Durbin regression.

>
> It is, however, not possible to generate a sequence matching an arbitrarily
> specified correlation structure and there is no guarantee that an
> estimate of the correlation structure obtained from a small sample will
> be realizable. It is found that the Levinson-Durbin regression diverges
> when run with the lag correlation functions generated from the
> \citet{jones_etal1986}
> northern hemisphere temperature record and also that from the HCA composite.

>
> For the northern hemisphere temperature record, this is resolved by truncating the
> regression after $n=50$.
> The sample lag-correlation coefficients are, in any case, unreliable beyond this
> point.
> Truncating the regression results in a random sequence with a lag correlation
> fitting that
> specified up to lag 50 and then decaying.
> For the HCA composite, the sample lag-correlation, $C(n)$, is scaled by $\exp(-0.0001 n)$,
> where n is the lag in years.

>
> {\bf Appendix C: Acronyms}
>
> Table 4 shows a list of acronyms used in this paper.
> \begin{table}
> \begin{tabular}{|l|p{12cm}|}
> \hline
> ABD & Age Band Decomposition tree ring standardisation method \cr

```

> \hline
> CSM & Climate System Model: A coupled ocean-atmosphere climate model produced by
NCAR,
> http://www.cgd.ucar.edu/csm/ \cr
> \hline
> CFM & Climate Field Reconstruction: method for reconstructing spatial structures
> of past climate variables using proxy data \cr
> \hline
> CVM & Composite plus Variance Matching reconstruction method \cr
> \hline
> ECHO-G & Hamburg coupled ocean-atmosphere climate model \cr
> \hline
> EOF & Empirical Orthogonal Component \cr
> \hline
> INVR & Inverse Regression reconstruction method \cr
> \hline
> IPCC & The Intergovernmental Panel on Climate Change, established by the
> World Meteorological Organization (WMO) and the United Nations Environment
Programme (UNEP)
> to assess scientific, technical and socio-economic information relevant for the
understanding of climate change, its potential impacts and options for adaptation
and mitigation. It is open to all Members of the UN and of WMO. \cr
> \hline
> ITRDB & International Tree-Ring Data Bank, maintained by the NOAA Paleoclimatology
> Program and World Data Center for Paleoclimatology (www.ncdc.noaa.gov/paleo) \cr
> \hline
> MWP & Medieval Warm Period \cr
> \hline
> PC & Principal Component \cr
> \hline
> RCS & Regional Curve Standardisation tree ring standardisation method \cr
> \hline
> \end{tabular}
> \caption{Acronyms used in the text}
> \end{table}
>
> \bibliographystyle{egu}%
> \bibliography{citations,extras}
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by id1/mitrie/plot_recon.pro
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f01}}
> \caption{\label{fig:1}
> Various reconstructions. with mean of 1900 to 1960 removed.
> }
> \end{figure*}
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by id1/paleo/mbh_70.pro
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f02}}
> \caption{\label{fig:2}
> Data blocks for PC calculation by MBH1998. Each of the 212 data series is shown as
a horizontal
> line over the time period covered. The dashed blue rectangles indicate some of the
blocks of data
> used by MBH1998 for their proxy principal component calculation, using fewer
series for longer time
> periods. The red rectangle indicates the single block used by MM2003, neglecting
all data prior
> to 1619.
> }

```

```

> \end{figure*}
>
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/do_eof.py
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f03}}
> \caption{\label{fig:3}
> First Principal Component of the North American proxy record collection, following
MBH1998.
> The black line is the MBH1998 archived version.
> The other lines differ only in the method of standardisation of series prior to
calculation of the
> principal components.
> Red: calculated following the MBH1998 method, the individual series have the mean
of the calibration
> period removed and are normalised by the variance of the detrended series over
that period;
> Blue: with the mean of the whole series removed, and normalised with the variance
of the whole series.
> Green: mean removed but no normalisation.
> }
> \end{figure*}
>
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f13}}
> \caption{\label{fig:4}
> Reconstruction back to 1000, calibrated on 1856 to 1980 northern hemisphere
temperature,
> using the MBH1999 proxy data collection.
> The MBH1999 NH reconstruction and the Jones et al. (1986) instrumental data are
shown for comparison.
> All data have been smoothed with a 21-year running mean.
> }
> \end{figure*}
>
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f12}}
> \caption{\label{fig:5}
> As Fig.~4, but using the MBH1998 data collection back to 1400AD.
> }
> \end{figure*}
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f10}}
> \caption{\label{fig:6}
> Reconstruction back to 1000AD, calibrated on 1856 to 1980 northern hemisphere
temperature,
> using a composite and variance matching,
> for a variety of different data collections.
> The MBH1999 and HPS2000 NH reconstructions and the Jones et al. (1998)
instrumental
> data are shown for comparison.
> Graphs have been smoothed with a 21-year running mean and centered on 1866 to
1970.

```

```

> The maximum of the 'Union' reconstruction in the pre-industrial period (0.227K,
1091AD) is shown
> by a short cyan bar, the maximum of the instrumental record (0.841K, 1998AD) is
shown as a
> short purple bar.
> }
> \end{figure*}
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f11}}
> \caption{\label{fig:7}}
> As Fig.~6, except using inverse regression.
> }
> \end{figure*}
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f14}}
> \caption{\label{fig:8}}
> Lag correlations for proxy composites and instrumental record (gray).
> }
> \end{figure*}
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f09}}
> \caption{\label{fig:9}}
> The 'Union' reconstruction, using 'composite plus variance scaling', for the
> calibration period. Also shown is the level of the maximum plus two standard
errors.
> The Jones and Mann instrumental data is plotted as a dashed line.
> }
> \end{figure*}
>
> \end{document}
> deliberate bad speling
>
> \vfill\eject
>
> {\it\small
> Both these questions could be answered by a detailed knowledge of the
> climate and its forcings over the past 1000 years, but the detailed
> instrumental record only extends back to 1856. Hence ... [[]]
>
> %%The motivation for the study of past climate variability is twofold:
> Current projections of future climate change are still burdened with
> some level of uncertainty, even within a particular scenario of future
> greenhouse concentrations. Although all climate models simulate an
> increase of global temperatures in this century, the range of warming
> simulated by different models still covers a wide range \citep{IPCC2001}.
> A much pursued goal is to reduce this uncertainty range.
> A question is whether warming of magnitude similar to that observed in the
> 19th and 20th centuries, very likely caused at least to a large part by
> anthropogenic greenhouse gas, has also occurred in the preindustrial recent past,
> when, to a large extent, only natural forcings of the climate system were
active.
>
> {\small\it Reconstructions of the climate of the past millennium can help us to
> answer the second point by describing the magnitude of

```

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> global temperature fluctuations in the past and can address the first
> point by helping to quantify the climate sensitivity: the
> ratio of the response to the forcing.}
> Progress in both questions can be achieved through the analysis
> of reconstructions and simulations of the climate of the past millennium:
> firstly,
> we wish to know whether current high global temperatures are
> within the range of natural variability. Secondly, we wish to
> evaluate the skill and reliability of climate models.
> %%The rise in global mean temperatures since then is
> Therefore, some form of empirical reconstruction based on early-instrumental
> records, documentary evidence and proxy data is needed.
> %%On the other hand,
> %%the global warming observed in the past 2 centuries may be partly
> %%due to the recovery from an extended
> %%period of anomalously low temperatures which was reflected
> %%in a large number of indirect European records.
> %%[omit above sentence (AM)??]
> %%[justify "recovery" (JE)??]
> %%[was it really gradual (JE)]
> %%"gradual deleted": jones and mann suggest that hemispheric mean cooling trend
> %% is "relatively steady" in contrast to more episodic cooling in Europe,
> %% but esper et al (2002) suggests that attributing this difference to
> %% hemisphere vs. europe is wrong, it might be whole hemisphere vs.
extra-tropical,
> %% or it might be failure to resolve variability.
> %[check]: copied from Gabi's email -- needs clearing up.
> %%However, some unsolved questions will remain.
> %%For instance, the climate sensitivity may depend on the nature of the external
> %%forcing (greenhouse gas, solar irradiance, etc), so that an estimation
> %%of past climate sensitivity has still to be considered with some care.
> %%There are indeed indications that climate sensitivity to changes in solar
> %%forcing is lower than to changes to greenhouse gas forcing
> %%\citep{tett_etal2005+, joshi_etal2003}.
> %%[be more precise -- (i.e. in terms of $K W^{-1} m^2$??)]
> %::joshi et al show a 0-20% difference between sensitivity to solar forcing
> %%compared to CO2 forcing. This is much less than variability in sensitivity
> %%among models.
> %%[this is not really relevant if the difference in climate sensitivity between
> %%forcings is much less than that between, say, models]
>
> A wide range of proxy
> data sources which have been exploited for this problem
> \citep[reviewed in][jones_mann2004}.
> Tree rings are a particularly important source of information
> within the time frame of the last millennium. The precise dating which
> is provided by the annual growth rings allows anomalous growth
> rates to be compared reliably with historical events.
> However, its not straightforward to retrieve the climate variability
> at timescales that exceed the typical life span of a tree (see Sect.~2.5 below).
> Statistical regression against instrumental temperature data is often used
> because the majority of proxy records cannot be directly related to temperature
> by deterministic models
> (two exceptions, reconstructions obtained from borehole temperatures
> and those based on glacial advance and retreat, are discussed below).
> Appendix A gives mathematical details of some basic statistical measures.
> The measures of skill used by MBH1998, MBH1999 are the
> R^2 test, which measures the degree of coherence between two data
> sets, and the 'Reduction of Error' (RE) statistic, which measures the
> effectiveness of one series (typically a model or prediction)
> in explaining the total (i.e. including the mean) variance in another (the
verification data).
>

```

> The statistical tests on these measures of skill are described
> in many text books, and their application is straight forward
> when all sources of noise contaminating the
> data are well characterised. The difficulty which arises
> in many applications, including climate reconstructions, is that
> the noise has significant but poorly characterised correlations.
> % [is this true for tests of skill -- probably not for analytical tests of RE]]
> }
> \vfill\eject
> \vfill \eject
>
> The B\"urger et al. analyses use a collection of pseudo-proxies created from
> pseudo observations of a climate simulation with added white noise.
> This is a pragmatic approach -- there is little reliable information about
> the true nature of the noise spectrum. It has been suggested that bristlecone
> pines
> in N. America have an anomalous growth trend in the 20th century which is
> coherent among that species. The inverse regression algorithm can give large
> weight to individual proxies and negative weight to others: this may be
> correct in some circumstances, but in others it could amplify the error.
> The composite approach, on the other hand, is robust:
> simply taking the mean of the available proxies does not rely on
> specific assumptions about the noise spectrum.
>
> \vfill\eject
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{figz/c_var_nh_reconc_10_1000_c}}
> \centering{\includegraphics[width=12cm]{figs/cpd-2006-xxxx-f04}}
> \caption{\label{fig:1}
> As Fig.~7, except
> using composite and variance matching.
> }
> \end{figure*}
>
> \vfill\eject
>
> \begin{figure*}[h]
> %% produced by pylab/plot_regc.py
> \centering{\includegraphics[width=12cm]{figz/c_var_nh_reconc_10_1000_c}}
> \centering{\includegraphics[width=12cm]{figs/cpd-2006-xxxx-f04}}
> \caption{\label{fig:1}
> The ``Union'' reconstruction, using `composite plus variance scaling', for the
> calibration period. Also shown is the level of the maximum plus two standard
> errors.
> The Jones and Mann instrumental data is plotted as a dashed line.
> }
> \end{figure*}
>
>
>
> Willmott, C.J., 1981. On the validation of models. Phys. Geog., 2, 184-194
>
>
> {\bf A2: Principal Components}
>
> Principal component analysis is a standard technique for reducing the
> volume of data while attempting to retain as much of the variability
> of the original data as possible.
>
> Stage (2) establishes an empirical link between the proxy records and
> temperature. In MBH1998 inverse least squares regression of the
> proxy network against the principal components of the measured temperature field,

```

> over the period 1902 to 1980, is used.

>

> Stage (3), the verification stage, determines how many, if any, of the
> reconstructed time series for the principal components can be
> considered to have some descriptive value. This is done by evaluating the
> fit of the implied fields to the observations in the verification period, 1856 to
> 1901.

> The northern hemisphere mean temperature is calculated from the
> The uncertainties are calculated from the residuals to the fit in the calibration
> period.

>

> \citet{mcintyre_mckitrick2005c} assert that the fact that omission of data
> led to a different result demonstrates that the method is unreliable.
> This would be true if the computation of a time series were the
> end point of the analysis. However, the need to verify the computed series
> was recognised by MBH1998. This is discussed further below.

>

> \subsubsection{Spurious metaphors}

>

> The term ``hockey-stick" has become widely used, particularly in the US
> media, to refer to the temperature history implied by the MBH1999
> temperature reconstruction. It did not originally apply to the reconstruction
> itself, which has a relatively minor temperature increase in the early
> 20th century, but rather to the combination of this series with the
> more recent observed temperature trends: the combination shows
> a dramatic increase in the 20th century, substantially greater than anything
> that occurred in the past millennium.

> The first attempt to attach any scientific meaning to the phrase
> was with the introduction of a ``hockey stick index"
> \citet{mcintyre_mckitrick2005a} (hereafter MM2005).
> This index is defined in terms of the ratio of the variance at the end of a time
> series
> to the variance over the remainder of the series.
> MM2005 argue that the way in which
> a principal component analysis is carried out in MBH generates an artificial
> bias towards a high ``hockey-stick index" and that the statistical significance of

> the MBH results may be lower than originally estimated.
> %% and that this is responsible for the
> %%shape in the MBH temperature reconstruction.
> %%Martin: I think that what MM05 indicate is that "hockey-stick may arise from
> random time series more easily as previously thought, when using the decentered
> PCs. I am not sure if they make this decentering responsible for the final output
> in MBH.

> %%

> \subsection{Validation}

>

> As noted above, MM2003 have shown that removing data
> degrades the result, as might be expected.
> Among the adjustments which they characterize as ``corrections" was the
> omission of the 3 principal components mentioned above.
> In fact, 70\% of the 90 time series extending back to
> 1400 are omitted from their analysis.

>

> In principle, it would be possible to estimate the accuracy of
> reconstructions calculated by regression from the data in the
> calibration period. However, this calculation can easily be biased
> by unreliable assumptions about the noise covariances within
> the calibration period.
> MBH1998, 1999 follow a more robust approach, using independent
> data from a validation period (1856 to 1901) to,
> firstly, determine whether a reconstruction has any relation to temperature
> and, secondly, estimate the error variance.

>
 > MM2003, however, omitted the validation phase.
 > \citep{wahl_ammann2005} have carried out a detailed investigation
 > of the robustness of the MBH1998 technique to address this
 > and many other issues. They find that the MM2003 series fails the
 > validation tests used by MBH1998.
 >
 > As an illustration of the robustness of the reconstruction,
 > figures 5 and 6 shows a reconstructions made using the MBH1999 and MBH1998 data
 > respectively.
 > Regression against northern hemispheric mean temperature is used
 > instead of regression against principal components of
 > temperature. There are differences, but key features remain.
 > [[more details in appendix and/or supplementary materials]]
 > MM2003 draw attention to the fact that one time series,
 > ``CANA036'' in the ITRDB classification, contributed
 > by Gasp'e, appears twice in the MBH1998 database.
 > This error is corrected in the red dashed curve of Fig.~5,
 > which is almost identical to the green curve, which retains the duplication.
 >
 > with our simplification of the method it is possible
 > to use the entire instrumental record for calibration.
 > This leaves no data for validation, but the difference
 > between this and a reconstruction based on a shorter
 > period gives some idea of the robustness.
 > Figure 4b shows the result.
 >
 > Finally, MM question the calculation of uncertainty limits.
 > This depends on the number of degrees of freedom
 > assigned to the data. MM state that the standard method used
 > by MBH is wrong, and that a lower number of degrees of
 > freedom is appropriate because of long range correlations in
 > the data. MBH use the lag-one autocorrelation to estimate
 > the degrees of freedom.
 >
 > In all such tests it is necessary to remember the distinction between the
 > sample correlation, which one is forced to deal with, and
 > the actual correlation, we cannot know exactly. For this reason
 > it is generally unwise to use methods which rely on statistics
 > which cannot be estimated robustly in a small sample.
 >
 > MM05 also confuse the auto-correlation structure of the tree-ring data,
 > which are known to have an environmental signal with correlations
 > on at least the decadal time-scale, with the auto-correlation of the
 > residuals which should be used in estimating the noise structure.
 > \vfill\eject
 > \begin{figure*}[h]
 > %% produced by id1/paleo/mbh_70.pro
 > \centering{\includegraphics[width=12cm]{cpd-2006-xxxx-f03}}
 > \caption{\label{fig:1}
 > Data blocks for PC calculation by MBH.
 > }
 > \end{figure*}
 >
 >
 >
 > \subsection{Natural variability and forcings}
 >
 > Global temperature can fluctuate through natural internal variability of
 > the climate system (as in the El Ni~no phenomenon), through
 > variability in natural forcings (solar insolation, volcanic aerosols,
 > natural changes to greenhouse gas concentrations) and human changes.
 >

