

The storm that spilled out of the teacup

Hacked emails from the University of East Anglia's Climatic Research Unit have generated much more heat than light. **Simon Evans** reports

Whether you call it "Climategate" or "CRU-hack" one subject dominated the headlines in the run up to Copenhagen – and that probably is not a coincidence. On 17 November more than 1,000 emails and thousands of other files from servers at the University of East Anglia's Climatic Research Unit (CRU) were made publicly available on the web.

In the following days and weeks climate sceptics claimed to have found evidence of data manipulation, malpractice and more in correspondence involving CRU's director, Professor Phil Jones, and other prominent climate scientists.

"It appears from the details of the scandal that there is no relationship whatsoever between human activities and climate change," Saudi Arabia's lead Copenhagen negotiator Mohammed Al-Sabban told the BBC. He maintained governments would not be willing to agree to emissions cuts without new evidence proving the scientific picture is "settled".

The UK's energy and climate secretary Ed Miliband saw things differently. "The science is clear and settled," he told a pre-Copenhagen press briefing.

They cannot both be right. It turns out neither are.

Mr Al-Sabban is wrong because, as Mr Miliband puts it, one set of emails do not undo decades of climate science. There is no need to take his word for it: the University of East Anglia has announced an independent review of the matter during which Professor Jones is standing down as CRU director. It should report next spring.

But Mr Miliband is wrong to say the science is settled. It cannot be so, by its very nature. "If science ever stops asking questions it

stops being science and becomes dogma," says UEA's Professor Mike Hulme, founding director of the UK's Tyndall Centre for Climate Change Research.

It might not make for such a good soundbite but Mr Miliband should beware of overstating or oversimplifying the case. The problem with human nature is we just cannot help doubting statements that sound a little too certain.

To set all this in context, it is worth reminding ourselves of the logic of climate change. Thanks to heat-trapping gases in the atmosphere such as carbon dioxide and water vapour, Earth has a natural greenhouse or 'Goldilocks' effect. It ensures the temperature is not too cold (like Mars) not too hot (like Venus) but just right.

Humans have been adding to the greenhouse effect, mainly by burning fossil fuels and destroying forests. For more than a century this has been predicted to lead to warming. Warming has indeed been observed, especially in the past 50 years.

Using the best scientific understanding of natural causes of warming such as solar activity, cosmic rays, orbital wobbles, tectonic shifts and volcanoes, supercomputer-based climate models cannot match recent warming.

Once observed increases in greenhouse gases are added in, measured temperatures and models match. This, in a nutshell, leads to the conclusion that our emissions caused recent warming and further emissions will add to more warming.

Sincere convictions

On the basis of the hacked CRU files, sceptics – whether they have read them or just read about them – are arguing as follows: global warming has stopped; global warming has been fabricated through manipulated temperature data; climate scientists colluded to exclude sceptical voices from the debate or prevent access to data; climate data has been destroyed.

There is a large, vociferous community who believe human-induced greenhouse gas emissions are not changing the climate. They passionately want the rest of the world to know this and the media, internet and blogosphere give them the means to do so. To portray them as merely the creation of lobbying and propaganda by fossil-fuel interests is a mistake – though some, like Mr Al-Sabban, have an obvious interest in coal, oil or gas. Most sceptics are sincere in their beliefs but very few are climate change scientists.

The 'Climategate' hacking was a tremendous coup for the sceptics in the run-up to the UN climate summit in Copenhagen. It seems likely its timing was planned for just that reason.

CONDENSER

- Thousands of hacked emails from the University of East Anglia's Climatic Research Unit were released on the web in the run up to Copenhagen climate summit.
- Sceptics say the emails scotch climate science.
- Allegations include that these emails reveal a coverup to hide global cooling, data tampering to fabricate global warming and manipulation of the peer review process.
- The emails reveal nothing of the sort. The global warming trend observed in recent decades continues and humanity is still very likely the cause.



Bristlecone pines: the width of growth rings in long-lived trees have helped climate scientists estimate past temperatures

Before it happened, opinion polls had already shown that the public believe there is far less consensus among scientists on man-made climate change than actually exists. This is, at least in part, due to the media's twin appetites for controversy and 'balance'. The hacked emails and files, or rather the press coverage they whipped up, can only add to those public doubts.

