Independent Review Team – UEA/CRU

Formal Record

Notes of Interviews with Prof Philip Jones, Dr. Tim Osborn and Ian Harris

Interviewers Prof Peter Clarke & Prof. Jim Norton

Interview carried out at UEA on 4th March 2010

Introduction

1. Peter Clarke set the scene by noting that the purpose of the day was to gain a "bottom up" context for the CRUTEM data sets. We were not primarily exploring individual allegations; rather we wanted to understand the broader history, context and working practices in respect of the CRUTEM data assembly, processing and publication. Inevitably there would be some duplication with material already submitted as formal written answers to our initial written questions, but the CRU team were asked to bear with us.

Information about data sets

2. Prof. Jones explained that he had started work in the early 1980s on what later became the CRUTEM datasets. The CRUTEM series of datasets were first published in 1994 (nominally CRUTEM1). CRUTEM2 was published in 2003 and the current version is CRUTEM 3 published in 2006. The HadCRUT datasets are published jointly with the Met. Office incorporating sea as well as land temperature data.

3. The complexity of assembling these data sets was explored, following the descriptions given in the relevant publications, which the review team had read. Not all land temperature stations were present 25 years ago. Much work had been required on improving data quality (where potential errors had been introduced by instrument changes, location moves or simple recording errors). Some data was already homogenised and some raw. There were also differences in the calculation methods for mean temperatures (e.g. Australia changed its calculation method from November 1994 onwards). Data had been collected by local national Met. Offices for a variety of original purposes. For early data, much had to be hand entered from the original print yearbooks.

4. Between three and five person-years of CRU effort had gone into data collection and processing during the mid-1980s. This gave rise to an early version of CRUTEM (designated CRUTEM1986) in which 3276 stations were used, of which 314 had been adjusted by the CRU team. In CRUTEM3, 4348 stations were used, of which 298 had been adjusted by the CRU in the mid-1980s. Some other stations were permanently excluded, as confidence in the necessary adjustments was inadequate. The identification of the stations used and the description of the data processing steps were stated to be described in the published scientific literature, which is the definitive source. As example the following points were made about station data adjustments:

- Pair-wise comparisons were made where individual stations were sufficiently adjacent;
- Following the 2003 update (CRUTEM2), multiple versions were found to exist for some stations – sources used different station identifiers, co-ordinates and names for the same station. This was corrected in CRUTEM3 published in 2006.
- Testing for homogeneity (individual station data series being consistent through time) was carried out in the formation of the CRUTEM1986 dataset. It was confirmed that no further adjustments for inhomogeneities had taken place since 1986. Though much of the CRUTEM1986 data remains in the later datasets;
- Some stations were excluded on grounds of data quality, where confidence in the necessary adjustments was inadequate. In particular 38 stations were removed because they showed apparent non-climatic warming relative to neighbours;
- Looking at the CUTEM1986 adjustments overall they were almost equally balanced both up and down in temperature. So whilst locally significant the adjustments had almost zero impact on the global figures. (See page 6-8 of written evidence from CRU on Issue 4).
- CRU corrections were always worked through back to the earliest data.
- The CRU had used a rigorous process for station selection – almost all tied back to, and documented in, publications.

5. *One potential recommendation for our report might relate to the need for greater global standardisation in the collection of such primary data by multiple national bodies and greater clarity and standardisation in the associated metadata. It should be noted that such a recommendation has apparently been made in the past but to little effect so far.*

<u>Access to primary and intermediate data sets</u>

6. Prof Jones explained the extent to which the primary climate data used in CRUTEM3 was in the public domain:

- The Global Historical Climatology Network (GHCN) now had data on some 7000 land temperature measurement stations available. (This included more US stations than CRU had used for their own analysis). GHCN is provided by the US National Oceanic and Atmospheric Administration (NOAA) through its National Climatic Data Centre (NCDC).
- NCAR and WWR are repositories of much station data.

- There were also two other World Climatic Data Centres (including one in Russia) beyond the US NCDC.
- Paper-based World Weather Records (WWR) exist, originally collated by US Smithsonian Institution dating back to the 19th Century. These were taken over in the 1940's by the US Department of Commerce.
- The Carbon Dioxide Information Analysis Centre (CDIAC) had long provided pre-1991 data on both locations and measurements.
- The "TR017, 022 and 027" reports from the US Department of Energy had been in the public domain as physical books but have gone out of print. CRU distributed physical copies from 1986 until 2000, when stock ran out. This year, CRU had these documents scanned and plans to place the images online for public access. These documents fully report the stations used, and the adjustments made in the original CRUTEM1986 dataset.