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- > Analysis of the physical links between the estimated temperature changes
- > of the past millennium and estimated variations in the
- > different forcing mechanisms can give improve our understanding of those
- > mechanisms and help to validate the estimated temperature and
- >
- > \citet{goosse_etal2005} investigate the role of natural variability using
- > an ensemble of 25 climate model simulations of the last millennium
- > and forcing estimates from \citet{crowley2000}.
- > They conclude that natural variability dominates local and regional
- > scale temperature anomalies, implying that most of the variations
- > experienced by a region such as Europe over the last millennium could
- > be caused by natural variability. On the hemispheric and global scale, however,
- > the
- > external forcing dominates.
- > This reinforces similar statements made by JOS1998. \citet{goosse_etal2005}
- > make the new point, that noise can lead to regional temperature anomalies
- > peaking at different times to the forcing, so that disagreements in
- > timing between proxy series should not necessarily be interpreted as meaning there
- > is no common forcing.
- >
- > Analysis of natural climate forcings \citet{crowley2000}
- > show that changes in atmospheric aerosol content due to changes
- > in volcanic activity and changes in solar irradiance
- > can explain this long term cooling through most of the millenium,
- > shown by paleoclimate reconstructions,
- > and the observed warming in the late 19th century.
- > \citet{hegerl_etal2003} analyse the correlations between four
- > reconstructions (MBH1999, BOS2001, ECS2002, and a modified version of CL2000)
- > and estimated forcings \citet{crowley2000}.
- > They find that that natural forcing, particularly by
- > volcanism, explains a substantial fraction of decadal variance, also in
- > new high-variance reconstructions. Greenhouse gas forcing is detectable
- > with high significance level in all analyzed reconstructions analyzed.
- > \citet{weber2005b} carries out a similar analysis with a wider range
- > of reconstructions.
- > It is shown that the correlation between reconstructed
- > global temperatures and forcings are similar to those derived from
- > the ECBILT climate model \citet{opsteegh_etal1998}.
- > The trend component over the period 1000 to 1850 is, however, larger in the
- > reconstructions compared to the forcings.
- >
- > The methods employed by
- > \citet{hegerl_etal2006+} attribute about a third of the early 20th century
- > warming, sometimes
- > more, in high-variance reconstructions to greenhouse gas forcing.
- > These results indicate that enhanced variability in the past does not
- > make it more difficult to detect greenhouse warming, since a large
- > fraction of the variability can be attributed to external forcing.
- > Quantifying the influence of external forcing on the proxy records is
- > therefore more relevant to understanding climate variability and its
- > causes than determining if past periods were possibly as warm as the
- > 20th century.
- >
- > The dominance of volcanic forcing over solar variability found in some of the
- > above studies is consistent with recent questioning of the
- > magnitude of low-frequency solar forcing \citet{lean_etal2002, foukal_etal2004}.
- > \subsection{Tests of skill in reconstructions}
- >
- > RE: Reduction of Error
- >
- > \be
- > RE = 1. - { \overline{ (y- \hat{y}^\prime)^2 } \over
- > \overline{ y^2 } }

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> \ee
>
>

--

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730. 1155150358.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: cbaisan@dakotacom.net
Subject: Re: help with an idea?
Date: Wed Aug 9 15:05:58 2006

Dear Chris
just wondering what became of my forwarded request (from you to Tony) ? Have not received any feedback and still anxious to follow this up
cheers
Keith
At 15:53 17/10/2003, you wrote:

Keith,
I am inclined to forward your note to Tony Caprio - any objections? He has the best temperature sensitive foxtail pine material I am aware of.

I have some sense that there is a change in regional climate patterns prior to 1000AD in the western US. Not sure what or why...

Matt Salzer and Malcolm Hughes are working on 3k yr material from temperature sensitive upper tree-line sites in the west. John King knows a great deal about the Sierra collections and data.

MaryBeth Keifer and Andrea Loyd-Faste collected the Sierra Foxtail you referred to.

Chris B.

> Hi Lisa and Chris and Ed

>

> The first point of this message is to ask for access to the raw data
> for the Boreal and Camp Hill Foxtail pine chronologies (Lisa) that I
> believe you and/or your students produced and similar data that you
> may have (Chris). for the area inland of the Santa Barbara Basin ,
> California. I am also trying to stimulate your interest and hopefully
> start a joint collaboration (Lisa , Chris and Ed). Please allow me to
> explain . I was reading some papers on the putative link between North

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> Atlantic temperatures (oxygen isotope record from Greenland) and
> climate (bio-turbation index) in the Santa Barbara basin , on the
> 1000-year time scale (papers by Boyle and Leuschner et al. in the
> PAGES QSR Volume published in 2000). It got me to thinking whether a
> robust regional temperature chronology for North west Scandinavia
> might show any associations with any climate factors as represented in
> either high or low elevation tree-ring chronologies in western
> California , at higher temporal resolution (perhaps decades to
> century) - and hence whether there is any evidence for a thermohaline
> link (or other more direct dynamic atmospheric connection) operating
> on various time scales. Of course there are problems with what
> specific climate response one would investigate (in terms of season
> and variable). However, as a first look I compared our Tornetrask
> temperature reconstruction (JJA in Northern Sweden) with a (very) few
> series I had for the west US - among which were the chronologies
> mentioned above from AD 800 that Jan Esper and Ed produced for their
> Science paper, using data supplied by Lisa I believe .

> Now I don't actually like the general way they applied the RCS (-
> using
> a very large scale standardisation curve based on disparate data from
> a very wide expanse of sites across the Northern Hemisphere - but as
> Ed might say " it seems to work "). However, the association between
> the Tornetrask series and the curves for Boreal/ Upper wright have
> stimulated me to try to look deeper and solicit your interest and
> help. In my opinion, for the 600-year period between AD 1100 and 1700
> the similarity in the 5 circa 120-year cycles that make up these
> series certainly warrant serious further study. The similarity is not
> apparent before this but the two California series themselves show
> little agreement in the earlier 300 years of data that I have seen,
> implying that the common signal at the regional level may not be well
> represented in either anyway. This could be a standardisation issue
> though. By producing more robust mean series and especially by
> extending the series back before the post Christian era we could
> significantly extend the power of the comparison. I would like to
> establish well replicated series (using more-local RCS curves based
> applied to more, and longer, data) for both the Tornetrask (and
> possibly Northern Finnish) region and the combined set from Upper
> wright and Boreal and any other nearby Foxtail data (from the region
> of the 118 degrees west 36 degrees north) . We have earlier (than
> circa AD 800) data for Tornetrask and Finland , showing good inter
> region coherence . If we can establish stronger evidence of a North
> Atlantic/Eastern Pacific link (at different time scales perhaps) we
> can look at other high resolution records to establish the nature of
> the likely forcing and the possible climate dynamic mechanisms. What
> do you think? Can I play with your data to this end ? Whatever you
> think , I would appreciate it if you would treat this as confidential
> and any thoughts on the idea , or pointers to relevant data sets are
> still welcome.

> All the very best
> Keith

>
> --
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>
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> [1]<http://www.cru.uea.ac.uk/cru/people/briffa/>

> :)))))))))))))))))))))

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tel: 520-621-7681
Fax: 520-621-8229
)..)))))))))..))))))))))..)))))))

--
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Phone: +44-1603-593909
Fax: +44-1603-507784
[2]http://www.cru.uea.ac.uk/cru/people/briffa/

References

- 1. http://www.cru.uea.ac.uk/cru/people/briffa/
- 2. http://www.cru.uea.ac.uk/cru/people/briffa/

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From: Keith Briffa <k.briffa@uea.ac.uk>
To: Hans von Storch <hvonstorch@web.de>
Subject: Re: open data access?
Date: Fri Aug 11 17:57:15 2006

Hans
just too bogged down with stuff to even read their crap - but I have no intention
of withholding anything. will supply the stuff when I get five minutes!! no idea
what the so-called update stuff is about
Keith
At 11:19 05/08/2006, you wrote:

Dear Keith,
I read this comment on the prometheus-weblog of Roger Pielke jr:
"Ask Briffa for site identifications for Briffa et al 2001? while you're at it,
ask him for the measurement data for Taimyr, Tornetrask update and Yamal? Ask Briffa
why he didn't publish the updated Polar Urals results."
The background of this inquiry seems to be the replicability of your studies. I
think this is a reasonable request, but some people claim that you would "stonewall"
any such attempts. ("The issue of data access was discussed in the dendro conference in
Beijing - some people suggesting that withholding data was giving the trade a black eye.
Industry leaders, such as presumably Briffa, said that they were going to continue
stonewalling.") I can not believe this claim, and I would greatly appreciate if
you would help me to diffuse any such suspicions.
As you possibly have heard, I had a chance to hear a lot what is said on

Capitol Hill

(see attachment) - and I am concerned if we do not apply a truly open data and algorithm-policy, our credibility will be severely damaged, not only in the US but also in Europe. "Open" means also to provide data to groups which are hostile to our work - we have done so with our ECHO-G data, which resulted in two hostile comments in "science", which were, however, useful as they helped to clarify some issues. All the best,
Hans

--
Hans von Storch
hvonstorch@web.de; skype: hvonstorch
presently: Kaspervej 2, 4673 Rödving, Danmark
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--
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[2]<http://www.cru.uea.ac.uk/cru/people/briffa/>

References

1. <http://w3g.gkss.de/staff/storch>
2. <http://www.cru.uea.ac.uk/cru/people/briffa/>

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#####

From: Hans von Storch <hvonstorch@web.de>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: open data access?
Date: Fri, 11 Aug 2006 21:32:50 +0200
Cc: Hans von Storch <hans.von.storch@gkss.de>, Hans Graf <hfg21@cam.ac.uk>

Dear Keith,

I think we have to take this talking and questioning seriously. what we do is important and we have to allow for replication. when we were confronted with such requests concernig the ERIK-simulations, we were initially reluctant, but now we gave the data to everybody. Got us two critical comments in "science" but I think it was worth it.

Do you mind if I publish your response? would be the prometheus weblog. I could ask what is meant with "update" - I do not know what is meant; I had just quoted a request which I find in principle not unreasonable - and I am happy to hear that you in principle agree.

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Regards,
Hans

> -----Ursprüngliche Nachricht-----
> Von: Keith Briffa <k.briffa@uea.ac.uk>
> Gesendet: 11.08.06 18:57:25
> An: Hans von Storch <hvonstorch@web.de>
> Betreff: Re: open data access?

> Hans
> just too bogged down with stuff to even read
> their crap - but I have no intention of
> withholding anything. will supply the stuff when
> I get five minutes!! no idea what the so-called update stuff is about
> Keith
>
> At 11:19 05/08/2006, you wrote:
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> >
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> >stonewalling.") I can not believe this claim,
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> >As you possibly have heard, I had a chance to
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> >apply a truly open data and algorithm-policy,
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> >only in the US but also in Europe. "Open" means
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> >to our work - we have done so with our ECHO-G
> >data, which resulted in two hostile comments in
> >"science", which were, however, useful as they helped to clarify some issues.
> >
> >All the best,
> >Hans
> >
> >
> >--
> >Hans von Storch
> >hvonstorch@web.de; skype: hvonstorch
> >
> >presently: Kaspervej 2, 4673 Rödving, Danmark

mail.2006

I suggested addition of a phrase in lines 32-33 on page 6-3 regarding MM 2003 and analysis of it by Wahl-Ammann 2006. I also suggest a (logically useful) change from singular to plural in line 42 of that page. The changes are in RED/BOLD font.

[I should note that AW 2006 is still in "in press" status, and its exact publication date will be affected by publication of an editorial designed to go with it that Caspar and I are submitting this weekend. Thus I cannot say it is certain this article will come out in 2006, but its final acceptance for publication as of 2/28/06 remains completely solid.]

Also, I added the full information for the Wahl-Ritson-Ammann 2006 Science article in the references section, also in RED/BOLD font.

By the way, is the "AJS" NCAR-CSM model in Fig. 6-13 the one Caspar did? I couldn't tell this for sure from the information in the text. If it is, perfect. If not, is there a way to include his millenium run?

Thanks to you and all the authors for you painstaking work.

Peace, Gene
Dr. Eugene R. Wahl
Asst. Professor of Environmental Studies
Alfred University

607-871-2604
1 Saxon Drive
Alfred, NY 14802

From: Keith Briffa [mailto:k.briffa@uea.ac.uk]
Sent: Mon 7/31/2006 10:29 AM
To: Wahl, Eugene R
Subject: RE: confidential

First Gene - let me say that I never intended that you should spend so much time on this - though I really appreciate your take on these points. The one you highlight here - correctly warns me that in succumbing to the temptation to be lazy in the sense of the brief answer that I have provided - I do give an implied endorsement of the sense of the whole comment. This is not, of course what I intended. I simply meant to agree that some reference to the "divergence" issue was necessitated. I will revise the reply to say briefly that I do not agree with the interpretation of the reviewer. I am attaching what I have done (see blue highlighting) to the section in response to comments (including the addition of the needed extra section on the "tree-ring issues" called for by several people). I have had no feedback yet on this as it has not been generally circulated, but thought you might like to see it. PLEASE REMEMBER that this is "for your eyes only". Please do NOT feel that I am asking /expecting you to go through this in any detail - but given the trouble you have taken, I thought it reasonable to give you a private look. Cheers
Keith

At 07:16 27/07/2006, you wrote:
>Hi Keith:

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>
>Here is the text with my comments. I will go over the "stolen"
>parts (highlighted in blue outline) for a final time tomorrow
>morning, but I wanted to get this to you ASAP. The main new point I
>have to make is added in bold/blue font on pp. 101-103. I question
>the way the response to the comment there is currently worded, as it
>seems to imply that the divergence issue really does invalidate any
>dendro-based reconstructions before about 1850--which I imagine is
>not what you would like to say. I give a series of arguments
>against this as a general conclusion. Maybe I got over-bold in
>doing so, as in my point (1) I'm examining issues that are at the
>very core of your expertise! Excuse me that one, but I decided to
>jump in anyway. Let me know if I got it wrong in any way!
>
>There are other quite minor suggestions (mostly focused on
>referencing other responses in a few places) that are also in
>bold/blue. These go on into the "120's" in terms of page numbers.
>
>This is really a lot of work you've taken on, and I REALLY
>appreciate what you and the others are doing!
>
>[I've also been a lot involved with helping to get a person from the
>Pew Center for Global Climate Change ready to testify in front of
>the House Energy and Environment Committee tomorrow. That is why I
>couldn't get this done and sent to you earlier today. Send Mike
>Mann and Jay Gullledge (Pew Center) all good thoughts for strength and clarity.]
>
>
>NB -- "r" towards the end of the filename stands for my middle initial.
>
>
>Peace, Gene
>Dr. Eugene R. Wahl
>Asst. Professor of Environmental Studies
>Alfred University
>
>607-871-2604
>1 Saxon Drive
>Alfred, NY 14802
>
>_____
>
>From: Keith Briffa [mailto:k.briffa@uea.ac.uk]
>Sent: Mon 7/24/2006 3:16 PM
>To: Wahl, Eugene R
>Subject: RE: confidential
>
>
>
>
>Gene
>here is where I am up to now with my responses (still a load to do) -
>you can see that I have "borrowed (stolen)" from 2 of your responses
>in a significant degree - please assure me that this OK (and will not
>later be obvious) hopefully.
>You will get the whole text(confidentially again) soon. You could
>also see that I hope to be fair to Mike - but he can be a little
>unbalanced in his remarks sometime - and I have had to disagree with
>his interpretations of some issues also.
>
>Please do not pass these on to anyone at all.
>Keith

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>
>
>
>will pass all comments to you before they are fixed in stone- nothing
>from review article will be mentioned.
>Really grateful to you - thanks
>Keith
>
>At 05:08 22/07/2006, you wrote:
> >Hi Keith:
> >
> >Glad to help. (!)
> >
> >If I could get a chance to look over the sections of my text you
> >would post to the comments before you do, I would appreciate it. If
> >this is a burden/problem let me know and we'll work it out.
> >
> >If it is anything from the wahl-Ammann paper, of course that is fine
> >to use at once since it is publicly available. There will only be
> >exceedingly minor/few changes in the galleys, including a footnote
> >pointing to the extended RE benchmarking analysis contained in the
> >Ammann-Wahl review article.
> >
> >What I am concerned about for the time being is that nothing in the
> >review article shows up anywhere. It is just going in, and
> >confidentiality is important. The only exception to this are the
> >points I make in my blue comments in the big review file on page
> >104, concerning the MM way of benchmarking the RE statistic. Those
> >comments are fine to repeat at this point. [Please excuse my
> >hesitance in this way.]
> >
> >Actually, all the other blue comments I made in the big review file
> >are also fine to use at once.
> >
> >
> >Again, if this request is in any way a problem, let me know and
> >we'll figure out something.
> >
> >
> >Peace, Gene
> >Dr. Eugene R. Wahl
> >Asst. Professor of Environmental Studies
> >Alfred University
> >
> >
> >From: Keith Briffa [mailto:k.briffa@uea.ac.uk]
> >Sent: Fri 7/21/2006 2:00 PM
> >To: Wahl, Eugene R
> >Subject: RE: confidential
> >
> >
> >Gene
> >your comments have been really useful and reassuring that I am not
> >doing MM a disservice. I will use some sections of your text in my
> >comments that will be eventually archived so hope this is ok with
> >you. I will keep the section in the chapter very brief - but will
> >cite all the papers to avoid claims of bias. I really would like to
> >discuss the whole issue of the reconstruction differences at a later
> >, less stressful time. I completely accept the arguments about the
> >limitation in the r^2 and the value of capturing longer-term variance
> >. I think I will have to stop now as the temp and humidity are killing here.
> >
> >
> >Thanks a lot again