The effect may not endure. Certainly mainstream media interest in Climategate was dwindling as ENDS went to press. But it is unfortunate that some of the wilder allegations about bad behaviour and bad faith on the part of climate scientists have gained credibility simply through uncritical repetition in the media. The BBC, too, has mistakenly added fuel to the fire (more on this later).

The findings of UEA's enquiry next spring lie several months in the future. In the meantime, ENDS has dissected some of the most egregious email quotes and the background to them. None of them give any reason to question the fundamentals: climate change is happening, humanity is very likely the cause, it is going to accelerate.

What the emails do show is a somewhat dismissive attitude towards the sceptics, a sense of what some have called 'tribalism' among the climate science community. "My colleagues and I accept that some of the published emails do not read well," Professor Jones said in an interview with the Press Association.

Some of the exchanges are certainly unedifying. We might like to imagine that the pursuit of scientific truth takes place in a rarefied atmosphere without bias, animosity and personality intruding. But that has never been the case, as even a casual reading of Newton's correspondence would show.

One area where there should be no doubt at all is in records of global average temperature. In its 2007 fourth assessment report

(AR4), the Intergovernmental Panel on Climate Change (IPCC) said "warming of the climate system is unequivocal".

This is strong stuff: IPCC reports are a forest of "more likely than nots" and "likelysts". Despite this, some people contend temperatures have been declining over the past decade and one of the CRU emails seems to play right into their hands.

"No individual is in a position to change conclusions or exclude relevant peer-reviewed literature from an IPCC assessment report"

IPCC working group

"Where the heck is global warming?" asks Kevin Trenberth, head of climate analysis at the US National Centre for Atmospheric Research. He goes on to write "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."

This sounds pretty damning from one of the lead authors of AR4. Except the first quote is taken out of context, and in fact reads: "I have my own article about where the heck is global warming?"

In that article, Dr Trenberth writes: "While a long-term trend is for global warming, short-term periods of cooling can occur and →

have physical causes associated with natural variability. However, such natural variability means that [heat] energy is rearranged or changed within the climate system, and should be traceable.”

It is this movement of energy that cannot be traced and Dr Trenberth is arguing for improvements in Earth observation systems that track heat as it moves between space, atmosphere, the Earth’s surface and deep or surface ocean waters.

If the Earth’s surface gets cooler the energy has not simply disappeared. Trenberth’s travesty is that we cannot yet say where it has gone with enough accuracy.

Even if Dr Trenberth does not agree, the idea that global warming has stopped still gets plenty of air time. A common ploy is to plot temperatures starting with the warmest year on record, 1998, up to 2008, which was only the tenth warmest. This seems to show a temperature plateau, if not outright decline.

“One irony is that the hockey stick... only played a peripheral role in the case for a human influence on recent climate change”

Myles Allen, University of Oxford

In its latest attempt to counter the argument, the Met Office has released a chart showing global temperature averages for each decade since the 1850s (see figure). It shows every decade since the 1950s has been warmer than the last and the ‘noughties’ are the warmest yet.

But some sceptics go further and question the temperature data itself. The CRU and the Met Office’s Hadley Centre maintain HadCRUT, a series of global average temperatures starting from 1850.

Individual readings are taken at thousands of weather stations around the world, compiled by national meteorological services and sent to CRU. A simple average of this ‘raw’ station data would be biased towards the temperature of regions with lots of weather stations. It would suffer inconsistencies from changes in thermometer technology and reader error. New buildings erected near the station could increase local temperatures.

All these factors must be taken into account and adjusted for. CRU has made subjective choices on how to do this and has published papers describing what they were.

Were the adjustments made appropriate? Could the CRU have manipulated procedures to show warming where there was none? Did CRU throw out the raw data, perhaps to cover its tracks?

People wanted answers. In one of the hacked emails, Professor Jones writes that sceptics “have been after the CRU station data for years. If they ever hear there is a Freedom of Information (FOI) Act now in the UK, I think I’ll delete the file rather than send to anyone.”

In fact, CRU received 58 FOI requests for the data in a single five-day period this summer, according to an August report in the leading science journal *Nature*. Yet more than 95% of the raw data in question has been accessible for years, the university has pointed out. The rest are subject to confidentiality agreements with the source countries who want to sell the information.