7. The amount of computer code used to process the station data into the grid structure used for global analysis is minimal (of order a few 100 lines) and could easily be produced independently by other researchers (The UK Met. Office has now published an equivalent script in PERL). The processes carried out by this code were stated to be fully documented in published papers. It was asserted that no FoIA request had ever been received by the CRU for the release of the CRUTEM3 computer code.

8. A five level hierarchy of data sources was described:
   - Level One – Raw data from individual weather stations;
   - Level Two – Data assembled by individual national Met. Offices;
   - Level Three – Data assembled on a multi-country regional basis e.g. for Scandinavia;
   - Level Four – Raw data collated on a global basis such as GHCN and WWR; and
   - Level Five Data subject to selection and homogenisation process by organisations such as the CRU and GHCN.

9. **The assertion by CRU is that these primary data sources at levels 1 through 4 are (or have been) publically available, for example from GHCN. In respect of the CRUTEM series created from these, the CRU:**
   - **Have consistently indicated requests for raw data in part or in whole should be properly directed to the publicly available sources and the owners of that data. CRU themselves are neither funded as a secondary data repository, nor do they have the right to pass on much 3rd party data.**

- **Had fully published the CRUTEM1986 data set (including all selection and homogenisation assumptions) produced by drawing on these primary data sources. These had been fully available online long before the current controversy over FoIA/EIR requests.**
- **For subsequent versions (CRUTEM1/2/3) published papers (Jones, 1994; Jones & Moberg, 2003; and Brohan et al., 2006) make clear that CRU did not make any further adjustments to station data. These publications also provide, in general terms, details on stations added and the sources of that data.**
- **Responded (after some months) to a FoIA request in 2007 for a complete list of the stations used, thus it would have been possible (with the exception of a small, and potentially insignificant, number of stations not made available by the primary data holders) to repeat the CRU work from primary sources.**
- **The list of exact stations used was published for CRUTEM1986 in 1986 and for CRUTEM3 in 2007.**

Potential 'Common Mode' errors

10. The discussion explored potential common mode errors both within the CRU work and across all the sources of processed land temperature data. The following key points were made:
    - The effect critically depended on when the urbanisation took place during the data series e.g. largely insignificant for say London, but potentially significant for the new urban centres in, for example, China.
    - Careful (and fully published) research by the CRU had resulted in increased one-sided systematic error, estimated to be 0.05C/century, to reflect this error related to urbanisation.
11. It was noted that all sources ultimately draw on subsets of the same global network of land temperature measurement stations. Systematic errors in that base network of measurements would impact all processed conclusions – though it is hard to see how such systematic errors might arise in practice… Confidence is increased by the fact that two completely different subsets of the data produce the same global and hemispheric temperature series back to 1900.

Development of computer software/code within the CRU

12. Dr. Tim Osborn explained that (as documented earlier at paragraph 7) the amount of software involved in the production of the CRUTEM data sets was minimal and the algorithms implemented were fully documented. The largest software programs developed by the CRU (as part of other climate modelling)

were around 6000 lines of code of which typically 2000 would come from standard libraries – small in normal IT terms.

13. It was noted that Prof Phil Jones and Dr Tim Osborn use both FORTRAN and IDL programming languages. Others within the CRU use languages such as MATLAB and 'R' according to preference and requirement. There were no CRU wide standards for programming and it was up to each individual to develop their own quality control processes. Similarly there was no central repository of data other than the CRU website. However as a condition of funding from the Natural Environment Research Council (NERC) all results produced under their sponsorship were archived at the British Atmospheric Data Centre (BADC). This process of archiving had been in place for five years.

Concerns over Chinese station data

14. Prof Jones pointed out that he had published a paper in 1990 discussing the potential urbanisation impacts on Chinese station data. This was based on data from 42 'rural' and 42 'urban' stations. The results for 1954 to 1983 suggested that the urbanisation impact had been negligible. He did not believe (as has been alleged) that there had been gross moves of location of measuring stations, but recognised that there could well have been local moves. In 2007, Prof Jones had re-visited the original 1990 paper and worked with Li on re-analysis of the Chinese datasets for some 700 stations. From this, he could identify the original 42 'rural' stations and 40 of the 'urban' stations used in the 1990 paper. The results were very similar – the corrections made again tended to cancel out, (as per paragraph 4 bullet point five and Figure 5 of Jones et al., 2008).