> >
> >Keith
> >
> >At 18:39 21/07/2006, you wrote:
> > >Hi Keith:
> > >
> > >I'm sorry that there is a bit to digest...although I know it is just
> > >a result of the nature of things.
> > >
> > >By the way, copied below is a synopsis that I sent this morning to a
> > >person in DC who is working on all this with regard to the House of
> > >Representative hearings. Evidently, there is to be at least one
> > >more hearing next week, and Mike Mann will go. The person I sent
> > >this to is trying to understand the importance of the proxy PC
> > >issues --especially how, no matter what way the PC extraction is
> > >done, the reconstructions converge if the structures actually
> > >present in the data are not tossed out by truncating the number
> > >retained PCs at a too low level. What I've copied is this
> > >synopsis. I think it is straightforward -- maybe a bit dense, but
> > >at least brief.
> > >
> > >Also, let me know if I can help on the issue of RE vs r^2 . I could
> > >write a few brief sentences as something for you to look at if you
> > >would like. Wahl-Ammann show very clearly that there is objectively
> > >demonstrated skill at the low-frequency level of the verification
> > >period mean for all the MBH segments, although the earlier MBH
> > >segments do have really low r^2 values (indicating very little skill
> > >at the interannual level). Our argument that to throw out the
> > >reconstruction completely based on the fastest varying frequency,
> > >when it has objectively demonstrable meaning at lower frequencies,
> > >is to me quite reasonable. That it is some how entirely ad hoc, as
> > >McIntyre claims in one (more?) of his comments, is neither logical
> > >nor factual in my perspective. The idea of frequency dependent
> > >skill/non-skill is not new to the literature, and the independent
> > >re-reviewer that Steve Schneider had look over Wahl-Ammann said s/he
> > >had experienced this issue in his/her work. G.
> > >
> > >
> > >***** COPIED TEXT *****
> > >
> > >What it boils down to in the end is as follows:
> > >
> > >1) The different reference periods used to calculate proxy PCs from
> > >>N. America (calibration only for MBH, full period for MM) only have
> > >>the effect of re-arranging how the hockey stick shape appears across
> > >>the rank ordering of PCs. In MBH it is concentrated in PC1. In the
> > >>full-period method, it is spread over PCs 1 and 2. If one adds PCs
> > >>1 and 2 (either arithmetically or as vectors) from either
> > >>convention, you get an essentially IDENTICAL time series, only the
> > >>amplitudes are a bit different. [Note that the input data were
> > >>centered AND standardized before being put into the PC calculation
> > >>algorithm. This is important, as shown below.]
> > >>> WHEN ACTUALLY USED IN THE RECONSTRUCTION, THE DIFFERENCE
> > >>> IS MINISCULE -- MBH is colder over 1400-1449 by 0.05 degrees!
> > >>
> > >>2) IF the data are centered but NOT standardized and are input into
> > >>>in a PCA algorithm using the variance-covariance matrix and not the
> > >>>correlation matrix (the way MM did it), then the hockey stick shape
> > >>>shows up in PC4. MM in fact reported this first in their 2005
> > >>>Energy and Environment article. In effect, the first two PCs are
> > >>>ARE ACTING TO DO THE STANDARDIZING OF THE DATA not done as a
> > >>>pre-processing step. [When the correlation matrix is used instead
> > >>>in the PCA algorithm, then the standardization is in effect done by

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> > >the algorithm, because all the correlations are "standardized" by
> > >construction--they all range between 0 and 1.]
> > > when 4 PCs from this calculation method are used rather
> > > than 2 PCs calculated as above, then the RECONSTRUCTION CONVERGES
> > > TO THE SAME AS ABOVE.
> > >
> > >3) Thus, all the different "flavors" for PC extraction have
> > >essentially no effect on reconstruction when one does the exercise
> > >of adding PCs sequentially from 2 to 5 for any flavor. In the case
> > >of (1), the reconstructions converge by the second PC. In the case
> > >of (2), they converge by PC4. They don't change with higher order
> > >PCs added.
> > > THIS SHOULD BE EXPECTED FROM FIRST PRINCIPLES. That is,
> > > the same underlying information is there in all cases, it is only
> > > how the structures present in these data are spread across the rank
> > > order of PCs, as explained. The simple exercise of taking the
> > > reconstructions to convergence across the number of PCs used shows
> > > this clearly.
> > >
> > >4) In fact, MM essentially say all this in the 2005 EE
> > >article--INCLUDING ABOUT THE RECONSTRUCTION RESULTS -- but they
> > >strongly claim that the movement of the hockey stick shape to the
> > >4th PC shows it is not a leading pattern of variance as MBH claim,
> > >and thus should not be used. This might be logical if their
> > >analysis was an apples-apples comparison, but it is not, due to the
> > >PCA method they use and applying it on NON-standardized data.
> > > THESE TWO DIFFERENCES (which one can only fully get
> > > from their actual code, not in the articles published) DRIVE THEIR
> > > ENTIRE ARGUMENT ON THIS PARTICULAR ISSUE. what they do not say is
> > > that convergence to something like the MBH result is expectable,
> > > and indeed MUST happen given the data used, because the hockey
> > > stick shape is actually IN the data, it is NOT an artifact of PC
> > > calculation procedure.
> > >
> > >
> > >5) FINALLY, note that all of this rests on the foundation that
> > >keeping the bristlecone pine records in the data is appropriate,
> > >which Caspar and I find can be reasonable presumption. If one
> > >believes that the bristlecone data should be removed, then the
> > >1400-1449 reconstruction does not pass verification testing with the
> > >RE statistic, and the MBH reconstruction should commence from 1450 on out.
> > >
> > >Although there are a number of reasons to keep the bristlecone data
> > >in, maybe the most compelling reason they are a NON-ISSUE is that,
> > >over the common period of overlap (1450-1980), the reconstruction
> > >based on using them from 1400-1980 is very close to the
> > >reconstruction based on omitting them from 1450-1980. Since the
> > >issues about the bristlecone response to climate are primarily about
> > >1850 onwards, especially 1900 onwards [KEITH -- PLEASE LET ME KNOW
> > >IF I AM NOT ACCURATE IN THIS], there is no reason to expect that
> > >their behavior during 1400-1449 is in any way anomalous to their
> > >behavior from 1450-1850. Thus, THERE IS NO REASON TO THINK THAT THE
> > >BRISTLECONES ARE SOMEHOW MAKING THE 1400-1449 SEGMENT OF THE MBH
> > >RECONSTRUCTION BE INAPPROPRIATELY SKEWED.
> > >
> > >
> > >***** END OF COPIED TEXT *****
> > >
> > >Peace, Gene
> > >Dr. Eugene R. Wahl
> > >Asst. Professor of Environmental Studies
> > >Alfred University
> > >

mail.2006

> > >607-871-2604
 > > >1 Saxon Drive
 > > >Alfred, NY 14802
 > > >
 > > >
 > > >From: Keith Briffa [mailto:k.briffa@uea.ac.uk]
 > > >Sent: Fri 7/21/2006 4:51 AM
 > > >To: Wahl, Eugene R
 > > >Subject: RE: confidential
 > > >
 > > >
 > > >
 > > >Gene
 > > >thanks a lot for this - I need to digest and I will come back to you.
 > > >
 > > >thanks again
 > > >Keith

> > >--
 > > >Professor Keith Briffa,
 > > >Climatic Research Unit
 > > >University of East Anglia
 > > >Norwich, NR4 7TJ, U.K.
 > > >
 > > >Phone: +44-1603-593909
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 > > >
 > > ><http://www.cru.uea.ac.uk/cru/people/briffa/>

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>, t.osborn@uea.ac.uk, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: Fwd: Tett et al. paper
Date: Sun, 13 Aug 2006 15:32:38 -0600
Cc: IPCC-WG1 <ipcc-wg1@a1.noaa.gov>

Hi Mel - thanks. Since chap 6 CA Tim Osborn is an author on this paper, I'm sure he and Keith have made the right call.

Thanks again, Peck

X-Sieve: CMU Sieve 2.2
Date: Thu, 10 Aug 2006 09:44:03 -0600

From: IPCC-WG1 <ipcc-wg1@a1.noaa.gov>
X-Accept-Language: en-us, en
To: Jonathan Overpeck <jto@u.arizona.edu>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: Tett et al. paper

Hi Peck and Eystein,
Although the deadline for additional accepted papers has now passed, this submission comes from a CLA (Gabi Hegerl) so am forwarding on. Official acceptance of the Tett et al. paper was 2 June. My understanding is that you already have a copy, but will forward the copy sent in by Simon just in case.
Cheers,
Mel

