**Climate sceptics: Game over**

My recent paper in *Climate Dynamics* hit a raw nerve. Its conclusion – that the probability of global warming being caused by natural factors is negligible – sparked an outcry from climate-change deniers.

Within hours of the paper’s findings being disseminated online, one leading contrarian, Lord Christopher Monckton of Brenchley, had deliciously dignified it as “a mephiticly ectoplasmic emanation of the forces of darkness.” A few days later, a Calgary-based group with the Orwellian name “Friends of Science” dismissed my study’s conclusion and called on McGill University’s chancellor to retract the university’s press release about it.

I could understand the critics’ consternation: After years of fighting a losing rear-guard battle against virtually the entire scientific community, they were retrenched behind a seemingly impenetrable line of defense: their assertion that the numerical models predicting the warming are wrong, and that the warming is natural. Now, their fortress has been demolished.

For decades scientists have done their best to prove the hypothesis that the warming is human-made. In September’s fifth Assessment Report (AR5), the International Panel on Climate Change concluded that it is “*extremely* *likely* that human influence has been the dominant cause of the observed warming since the mid-20th century” –- strengthening its 2007 assessment that this was “likely.” The new approach changes the game by taking the opposite strategy. Rather than try to prove that anthropogenic warming is correct, it proves that natural warming is incorrect: that it has such a tiny probability – less than 1% - probably less than 0.1% - that it can be dismissed. The beauty here is that whereas no scientific theory can every proved to be true beyond reasonable doubt, a single decisive experiment *can* disprove a theory, in this case that the warming is natural. Even better, the disproof doesn’t need supercomputers -- only data and a little nonlinear geophysics. Without natural variability to fall back on, the only way to avoid the conclusion that the warming is human-made is to invoke a third alternative, a miracle-type hypothesis of the sort “let’s temporarily suspend the laws of physics”.

The results of my study depend on two sets of temperature data: the first is made up of industrial-period, instrument-based estimates of global temperatures since 1880 showing an industrial epoch warming of about 0.9 oC; the second draws on global scale pre-industrial paleotemperature reconstructions (from tree rings, boreholes, ice cores, etc.) from 1500-1900 and shows that 125-year change of this amplitude has a negligible probability.

The initial denial counter-attack was predictable: discredit the data. However, over the last few years it has become increasingly clear that the instrumental temperatures are actually pretty reliable: series with diverse methodologies and sources well agree with each other.

Similarly, ever since temperature reconstructions first appeared in 1998, the deniers have vilified them because they indicate that today’s global temperatures are the highest experienced in the last millennium. Deniers mistakenly think that if they could establish that today’s temperatures are lower than in the 13th century - during the so-called “medieval warming event” – that this would somehow prove that the recent warming is natural.

In fact, whether or not 13th century British peons were roasting is irrelevant. What my study shows is that the 125-year *change* in temperature from 1880-2004 was so large that its probability of being natural was negligibly small. If the temperature changes are slow enough, however, there is nothing stopping the changes from becoming large over longer periods. The probability estimate of 0.1% applies only to 125-year intervals – not to the 500-1000 year scales of relevance to the medieval peons. And, for 125 years changes, the paleo data are indeed highly reliable. Finally, my conclusions apply to changes in the global temperature: obviously local and regional temperatures can change by much more than the global average.

While there’s no point in waiting for the hard-core deniers to surrender, it’s time to recognize that there are no longer any intellectually defensible alternatives to anthropogenic warming. Let’s stop the pretence that deniers are just sceptics and that there is any substance to this debate.

The game is over, we need to move on.

Where does this leave us? The axing of the Canadian Fund for Climate and Atmospheric Science (CFCAS) in 2011 undermined Canadian climate research. For example, my work was unfunded and was only possible thanks to the existence of open foreign data bases. The CFCAS demolition is symptomatic of our government’s priorities. Rather than trying to better understand and protect our fragile boreal environment, northern investment has focused on new military installations. Rather than making bold initiatives in carbon free energies, the government has shamelessly promoted the dirtiest fuels for the richest multinationals. Rather than supporting international efforts to limit climate damage – no matter how imperfect - it has reneged on its Kyoto responsibilities and has sabotaged international cooperation.

We need a future.

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