15. Prof. Jones did however note that 'rural' was a relative matter in Chinese terms, there were very few genuinely rural stations. Almost all were in towns of one size or another. He also noted that, whilst extensive Chinese data was available in print form in China, only a subset was widely available electronically – this was again a cause of confusion. He also noted that most Chinese stations were not used in the global analysis, as there was insufficient duration of data available. Prof Jones offered to rerun his global averages excluding all Chinese, Hong Kong, Macau and Taiwanese data. He expected to see little change in the overall results. This offer was welcomed by the interviewers. **Note: Subsequent to the meeting Prof Jones followed up on this offer. See Appendix 1.**

The context for the 'Harry Read Me' document

16. Ian Harris ("Harry") was asked to provide the context for the leaked 'Harry Read Me' document. It was noted that this had no link with the CRUTEM data sets, but was instead part of an entirely separate CRUTS (CRU Time Series) project. CRUTS was developed for use in, amongst numerous other areas, agronomy modelling and provided data for eight parameters in half-degree cells over land only. An original project had been carried out in 2002 by a post-doctoral fellow

no longer available to the CRU. The BADC had asked for an update and then the capability to run regular updates themselves drawing on published data sets (Monthly Climate Data for the World updates – MCDW, CLIMAT a multi parameter data set, and material from the Australian Met Office). The software project had been highly problematic even in reproducing the original 2002 results and had, in the end, required almost complete re-development from scratch. The vexed document was simply a personal record of Ian Harris's frustration when working from the original code base.

Suggestions that e-mails should be deleted

17. Prof Jones, in response to questioning, noted that he had not received any specific training on DPA/FoIA/EIR issues from the UEA.

Jim Norton

19th April 2010

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Appendix One

Further analysis omitting stations first in Mainland China, Taiwan, Hong Kong and Macau (Figure A) and second omitting all stations in the former Soviet Union (Figure B).

Figure 'A' indicates almost no effect on the Global and Northern Hemisphere averages. For the (larger) area of Figure 'B' some differences appear but the character of the curve from the 19th century is similar.