--

~~~~~  
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NOAA Chemical Sciences Division  
325 Broadway DSRC CSD08  
Boulder, CO 80305, USA  
Phone: +1 303 497 7072  
Fax: +1 303 497 5686/5628  
Email: [1]ipcc-wg1@a1.noaa.gov

--

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<http://www.ispe.arizona.edu/>

Attachment Converted: "c:\eudora\attach\Tett\_etal.pdf"

References

1. mailto:ipcc-wg1@al.noaa.gov

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From: Eduardo Zorita <Eduardo.Zorita@gkss.de>  
To: m.n.juckles@rl.ac.uk, " Moberg; Anders " <anders.moberg@natgeo.su.se>, Gabi Hegerl <hegerl@duke.edu>, esper@wsl.ch, " Briffa; Keith " <k.briffa@uea.ac.uk>, " Osborn; Tim " <t.osborn@uea.ac.uk>, m.allen1@physics.ox.ac.uk, weber@knmi.nl  
Subject: comments to mitrie manuscript  
Date: Thu, 17 Aug 2006 12:31:28 +0200

ï»¿

Due to the ongoing debate, this has turned an even more difficult manuscript. In general, I think Martin did a very good job in the review of the literature. Concerning the new reconstructions and the evaluation of McIntyre work, I would not fully agree with some of the conclusions, which I thin do not follow from the material presented in the text. I have some remarks on this which you may consider useful. But I think that I am not the one that should give the manuscript the final shape, as Martin is the person in charge of the project. Please, consider the following comments as suggestions.

eduardo

Consensus: I would tend to avoid the word 'consensus', since it is not a well defined concept. Depending on the meaning of consensus, each would agree with it to a certain degree. I would prefer to refer to a particular IPCC conclusion, or something similar. I think this review of the literature is very well written and informative, but I am not sure that each one of us will agree with each one of the concussions of each of the papers.

Page 12, section 2.8. I think the text is somewhat vague here, and it could be misunderstood. Mann et al (2005) tested the RegEM method, not the original MBH98 method. It is true that applied to the real proxies both methods, according to Mann, yield very similar results. But strictly speaking , Mann did not test the MBH98 method in the CSM simulation. The MBH98 method is thereby only by implication

I tested the the sensitivity of the MBH98, and not of RegEM, to the length of the calibration period. It may be the RegEM is less sensitive or not at all. Figure 4 and 5, if I understood well, support this dependency of MBH to the calibration period. Am I correct to interpret the large differences between the original MBH reconstruction (dashed red) and the black curve as due to the different calibration period (1901-1980 versus 1856-1980) and to the use of the leading PC or NHT as calibration target? At least in the period prior to 1600 I think these are the only methodological differences between both curves (?).

My interpretation of this figure is also somewhat different. If the final reconstructions differs so strongly by using a longer calibration period (in general yielding stronger decadal variability in the reconstruction) I would tend to think that the method based on these proxies is quite unstable. What would happen if the calibration period could have been extended to 1800, for instance?.

Page 15: top. The role of forcing on the global or NH T is also recognized in the correlation between the NHT simulated by ECHO-G and CSM for the millennium. For the case of a second ECHO-G simulation /Gonzalez-Rouco et al.) the agreement is very close at 30-year timescale.

Section 3, beginning.

In my opinion, MM05 stress the inadequacies and uncertainties in the MBH work, but they not put forward their own reconstruction implying a warmer-than-today MWP. They believe that this is true, but in their works so far, at least to my knowledge, they do not assert that the MWP was warmer than present, only that the uncertainties are too large for such a claim.

Section 3: Consensus. This paragraph may be problematic. Again what is the consensus? If we look at the recent NAS report, which again not every one would agree with, the 'consensus' is reduced to the past 400 years in comparison to IPCC, leaving ample space for speculation before this period. Does the NAS report belong to the consensus? perhaps partially, but I am not sure to what extent.

Section 3, discussion of MM05 and hockey-stick index. I have here a certain level of disagreement with these paragraphs. The issue raised by MM05 would be that the de-centering of the proxies prior to the calculations of the principal components tends to produce hockey-stick-shaped leading PC. I think this effect is true, at least with spatially uncorrelated red-noise series. It can be easily verified and it has been recognized in the NAS, the Wegman report and by Francis Zwiers. To be fair, following this issue is the problem of the truncation- just to keep the leading PC or further PCs down the hierarchy, and if this is done, the final differences could be probably minor. in the final reconstructions. But the paragraph implies, in my opinion, that this criticism by MM05 has no grounds, which as I said is problematic and could open the manuscript with criticisms based on these recent reports.

I think that the calculation shown in Figure 3 is very useful, as it boils down to the issue raised by MM05: how relevant is the de-centering and standardization with real proxies?. Apparently, I get a different message from Figure 3 (although I may have misinterpreted the text). I see quite large differences in the 20th century between the original MBH leading PC and the 'correct' calculation (whole period centering and standardization, blue line). Only the original MBH PC shows a positive trend in the 20th century. The blue line seems even to show a negative trend or no trend at all. If this PCs were to be used in the MBH regression model (with trend included in the calibration) the results could be quite different. I would tend to think that this figure actually supports the MM05 criticism, since the hockey-stick shape of the leading PC disappears.

Section 3, end, bristlecone pines. I am also worried by this paragraph. The recent NAS report clearly states that the bristlecone pines should not be used for reconstructions in view of their potential problems. They cite previous analysis on this issue. I think that to refer to just one study indicating no fertilization effect could not be enough. However, I am not a dendroclimatologist. This could open the door to potential problems.

Section 4, end. years 1997 and onwards were the warmest in the millennium. I see here also potential problems with this claim, and I do not see the need to make our lives more complicated. The NAS report expressed that the uncertainties are too large for this type of conclusion and certainly this conclusion would attract some attention from the reader. I see two lines of criticism on this: one is that the standard errors have been calculated with the calibration residuals and these are an underestimation of the true uncertainties. A reviewer may require that the uncertainty range be calculated by cross-calibration or bootstrapping. In the case of CVM perhaps this effect is not very important, as there is just one free parameter, but in the case of inverse regression there are much many more free parameters and the true uncertainties can be quite different from those estimated from the calibration residuals. This potential criticism could be exacerbated by the fact that the new reconstruction has not been tested in a validation period.

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The other line of criticism could be that the calibration period has been, as in all reconstructions, a priori truncated -data after 1980 are not considered as the proxies are known to not follow the temperature. Strictly speaking this truncation can be only justified by a credible physical explanation about the cause of this divergence. Statistically, I think it is not correct to a priori ignore some data because they do not fit. If one does so, I think the uncertainty range should be enlarged to encompass the possibility that this divergence could have happened in the past, i.e. an additional standard deviation of the instrumental NH T in the period 1980-2000 (or perhaps more correct, the square root of the sum of the error variance and the NHT variance in 1980-2000). Alternatively, one could include the period 1980-2000 in the calibration and due to the divergence the standard errors would grow, but perhaps this is practically not possible as the proxy time series may not have been archived for the last 20 years.

Section 5, conclusions.

I share the worry of Anders Moberg about the wording 'serious flaws' in the analysis of MM05. This sentence would be based on Figure 3, if I understood properly, but as I said I think Figures 3 actually does not support this conclusion.

Finally, I think it would strategically better to avoid conflicts on the particular point of whether some particular year was the warmest of the millennium or not, and to stress the fact that all reconstructions, also the new ones presented in the manuscript (with one exception) show MWP temperatures lower than late 20th century temperatures.

Another conclusion could be, in my view, that the average temperature in the cold centuries in the millennium seems to be still quite uncertain. The new reconstructions, or the calculation of the leading PCs of the proxies, seem to be still quite sensitive to particular choices in the statistical set-up.

736. 1156334874.txt

#####  
#####

From: "Michael E. Mann" <mann@meteo.psu.edu>  
To: Keith Briffa <k.briffa@uea.ac.uk>  
Subject: ECHO-G?  
Date: Wed, 23 Aug 2006 08:07:54 -0400  
Reply-to: mann@psu.edu  
Cc: Scott Rutherford <srutherford@rwu.edu>

<x-flowed>  
HI Keith,

If the offer still stands, we wanted to get from you the ECHO-G surface temperature field, so we can do some tests of RegEM with this. So far we've only tested on CSM 1.4 and it would be nice to test this on on ECHO-G, especially since other groups apparently now also have the ECHO-G output (e.g. Mark Cane's group and Francis Zwiers' group).

Thanks in advance for any help w/ this,

mike

--  
Michael E. Mann  
Associate Professor

mail.2006  
Director, Earth System Science Center (ESSC)

Department of Meteorology Phone: (814) 863-4075  
503 Walker Building FAX: (814) 865-3663  
The Pennsylvania State University email: mann@psu.edu  
University Park, PA 16802-5013

<http://www.met.psu.edu/dept/faculty/mann.htm>

</x-flowed>

737. 1156988605.txt

#####  
#####

From: Eystein Jansen <Eystein.Jansen@geo.uib.no>  
To: Keith Briffa <k.briffa@uea.ac.uk>  
Subject: Fwd: Chpt 6 - last 1000 yrs  
Date: Wed, 30 Aug 2006 21:43:25 +0200  
Cc: Jonathan Overpeck <jto@u.arizona.edu>

Hi Keith,

John should have the latest versions of the comments file and the chapter text, i.e. the ones that went out for LA review this summer. I believe he is after some more specific answers in the comments and not so much changes to the text, and has selected the bristlecone issue, the divergency issue and the verification and robustness issues. If you are unsure what comments or text he refers to, I think the best thing is for to ask John for the specific comments he thinks are not adequate, or the specific lines of text which he suggests changed. It seems he needs some reassurance rather than you writing much new in terms of comments and text, so the best would be to talk to him and ask what he needs you to do to the documents.

Best wishes,

Eystein

Envelope-to: Eystein.Jansen@geo.uib.no  
Date: Wed, 30 Aug 2006 15:31:12 +0100  
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>

From: Keith Briffa <k.briffa@uea.ac.uk>  
Subject: Fwd: Chpt 6 - last 1000 yrs  
X-UEA-Spam-Score: -101.6  
X-UEA-Spam-Level: -----  
X-UEA-Spam-Flag: NO  
X-checked-clean: by exiscan on noralf  
X-UiB-SpamFlag: NO UIB: -13.8 hits, 8.0 required  
X-UiB-SpamReport: spamassassin found;  
-15 From is listed in 'whitelist\_SA'  
0.1 BODY: Message is 30% to 40% HTML  
0.0 BODY: HTML included in message  
1.1 BODY: Message only has text/html MIME parts

mail.2006

Eystein

now John sent these remarks - have not talked with him yet - but not sure what is required  
Keith

X-IronPort-AV: i="4.08,132,1154908800";  
d="scan'208,217"; a="17827006:sNHT58118592"

Subject: Chpt 6 - last 1000 yrs

Date: Wed, 16 Aug 2006 16:14:52 +0100

X-MS-Has-Attach:

X-MS-TNEF-Correlator:

Thread-Topic: Chpt 6 - last 1000 yrs

Thread-Index: AcbBRrj0FPNJH9bQTyCswuNw7Ln3bw==

From: "Mitchell, John FB \((Chief Scientist\)"  
<john.f.mitchell@metoffice.gov.uk>

To: "Keith Briffa" <k.briffa@uea.ac.uk>

Cc: "Mitchell, John FB \((Chief Scientist\)" <john.f.mitchell@metoffice.gov.uk>

X-UEA-Spam-Score: 2.1

X-UEA-Spam-Level: ++

X-UEA-Spam-Flag: NO

Hi Keith

I have tried to condense what I think the main issues for the and what the  
response is below. The weakest area seems to be statistical significance and by implication  
the likely/ very likely statements. I can't think of any easy solution - in the TAR  
for detection and attribution we used 95% limits on stats tests and then downrated  
them to allow for other uncertainties.

I am interested in your comments

John

Issues

1. Reliance on Bristlecone pine -

indicators for Response - the issues are in calibration period- they agree with other  
the rest of the record

2. Centring of principle components leads to "hockeysticks"-

Response - this makes only a small difference when standardised data used.

Comment - would be useful to know which reconstructions do and don't make this  
assumption- this could strengthen the response

3. The divergence issue-

Response - it is only apparent in high latitudes, and only with some trees.

divergence Comment- Do we know what happens if we eliminate those records with a  
problem. The wider issue is whether or not it is reasonable to extend the  
reconstructions outside the calibration range.

4. There are different ways of verifying reconstructions and assigning

significance

levels( calibration period or separate verifying period, different statistics)

Response ?

validated - Comment- it is difficult in the text to gauge how well reconstructions are  
eg using the calibration period to estimate errors as opposed to an independent

period clearly makes a difference. This is important where "likely", "very likely"are  
used- based on what statistics? I think this is the area where I think the current

response is weakest

5. Robustness-

Burger and Cubasch show a wide range of results using different  
assumptions-

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Response ?  
Mann makes a reasoned defence- there are other checks and tests which would rule out many of the arbitrary assumptions explored by Cubasch and Burger, but this is not clear in the response to M&M etc

--  
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Phone: +47-55-583491 - Home: +47-55-910661  
Fax: +47-55-584330

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#####  
#####

From: David Rind <[drind@giss.nasa.gov](mailto:drind@giss.nasa.gov)>  
To: Jonathan Overpeck <[jto@u.arizona.edu](mailto:jto@u.arizona.edu)>  
Subject: Re: urgent IPCC need  
Date: Thu, 31 Aug 2006 21:28:16 -0400  
Cc: joos <[joos@climate.unibe.ch](mailto:joos@climate.unibe.ch)>, Eystein Jansen <[eystein.jansen@geo.uib.no](mailto:eystein.jansen@geo.uib.no)>, Bette Otto-Bleisner <[ottobli@ncar.ucar.edu](mailto:ottobli@ncar.ucar.edu)>, [cddhr@giss.nasa.gov](mailto:cddhr@giss.nasa.gov), [rahmstorf@ozean-klima.de](mailto:rahmstorf@ozean-klima.de), Keith Briffa <[k.briffa@uea.ac.uk](mailto:k.briffa@uea.ac.uk)>

<x-flowed>  
Jonathan,

I haven't looked at these in great detail, but I have a problem with Martin making suggestions about the TSU Exec Summary for chap 6. weren't these decided by consensus among the Chap 6 authors? why does Martin have any say about this? Clarification is one thing, but some of these suggestions seem to be 'leading'. I think we should be very cautious about changing anything substantive here at the last moment. [This is the expurgated version of what I really thing.]

David

At 4:55 PM -0600 8/31/06, Jonathan Overpeck wrote:  
>Hi all - we need to submit our latest chap 6

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>Exec Summary to TSU tomorrow if we can. We can  
>still make changes, but I wanted to update with  
>Martin's suggestions taken into account. See the  
>attached and please comment regarding my strike  
>throughs and additions (yellow highlight).  
>Martin's comments are in yellowish text, and my  
>questions to you (especially FORTUNAT) are  
>highlighted in PURPLE.

>  
>Please send by tomorrow aft if you can.

>  
>Not that I've sent to those I think are on-line  
>right now. Will send to the whole team later  
>with more edited text.

>  
>Thanks, Peck

>--  
>Jonathan T. Overpeck  
>Director, Institute for the Study of Planet Earth  
>Professor, Department of Geosciences  
>Professor, Department of Atmospheric Sciences

>  
>Mail and Fedex Address:

>  
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><http://www.geo.arizona.edu/>  
><http://www.ispe.arizona.edu/>

>  
>Attachment converted:  
>Toltec:Ch06\_FinalDraft\_ExecSumV3.doc (WDBN/«IC»)  
>(1BEA76C7)

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#####  
#####

From: Jonathan Overpeck <jto@u.arizona.edu>  
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>  
Subject: Re: urgent IPCC need  
Date: Fri, 1 Sep 2006 15:25:20 -0600  
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Stefan Rahmstorf <rahmstorf@ozean-klima.de>, Bette Otto-Bleisner <ottobli@ncar.ucar.edu>, david.adelman@law.arizona.edu

Hi all - today has been a hectic one, with lots of good input from multiple folks. In the end, we agreed to stick with our existing bullets, which changes only where they would improve the clarity of what we were saying. Please check the attached - need Fortunat's detailed look in particular. Changes are all in yellow highlight. Two special

mail.2006

issues:

1) There is still concern that this bullet is too vague to be as useful as it could be:

o It is very likely that the global warming of 4 to 7 °C since the Last Glacial Maximum (ca. 21,000 years ago) occurred at an average rate about ten times slower than the warming of the 20th century.

but, perhaps the safest thing would be to leave as is.

2) As for the 1998/2005 warmest in last 1000 years issue, we suggest adding nothing new to the ES, in line with our chapter policy from Bergen, BUT adding something in the chapter along the lines of: " There is currently insufficient knowledge to form a consensus on the issue of how the warmth of individual years of the last 100 years compare with individual years of the last 1000 years" Keith, would you like to make a suggestion on the wording and placement?

The reasoning expressed by Stefan on this issue is undoubtedly shared by others outside our team, and perhaps a paper be written on this key topic to help the community reach better consensus.

Thanks for your continued dialog and work! Have a good weekend.

best, Peck and Eystein

dear All, thanks for being alert.

I think we have an agreement that Martin's comments are useful, but that we should change only those sentences where they clarify. Otherwise i agree with Stefan and Keith's statements below.

Eystein

At 15:45 +0100 01-09-06, Keith Briffa wrote:

I forgot to say that I too disagree with removing the first sentence re simulations being consistent with reconstructed NH temps. As Sefan says we need the context, and our results are independent of Chapter 9 in this regard.

Keith

At 15:37 01/09/2006, Stefan Rahmstorf wrote:

Hi Peck, Martin as in Manning? I have found his feedback very useful so far, so we should definitely look at what he suggests - he mostly tends to look for whether our sentences are clear. Obviously, he cannot suggest real changes in meaning, only issues of clarity, but the latter I would take very seriously. Mostly I find his small rewordings good, I comment on the larger points and exceptions below.

- I am against deleting the bullet on speed of deglacial change. This point is

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extremely effective. Just two days ago an oil industry person told me that there have been big natural climate changes like ice ages in the past, hence we need not worry. I responded that the biggest warming in recent climate history was the end of the last Ice Age - but that warming by about 5 °C took about 5,000 years, not a hundred. "Oh" he said, "Really so long? I didn't know that." I think it is a very important point, we need to make it. Maybe not in term of "average rate", may we should just say: the warming of 4-7 °C took about 5,000 years, as compared to a future change of up to the same magnitude within a century.

- Next ice age bullet in 30k seems fine to me.
- exceptional warmth: the SPM said: 20th C T increase likely the largest in a millennium - that is strengthened (perhaps very likely now?)

1990s likely the warmest decade in a millennium - that again is strengthened 1998 likely the warmest year - I'd say this is unchanged (except for 2005 challenging it), likely is only 66%! Even though the annual proxy data may be uncertain, as a physicist I would find it unlikely that there is a mechanism to cause a big warm outlier year that beats 1998 from a much cooler background state. How would that work - where would the heat come from?

So in my view we could actually say that these past SPM statements held up or were strengthened - but in fact I also like the bullet as it is.

- Paleoclimate model simulations are broadly consistent with the reconstructed NH temperatures over the past 1000 years. The rise in surface temperatures since 1950 very likely cannot be reproduced without including anthropogenic greenhouse gases in the model forcings, and it is very unlikely that this warming was merely a recovery from the pre-20th century cold period.

On this I disagree with deleting the first sentence, as the second one needs it to follow logically. And why should the paleo chapter suddenly make a statement on post-1950 warming, if it is not in the context of the past millennium?

Cheers, Stefan

--  
To reach me directly please use:  
<mailto:rahmstorf@ozean-klima.de>rahmstorf@ozean-klima.de

(My former addresses @pik-potsdam.de are read by my assistant Brigitta.)  
Stefan Rahmstorf  
<http://www.ozean-klima.de>www.ozean-klima.de  
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--  
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Phone: +47-55-583491 - Home: +47-55-910661  
Fax: +47-55-584330

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<http://www.ispe.arizona.edu/>

Attachment Converted: "c:\eudora\attach\Ch06\_FinalDraft\_ExecSumV4.doc"

740. 1157473748.txt

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From: "Mitchell, John FB \ (Chief Scientist\)" <[john.f.mitchell@metoffice.gov.uk](mailto:john.f.mitchell@metoffice.gov.uk)>  
To: "Stefan Rahmstorf" <[rahmstorf@ozean-klima.de](mailto:rahmstorf@ozean-klima.de)>, "Keith Briffa" <[k.briffa@uea.ac.uk](mailto:k.briffa@uea.ac.uk)>  
Subject: RE: Fwd: Re: [Wg1-ar4-ch06] NEW DRAFT FOR LA REVIEW  
Date: Tue, 5 Sep 2006 12:29:08 +0100  
Cc: "Eystein Jansen" <[Eystein.Jansen@geo.uib.no](mailto:Eystein.Jansen@geo.uib.no)>, "Jonathan Overpeck" <[jto@u.arizona.edu](mailto:jto@u.arizona.edu)>, "Jean Jouzel" <[jouzel@ds-mil.saclay cea.fr](mailto:jouzel@ds-mil.saclay cea.fr)>

Keith, Stefan

Its not my role as review editor to tell you what to write, just to make sure you have responded to the reviewers comments. For what its worth, I did find Keith's text quite involved. However, you do need to respond the the reviewers comments on Burger etc - if the flaws in von Storch paper cast doubt on the subsequent papers, then why not include a sentence in the chapter that says so, and list just the key papers affected.

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I hope this helps

john

Professor John Mitchell OBE FRS Chief Scientist,  
Met Office FitzRoy Road Exeter EX1 3PB United Kingdom  
Tel. +44(0)1392884604 Fax:+44 (0) 870 9005050  
E-mail: john.f.mitchell@metoffice.gov.uk [1]<http://www.metoffice.gov.uk>

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From: Stefan Rahmstorf [mailto:rahmstorf@ocean-klima.de]  
Sent: 01 September 2006 13:02  
To: Keith Briffa  
Cc: Mitchell, John FB (Chief Scientist); Eystein Jansen; Jonathan Overpeck  
Subject: Re: Fwd: Re: [Wg1-ar4-ch06] NEW DRAFT FOR LA REVIEW

Dear Keith,  
you disagree with my proposed revision of the paragraph re. the Von Storch papers, but you do not give any reasons or arguments for that. I think there are some good reasons to shorten this discussion and to clarify it, and I would welcome to hear your reasons against it.

Firstly, I think your original discussion was too long and complex to understand for non-specialists, and, at this level of detail, not policy-relevant. It took up a disproportionate amount of space for what we can learn from it.

Secondly, I don't think we need to cite all those Storch-spinoff papers by Bürger/Cubasch. Most people whose judgement I value (e.g., David Ritson, who I think has no vested interest but a very detailed knowledge of the issue) think these papers are irrelevant at best and misleading at worst (he actually has used stronger wording). You may also have seen that the latest in this series, making similar points, is highly criticised by anonymous reviewers on the open discussion site of the journal *Climate of the Past*, where one reviewer (this is not the even more scathing review by Mann) recommends rejection of the Bürger/Cubasch paper because of "numerous errors and inaccuracies in the use of statistical concepts and methods".

Third, if we cite Von Storch et al. 2004 we need to be very clear that a number of key statements are simply incorrect, which is a fact that is not in dispute and documented in the literature. They implemented the Mann et al. method incorrectly, and it is at least unclear whether in their follow-up paper they have now fixed this (Ritson, who discovered the problem in their original paper in the first place, thinks they still have a problem, the detrending step was not the only one - and certainly in no paper have VS et al. shown

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any test that verifies their algorithm). Also, they were hiding a major artificial climate drift (which they must have known about, and which makes up half of their climate signal) - it is at least unclear whether you can expect a proxy method based on physical patterns of climate variability to reconstruct an unphysical drift, which has a completely different pattern. I simply think that because of this flaw, we cannot trust or cite any results from this particular ECHO-G run, which also affects several of the Bürger/Cubasch papers using the same data set. Given that the VS04 paper was used in the US Senate and other high-profile fora to discredit IPCC, I think it is imperative that we clarify this and leave our readers in no doubt about the fact that the VS04 results have proven to be incorrect in a major way. I am aware that you authored a favorable Science Perspective on the VS04 paper at the time, but you could not have known of those errors back then, and for a long time I thought myself that it was a valid paper. Therefore, if we state clearly in our chapter what is wrong with it, I do not think this would be a loss of face for you - quite the contrary. I also think you have done a brilliant job on the rest of the very difficult discussion of the past millennium.

Best wishes, Stefan

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 To reach me directly please use: [2]rahmstorf@ozean-klima.de  
 (My former addresses @pik-potsdam.de are read by my assistant Brigitta.)

Stefan Rahmstorf  
 [3]www.ozean-klima.de  
 [4]www.realclimate.org

References

1. <http://www.metoffice.gov.uk/>
2. <mailto:rahmstorf@ozean-klima.de>
3. <http://www.ozean-klima.de/>
