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COMMUNICATING CLIMATE SCIENCE AND THOUGHTS ON CLIMATEGATE

Kevin E Trenberth*
NCAR, Boulder, CO 80307

1. INTRODUCTION: CLIMATEGATE

This article briefly summarizes my views that have formed in recent years on communicating climate change in the light of first hand experiences in so-called "climategate". The latter term refers to the emails and personal information about individuals, including me, that were illegally taken from the University of East Anglia through a hacking incident. The material published relates to the work of the globally-respected Climatic Research Unit (CRU) and other scientists around the world. The selective publication of some stolen emails taken out of context and distorted is mischievous and cannot be considered a genuine attempt to engage with the climate change issue in a responsible way. Instead there should be condemnation of the abuse, misuse and downright lies about the emails: that should be the real climategate!

I was involved in just over 100 of the hacked email messages. In my case, one cherry-picked email quote went viral and at one point it was featured in over 110,000 items (in Google). Here is the quote: *"The fact is that we can't account for the lack of warming at the moment and it is a travesty that we can't."* It is amazing to see this particular quote lambasted so often. It stems from a paper I published bemoaning our inability to effectively monitor the energy flows associated with short-term climate variability. It is quite clear from the paper that I was not questioning the link between anthropogenic greenhouse gas emissions and warming, or even suggesting that recent temperatures are unusual in the context of short-term natural variability. But that is the way a vast majority of the internet stories and blogs interpreted it.

Corresponding author: Kevin E Trenberth, NCAR, PO Box 3000, Boulder, CO 80303.
Email: trenbert@ucar.edu

Several of the emails document the detailed procedures used in the Intergovernmental Panel on Climate Change (IPCC) AR4 Fourth Assessment report for Chapter 3 (for which Phil Jones and Kevin Trenberth were coordinating lead authors) and other chapters. In a hacked email from Phil Jones (not cc'd to me), he wrote: "*I can't see either of these papers being in the next IPCC report. Kevin and I will keep them out somehow – even if we have to redefine what the peer-review literature is!"* AR4 was the first time Jones was on the writing team of an IPCC Assessment. The comment was naïve and sent before he understood the process and before any lead author meetings were held. It was not sanctioned by me. Both of the papers referred to were in fact cited and discussed in the IPCC. As a veteran of 3 previous IPCC assessments I was well aware that we do not keep any papers out, and none were kept out. We assessed all papers even though not all could be included owing to space limitations. Moreover, the extensive review process, which is a hundred times more rigorous than that for any individual paper, brought to our attention any papers we may have missed.

Three investigations of the alleged scientific misconduct of the Climate Research Unit at the University of East Anglia — one by the UK House of Commons Science and Technology Committee, a second by the Scientific Assessment Panel of the Royal Society, chaired by Lord Oxburgh, and the latest by the Independent Climate Change E-mails Review, chaired by Sir Muir Russell — have confirmed what climate scientists have never seriously doubted: established scientists depend on their credibility and have no motivation in purposely misleading the public and their colleagues. Moreover, they are unlikely to make false claims that other colleagues can readily show to be incorrect. They are also understandably (but

inadvisably) reluctant to share complex data sets with non-experts that they perceive as charlatans (Hasselman 2010).

Scientists make mistakes and often make assumptions that limit the validity of their results. They regularly argue with colleagues who arrive at different conclusions. These debates follow the normal procedure of scientific inquiry. The IPCC assessments are a means of taking stock and avoiding some of the "noise" created by the different approaches and thereby providing conservative but robust statements about what is known and what is not.

2. THE DENIERS

But their critics are another matter entirely, and their false claims have not been scrutinized or criticized anything like enough! Perhaps climategate comes from the somewhat inept response of climate scientists to criticisms from various sources. The climate change deniers have very successfully caused major diversions from the much needed debate about what to do about climate change and how to implement it. It is important that climate scientists learn how to counter the distracting strategies of deniers. Debating them about the science is not an approach that is recommended. In a debate it is impossible to counter lies, and caveated statements show up poorly against loudly proclaimed confident statements that often have little or no basis. Scientific facts are not open to debate and opinion because they are evidence and/or physically based. Moreover a debate actually gives alternative views credibility. On the other hand there is a lot of scope for debate about exactly what to do about the findings.

3. THE MEDIA

The media have been complicit in this disinformation campaign of the deniers. Climate varies slowly and so the message remains similar, year after year — something not exciting for journalists as it is not "news". Controversy is the fodder of the media, not truth, and so the media amplify the view that there are two sides and give unwarranted attention to views of a small minority or those with vested interests or ideologies. The climate deniers have been successful in by-passing peer review yet attracting media attention. In those respects the media are a part of the problem. But they have to be part of the solution.