Back in August, Professor Jones told *Nature*: “We’re trying to make them all available.” And of course the CRU and Met Office are now working double time to secure agreements so they can

publish the lot. Meanwhile, the Met Office has publicly released a globally representative subset of the station data.

The CRU says “no record has been deleted”. For his part, Professor Jones told the Press Association: “We’ve not deleted any emails or data here at CRU. I would never manipulate the data one bit – I would categorically deny that.”

But what of the raw data processing? Bloggers have been busily dissecting one of the hacked files named “harry_read_me.txt”. The file is said to contain poor-quality code, software bugs, “fudge factors” and frank admissions from the author “that my abilities are short of what’s required here”.

BBC 2’s *Newsnight* of 3 December ran the story, describing the file as “the source code for the CRU”. Surely, here was evidence the temperature data had been fiddled. A software engineer was asked if he would be comfortable “betting billions or trillions of dollars on the basis of this code”. He said no, because it held errors that would mean “data is being lost”.

This sounds bad, possibly fatal to CRU’s credibility. Except this code was not used to create the HadCRUT temperature dataset. The Met Office plans to publish the genuine article shortly.

Overwhelming evidence

As it happens, none of this really matters. We could throw out HadCRUT at a stroke and it would have little impact. Another two independent temperature records maintained in the US show near-identical warming trends.

On top of this, numerous completely separate lines of evidence support the existence of global warming. The Arctic is warming, its sea ice is thinning and retreating. Sea level is on the rise. Glaciers are melting at an accelerating rate. Spring is arriving sooner. Treelines are advancing up mountainsides. And fish are migrating to deeper, cooler depths or more northerly latitudes.

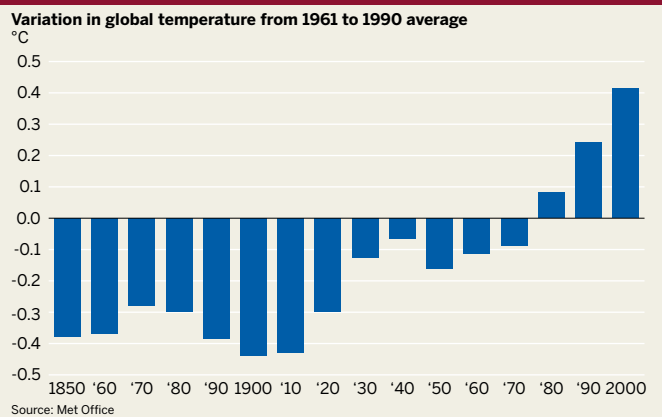
The sceptics, and a substantial proportion of the public, believe these changes are natural and not humanity’s fault. The climate scientists, backed by their computer simulations of the workings of the atmosphere, land and oceans, say they are wrong – it is us.

Why should anyone believe in the predictions of immensely complex computer models? Because they do an excellent job of simulating the Earth’s climate to date. And, perhaps, because we already depend on all manner of computer simulations for our lives, livelihoods and the smooth functioning of our society.

In another frequently cited email, Professor Jones writes: “I’ve just completed [Michael Mann’s] *Nature* trick... to hide the decline.” This is supposed to be further incriminating evidence that recent global cooling has been concealed.

Once again the reality is both more mundane, and more complex. There are no direct records of temperature from before the

A CENTURY OF WARMING



thermometer was invented. Scientists use so-called proxy records instead. Some of the longest proxies come from ice cores. Clues to past temperatures are revealed in the ratio of oxygen isotopes trapped in air bubbles in the ancient ice.

Here, Professor Jones is talking about tree-ring data. Trees tend to grow faster when it is warmer in summer, so the width of successive tree-rings is a proxy for summer temperatures.

In one tree-ring record compiled by Professor Keith Briffa, also at UEA, there is an unexplained decline in these proxy temperatures after about 1960 – in the real world temperatures kept steady or rose. This mismatch is what Professor Jones sought to “hide”. Professor Briffa himself pointed out the decline in a 1998 *Nature* paper and said it made the proxy unreliable for recent years.

It seems ludicrous to suggest these trees truthfully represent an actual decline in temperature while all other records including thermometers are faulty, so something else must be going on. No one is sure what this is; one suggestion is that it reflects stunted growth due to air pollution.