4. <http://www.realclimate.org/>

741. 1157546057.txt  
 #####  
 #####

From: "Michael E. Mann" <mann@meteo.psu.edu>  
 To: Tim Osborn <t.osborn@uea.ac.uk>  
 Subject: Re: followup  
 Date: wed, 06 Sep 2006 08:34:17 -0400  
 Reply-to: mann@psu.edu  
 Cc: Scott Rutherford <srutherford@rwu.edu>, Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>  
 Tim, thanks a bunch. This all sounds very good. We're finalizing a pseudoproxy paper for JGR based on the various tests w/ the CSM simulation I showed in Wengen, and will send you a copy once it's finalized. A natural followup would be a similar analysis applying to the ECHO-G simulation, and we would enjoy collaborating w/ you and Keith

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on this. We were also thinking of doing some "mixed signal" analyses, where the pseudoproxies represent a combination of temp and precip (including limiting cases of pure temp and pure precip). This might be a natural way to incorporate the ECHO-G results. We'll let you know if we have any trouble w/ format, etc.

thanks again,

mike

Tim Osborn wrote:

> Hi Mike and Scott,  
>  
> below are details about accessing the ECHO-G data from the SO&P  
> web-archive. There are time series plots of various variables and  
> regions that might be useful for a quick overview of what's going on,  
> plus the temperature fields (and fields for other variables) can be  
> accessed in netCDF format (hope that format is ok, if not I can make a  
> conversion for you but that won't be till next week).  
>  
> I'd like to add to Keith's reasons why we'd like to be involved in the  
> outcome of analysis of these data. The extra reason is that we  
> (Keith/me) are free to use these data and thus by extension you can  
> too provided we collaborate. Fidel Gonzalez-Rouco or GKSS aren't yet  
> ready to make them completely open access, preferring to consider each  
> 3rd party request and decide on that basis. I did ask Eduardo Zorita  
> about making them available for pseudo-proxy challenge after the  
> wengen meeting, but I haven't yet followed up to find out his  
> decision. The bottom line is that they might well make them available  
> for you to do your own thing with, but if you are happy to collaborate  
> with us then you can definitely use them immediately.  
>  
> The data are available from here:  
>  
> <http://www.cru.uea.ac.uk/cru/projects/soap/data/model/echog.htm>  
>  
> Near the bottom you will find the link to the password-protected model  
> data (this includes the time series plots too). The login details for  
> this are:  
>  
> soapech  
> od2004  
>  
> The 2m air temperature is 3rd in the list of variables. 'Erik' is the  
> simulation with all forcings, 'Enat' just has natural forcings through  
> to the present. The easiest way to get all the monthly 2m air  
> temperature fields for Erik is to use 'wget'. There is help for how  
> to use 'wget' if you aren't familiar.  
>  
> The site was designed to be fairly self explanatory; hope you find it  
> so. If not, please just ask.  
>  
> Best wishes  
>  
> Tim  
>  
> At 18:30 05/09/2006, Michael E. Mann wrote:  
>  
>> sure thing Keith, thanks. and of course, we'll keep you fully in the  
>> loop on our findings. I'm copying to Scott, as he's the one who will  
>> probably obtain the data from Tim. Thanks again, got to go teach now...  
>>

>> mike  
>>  
>> Keith Briffa wrote:  
>>  
>>> mike  
>>> simply missed the first and been away since second message -  
>>> forwarding to Tim to arrange access to these data ( I am assuming  
>>> Hans will not mind but best not say anything yet ) we wish to be  
>>> involved in this follow up please as it will be a SOAP product and  
>>> Tim (especially) and I did stuff to get these data produced and in a  
>>> form for dissemination. I am rushing now to Austria for a week .  
>>> cheers  
>>> Keith  
>>>  
>>> At 13:51 28/08/2006, you wrote:  
>>>  
>>>> Keith, I didn't receive a response to my previous inquiry so I'm  
>>>> resending. Also copying to Phil in case you haven't been reading  
>>>> email for some reason.  
>>>>  
>>>> We would like to run our RegEM analysis through the ECHO-G  
>>>> simulation results. It appears that the results of that simulation  
>>>> have been widely disseminated to other groups, and yet they are not  
>>>> publically available to our knowledge.  
>>>>  
>>>> As per your previous suggestion, we would be grateful if we could  
>>>> acquire the surface temperature field for the simulation from you  
>>>> for some analyses we're doing.  
>>>>  
>>>> Thanks in advance for any help,  
>>>>  
>>>> mike  
>>>>  
>>>> --  
>>>> Michael E. Mann  
>>>> Associate Professor  
>>>> Director, Earth System Science Center (ESSC)  
>>>>  
>>>> Department of Meteorology                      Phone: (814) 863-4075  
>>>> 503 Walker Building                              FAX:     (814) 865-3663  
>>>> The Pennsylvania State University              email:  mann@psu.edu  
>>>> University Park, PA 16802-5013  
>>>>  
>>>> <http://www.met.psu.edu/dept/faculty/mann.htm>  
>>>>  
>>>>  
>>>> --  
>>>> Professor Keith Briffa,  
>>>> Climatic Research Unit  
>>>> University of East Anglia  
>>>> Norwich, NR4 7TJ, U.K.  
>>>>  
>>>> Phone: +44-1603-593909  
>>>> Fax: +44-1603-507784  
>>>>  
>>>> <http://www.cru.uea.ac.uk/cru/people/briffa/>  
>>>>  
>>>>  
>>>>  
>>>> --  
>> Michael E. Mann  
>> Associate Professor

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 >>  
 >  
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 > Climatic Research Unit  
 > School of Environmental Sciences, University of East Anglia  
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 >  
 > e-mail: t.osborn@uea.ac.uk  
 > phone: +44 1603 592089  
 > fax: +44 1603 507784  
 > web: <http://www.cru.uea.ac.uk/~timo/>  
 > sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>  
 >  
 > \*\*Norwich -- City for Science:  
 > \*\*Hosting the BA Festival 2-9 September 2006  
 >

--  
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 Director, Earth System Science Center (ESSC)

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 The Pennsylvania State University email: mann@psu.edu  
 University Park, PA 16802-5013

<http://www.met.psu.edu/dept/faculty/mann.htm>

</x-flowed>

742. 1158153059.txt

#####  
 #####

From: Jonathan Overpeck <jto@u.arizona.edu>  
 To: Keith Briffa <k.briffa@uea.ac.uk>  
 Subject: Re:  
 Date: wed, 13 Sep 2006 09:10:59 -0600  
 Cc: rahmstorf@ozean-klima.de, Bette Otto-Bleisner <ottobli@ncar.ucar.edu>, cddhr@giss.nasa.gov, joos <joos@climate.unibe.ch>, Eystein Jansen <eystein.jansen@geo.uib.no>, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>, t.osborn@uea.ac.uk

Keith - thanks for this and the earlier updates. Stefan is not around this week, but hopefully the others on this email can weight in. My thoughts...

1) we MUST say something about individual years (and by extension the 1998 TAR statement) -  
 do we support it, or not, and why.

2) a paragraph would be nice, but I doubt we can do that, so..

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4) I think the second sentence could be more controversial - I don't think our team feels it is valid to say, as they did in TAR, that "It is also likely that, in the Northern Hemisphere,... 1998 was the warmest year" in the last 1000 years. But, if you think about it for a while, Keith has come up with a clever 2nd sentence (when you insert "Northern Hemisphere" language as I suggest below). At first, my reaction was leave it out, but it grows on you, especially if you acknowledge that many readers will want more explicit prose on the 1998 (2005) issue.

Greater uncertainty associated with proxy-based temperature estimates for individual years means that it is more difficult to gauge the significance, or precedence, of the extreme warm years observed in the recent instrumental record. However, there is no new evidence to challenge the statement made in the TAR that 1998 (or the subsequent near-equivalent 2005) was likely the warmest of Northern Hemisphere year over the last 1000 years.

5) I strongly agree we can't add anything to the Exec Summary.

6) so, if no one disagrees or edits, I suggest we insert the above 2 sentences to end the last (summary) para of 6.6.1.1. Or should we make it a separate, last para - see point #3 above why I don't favor that idea as much. But, it's not a clear cut issue.

Thoughts? Thanks all, Peck

Eystein and Peck

I have thought about this and spent some time discussing it with Tim. I have come up with the following

Greater uncertainty associated with proxy-based temperature estimates for individual years means that it is more difficult to gauge the significance, or precedence, of the extreme warm years observed in the recent instrumental record. However, there is no new evidence to challenge the statement made in the TAR that 1998 (or the subsequent near-equivalent 2005) was likely the warmest in the last 1000 years. This should best go after the paragraph that concludes section 6.6.1.1 I believe we might best omit the second sentence of the suggested new paragraph - but you might consider this too subtle (or negative) then. I think the second sentence is very subtle also though - because it does not exclude the possibility that the same old

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evidence that challenges the veracity of the TAR statement exists now , as then!  
I think this could go in the text where suggested , but I think it best NOT to have a bullet about this point.We need to check exactly what was said in the TAR . Perhaps a reference to the Academy Report could also be inserted here?  
Anyway, you asked for a straw-man statement for all to argue about so I suggest we send this to Stefan, David , Betty and whoever else you think.  
cheers  
Keith

--  
Professor Keith Briffa,  
Climatic Research Unit  
University of East Anglia  
Norwich, NR4 7TJ, U.K.

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Fax: +44-1603-507784  
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<http://www.geo.arizona.edu/>  
<http://www.ispe.arizona.edu/>

743. 1158175939.txt  
#####  
#####

From: Keith Briffa <k.briffa@uea.ac.uk>  
To: Eystein Jansen <Eystein.Jansen@geo.uib.no>, Jonathan Overpeck <jto@u.arizona.edu>  
Subject: No Subject  
Date: Wed, 13 Sep 2006 15:32:19 +0100

Eystein and Peck  
I have thought about this and spent some time discussing it with Tim. I have come up with the following  
Greater uncertainty associated with proxy-based temperature estimates for individual years means that it is more difficult to gauge the significance, or precedence, of the extreme warm years observed in the recent instrumental record. However, there is no new evidence to challenge the statement made in the TAR that 1998 (or the subsequent near-equivalent 2005) was likely the warmest in the last 1000 years.

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but you might consider this too subtle (or negative) then. I think the second sentence is  
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Anyway, you asked for a straw-man statement for all to argue about so I suggest  
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[1]<http://www.cru.uea.ac.uk/cru/people/briffa/>

References

1. <http://www.cru.uea.ac.uk/cru/people/briffa/>

744. 1158180188.txt  
#####  
#####

From: David Rind <[drind@giss.nasa.gov](mailto:drind@giss.nasa.gov)>  
To: Jonathan Overpeck <[jto@u.arizona.edu](mailto:jto@u.arizona.edu)>  
Subject: Re:  
Date: Wed, 13 Sep 2006 16:43:08 -0400  
Cc: Keith Briffa <[k.briffa@uea.ac.uk](mailto:k.briffa@uea.ac.uk)>, rahmstorf@ozean-klima.de, Bette Otto-Bleisner <[ottobli@ncar.ucar.edu](mailto:ottobli@ncar.ucar.edu)>, cddhr@giss.nasa.gov, joos <[joos@climate.unibe.ch](mailto:joos@climate.unibe.ch)>, Eystein Jansen <[eystein.jansen@geo.uib.no](mailto:eystein.jansen@geo.uib.no)>, "Ricardo Villalba" <[ricardo@lab.cricyt.edu.ar](mailto:ricardo@lab.cricyt.edu.ar)>, t.osborn@uea.ac.uk

Leaving aside for the moment the resolution issue, the statement should at least  
be consistent with our figures. Fig. 6-10 looks like there were years around 1000 AD  
that could have been just as warm - if one wants to make this statement, one needs to  
expand the vertical scale in Fig. 6-10 to show that the current warm period is 'warmer'.

Now getting back to the resolution issue: given what we know about the ability to  
reconstruct global or NH temperatures in the past - could we really in good  
conscience say we have the precision from tree rings and the very sparse other data to make any  
definitive statement of this nature (let alone accuracy)? While I appreciate the cleverness  
of the second sentence, the problem is everybody will recognize that we are 'being

clever' - at  
what point does one come out looking aggressively defensive?

I agree that leaving the first sentence as the only sentence suggests that one is somehow doubting the significance of the recent warm years, which is probably not something we want to do. What I would suggest is to forget about making 'one year' assessments; what Fig. 6-10 shows is that the recent warm period is highly anomalous with respect to the record of the last 1000 years. That would be what I think we can safely conclude the last 1000 years really tells us.

David

At 9:10 AM -0600 9/13/06, Jonathan Overpeck wrote:

Keith - thanks for this and the earlier updates. Stefan is not around this week, but hopefully the others on this email can weight in. My thoughts...

1) we MUST say something about individual years (and by extension the 1998 TAR statement) - do we support it, or not, and why.

2) a paragraph would be nice, but I doubt we can do that, so..

3) I suggest putting the first sentence that Keith provides below as the last sentence, in the last (summary) para of 6.6.1.1. To make a stand alone para seems like a bad way to end the very meaty section.

4) I think the second sentence could be more controversial - I don't think our team feels it is valid to say, as they did in TAR, that "It is also likely that, in the Northern Hemisphere,... 1998 was the warmest year" in the last 1000 years. But, it you think about it for a while, Keith has come up with a clever 2nd sentence (when you insert "Northern Hemisphere" language as I suggest below). At first, my reaction was leave it out, but it grows on you, especially if you acknowledge that many readers will want more explicit prose on the 1998 (2005) issue.

Greater uncertainty associated with proxy-based temperature estimates for individual years means that it is more difficult to gauge the significance, or precedence, of the extreme warm years observed in the recent instrumental record. However, there is no new evidence to challenge the statement made in the TAR that 1998 (or the subsequent near-equivalent 2005) was likely the warmest of Northern Hemisphere year over the last 1000 years.

5) I strongly agree we can't add anything to the Exec Summary.

6) so, if no one disagrees or edits, I suggest we insert the above 2 sentences

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to end

- see the last (summary) para of 6.6.1.1. Or should we make it a separate, last para point #3 above why I don't favor that idea as much. But, it's not a clear cut issue.

Thoughts? Thanks all, Peck

come up Eystein and Peck  
I have thought about this and spent some time discussing it with Tim. I have up with the following

individual Greater uncertainty associated with proxy-based temperature estimates for years means that it is more difficult to gauge the significance, or precedence, of the extreme warm years observed in the recent instrumental record. However, there is no new evidence to challenge the statement made in the TAR that 1998 (or the subsequent near-equivalent 2005) was likely the warmest in the last 1000 years.

- but This should best go after the paragraph that concludes section 6.6.1.1 I believe we might best omit the second sentence of the suggested new paragraph - but you might consider this too subtle (or negative) then. I think the second sentence is very subtle also though - because it does not exclude the possibility that the same old evidence that challenges the veracity of the TAR statement exists now , as then!

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Anyway, you asked for a straw-man statement for all to argue about so I suggest we send this to Stefan, David , Betty and whoever else you think.  
cheers  
Keith

--

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<http://www.geo.arizona.edu/>  
<http://www.ispe.arizona.edu/>

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745. 1158204073.txt

#####  
#####

From: Eystein Jansen <Eystein.Jansen@geo.uib.no>  
To: Jonathan Overpeck <jto@u.arizona.edu>, David Rind <drind@giss.nasa.gov>  
Subject: Re:  
Date: Wed, 13 Sep 2006 23:21:13 +0200  
Cc: Keith Briffa <k.briffa@uea.ac.uk>, rahmstorf@ozean-klima.de, Bette Otto-Bleisner <ottobli@ncar.ucar.edu>, cddhr@giss.nasa.gov, joos <joos@climate.unibe.ch>, Eystein Jansen <eystein.jansen@geo.uib.no>, "Ricardo Villalba" <ricardo@lab.cricyt.edu.ar>, t.osborn@uea.ac.uk

Hi all,

My take on this is similar to what Peck wrote. My suggestion is to write:

Greater uncertainty associated with proxy-based temperature estimates for individual years means that it is more difficult to gauge the significance, or precedence, of the extreme warm individual years observed in the recent instrumental record, such as 1998 and 2005, in the context of the last millennium.

I think this is scientifically correct, and in essence means that we, as did the NAS panel say, feel the TAR statement was not what we would have said. I sympathise with those who say that it is not likely that any individual years were warmer, as Stefan has stated, but I don't think we have enough data to qualify this on the hemispheric mean.

Best wishes,

Eystein

If this is interpreted as a criticism of the TAR, then I think we

At 14:09 -0600 13-09-06, Jonathan Overpeck wrote:

thanks David - lets see what others think. I agree, that we don't want to be seen as being too clever or defensive. Note however, that all the TAR said was "likely" the warmest in the last 1000 years. Our chapter and figs (including 6.10) make it clear that it is unlikely any multi-decadal period was as warm as the last 50 years. But, that said, I do feel your are right that our team would not have said what the TAR said about

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1998, and thus, we should delete that second sentence.

any other thoughts team?

thx, peck

Leaving aside for the moment the resolution issue, the statement should at least be consistent with our figures. Fig. 6-10 looks like there were years around 1000 AD that could have been just as warm - if one wants to make this statement, one needs to expand the vertical scale in Fig. 6-10 to show that the current warm period is 'warmer'.

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Keith

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Phone: +47-55-583491 - Home: +47-55-910661  
Fax: +47-55-584330

746. 1158324958.txt

#####  
#####

From: Jonathan Overpeck <jto@u.arizona.edu>  
To: Keith Briffa <k.briffa@uea.ac.uk>  
Subject: Re: 1988/2005  
Date: Fri, 15 Sep 2006 08:55:58 -0600  
Cc: David Rind <drind@giss.nasa.gov>, rahmstorf@ozean-klima.de, Bette Otto-Bleisner <ottobli@ncar.ucar.edu>, cddhr@giss.nasa.gov, Ricardo Villalba <ricardo@lab.cricyt.edu.ar>, t.osborn@uea.ac.uk, joos <joos@climate.unibe.ch>, Eystein Jansen <eystein.jansen@geo.uib.no>, <oyvind.paasche@bjerknes.uib.no>

<x-flowed>  
Thanks Keith, Tim and Fortunat for your input.  
We'll go with what we have then - Eystein's suggestion minus the second "individual".

Eystein and Øyvind - just want to double check that you've deleted that 2nd "individual" in the all important 1998 sentence??

Thanks, Peck

>I do not disagree either - in fact I preferred  
>not to make the "too clever" second statement in  
>my "straw man" as I said at the time. If this is  
>the consensus (and I believe it is the  
>scientifically correct one) then I would be  
>happy with Eystein's sentence. The worry is that  
>we have inserted this late with no refereeing  
>and no justification in the text. I would also  
>suggest dropping the second "!individual" in the  
>sentence.

>  
>At 10:50 15/09/2006, Fortunat Joos wrote:  
>>Hi,  
>>  
>>I support Eystein's suggestion and agree with David.

>>  
>>If there is not sufficient evidence to support  
>>or dismis claims whether 1998 or  
>>2005 was the warmest year of the millennium than we should indeed say so.  
>>It is the nature and the strenght of the IPCC  
>>process that points from the TAR  
>>and earlier reports get reconsidered and  
>>reassessed. It is normal that earlier  
>>statements get revised. Often statements can be strenghtened, but sometimes  
>>statements can not be supported anymore. Our job is to present the current  
>>understanding of science as balanced as possible.

>>  
>>with best wishes,

>>  
>>Fortunat

>>Quoting Eystein Jansen <Eystein.Jansen@geo.uib.no>:

>>  
>>> Hi all,  
>>> My take on this is similar to what Peck wrote. My suggestion is to write:

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>>>  
>>> Greater uncertainty associated with proxy-based  
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>>>  
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>>> >multi-decadal period was as warm as the last 50  
>>> >years. But, that said, I do feel your are right  
>>> >that our team would not have said what the TAR  
>>> >said about 1998, and thus, we should delete that  
>>> >second sentence.  
>>> >  
>>> >any other thoughts team?  
>>> >  
>>> >thx, peck  
>>> >  
>>> >  
>>> >>Leaving aside for the moment the resolution  
>>> >>issue, the statement should at least be  
>>> >>consistent with our figures. Fig. 6-10 looks  
>>> >>like there were years around 1000 AD that could  
>>> >>have been just as warm - if one wants to make  
>>> >>this statement, one needs to expand the  
>>> >>vertical scale in Fig. 6-10 to show that the  
>>> >>current warm period is 'warmer'.  
>>> >>  
>>> >>Now getting back to the resolution issue: given  
>>> >>what we know about the ability to reconstruct  
>>> >>global or NH temperatures in the past - could  
>>> >>we really in good conscience say we have the  
>>> >>precision from tree rings and the very sparse  
>>> >>other data to make any definitive statement of  
>>> >>this nature (let alone accuracy)? while I  
>>> >>appreciate the cleverness of the second  
>>> >>sentence, the problem is everybody will  
>>> >>recognize that we are 'being clever' - at what  
>>> >>point does one come out looking aggressively  
>>> >>defensive?  
>>> >>

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>>> >> I agree that leaving the first sentence as the  
>>> >>>only sentence suggests that one is somehow  
>>> >>>doubting the significance of the recent warm  
>>> >>>years, which is probably not something we want  
>>> >>>to do. What I would suggest is to forget about  
>>> >>>making 'one year' assessments; what Fig. 6-10  
>>> >>>shows is that the recent warm period is highly  
>>> >>>anomalous with respect to the record of the  
>>> >>>last 1000 years. That would be what I think we  
>>> >>>can safely conclude the last 1000 years really  
>>> >>>tells us.  
>>> >>  
>>> >>David  
>>> >>  
>>> >>>At 9:10 AM -0600 9/13/06, Jonathan Overpeck wrote:  
>>> >>>>Keith - thanks for this and the earlier  
>>> >>>>updates. Stefan is not around this week, but  
>>> >>>>hopefully the others on this email can weight  
>>> >>>>in. My thoughts...  
>>> >>>>  
>>> >>>>1) We MUST say something about individual  
>>> >>>>years (and by extension the 1998 TAR  
>>> >>>>statement) - do we support it, or not, and why.  
>>> >>>>  
>>> >>>>2) a paragraph would be nice, but I doubt we can do that, so..  
>>> >>>>  
>>> >>>>3) I suggest putting the first sentence that  
>>> >>>>Keith provides below as the last sentence, in  
>>> >>>>the last (summary) para of 6.6.1.1. To make a  
>>> >>>>stand alone para seems like a bad way to end  
>>> >>>>the very meaty section.  
>>> >>>>  
>>> >>>>4) I think the second sentence could be more  
>>> >>>>controversial - I don't think our team feels  
>>> >>>>it is valid to say, as they did in TAR, that  
>>> >>>>"It is also likely that, in the Northern  
>>> >>>>Hemisphere,... 1998 was the warmest year" in  
>>> >>>>the last 1000 years. But, if you think about  
>>> >>>>it for a while, Keith has come up with a  
>>> >>>>clever 2nd sentence (when you insert "Northern  
>>> >>>>Hemisphere" language as I suggest below). At  
>>> >>>>first, my reaction was leave it out, but it  
>>> >>>>grows on you, especially if you acknowledge  
>>> >>>>that many readers will want more explicit  
>>> >>>>prose on the 1998 (2005) issue.  
>>> >>>>  
>>> >>>>Greater uncertainty associated with  
>>> >>>>proxy-based temperature estimates for  
>>> >>>>individual years means that it is more  
>>> >>>>difficult to gauge the significance, or  
>>> >>>>precedence, of the extreme warm years observed  
>>> >>>>in the recent instrumental record. However,  
>>> >>>>there is no new evidence to challenge the  
>>> >>>>statement made in the TAR that 1998 (or the  
>>> >>>>subsequent near-equivalent 2005) was likely  
>>> >>>>the warmest of Northern Hemisphere year over  
>>> >>>>the last 1000 years.  
>>> >>>>  
>>> >>>>5) I strongly agree we can't add anything to the Exec Summary.  
>>> >>>>  
>>> >>>>6) so, if no one disagrees or edits, I suggest  
>>> >>>>we insert the above 2 sentences to end the  
>>> >>>>last (summary) para of 6.6.1.1. Or should we

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>>> >>>make it a separate, last para - see point #3  
>>> >>>above why I don't favor that idea as much.  
>>> >>>But, it's not a clear cut issue.  
>>> >>>  
>>> >>>Thoughts? Thanks all, Peck  
>>> >>>  
>>> >>>  
>>> >>>>Eystein and Peck  
>>> >>>>I have thought about this and spent some time  
>>> >>>>discussing it with Tim. I have come up with  
>>> >>>>the following  
>>> >>>>  
>>> >>>>>>Greater uncertainty associated with  
>>> >>>>>>proxy-based temperature estimates for  
>>> >>>>>>individual years means that it is more  
>>> >>>>>>difficult to gauge the significance, or  
>>> >>>>>>precedence, of the extreme warm years  
>>> >>>>>>observed in the recent instrumental record.  
>>> >>>>>>However, there is no new evidence to  
>>> >>>>>>challenge the statement made in the TAR that  
>>> >>>>>>1998 (or the subsequent near-equivalent 2005)  
>>> >>>>>>was likely the warmest in the last 1000 years.  
>>> >>>>  
>>> >>>>>>This should best go after the paragraph that concludes section 6.6.1.1  
>>> >>>>  
>>> >>>>>>I believe we might best omit the second  
>>> >>>>>>sentence of the suggested new paragraph - but  
>>> >>>>>>you might consider this too subtle (or  
>>> >>>>>>negative) then. I think the second sentence  
>>> >>>>>>is very subtle also though - because it does  
>>> >>>>>>not exclude the possibility that the same old  
>>> >>>>>>evidence that challenges the veracity of the  
>>> >>>>>>TAR statement exists now , as then!  
>>> >>>>>>I think this could go in the text where  
>>> >>>>>>suggested , but I think it best NOT to have a  
>>> >>>>>>bullet about this point.We need to check  
>>> >>>>>>exactly what was said in the TAR . Perhaps a  
>> >>>>>>reference to the Academy Report could also be  
>>> >>>>>>inserted here?  
>>> >>>>  
>>> >>>>>>Anyway, you asked for a straw-man statement  
>>> >>>>>>for all to argue about so I suggest we send  
>>> >>>>>>this to Stefan, David , Betty and whoever  
>>> >>>>>>else you think.  
>>> >>>>>>cheers  
>>> >>>>>>Keith  
>>> >>>>  
>>> >>>>--  
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>>> >>>>>>Climatic Research Unit  
>>> >>>>>>University of East Anglia  
>>> >>>>>>Norwich, NR4 7TJ, U.K.  
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>>> >>>>  
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>>> >

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#####  
