Comment: 11th Century Cross-dating in Briffa et al. [1995]

The temperature reconstruction for the Polar Urals of Briffa et al.[1], influential in many multiproxy recent climate studies,[2,3,4,5] claimed that the early 11th century was cold and that 1032 was the "coldest year of the millennium". While attempting to verify this claim we examined the cross-dating of tree cores used for early 11th century results. Core replication in the 11th century portion is below minimum dendrochronological quality control standards, and 3 of the 4 cores assigned to the pre-1047 interval cannot be securely dated, implying the proxy series is not usable prior to 1076 at the earliest (5 cores) and preferably 1146, when 10 cores are available.[6] The chronology cannot provide a basis for comparing the 11th century climate to the present.

All tests were carried out on measurement data archived at the World Data Center for Paleoclimatology[7]. First, we ran COFECHA[8], a standard dendrochronological cross-dating tool. Three of 4 cores dated prior to 1047 (cores 862450, 862450 and 862470) were identified as problematic under usual COFECHA diagnostics. Second, we examined the cross-dating working papers kindly supplied by P. Jones (pers. comm.). These working papers showed correlations of individual ring width (RW) and maximum density (MXD) series for each core to their respective master chronologies; the values for these 3 cores were the lowest in the entire corpus of 93 cores. Thirdly, we applied a methodology of Wigley et al.[9], in which each core was tested against the master chronology by calculating the t-statistic under hypothesized start dates sliding from 914 to 1900. Well-dated modern cores have a distinct upspike at the correct date: for example, RW core 862462 has a t-statistic of 14.9 at the correct start date of 1858 and otherwise has absolute values less than 4 (see Figure 1 below), with similar results for MXD statistics. The t-statistics for the questionable cores exhibit no such spikes, instead they are all in the range of incorrectly dated modern cores for both RW and MXD measurements, precluding a secure cross-dating. Fourthly and circumstantially, the dates assigned to these three cores are much earlier than dates for subfossil cores with nearby identification numbers, which are presumably nearby physically as well.

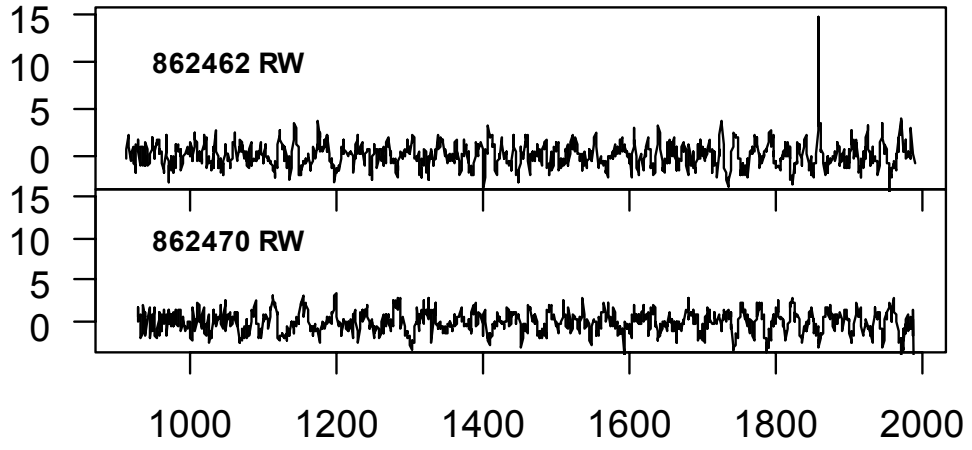

Figure 1. Polar Urals Cross-dating. a) t-statistic for RW measurements from well-dated modern core, showing distinct upspike at correct date; b) same for questionable "early" core. MXD results are similar.

For these reasons, the three cores in question cannot reasonably be assigned to the early 11th century. This makes the earliest usable date for the Polar Urals series at least 1076, when 5 cores are available, or preferably 1146, when 10 cores are available. Since, in several recent studies this proxy series influences the ranking of the 11th century climate to that of the 20th, the inadmissibility of the earliest portion should be noted.

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[1] Briffa, K.R., Jones, P.D., Schweingruber, F.H., Shiyatov, S.G. and Cook, E.R. (1995), *Nature* 376, 156-159.

[2] Jones, P. D., Briffa, K. R., Barnett, T. P. and Tett, S. F. B., (1998), *The Holocene*, 8, 455-471.

[3] Mann, M.E., Bradley, R.S. and Hughes, M.K. (1999), *Geophysical Research Letters* 26, 759-762.

[4] Crowley, T.J. and Lowery, T.S., (2000), *Ambio* 29, 51-54.

[5] Jones, P. D., and Mann, M.E. (2004), *Rev. Geophys.*, 42, RG2002, doi:10.1029/2003RG000143.

[6] Esper, J. and Gärtner, H. (2001), *Erdkunde* 55, 277-287.

[7] Datasets russ021w for ring width and russ021x for maximum density. Editing was required as discussed in the Supplementary Information.

[8] Grissino-Mayer, H. D. (2001), *Tree-Ring Research* 57, 205-221. Software downloaded from http://www.ltrr.arizona.edu/pub/dpl/.

[9] Wigley, T.M.L., Jones, P.D. and Briffa, K.R. (1987), *J. Arch. Sci.* 14, 51-64.