PROPOSAL FOR A NEW INTERNATIONAL ANALYSIS OF LAND SURFACE AIR TEMPERATURE DATA

CONTENT OF DOCUMENT:

UK Met Office submits this document for consideration by the CCI session

Appendix:

- Proposal for a new international analysis of land surface air temperature data

PROPOSAL FOR A NEW INTERNATIONAL ANALYSIS OF LAND SURFACE AIR TEMPERATURE DATA

Submitted by UK Met Office

Executive summary

Surface temperature datasets are of critical importance for detecting, monitoring and communicating climate change. They are also essential for testing the validity of the climate models that are used to produce predictions of future climate change. The current datasets, constructed in the UK and US using different methodologies, agree in showing that the world is warming. Taken together these records provide a robust indicator of global change and form part of the evidence base that led the IPCC Fourth Assessment Report to conclude that "warming of the climate system is unequivocal".

To meet future needs to better understand the risks of dangerous climate change and to adapt to the effects of global warming, further development of these datasets is required, in particular to better assess the risks posed by changes in extremes of climate. This will require robust and transparent surface temperature datasets at finer temporal fidelity than current products.

The current surface temperature datasets were first put together in the 1980s to the best standards of dataset development at that time; they are independent analyses and give the same results, thereby corroborating each other.

In the case of the CRU land surface temperature dataset (CRUTEM3, which forms the land component of the HadCRUT dataset) there are substantial IPR issues around the raw station data that underpin the dataset; we are actively pursuing resolution of these issues so that the base data can be made openly available. We know that several stations have already been explicitly forbidden from release by the rights' holders so we will not be able to release all the under-pinning station data.

Consequently we have been considering how the datasets can be brought up to modern standards and made fit for the purpose of addressing 21st Century needs. We feel that it is timely to propose an international effort to reanalyze surface temperature data in collaboration with the World Meteorological Organization (WMO), which has the responsibility for global observing and monitoring systems for weather and climate.

The proposed activity would provide:

1. Verifiable datasets starting from a common databank of unrestricted data at both monthly and finer temporal resolutions (daily and perhaps even sub-daily);

2. Methods that are fully documented in the peer reviewed literature and open to scrutiny;

3. A set of independent assessments of surface temperature produced by independent groups using independent methods;

4. Robust benchmarking of performance and comprehensive audit trails to deliver confidence in the results;

5. Robust assessment of uncertainties associated with observational error, temporal and geographical in homogeneities.

It is important to emphasize that we do not anticipate any substantial changes in the resulting global and continental-scale multi-decadal trends. This effort will ensure that the datasets are completely robust and that all methods are transparent.

Background

In many respects HadCRUT has been the default choice of surface dataset in all 4 IPCC Assessment Reports. However we must stress that other independent datasets are used which support the HadCRUT data. There are three centres which currently calculate global average temperature each month:

- Met Office, in collaboration with the Climatic Research Unit (CRU) at the University of East Anglia (UK);
- Goddard Institute for Space Studies (GISS), which is part of NASA (USA);
- National Climatic Data Center (NCDC), which is part of the National Oceanic and Atmospheric Administration (NOAA) (USA).

These groups work independently and use different methods in the way they process data to calculate the global average temperature. Despite this, the results of each are similar from month to month and year to year, and there is robust agreement on temperature trends from decade to decade.

All existing surface temperature datasets are homogenized at the monthly resolution, and are therefore suitable for characterizing multi-decadal trends. These are adequate for answering the pressing 20th Century questions of whether climate is changing and if so how. But they are fundamentally ill-conditioned to answer 21st Century questions such as how extremes are changing and therefore what adaptation and mitigation decisions should be taken. Monthly resolution data cannot verify model projections of extremes in temperature which by definition are (sub-) daily resolution events.

Through collaboration with NCDC we have two quality controlled, but not homogenized products at the daily and sub-daily resolution (HadGHCND and HadISD – the latter about to be submitted to peer review), spanning 1950 onwards and 1973 onwards respectively. However, because these are not homogenized, they may retain time-varying biases. It is an open scientific question as to whether homogenization is feasible at these timescales whilst retaining the true temporal characteristics of the record. In particular, seasonally invariant adjustments which are adequate for monthly timescale data will be grossly inadequate at the daily or sub-daily resolution. Clearly homogenization of these data is highly desirable but some detailed research is needed to define the best approach.

The way forward

Recognizing that no single institution can undertake such a fundamental data collection, re-analysis and verification process single-handedly, we would envisage this as a broad community effort – a 'grand challenge' so to speak - involving UK and international partners.

The UK would convene a workshop to be hosted by the Met Office Hadley Centre and invite key players who could plausibly create such datasets with the aim of initiating an agreed community challenge to create an ensemble of open source land temperature datasets for the 21st Century both at monthly temporal resolution and also at the daily and sub-daily timescales needed to monitor extremes. Such an approach would help distribute many of the basic tasks, ensuring that the most appropriate parties were responsible for each part as well as providing a focused framework and timeline. This effort would ideally have involvement from, and be coordinated under, the umbrella of one or more of the Commission for Climatology, the Global Climate Observing System, or the World Climate Research Programme, with assistance from other WMO constituent bodies as appropriate.

Activities that would be required within any overall programme are:

1. Creation of an agreed international databank of surface observations to be made available without restriction, akin to the I-COADS databank in the ocean domain. Note that NCDC already have substantial efforts in this regard and would be a key participant and likely host as the designated world data bank. Data to be available at monthly, daily and sub-daily resolutions;

2. Multiple independent groups undertake efforts to create datasets at various temporal resolutions based upon this data-bank. Participants will be required to create a full audit trail and publish their methodology in the peer-reviewed literature. Strong preference will be given to automated systems and creations of ensembles that reflect the uncertainties in the observations and methods;

3. One or more groups to create realistic test-cases of the spatio-temporal observational availability by sampling output from a range of climate simulations from a number of models, adding realistic error structures;

4. Groups to run their algorithms against the test-cases and one or more groups, preferably completely independent, to undertake a holistic assessment based upon the results of this verification exercise from all groups.