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From: Tim Osborn <t.osborn@uea.ac.uk>  
To: Øyvind Paasche <oyvind.paasche@bjerknes.uib.no>  
Subject: Re: Final checks on figures and captions Email 1 of 2  
Date: Fri Sep 15 12:01:00 2006  
Cc: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <Eystein.Jansen@geo.uib.no>, Jonathan Overpeck <jto@u.arizona.edu>

Hi Øyvind,  
I was off work yesterday so I couldn't check the tables until today. Keith and I have spotted some corrections that need to be made, some my mistakes and some due to other changes. Sorry! Anyway all are shown as tracked changes (plus explanation comments) in the attached file. Hope this is all clear and ok.  
Cheers  
Tim  
At 17:02 13/09/2006, Øyvind Paasche wrote:

tim - that's very good, the minor error in box fig.1 is now corrected. I think the lines in fig.6.10 and 6.14 are sufficiently thick so if its up to me we'll leave them as they are. I believe that all the figures are incorporated into the word file the same way and I can't see any big difference between 6.10 and 6.14. TSU have eps formats of all the figures and in the end they will probably use an entirely different program than word to construct the report, so I guess there's nothing to worry about. Anyway, I have cleaned the standing version of the tables (attached) and if you

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(and/or  
Keith) could go through them a last time and check that everything is as it  
should be  
that would be nice. I have one question concerning one of the refs in table  
6.2: Does  
Bertrand et al., 2002b correspond to  
Bertrand, C., M.F. Loutre, M. Crucifix, and A. Berger, 2002b: Climate of the  
last  
millennium: a sensitivity study. Tellus Series a-Dynamic Meteorology and  
Oceanography,  
54(3), 221-244.  
Cheers,  
Øyvind

Hi,  
I've checked that the figures and captions are the final versions and they are  
all  
correct for figures 6.10-6.14.  
I've also checked Box 6.4, Figure 1 and here there is an error with the  
caption. The  
caption ends with the reference period which currently states '...the period  
800-1995.'  
I got this wrong. The correct statement is "...the period 1001-1980."  
Sorry about that (it was a mistake carried over from our earlier use of the  
figure from  
Osborn and Briffa, 2006, Science: for that paper we did use 800-1995).  
Were you also after a check of the image quality? The figures I'm involved  
with all  
look pretty good, except that 6.10 is a bit blurry or lower quality. Was it  
inserted  
into word in a different way to the others that might have degraded the image?  
Also, I  
wonder whether I should make the lines on Figure 6.10(b) and/or Figure 6.14(b)  
any  
thicker? Please let me know if you want me to do this.

Cheers

Tim

At 01:46 13/09/2006, Jonathan Overpeck wrote:

Hi all - we're editing main text, and we think we're close to the right length  
without  
having to make significant cuts beyond what you've seen already - it's mostly  
down to  
editing for consistent style and clarity. That's good news.  
Øyvind recently sent (working very late over their) the attached figs and  
caption files  
(being sent in two files to keep each half under 10 Mb), and rather than Peck  
trying to  
figure out if it's all perfect, we're sending to YOU look at your figures and  
captions  
to make sure they are the most up-to-date versions. Thanks! It's a challenge to  
make  
sure we have all the most recent pieces, although we're betting that we're  
doing ok.  
Tomorrow (I hope - thanks Øyvind!) we'll send tables - hoping Tim, Keith, and  
Fortunat  
will be waiting to comment/edit if needed.  
we're in much better shape than last cycles thanks to all your hard work - hope  
we can  
make this last bit easy for you. We appreciate you working fast when we send  
material.  
Thanks, Peck and Eystein

--

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\*\*Norwich -- City for Science:  
\*\*Hosting the BA Festival 2-9 September 2006

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References

1. <http://www.geo.arizona.edu/>
2. <http://www.ispe.arizona.edu/>
3. <http://www.cru.uea.ac.uk/~timo/>
4. <http://www.cru.uea.ac.uk/~timo/sunclock.htm>

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#####  
#####

From: Jonathan Overpeck <[jto@u.arizona.edu](mailto:jto@u.arizona.edu)>  
To: Gabi Hegerl <[hegerl@duke.edu](mailto:hegerl@duke.edu)>  
Subject: Re: cheers!  
Date: Tue, 19 Sep 2006 11:37:49 -0600  
Cc: Keith Briffa <[k.briffa@uea.ac.uk](mailto:k.briffa@uea.ac.uk)>, Eystein Jansen <[eystein.jansen@geo.uib.no](mailto:eystein.jansen@geo.uib.no)>

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Hi Gabi - we do loose quite a bit (e.g., boreholes and other proxies) back beyond 500, so that's why we drew the "very likely" line there. But, we did stay as strong as the TAR back 1300, so that was our compromise on certainty. I believe the forcing series also start to get more uncertain pretty fast back beyond even 400 years ago, but

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I'm pretty impressed with the match between simulated and observed NH climate back ca. 700 years (e.g., our Figs 6.13 and 6.14). Thus, I bet you are right that we know back to 700 pretty well, but not well enough to go with "very likely" in the all important chap 6 bullet.

Not sure this helps, but we do need to pay attention as we do the SPM to get the right balance.

I'll cc to Keith in case he wants to chime in, which would be appreciated.

thanks, peck

>p.s. hope you are all recovered etc!  
>I have one chapter question: We were waffling back and forth if we  
>SHOULD go with the chapter 6  
>assessment on the last 500 being better reconstructed than say last  
>700, but in the end, we stuck with  
>last 700 because some results rely on using a long timehorizon to  
>separate like ghg and solar signals.  
>To say that very likely a substantial fraction of the variance on  
>those records is externally forced (nother  
>words, detectable external signals in reconstructions).  
>Does this seem ok to you? In the SPM session we had some waffling  
>about 5 vs 7 centuries.

>  
>Gabi

>Jonathan Overpeck wrote:

--  
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#####  
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From: Gabi Hegerl <hegerl@duke.edu>  
To: Keith Briffa <k.briffa@uea.ac.uk>  
Subject: Re: 5 to 7 centuries  
Date: wed, 20 Sep 2006 12:37:42 -0400  
Cc: Eystein Jansen <Eystein.Jansen@geo.uib.no>, Jonathan Overpeck  
<jto@u.arizona.edu>, Francis Zwiers <Francis.Zwiers@ec.gc.ca>

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I asked Tom about it, he says (but I realize he is one sample of the volcano enthusiasts) it could have been El Chichon, the eruption seems to be huge, but there is

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concerns that different physics would apply to such a large eruption making it cause different climate impacts (he cites a paper for that that I promptly forgot). I am always slightly nervous about the fact that this one doesn't show up in the data, and wondering if there is a sliver of circularity, but I think results like my detection stuff and probably also EPOCH stuff (I could try) are quite robust to missing an eruption, even a biggie.

Greetings everybody!

Gabi

Keith Briffa wrote:

> Hi everyone - just been at a meeting all day so just seen this . I  
> agree with Eystein et al . so no problems . Interested to know what  
> you mean Gabi about the 1256 eruption - we have been looking at the  
> empirical evidence for a contemporaneous cooling with ambiguous results  
> cheers  
> Keith

>  
>  
>  
> At 20:16 19/09/2006, Eystein Jansen wrote:

>  
>> Hi Gabi,  
>> this is fine with me and does not seem to contradict Ch6.  
>> Eystein

>>  
>>  
>>  
>> At 15:06 -0400 19-09-06, Gabi Hegerl wrote:

>>  
>>> Sounds good - since forcing and temperature reconstructions are  
>>> independent,  
>>> I think it was defensible to make a statement about role of forced  
>>> response 700 yrs back in Ch9.  
>>> Is it ok to keep 700 yrs about significant externally forced  
>>> component in SPM?  
>>> Susan is finetuning that bullet right now so that's why I thought it  
>>> would be good to know if you guys are  
>>> happy.  
>>> We justified Ch9's assessment based on your figure 6.13 showing  
>>> model and recon agreement, and on few detection  
>>> studies and some qualitative agreement studies all saying the  
>>> agreement is not spurious.  
>>> One issue going beyond further is 1256 eruption, which is not that  
>>> well understood,  
>>> so it gets a bit dicey beyond I think!

>>>  
>>> Gabi

>>>  
>>> Jonathan Overpeck wrote:

>>>  
>>>> Hi Gabi - we do lose quite a bit (e.g., boreholes and other  
>>>> proxies) back beyond 500, so that's why we drew the "very likely"  
>>>> line there. But, we did stay as strong as the TAR back 1300, so  
>>>> that was our compromise on certainty. I believe the forcing series  
>>>> also start to get more uncertain pretty fast back beyond even 400  
>>>> years ago, but I'm pretty impressed with the match between

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>>>> simulated and observed NH climate back ca. 700 years (e.g., our  
>>>> Figs 6.13 and 6.14). Thus, I bet you are right that we know back to  
>>>> 700 pretty well, but not well enough to go with "very likely" in  
>>>> the all important chap 6 bullet.

>>>>  
>>>> Not sure this helps, but we do need to pay attention as we do the  
>>>> SPM to get the right balance.

>>>>  
>>>> I'll cc to Keith in case he wants to chime in, which would be  
>>>> appreciated.

>>>>  
>>>> thanks, peck

>>>>  
>>>>> p.s. hope you are all recovered etc!  
>>>>> I have one chapter question: we were waffling back and forth if we  
>>>>> SHOULD go with the chapter 6  
>>>>> assessment on the last 500 being better reconstructed than say  
>>>>> last 700, but in the end, we stuck with  
>>>>> last 700 because some results rely on using a long timehorizon to  
>>>>> separate like ghg and solar signals.  
>>>>> To say that very likely a substantial fraction of the variance on  
>>>>> those records is externally forced (nother  
>>>>> words, detectable external signals in reconstructions).  
>>>>> Does this seem ok to you? In the SPM session we had some waffling  
>>>>> about 5 vs 7 centuries.

>>>>>  
>>>>> Gabi

>>>>>  
>>>>> Jonathan Overpeck wrote:

>>>>  
>>>>  
>>>>  
>>>> --

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#####

From: "Saffron O'Neill" <s.o-neill@uea.ac.uk>
To: <t.osborn@uea.ac.uk>
Subject: panel meeting and ice extent modelling
Date: Mon, 2 Oct 2006 10:46:26 +0100

<x-flowed>
Hi Tim

I've found some 'communicating cc' ref's which I've attached - nothing too hard going! Futerra's 'rules of the game' is a good intro to what climate change communicators should be working towards in terms of best practice. Sophie's poster is a summary of the main findings of her PhD research from a couple of years back in ENV, and is a message that some NGOs in particular would still do well to heed! Finally, the communicating CC document is an outline of Defra's recent initiative, as followed on from Futerra's consultancy work.

PhD stuff: at the last panel meeting, we agreed to meet again in early October. However, I think this meeting would best be delayed until we know exactly what info we can obtain for the expert elicitation as r.e. ice extent maps, time series etc.

I forwarded on the email from Xiangdong Zhang a few days ago - he's happy to give me some plots showing 2-D distribution of sea ice concentrations around 2050 and also animations from 1900-2100 under the A1B scenario.

How is the ice modelling going? Do you think you'd be able to get some plots say by w/c 9th Oct so we could talk about them in the meeting?

Cheers

Saffron

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Attachment Converted: "c:\documents and settings\tim osborn\my documents\eutora\attach\RulesOfTheGame.pdf"

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From: Jonathan Overpeck <jto@u.arizona.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>, Eystein Jansen <eystein.jansen@geo.uib.no>
Subject: Re: VERY URGENT HELP NEEDED TO ADDRESS FINAL DRAFT PROBLEM
Date: Fri, 6 Oct 2006 09:11:04 -0600

Hi Keith and Eystein - thanks for the timely and helpful (very) feedback, Keith. Your suggestions for 4 and 5 seem fine, and I wonder only about 6. I too am not sure where the final clause came from, but I'll guess it was a suggestion of Stefan's that then stood the text of time. In the spirit of trying hard not to change the meaning of bullets in the ES from what the LA team agreed to in Bergen, what about changing this clause in the ES to read "natural recovery", i.e.:

and it is very unlikely that this warming was merely a natural recovery from the pre-20th century cold period."

This takes away the ambiguity, and does serve to address a widely held misconception outside of our community - or at least to phrase the issue in terms that some might find more useful.

If we keep this phrase, then I would suggest restating the entire ES sentence at the end of 6.6.3.

Is this ok? Again, I'm motivated by our team agreement - I do think we could delete this phrase since it's more repetitive than new meaning, but would rather not unless it really does not work. Personally, I like it as modified above, because it hammers the important point from a slightly different perspective - one that seems to be on the minds of the public still.

Thanks, both, for letting me know what you think fast.

best, peck

Hi Peck and Eystein
In response to Points 4-6

4. Add the following after past 1300 years. on line 13 page Y-33

very likely that average Northern Hemisphere temperatures during the second half of the 20th century were warmer than any other 50-year period in the last 500 years. "

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Do not put anything in Box 6.4 which is written from the reverse perspective - evidence

of medieval period not good enough to say warmer than now. Also confuses statements

about 500 years and longer (1000 year) Medieval ,time.

5. The person who says this has not read the text - see lines 28-33 on Y-32 where I

think this is well covered.

6. If you read the text on lines 1-10 of PAGE Y-38 I think this meaning is clearly

conveyed. It is not in the same words -but easily supports the ES statement.

HOWEVER, I do not like the last part of the statement (and not sure where this came

from) because it is ambiguous and anyway implied by prior statement. I strongly

urge you

to remove the section

"and it is very unlikely that this warming was merely a recovery from the pre-20th

century cold period."

These would sort things out I believe

cheers

Keith

At 19:26 05/10/2006, you wrote:

Hi Keith and Tim - we just got the attached consistency feedback doc from the TSU, and

I've added my thoughts in red. We need your feedback on items 4-6 REALLY FAST. Tim, if

Keith's not around to help, please do the job - the TSU has zero time to give us.

I think the solutions to #5 and 6 are easy as I suggested (although I don't have

confirmation from Susan or Martin that we can just do as I suggest, but it seems logical

to me - if you can suggest an even better solution, pls do.

I'll send the official chap 6 final draft text next - at least as it stands today.

thanks for dealing with this, perhaps before you go to sleep this evening.

Best, Peck

--

Jonathan T. Overpeck
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Professor, Department of Geosciences

Professor, Department of Atmospheric Sciences

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--

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--

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<http://www.ispe.arizona.edu/>

752. 1160142338.txt

#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Christoph Kull <christoph.kull@pages.unibe.ch>
Subject: Re: [Fwd: 2006ES001559 Decision Letter]
Date: Fri, 06 Oct 2006 09:45:38 -0400
Reply-to: mann@psu.edu
Cc: Thorsten Kiefer <thorsten.kiefer@pages.unibe.ch>, Heinz Wanner <wanner@giub.unibe.ch>, Phil Jones <p.jones@uea.ac.uk>, Keith Briffa <k.briffa@uea.ac.uk>

thanks very much Christoph, that's perfect.
regards,
mike
Christoph Kull wrote:

Hi Mike,
If the EOS-piece is not already submitted...
Below a paragraph we propose to use for the short description of the second project.

"Furthermore, the participants identified the need and a major opportunity to improve the quality and value of climate reconstructions. Therefore, a workshop is planned to assess uncertainties in proxies in a coherent way and to develop strategies for future collection and integration of proxy data from key regions. The workshop will focus on climate proxies that have decadal or better temporal resolution and will involve the world data centers."

Thanks a lot! Best wishes!

Christoph

On 30.09.2006 19:56, "Michael E. Mann" [1]<mann@meteo.psu.edu> wrote:

Dear Keith/Phil/Thorsten/Christoph/Heinz,

Sorry this took Eos so long. No surprises here. A few minor revisions and it should be ready for publication. Please see attached revised version and response to reviewers. I've highlighted in yellow one place in the draft where

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We feel as if we cannot completely hide the fact that we have confirmed our result w/ GKSS, hence the "compromise" suggested above. Meanwhile, we can pursue a more thorough, official collaborative effort in the future.

Thoughts on this?

thanks,

mike

--

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The Pennsylvania State University email: mann@psu.edu
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<http://www.met.psu.edu/dept/faculty/mann.htm>

</x-flowed>

Return-Path: <k.briffa@uea.ac.uk>
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 by mail.meteo.psu.edu (Postfix) with ESMTP id 08C5B204B4A
 for <mann@meteo.psu.edu>; Fri, 13 Oct 2006 11:51:52 -0400 (EDT)
Received: from mailgate5.uea.ac.uk (mailgate5.uea.ac.uk [139.222.130.185])
 by tr12n05.aset.psu.edu (8.13.6/8.13.2) with ESMTP id k9DFpkix2199660
 for <mann@psu.edu>; Fri, 13 Oct 2006 11:51:49 -0400
Received: from [139.222.130.167] (helo=ueams2.uea.ac.uk)
 by mailgate5.uea.ac.uk with esmtp (Exim 4.50)
 id 1GYP3d-0000kt-V7
 for mann@psu.edu; Fri, 13 Oct 2006 16:34:50 +0100
Received: from [139.222.104.74] (helo=angara.uea.ac.uk)
 by ueams2.uea.ac.uk with esmtp (Exim 4.51)
 id 1GYP3d-00037Y-JU; Fri, 13 Oct 2006 16:34:45 +0100
Message-Id: <7.0.0.16.0.20061013163526.03552e98@uea.ac.uk>
X-Mailer: QUALCOMM windows Eudora Version 7.0.0.16
Date: Fri, 13 Oct 2006 16:36:51 +0100
To: mann@psu.edu
From: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: GKSS results
Cc: Tim Osborn <t.osborn@uea.ac.uk>
In-Reply-To: <452BCB6C.1070306@meteo.psu.edu>
References: <452BCB6C.1070306@meteo.psu.edu>
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X-PSU-Spam-Flag: NO
X-PSU-Spam-Hits: -2.599

mail.2006

<x-flowed>

Mike

Tim and I have discussed this round and round and our response is attached

what do you think

best wishes Keith

At 17:33 10/10/2006, you wrote:

>Dear Tim/Keith,

>

>I hope all is well with both of you.

>

>We've been doing a number of sensitivity tests w/ RegEM using both
>the CSM simulation, and now more recently the GKSS simulation data
>we got from you. There are some methodological developments we'll
>describe soon, related to what is the most reliable regularization
>method in RegEM, ridge regression and truncated total least squares.
>We are now leaning towards the latter because of potential
>non-convergence problems in some cases w/ the former. More on that soon.

>

>More relevant, however, are the results. As you can see from the
>attached plot, RegEM works quite well w/ GKSS, using a short
>calibration period (1900-1980, corresponding to years 900-980 in the
>attached plot) and both white and red pseudoproxy noise (we used
> $\rho=0.5$ in the attached, but similar result for other values).

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>The most interesting result is that while RegEM reconstructs the
>full NH series well throughout, in the case of the CSM simulation,
>it does modestly underestimate the warmth of the earliest centuries
>in the GKSS Erik simulation (it fits everything else, including the
>LIA cooling, very well). We feel that this is likely due to problem
>of correctly identifying the 'drift' pattern using CFR methods.

>

>The long and short of this is that we would like to be able to show
>this result in a (very short!) J. Climate response we need to
>finalize, to a comment on Mann et al (2005) J. Clim by Zorita and
>Von Storch. We would show you this response for comment of course,
>and would add you as co-authors. We have cleared with Andrew Weaver
>that this would be an acceptable course of action. We are hoping
>you are in agreement with this?

>

>please let us know ASAP, we have to finalize our response within days.

>

>thanks,

>

>mike

>

>---

>Michael E. Mann

>Associate Professor

>Director, Earth System Science Center (ESSC)

>

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>

>

--

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</x-flowed>

Attachment Converted: "c:\documents and settings\tim osborn\my documents\eudora\attach\letter to Mike - 131.10.06.doc"

754. 1160771811.txt

#####

From: Keith Briffa <k.briffa@uea.ac.uk>
To: mann@psu.edu
Subject: Re: GKSS results
Date: Fri Oct 13 16:36:51 2006
Cc: Tim Osborn <t.osborn@uea.ac.uk>

Mike

Tim and I have discussed this round and round and our response is attached
what do you think
best wishes Keith

At 17:33 10/10/2006, you wrote:

Dear Tim/Keith,

I hope all is well with both of you.

We've been doing a number of sensitivity tests w/ RegEM using both the CSM simulation, and now more recently the GKSS simulation data we got from you. There are some methodological developments we'll describe soon, related to what is the most reliable regularization method in RegEM, ridge regression and truncated total least squares. We are now leaning towards the latter because of potential non-convergence problems in some cases w/ the former. More on that soon. More relevant, however, are the results. As you can see from the attached plot, RegEM works quite well w/ GKSS, using a short calibration period (1900-1980, corresponding to years 900-980 in the attached plot) and both white and red pseudoproxy noise (we used rho=0.5 in the attached, but similar result for other values). The most interesting result is that while RegEM reconstructs the full NH series well throughout, in the case of the CSM simulation, it does modestly underestimate the warmth of the earliest centuries in the GKSS Erik simulation (it fits everything else, including the LIA cooling, very well). We feel that this is likely due to problem of correctly identifying the 'drift' pattern using CFR methods.

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The long and short of this is that we would like to be able to show this result in a (very short!) J. Climate response we need to finalize, to a comment on Mann et al (2005)

J. Clim by Zorita and Von Storch. We would show you this response for comment of course, and would add you as co-authors. We have cleared with Andrew weaver that this would be an acceptable course of action. We are hoping you are in agreement with this? please let us know ASAP, we have to finalize our response within days.
thanks,
mike

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References

- 1. http://www.met.psu.edu/dept/faculty/mann.htm
- 2. http://www.cru.uea.ac.uk/cru/people/briffa/

755. 1161261884.txt

#####

From: "Michael E. Mann" <mann@meteo.psu.edu>
To: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: [Fwd: Re: GKSS results]
Date: Thu, 19 Oct 2006 08:44:44 -0400
Reply-to: mann@psu.edu

<x-flowed>
Hi Keith,

Certainly not, and sorry for not clarifying. This is the response to the J. Climate comment by Von Storch that we're talking about here. The final draft is due this week, and so that's why I needed to check if you & Tim wanted co-authorship if we were going to show the GKSS result.

We can certainly plan to do a more detailed followup analysis jointly, I would very much enjoy that. Something we've talked about doing is a set of experiments with "mixed proxies" where the proxies have a variable combination of surface temperature and precip components--it will be very interesting to see what happens in these cases.

Perhaps this would be a good opportunity for collaboration, where we

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could apply this to several different models including CSM and the models you guys are working with?

let me know what you think.

thanks,

mike

Keith Briffa wrote:

> Great Mike - but hope this does not mean that you will exclude our
> possible contribution to this paper
> Keith
>
> At 13:52 18/10/2006, you wrote:
>
>> thanks Tim. As luck would have it, zorita is providing the data to
>> Caspar anyway so this should now be a moot point. we'll keep you guys
>> updated on things,
>> Mike
>>
>> -----Original Message-----
>>
>> From: Tim Osborn <t.osborn@uea.ac.uk>
>> Subj: Re: [Fwd: Re: GKSS results]
>> Date: wed Oct 18, 2006 3:37 am
>> Size: 6K
>> To: mann@psu.edu, Scott Rutherford <srutherford@rwu.edu>
>> cc: Keith Briffa <k.briffa@uea.ac.uk>
>>
>> Hi Mike, your suggested compromise is acceptable to both Keith and
>> me. Good luck with the J. Clim. response. Cheers, Tim
>>
>> At 17:04 13/10/2006, Michael E. Mann wrote:
>> >Keith,
>> >
>> >I also figured this might be what you say, and I understand where
>> >you've coming from. This represents a bit of a dilemma too, as it
>> >seems unprofessional at best that Zorita and Von Storch have not
>> >made their code public, when we of course have made ours public.
>> >
>> >There are other sources where we could have gotten the GKSS
>> >data--I'm checking w/ Caspar for confirmation. I know that the Cane
>> >group has it, and I believe other groups have it nows too. So
>> >frankly, it is effectively now 'public domain' whether VS and Zorita
>> >like it or not!
>> >
>> >I propose, hoping that their is no loud objection, that we will
>> >include a line in our response indicating that we have confirmed
>> >that we get similar results using the GKSS Erik simulation. we'll
>> >leave it at that. We don't need to show that result necessarily,
>> >unless the editor/reviewers demand to see proof, and we certainly
>> >don't have to reveal where we got the GKSS data. As I mentioned,
>> >there are enough groups out there that now have it, that VS and
>> >Zorita would not know the source, and we would not reveal it.
>> >
>> >We feel as if we cannot completely hide the fact that we have
>> >confirmed our result w/ GKSS, hence the "compromise" suggested
>> >above. Meanwhile, we can pursue a more thorough, official
>> >collaborative effort in the future.
>> >
>> >Thoughts on this?

mail.2006

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>> >
>> >thanks,
>> >
>> >mike
>> >
>> >--
>> >Michael E. Mann
>> >Associate Professor
>> >Director, Earth System Science Center (ESSC)
>> >
>> >Department of Meteorology           Phone: (814) 863-4075
>> >503 Walker Building                 FAX: (814) 865-3663
>> >The Pennsylvania State University   email: mann@psu.edu
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>> >http://www.met.psu.edu/dept/faculty/mann.htm
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>> >
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>> [128.118.146.135])
>> >       by mail.meteo.psu.edu (Postfix) with ESMTPE id 08C5B204B4A
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>> >X-Mailer: QUALCOMM Windows Eudora Version 7.0.0.16
>> >Date: Fri, 13 Oct 2006 16:36:51 +0100
>> >To: mann@psu.edu
>> >From: Keith Briffa <k.briffa@uea.ac.uk>
>> >Subject: Re: GKSS results
>> >Cc: Tim Osborn <t.osborn@uea.ac.uk>
>> >In-Reply-To: <452BCB6C.1070306@meteo.psu.edu>
>> >References: <452BCB6C.1070306@meteo.psu.edu>
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>> >X-PSU-Spam-Flag: NO
```