For some, there is a bigger issue at stake. The divergence between tree-ring proxy and thermometer readings calls into question the reliability of proxies in general and the famous ‘hockey stick’ graph in particular – a version of which was used in Al Gore’s film *An Inconvenient Truth*. It shows recent temperatures are unprecedented in at least the past two millennia, bending abruptly upwards like the end of a hockey stick.

Another, developed by climatologist Michael Mann at Penn State University, has attracted much criticism and a full-blown US National Academy of Sciences inquiry demanded by the US congress. It is often described as crucial to the case that humans are causing global warming.

Sceptics say it was warmer 1,000 years ago during the medieval warm period, when vineyards supposedly thrived in northern England and the Vikings farmed in Greenland. If it was warmer then, when our greenhouse gas emissions were negligible and atmospheric CO₂ levels were lower, surely warming today is again due to natural variability. Humans have nothing to do with it.

But this is a non-sequitur. Even if it was much warmer around 1,000AD (and there is no scientific consensus that it was) that does not mean raised CO₂ levels are not causing warming now.

“One irony in all this is that [the hockey stick] was never a central piece of the evidence,” says Myles Allen, head of the climate dynamics group at the University of Oxford. “It only ever played a peripheral role in the case for a human influence on recent climate change.”

This case is based on the work of thousands of scientists and has many threads, woven together into successive IPCC assessment reports. Here too, say the sceptics, the nefarious hand of CRU’s Professor Jones has been at work. He stands accused of snipping the threads he did not like, having written in one email: “I can’t see either of these papers being in the next IPCC report. Kevin [Trenberth] and I will keep them out somehow – even if we have to redefine what the peer-reviewed literature is!”

Regardless of what Professor Jones wrote, the two papers in question were duly cited and discussed in IPCC AR4. In a post-Climategate statement standing by their findings in AR4, the IPCC’s working group on the physical science basis of climate change said “no individual is in a position to change conclusions or exclude relevant peer-reviewed literature from an IPCC assessment report”.

IPCC chair Rajendra Pachauri has said his organisation would review the CRU emails but emphasised “this is not an investigation”.

That is being left to the independent review set up by UEA. The House of Commons Science and Technology Select Committee has



On the record: glaciers are melting at an accelerating rate

weighed in too, asking UEA for an account of events, a description of the investigation and assurances no data has been lost.

Several Republican politicians in the US have called for congressional hearings into the affair. One, Wisconsin representative James Sensenbrenner told a 2 December committee hearing that the hacked emails revealed “a massive international scientific fraud” and complained of “scientific McCarthyism”. Worse, he saw “increasing evidence of scientific fascism”.

Ideological debate

All this serves to show the extent to which climate science has become a proxy for a wider debate about ideologies. “I’d like to see the really important questions raised by climate change being brought firmly into the domain of politics and ethics,” says UEA’s Professor Hulme.

Former Republican vice-presidential candidate Sarah Palin called on US president Barak Obama to boycott the Copenhagen summit because it “will be more about politics than science”. Which is as things should be; Copenhagen was meant to work out what to do about man-made climate change.

Concerns over ‘big government’ responses to the challenge and the ethics of discounting future generations’ well-being are all vital to the debate, but have nothing to do with climate change science.

Politicians, business and the public will have to come to terms with making decisions under conditions of uncertainty because science does not deal in absolutes. The IPCC has said we are “very likely” the cause of the recent observed warming. But “very likely” means only 90% certain.

When it comes to predicting the impacts of a certain degree of warming or finding an emissions path to stay below that level, the uncertainty only increases.

“Actually the state of climate knowledge has been remarkably stable over the last 20 years,” IPCC vice-chairman Jean-Pascal van Ypersele told the BBC.

Holding out the enticing prospect of ever better predictions from ever more complex models is a false promise, says Professor Hulme, because the Earth is so complex that some uncertainties are irreducible. More precise predictions will not in any case necessarily make for easier choices.

Mr Miliband has said: “The science demands we act.” Well no, it does not, and it can not. That is the job of leaders, politicians, campaigners and the public. All science can do is give us a good idea of what might happen if we do not act, and if we do. ■

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