4. THE SCIENTISTS

The main societal motivation of climate scientists is to understand the dynamics of the climate system (both natural and human induced), and to communicate this understanding to the public and governments. Most climate scientists have the goal of establishing the best information about the state of affairs as a basis for subsequent discussion about what to do about it: policy relevant but not policy prescriptive. They have faith in the scientific method and the efficacy of the established peer-review process in separating verifiable scientific results from baseless assertions. They find it disturbing that blogs by uninformed members of the public are given equal weight with carefully researched information backed up with extensive observational facts and physical understanding.

While statements about climate change are cautious and all sorts of caveats are applied by scientists, or else they are criticized by colleagues, the same is not true for the deniers. Many scientists withdraw from the public arena into the Ivory Tower after being bruised in skirmishes with the public via the press. Others are diverted from their science to address the concerns. There is continued pressure to do policy relevant but not policy prescriptive science. Scientists who cross the line to being advocates for courses of action are often perceived as pariahs by their colleagues because their science is potentially biased.

Many scientists also do not help with regard to communicating the role of global warming in climate. Prior to the 2007 IPCC report, it was appropriate for the null hypothesis to be that "there is no human influence on climate" and the task was to prove that there was. The burden of proof is high. In general in this case, scientists assume that there is no human

influence and to prove that there is requires statistical tests to exceed the 95% confidence level (5% significance level) to avoid a chance finding of a false positive. To declare erroneously that the null hypothesis is not correct is called a type I error, and the science is very conservative in this regard about making such an error. Scientists are thus prone to make what are called type II errors whereby they erroneously accept the null hypothesis when it is in fact false.

Given that global warming is "unequivocal", to quote the 2007 IPCC report, the null hypothesis should now be reversed, thereby placing the burden of proof on showing that there is no human influence. Such a null hypothesis is trickier because one has to hypothesize something specific, such as "precipitation has increased by 5%" and then prove that it hasn't. Because of large natural variability, the first approach results in an outcome suggesting that it is appropriate to conclude that there is no increase in precipitation by human influences, although the correct interpretation is that there is simply not enough evidence (not a long enough time series). However, the second approach also concludes that one cannot say there is not a 5% increase in precipitation. Given that global warming is happening and is pervasive, the first approach should no longer be used. As a whole the community is making too many type II errors.

So we frequently hear that "while this event is consistent with what we expect from climate change, no single event can be attributed to human induced global warming". Such murky statements should be abolished. On the contrary, the odds have changed to make certain kinds of events more likely. For precipitation, the pervasive increase in water vapor changes precipitation events with no doubt whatsoever. Yes, all events! Even if temperatures or sea surface temperatures are below normal, they are still higher than they would have been, and so too is the atmospheric water vapor amount and thus the moisture available for storms. Granted, the climate deals with averages. However, those averages are made up of specific events of all shapes and sizes now operating in a different environment. It is not a well posed question to ask "Is it caused by global warming?" Or "Is it caused by natural variability?" Because it is always both. It is worth considering whether the odds of the particular event have changed sufficiently that one can make the alternative statement "It is unlikely that this event would have occurred without global warming." For instance, this probably applies to the extremes that occurred in the summer of 2010: the floods in Pakistan, India, and China and the drought, heat waves and wild fires in Russia.

Another point is that we have substantial natural climate variability from events like El Niño and La Niña. Given that global warming is always going in one direction, it is when natural variability and global warming reinforce one another that records are broken and extremes occur. This takes place with warming in the latter part of and shortly after an El Niño event, for instance, as has happened in 2010.

When asked about what could and should be done about climate change, many scientists back away for fear of being labeled advocates. However, scientists should note that the IPCC strives to carry out policy relevant but not policy prescriptive science assessments, with considerable success. Given the physical science findings, what are the ramifications for society and the environment? It is important for scientists to recognize that Working Group II of IPCC deals extensively with the past and future expected impacts of climate change, the vulnerabilities that exist, and the adaptation and coping strategies for dealing with these. Similarly, Working Group III deals with options for mitigating the problem by reducing future emissions of greenhouse gases. Scientists should recognize that these options exist and, to the extent they are familiar with them, state what they are. Scientists should also be aware of the national and international discussions and negotiations underway to address the problem. Putting a price on carbon, carbon taxes and offsets, and cap and trade systems can be discussed in a neutral way to inform the public.