mail.2006

>> >X-PSU-Spam-Hits: -2.599
>> >
>> >Mike
>> >Tim and I have discussed this round and round and our response is
>> attached
>> >
>> >what do you think
>> >
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>> >
>> >At 17:33 10/10/2006, you wrote:
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>> >>we've been doing a number of sensitivity tests w/ RegEM using both
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>> >>that this would be an acceptable course of action. We are hoping
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>> >>please let us know ASAP, we have to finalize our response within days.
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>> >>thanks,
>> >>
>> >>mike
>> >>
>> >>--
>> >>Michael E. Mann
>> >>Associate Professor
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>> >>Department of Meteorology Phone: (814) 863-4075
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>> >--
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>> ><http://www.cru.uea.ac.uk/cru/people/briffa/>
>>
>> Dr Timothy J Osborn, Academic Fellow
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>> e-mail: t.osborn@uea.ac.uk
>> phone: +44 1603 592089
>> fax: +44 1603 507784
>> web: <http://www.cru.uea.ac.uk/~timo/>
>> sunclock: <http://www.cru.uea.ac.uk/~timo/sunclock.htm>
>
>
> --
> Professor Keith Briffa,
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--
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University Park, PA 16802-5013

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From: Keith Briffa <k.briffa@uea.ac.uk>
To: Martin Jukes <m.n.jukes@rl.ac.uk>

mail.2006

Subject: Re: Mitrie: Bristlecones
Date: Thu Nov 16 17:21:25 2006

Martin

This last point is likely true (though CO2 began to rise earlier than the 1960s and the authors of the original paper believed that the high elevation (and concomitant low CO2 partial pressure) may have amplified the response to small concentration changes. There is also the possibility that a synergistic increase in water-use (and possibly nitrogen use) efficiency could have contributed .