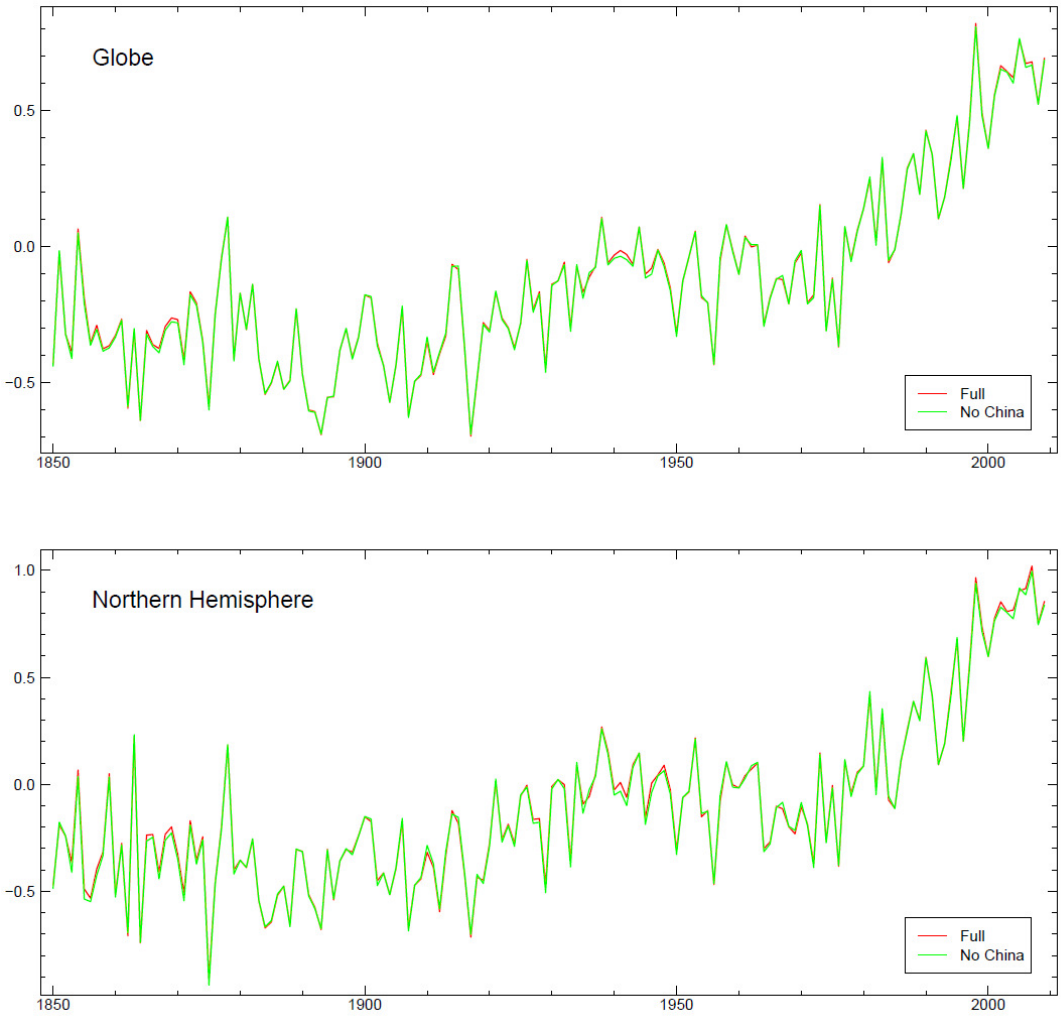

Figure A: Global and Northern Hemisphere averages, with the full network of land-based stations in red, and in green without stations in China, Taiwan, Hong Kong and Macau.

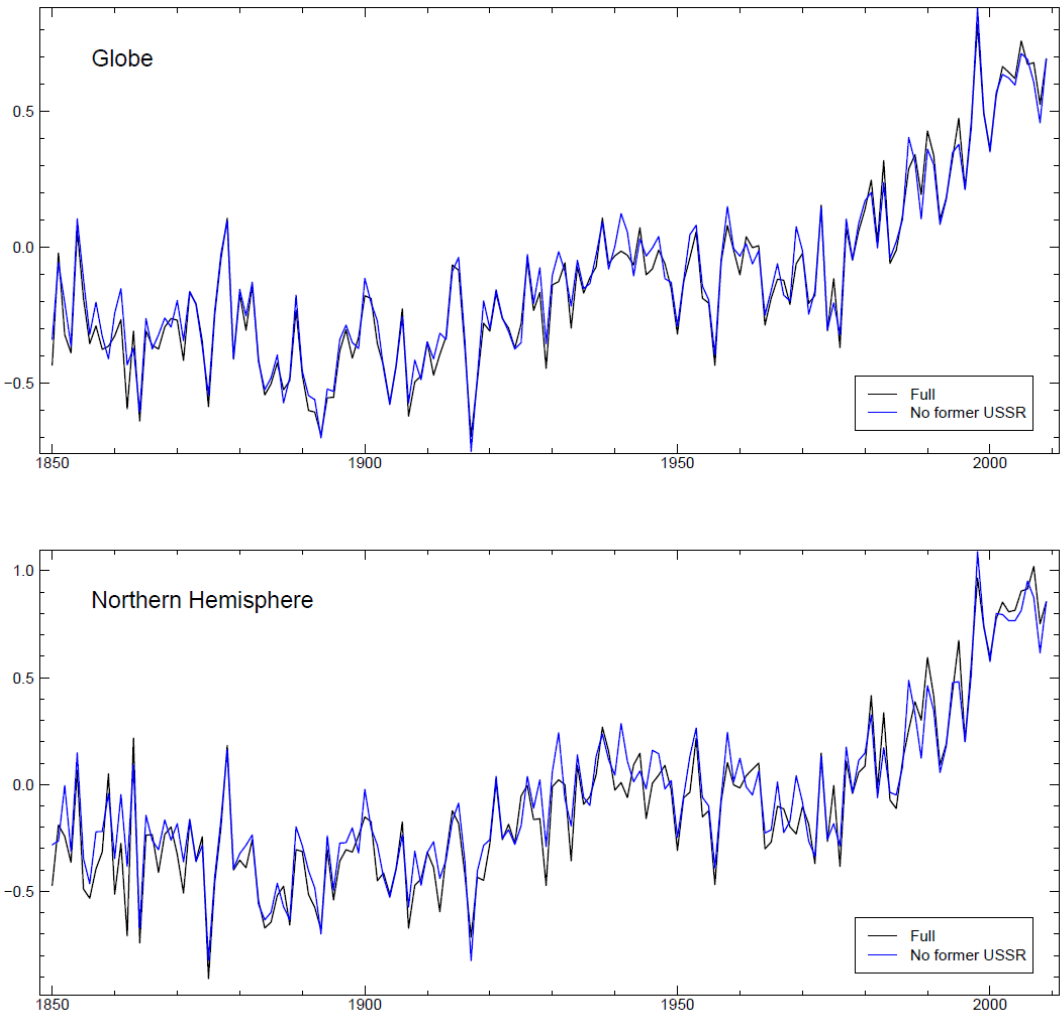

Figure B: Global and Northern Hemisphere averages, with the full network of land-based stations in black, and in blue without all stations in the former Soviet Union.