This is the print version of the Skeptical Science article 'CRU tampered with temperature data', which can be found at http://sks.to/tamper.

Did CRU tamper with temperature data?

What The Science Says:
The Independent Climate Change Email Review went back to primary data sources and were able to replicate CRU's results. This means not only was CRU not hiding anything, but it had nothing to hide. Though CRU neglected to provide an exact list of temperature stations, it could not have hid or tampered with data.

Climate Myth: CRU tampered with temperature data
"So recently the media picked up on the fact that CRU deleted the raw data for this important global temperature set long ago. We have known this for some time now. The interesting point is that it also seems each time they come across a new dataset it is simply replaced. So what we have is a process which allows the systematic choosing of ever warmer records over time which is so convoluted nobody can figure out what really happened." (The Air Vent)

Exhibit No. 1 of the climate conspiracy theory is a collection of emails stolen from the Climatic Research Unit (CRU) of the University of East Anglia (UEA), which appeared on the internet in November 2009. Though some of these "Climategate" emails can sound damning when quoted out of context, several inquiries have cleared the scientists. The most comprehensive inquiry, the Independent Climate Change Email Review, did something the media completely failed to do: it put the emails into context by investigating the main allegations. Its general findings (summarised here) were that the scientists' rigour and honesty are not in doubt, and their behaviour did not prejudice the advice given to policymakers, though they did fail to display the proper degree of openness.

One set of allegations against CRU concern its main area of research, the instrumental temperature record CRUTEM. The CRUTEM analysis is very similar to those produced by independent groups such as NASA's Goddard Institute for Space Studies (GISS) and NOAA's National Climatic Data Center (NCDC). Nevertheless, the contrarians allege that CRU manipulated data to fabricate a global warming trend; that CRU prevented critics from accessing the raw data and other information required to check its conclusions; and that CRU director Phil Jones failed to admit having cited fraudulent data twenty years ago. Thus they claim CRUTEM cannot be trusted.

To create the CRUTEM surface temperature analysis, CRU scientists take temperature data from 4,138 stations, and for each station they calculate the mean temperature for 1961-1990 and temperature anomalies relative to that period. They then arrange all this data into a 5x5 degree grid. This process requires that adjustments be made to account for sources of error such as changing station locations or urban heat island effect.

Following Climategate, several amateur climate bloggers have attempted their own analyses of global temperature trends, and arrived at very similar results to CRU, GISS, and NCDC. The Review took a similar approach, going back to primary sources and obtaining raw station data to see if it was possible for critics to replicate CRU's results. They were able to acquire as much data as necessary from both the Global Historical Climatology Network (GHCN) and the National Centre for Atmospheric Research (NCAR). They proceeded to write the computer code needed to analyse the data in the space of two days, without requiring any information from CRU.

Thus the Review demonstrated that CRU was not hiding anything: sufficient data was available to replicate CRU's results, and any competent researcher would be able to analyse it.

Furthermore, they had nothing to hide: both adjusted and unadjusted data yielded very similar results to CRUTEM, and CRU's homogenisation adjustments make no significant difference to the global average. Although the Review stopped short of drawing scientific conclusions, it appears that CRU's conclusions are robust.

Based on this, the Review concluded (its emphasis):

> **CRU was not in a position to withhold access to [temperature] data or tamper with it**. We demonstrated that any independent researcher can download station data directly from primary sources and undertake their own temperature trend analysis.
>
> **On the allegation of biased station selection and analysis, we find no evidence of bias**. Our work indicates that analysis of global land temperature trends is robust to a range of station selections and to the use of adjusted or unadjusted data. The level of agreement between independent analyses is such that it is highly unlikely that CRU could have acted improperly to reach a predetermined outcome. [1.3.1]

This is stated more explicitly in Chapter 6:

> It is impossible for a third party to tamper improperly with the data unless they have also been able to corrupt the GHCN and NCAR sources. We do not consider this to be a credible possibility, and in any case this would be easily detectable by comparison to the original NMO records [6.4]

The Review also considered the availability of metadata; that is, whether there was enough information available to identically replicate CRUTEM. As noted above, the computer code was no problem. Getting an exact list of temperature stations included in CRUTEM was more of an issue. Such a list was provided with the first version of CRUTEM in 1986, but CRU neglected to update it in the latest version, CRUTEM3, published in 2006.

An up-to-date list was not released until October 2007, in response to an FoI request. Even then, the Review Team found it was not straightforward to identify all the stations, due to a lack of standardisation. However, 90% could be matched with stations in the GHCN database, and CRU informed them that the remaining 10% could be obtained from other sources such as the relevant National Meteorological Office. As a "test case", the Review did obtain data directly from the Japanese NMO.

The Review makes the following criticism of CRU:

> **CRU should have made available an unambiguous list of the stations used in each of the versions of [CRUTEM] at the time of publication. We find that CRU's responses to reasonable requests for information were unhelpful and defensive.** [1.3.1]

The inquiry also briefly dealt with the allegation "that Jones was complicit in malpractice in failing to respond appropriately to allegations of fraud made against […] Professor Wei-Chyung Wang", whose data Jones cited in a 1990 paper on the urban heat island effect. The allegedly "fabricated" claim was that few if any of a certain selection of Chinese weather stations had moved over time. Wang's university investigated and rejected the accusation of fraud. Meanwhile, Jones responded within one year with a peer-reviewed analysis confirming the original conclusions. In any case, this was only one paper and does not change anything we know about the urban heat island effect.

> **The overall implication of the allegations was to cast doubt on the extent to which CRU's work in this area could be trusted and should be relied upon and we find no evidence to support that implication.** [1.3.1]

Despite being heralded as "the final nail in the coffin of anthropogenic global warming", Climategate has not even invalidated CRU's results, let alone the conclusions of the climate science community. In any case, the entire work of CRU comprises only a small part of the large body of evidence for anthropogenic global warming. That mountain of evidence cannot

be explained away by the behaviour of a few individuals.

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