However, I agree that the rapid growth increase is most likely a result of a change in the proportion of net photosynthetic production potential (ie needle mass) relative to the area of living cambium that could occur as a tree shifts from "normal" to strip bark form .If

this changes suddenly , as growth occurs only along a small strip rather than around the whole circumference (I know this is oversimplified) then you could easily get this apparent change in growth rate . BUT , if this is seen synchronously in many trees it would be hard to believe that this was the cause. To look at this would require a detail examination of

all the data (in relation to the precise sample geometry) . Changing precipitation trends , such as occurred pre- and post the mid 1970s will also confuse things .

Thanks Jan and Rob also for this discussion.

At 17:14 16/11/2006, Keith Briffa wrote:

To: Martin Juckes <m.n.juckes@rl.ac.uk>

From: Keith Briffa <k.briffa@uea.ac.uk>

Subject: Re: Mitrie: Bristlecones

In-Reply-To: <200611161642.00377.m.n.juckes@rl.ac.uk>

References: <21885F5ACD984446A17A573C47C6D846250054@exchng2.physics.ox.ac.uk>

<p06210202c1821017d50b@[10.15.4.248]>

<003701c7098e\$b8b4c850\$9d07d781@geos.ed.ac.uk>

<200611161642.00377.m.n.juckes@rl.ac.uk>

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authors of the original paper believed that the high elevation (and concomitant low CO2

partial pressure) may have amplified the response to small concentration changes. There

is also the - and I agree that the rapid growth increase is most likely a result of the

proportion of net photosynthetic production potential (ie needle mass) relative to the

area of living cambium .If this changes suddenly , as growth occurs only along a small

strip rather than around the whole circumference (I know this is oversimplified) then

you could easily get this apparent change in growth rate . To look at this would require

a detail examination of all the data (in relation to the precise sample geometry) .

However, changing precipitation trends pre- and post the mid 1970s will also confuse

things .At 16:41 16/11/2006, you wrote:

mail.2006

Thanks for all those comments.

I'm trying to avoid omitting data on the basis of circumstantial evidence, even when it is presented enthusiastically. The Bunn et al. study is interesting (attached) because they show estimated dates of the onset of strip-bark growth. It looks to me as though the growth anomaly of the strip-bark trees relative to the others is more to do with this change than anything else. The onset of a positive growth anomaly in the 1850s is certainly too early to be associated with CO2 increases.

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> I hope this helps the discussion

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> Rob

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> To: Keith Briffa ; Martin Juckes ; Myles Allen

> Cc: anders@misu.su.se ; Eduardo.Zorita@gkss.de ; hegerl@duke.edu ;

> weber@knmi.nl ; t.osborn@uea.ac.uk ; Wilson Rob

> Sent: Thursday, November 16, 2006 1:36 PM

> Subject: Re: Mitrie: Bristlecones

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mail.2006

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> > Although it probably doesn't feel like it, it seems to me you're
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> > From: Martin Jukes [[2]mailto:m.n.jukes@rl.ac.uk]
> > Sent: 10 November 2006 15:24
> > To: anders@misu.su.se; Eduardo.Zorita@gkss.de; hegerl@duke.edu;
> > esper@wsl.ch; k.briffa@uea.ac.uk; Myles Allen; weber@knmi.nl;
> > t.osborn@uea.ac.uk
> > Subject: Mitrie
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>
> > Apart from a couple of oversights in the documentation of the data
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>

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> > McIntyre hasn't come up with much yet. I need to read up a bit more
> on
> > the
> > different Tornetraesk/Fennoscandia series. There was an interesting
> > discussion on "cherrypicking", with contributors suggesting that
testing
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> > effect of removing each proxy series in turn was "cherrypicking" and
> > that
> > selecting series based on subjective analysis of what the series
look
> > like
> > would be much better!
> >
> > I've had a comment from the editor saying that responses to
non-refereee
> >
> > comments are optional, especially if the comments are not relevant
to
> > the
> > paper.
> >
> > cheers,
> > Martin
> >
> >
> >

> --
> Professor Keith Briffa,
> Climatic Research Unit
> University of East Anglia
> Norwich, NR4 7TJ, U.K.
>
> Phone: +44-1603-593909
> Fax: +44-1603-507784
>
> [3]<http://www.cru.uea.ac.uk/cru/people/briffa/>
>
>
>
>

> --
> PD Dr. Jan Esper
> Swiss Federal Research Institute WSL
> Zuercherstrasse 111, 8903 Birmensdorf, Switzerland
> Voice: +41-44-739 2510
> Fax: +41-44-739 2515
> [4]<http://www.wsl.ch/staff/jan.esper>

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1. <http://www.ncdc.noaa.gov/paleo/pubs/salzer2005/salzer2005.html>
2. <mailto:m.n.juckles@rl.ac.uk>
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#####

From: "Rob Wilson" <rob.wilson@ed.ac.uk>
 To: "Martin Juckles" <m.n.juckles@rl.ac.uk>
 Subject: Re: Mitrie: Bristlecones
 Date: Fri, 17 Nov 2006 08:54:54 -0000
 Cc: "Keith Briffa" <k.briffa@uea.ac.uk>, "Myles Allen" <allen@atm.ox.ac.uk>, "Jan Esper" <esper@wsl.ch>, <anders@misu.su.se>, <Eduardo.Zorita@gkss.de>, <hegerl@duke.edu>, <weber@knmi.nl>, <t.osborn@uea.ac.uk>

i>¿

Morning Martin,

It might be worth taking Keith's advice and contacting Malcolm Hughes.

I am not convinced that the Bunn study is fully relevant to addressing the use of BP data from Colorado and California as their study site is Montana. Malcolm gave a presentation earlier this year in Edinburgh which presented updated analyses on his BP work which played down the CO2 influence.

regards

Rob

----- Original Message -----

From: [1]Martin Juckles

To: [2]Rob Wilson

Cc: [3]Keith Briffa ; [4]Myles Allen ; [5]Jan Esper ; [6]anders@misu.su.se ;
 [7]Eduardo.Zorita@gkss.de ; [8]hegerl@duke.edu ; [9]weber@knmi.nl ;
 [10]t.osborn@uea.ac.uk

Sent: Thursday, November 16, 2006 4:41 PM

Subject: Re: Mitrie: Bristlecones

mail.2006

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Page 554

mail.2006

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25. <http://www.wsl.ch/staff/jan.esper>

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#####

From: Malcolm Hughes <mhughes@ltrr.arizona.edu>
To: Martin Jukes <m.n.jukes@rl.ac.uk>
Subject: Re: Bristlecone pines
Date: Mon, 20 Nov 2006 16:59:47 -0700
Cc: Keith Briffa <k.briffa@uea.ac.uk>

<x-flowed>

Martin Jukes wrote:

> Hello Prof. Hughes,

>

> I'm involved in a discussion with Stephen McIntyre about Bristlecone pines,
> which I have used as temperature proxies in a recent work
> (<http://www.copernicus.org/EGU/cp/cpd/2/1001/cpd-2-1001.htm>).

>

> I've read the NAS report section on this issue, and most of the references
> cited in the paragraph about bristlecones. I'm unimpressed by the evidence
> presented to support the idea that these valuable records of past climate
> should be discarded. In particular, the most relevant study appears to be
> that of Bunn et al., and this clearly shows anomalous strip-bark growth
> occurring well before significant atmospheric CO2 rises. Their study used
> whitebark pine, which is clearly not the same as bristlecone, but perhaps
> closer than the orange trees cited by Graybill and Idso.

>

> I'm looking for further literature and if possible data on the issue. Do you
> know of any data on anomalous growth in bristlecone strip-bark pines which is
> available for analysis?

>

> sincerely,

> Martin Jukes

>

Dear Dr. Jukes,

I'm afraid that, apart from the Bunn et al 2003 paper you mention, I know of no other recent literature or data directly relevant to this question. There is a graduate student here working on a dissertation related to this, but neither their data nor any publications on them are available at the moment. Two points concerning Graybill and Idso (1993): 1) I don't think the sour orange trees used in Sherwood Idso's experiments were stripbark - where did this idea come from? 2) when considering the use of upper forest border bristlecone pine (e.g. Sheep Mountain, Campito Mountain, and similar sites mainly above 3100m in the

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relevant region) as temperature proxies it would be a mistake to discount Figure 3 in Graybill and Idso (1993) which is a comparison of a ufb bristlecone pine chronology with a smoothed gridpoint reconstruction from maximum latewood density in quite different trees provided by Keith Briffa, one of your co-authors. I read this graph as confirmation of LaMarche's interpretation of the ufb bcp records as having a ~bidecadal temperature signal combined with an interannual precipitation signal, at least before the 20th century. This is referred to Hughes and Funkhouser (2003).

I hope this helps, Malcolm Hughes
</x-flowed>

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From: Keith Briffa <k.briffa@uea.ac.uk>
To: Malcolm Hughes
Subject: Fwd: Re: Mitrie: Bristlecones In confidence
Date: Tue Nov 21 09:51:52 2006

Malcolm
sorry , I should have cc'd this message sent to my coauthors some time ago(it pre-dates the message to you) , but I was sort of hoping this issue would recede . It would be useful to chat about this and other stuff if you are able to phone (afternoon my time preferably).
Cheers
Keith

Date: Thu, 16 Nov 2006 11:57:09 +0000
To: Martin Juckes <m.n.juckes@rl.ac.uk>, "Myles Allen" <allen@atm.ox.ac.uk>
From: Keith Briffa <k.briffa@uea.ac.uk>
Subject: Re: Mitrie: Bristlecones
Cc: anders@misu.su.se, Eduardo.Zorita@gkss.de, hegerl@duke.edu, esper@wsl.ch, weber@knmi.nl, t.osborn@uea.ac.uk
Martin and all,
I know Franco very well - but he has not worked extensively with the Bristlecones. I still believe that it would be wise to involve Malcolm Hughes in this discussion - though I recognise the point of view that says we might like to appear (and be) independent of the original Mann, Bradley and Hughes team to avoid the appearance of collusion. In my opinion (as someone how has worked with the Bristlecone data hardly at all!) there are undoubtedly problems in their use that go beyond the strip bark problem (that I will come back to later).
The main one is an ambiguity in the nature and consistency of their sensitivity to temperature variations. It was widely believed some 2-3 decades ago, that high-elevation trees were PREDOMINANTLY responding to temperature and low elevation ones to available water supply (not always related in a simple way to measured precipitation) . However, response functions (ie sets of regression coefficients on monthly mean temperature and precipitation data derived using principal components regression applied to the tree-ring data) have always shown quite weak and temporally unstable

associations between chronology and climate variations (for the high-elevations trees at least). The trouble is that these results are dominated by inter-annual (ie high-frequency) variations and apparent instability in the relationships is exacerbated by the shortness of the instrumental records that restrict analyses to short periods, and the large separation of the climate station records from the sites of the trees. Limited comparisons between tree-ring density data (which seem to display less ambiguous responses) imply that there is a reasonable decadal time scale association and so indicate a real temperature signal , on this time scale .The bottom line though is that these trees likely represent a mixed temperature and moisture-supply response that might vary on longer timescales.

The discussion is further complicated by the fact that the first PC of "western US" trees used in the Mann et al. analyses is derived from a mixture of species (not just Bristlecones) and they are quite varied in their characteristics , time span, and effective variance spectra . Many show low interannual variance and a long-term declining trend , up until about 1850 , when the Bristlecones (and others) show the remarkable increasing trend up until the end of the record. The earlier negative trend could be (partly or more significantly) a consequence of the LACK of detrending to allow for age effects in the measurements (ie standardisation) - the very early sections of relative high growth were removed in their analysis, but no explicit standardisation of the data was made to account for remaining slow width changes resulting from tree aging. This is also related to the "strip bark" problem , as these types of trees will have unpredictable trends as a consequence of aging and depending on the precise nature of each tree's structure .

Another serious issue to be considered relates to the fact that the PC1 time series in the Mann et al. analysis was adjusted to reduce the positive slope in the last 150 years (on the assumption - following an earlier paper by Lamarche et al. - that this increasing growth was evidence of carbon dioxide fertilization) , by differencing the data from another record produced by other workers in northern Alaska and Canada (which incidentally was standardised in a totally different way). This last adjustment obviously will have a large influence on the quantification of the link between these western US trees and N.Hemisphere temperatures. At this point , it is fair to say that this adjustment was arbitrary and the link between Bristlecone pine growth and CO2 is , at the very least, arguable. Note that at least one author (Lisa Gaumlich) has stated that the recent growth of these trees could be temperature driven and not evidence of

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CO2 fertilisation.

still
mean The point of this message is to show that that this issue is complex , and I believe the "western US" series and its interpretation in terms of Hemispheric

temperature is perhaps a "Pandora's box" that we might open at our peril!
What does Jan say about this - he is very acquainted with these issues?

cheers

Keith

At 15:01 15/11/2006, Martin Jukes wrote:

Hi,

Concerning Bristlecones, I had a sympathetic reply from Prof. North, but he deferred to the person who wrote the relevant paragraph in the NAS report (Franco Biondi) who is firmly of the view that strip-bark bristlecones should not be used. I've read a few of the articles cited to back up this statement and I am surprised by the extreme weakness of the evidence. There is one study of 27 strip-bark pines which shows that they clearly developed anomalous growth around 1850. Attributing this to CO2 is odd, to say the least. I'm writing a brief review of the literature which I'll send round in a few days time.

cheers,
Martin

On Sunday 12 November 2006 22:21, Myles Allen wrote:

> Although it probably doesn't feel like it, it seems to me you're doing
> rather well...

>

> -----Original Message-----

> From: Martin Jukes [[1]mailto:m.n.jukes@rl.ac.uk]

> Sent: 10 November 2006 15:24

> To: anders@misu.su.se; Eduardo.Zorita@gkss.de; hegerl@duke.edu;

> esper@wsl.ch; k.briffa@uea.ac.uk; Myles Allen; weber@knmi.nl;

> t.osborn@uea.ac.uk

> Subject: Mitrie

>

> Hello,

>

> well, I've had a few exchanges on climateaudit, and decided to leave
> them to
> it for a few days.

>

> I'm going to send an email to Prof. North of the NAS panel to ask if he
> really

> meant "don't use bristlecones", as he is quoted by McIntyre. I believe
> it

> would be incorrect to select sites on the basis of what the data from
> the

> sites looks like, and this makes up a substantial part of the argument
> in

> Graybill and Idso (1993).

>

> Does anyone know where I can get hold of the categorisation of the Sheep

>

> Mountain trees used by Graybill and Idso (ca534.rwl from the WDC for
> paleoclimatology I think) into "strip-bark" and "full-bark"? I've sent
> an

> email to the WDC query address.

>

> I've also sent of for a publication which is cited by co2science as
> using

> Sargasso Sea data with the dating shifted by 50 years (Loehle, 2004,
> Ecological Modelling). This appears to be a source of considerable

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> confusion
> among the climate sceptics. The shifted series fits nicely with the idea
> that
> the Medieval warm Period was warmer than the 20th century, so there is a
>
> widespread perception that it is being ignored to fudge the results.
>
> Apart from a couple of oversights in the documentation of the data files
>
> McIntyre hasn't come up with much yet. I need to read up a bit more on
> the
> different Tornetraesk/Fennoscandia series. There was an interesting
> discussion on "cherrypicking", with contributors suggesting that testing
> the
> effect of removing each proxy series in turn was "cherrypicking" and
> that
> selecting series based on subjective analysis of what the series look
> like
> would be much better!
>
> I've had a comment from the editor saying that responses to non-refereed
>
> comments are optional, especially if the comments are not relevant to
> the
> paper.
>
> cheers,
> Martin
>
>
>

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References

1. <mailto:m.n.juckles@rl.ac.uk>
2. <http://www.cru.uea.ac.uk/cru/people/briffa/>
3. <http://www.cru.uea.ac.uk/cru/people/briffa/>