Personally, I close this aspect of my presentations with a statement that "*you will be*

affected by climate change, and you already are, whether you believe it or not. But more than that, you will be affected by the outcomes of legislation and international treaties, perhaps even more!" As an example of misguided legislation one can point to the subsidies for production of ethanol from corn in the United States which produces marginal gains in fuel without adequately accounting for the damage to soils and other environmental aspects, and effects on the food supply.

5. THE POLITICIANS

The argument is that to make decisions, all aspects of the problem must be taken into account and it is the politicians who are supposed to do this, not the scientists, in order to represent all interests. My own observation is that while some politicians are indeed well informed and understand their role, most are not. The corrupting influence of funding from all sources of vested interests prevents many of them from doing the right thing on behalf of the country and civilization as a whole. It is clear that climate science has become politicized, and scientists are slow to recognize this. Politicians hide behind the apparent uncertainties and have failed to act. Hence while politicians are often also part of the problem, implementation of policies necessarily goes through them.

In the days of hundreds of TV channels and the internet, people do not have to hear "inconvenient truths" and become informed. As scientists we can continue to try with our message of what is happening and why, what is expected in the future, and what options there are to change the outcome, but we need to do more.

6. WHAT CAN BE DONE?

Environmental groups and one segment of scientists have focused on what is called "mitigation" that aims to reduce emissions of greenhouse gases and slow and ultimately stop climate change in its tracks. Decarbonizing the economy is very important for many reasons, not the least of which is climate change. However, by itself, I view this as short-sighted, as the steps required are so revolutionary as to be highly unlikely to be achieved. Instead, we must recognize that while there is considerable merit in slowing the pace of climate change, and we should work to reduce emissions, it is also essential that much stronger steps be taken to plan for and adapt to the change that is surely coming. How we cope with challenges ahead and build more resiliency in our system, are major questions that should be higher on the agenda.

The major failures in making progress, such as in Copenhagen in December 2009, imply that we should be more accepting that climate disasters are inevitable, along with environmental refugees, and so what are we going to do with them? Some steps in this direction were taken in the recent meeting in Cancun. It is too bad if success means that we are able to limit the outcome to an ongoing series of environmental disasters that inevitably happen locally as hurricanes strike, heat waves and wild fires take their toll, droughts cause famine, and water shortages or flooding (ironically — in different places, or different times) cause mayhem. The summer of 2010 with floods in Pakistan, India, and China, and devastating drought, heat waves and wild fires in Russia, is a case in point. Indeed, 2010 provided many such examples from the New England flooding and "Snowmageddon" in the Washington D.C. area in February and March to the flooding in California associated with a "Pineapple Express" of moisture from extending from the Hawaiin Islands to California in December. Growth of these disasters into a major catastrophe, war and strife, is something to be avoided if at all possible, but it is likely where we are headed.

The growing population and demands for higher standards of living mean that the planet is already over-populated, and far too many things are simply not sustainable in anything like their current form. The atmosphere is a *global commons*, shared by all. As we continue to exploit it and use it as a dumping ground, the outcome is the "tragedy of the commons" and we all lose. Unfortunately, society is not ready to

face up to these challenges and the needed changes in the way we create order and govern ourselves. Population issues are largely missing from the discussion, such as it is. Nonetheless, a number of pragmatic steps are possible, but they require planning for decades ahead, not simply the time until the next election.

Building a better observing system for ***climate***, better climate and earth system models and predictions, and the associated improved information system and climate services is one essential step (Trenberth 2008) as it reduces uncertainties, but uncertainties and natural variability are never going away. Nevertheless, the natural variability provides valuable opportunities for ongoing "news" and education, as teachable moments, but many scientists have not been helpful, and many TV weathercasters are poorly informed and sometimes downright hostile (Wilson 2009).

It continues to be frustrating at how difficult it is to find out just what has happened and the context from US government sources. Ironically, it is easier to find a forecast (e.g., http://www.cpc.noaa.gov), than it is to find and analysis and assessment of what has happened and why. Waiting 6 years for the next IPCC report is not an option. The media continue to report highly misleading material about how cold outbreaks, snow events, or one cold month nullifies global warming when the big picture continues to indicate otherwise.

Routine climate services and regular assessments of the state of the climate and the short-term prognosis as part of a climate service, much as is done for weather forecasts, is an essential development. At present this is being approached at best in a piecemeal fashion, and the needed investment is not available. It should be a high priority and linked to any climate legislation on mitigation and adaptation.

Climate change is a complex and multifaceted problem, involving not just the environment, but also energy, water, sustainability, the economy, foreign policy and trade, security and defense. Far too little is happening on all fronts: communicating and informing the public, reducing emissions and building new energy infrastructure by decarbonizing the economy (mitigation), and planning to cope with future climate change and its consequences.

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