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GLOBAL CLIMATE OBSERVING SYSTEM
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GCOS STEERING COMMITTEE
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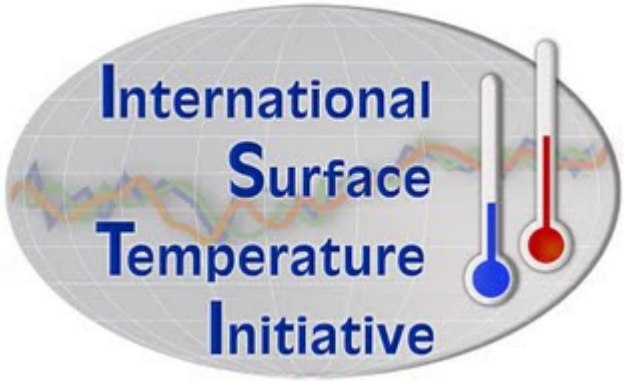
Item X.X

Progress Report for the International Surface Temperature Initiative



(Submitted by Kate Willett, Peter Thorne and the ISTI Steering Committee)

Summary and Purpose of Document

GCOS SC members are invited to note the progress to date with the International Surface Temperature Initiative (www.surfacetemperatures.org), instigated at a meeting in Exeter, UK in September 2010. Several potential synergies with ongoing GCOS mission areas are noted in the proposed actions.

ACTION(S) PROPOSED

- GCOS SC are invited to review the prototype databank archive (http://www.gosic.org/GLOBAL_SURFACE_DATABANK/GBD.html) and provide feedback on adequacy or otherwise for GCOS purposes during this pilot phase prior to a first version release in April 2012.

- GCOS SC are invited to recognise the ISTI databank as a GCOS data archive for land surface temperatures and other data and to help provide links between data sources and the databank curators at NCDC. Such recognition and linkages may help: acquisition of new data sources (both rescued historical data and data made available through new data-sharing agreements); communication and publication of the work of ISTI; and in gaining support from NMHSs, the research community and National Governments.

- GCOS SC are invited to provide constructive feedback on any aspects of the Initiative to the ISTI Steering Committee including guidance on GCOS standards and principles that ISTI should subscribe to. Feedback would be particularly welcome on the recently published Implementation Plan which includes a time line for achievements.

- GCOS SC are invited to consider appropriate ongoing reporting mechanisms to GCOS, if desired, recognising that the initiative is a voluntary effort only.

- It is noted that the Exeter workshop included a recommendation to GCOS to consider the instigation of a global surface reference network, modelled upon USCRN and GRUAN. This will assure the future record at a representative sample of sites through traceable and redundant measurements tied to metrological standards at well characterised sites free of artificial contaminant effects. GCOS SC are invited to consider the viability of such a network to ensure robust climate monitoring for posterity in their future strategic planning.

Progress Report for the International Surface Temperature Initiative

The International Surface Temperature Initiative (www.surfacetemperatures.org) concept, endorsed by the WMO Commission for Climatology at its 15th session, was launched at a meeting at the UK Met Office, Exeter in September 2010. It became formally recognised at the 2011 WMO Congress and for WMO purposes formally reports to the Commission for Climatology. It is now also formally endorsed by The International Envirometrics Society (TIES) branch of the International Statistical Institute (ISI). Efforts are also underway to gain formal recognition with the International Bureau of Weights and Measures (BIPM).

The purpose of ISTI is to provide a complete land surface temperature data resource for 21st Century climate science which requires high quality and high-resolution data-products with openness, transparency, verification, and user tools. It will provide the foundation for creation of a range of estimates within a common framework. This will aid decision-making at national and international scales and inform adaptation strategies. The Initiative is international and interdisciplinary - involving climate scientists, statisticians, metrologists and software engineers from around the world. It encompasses: data rescue and digitisation; an open, transparent and comprehensive land surface temperature databank with version control and provenance tracking (Figure 1); a programme of benchmarking and assessment for homogenisation algorithms (Figure 2); and a data-portal for multiple products estimating local, regional and global scale changes with platforms for data download, intercomparison and visualisation solutions (Figure 3).

The primary building block of ISTI is the land surface databank (stage 0 to 3 data – Figure 1). The databank is physically held at NCDC and mirrored at RIHMI. The aim is to make this the most comprehensive database for global surface temperatures (and other surface measurements eventually but starting with temperatures) where all available data is stored. It is also to make this the most open, transparent and traceable (to known origin) data source to date. As new data become available either through historical data rescue or new data-sharing agreements, these should all be fed into the databank. It is hoped and envisaged that this will create a one-stop-shop for land surface meteorological data. It is essential that as many original data format data (stage 0 paper/image, stage 1 native keyed format, stage 2 common digital format) and metadata as possible are also available and easily referenced to individual observations and that the practice of providing this becomes commonplace. The databank will also have clear version control. A pilot version of the databank is now up and running at http://www.gosic.org/GLOBAL_SURFACE_DATABANK/GBD.html. New data have already been obtained and placed in the databank and efforts are ongoing. A version 1 release scheduled for early- to mid-2012.

Robustness of data-products is also key to the ethos of ISTI. For this reason the benchmarking and assessment program (Figure 2) has been devised to provide objective and common intercomparison of data-products and their ability to represent the climate of a given region over time. Benchmarking of homogenisation algorithms has three main advantages: it provides objective intercomparison of data-products; it is a tool for quantifying parametric uncertainty in any one product; and it is a tool for advancing algorithm development. Existing programmes such as COST HOME have made large advances into the methods of benchmarking homogenisation algorithms and the work of ISTI will be strongly aligned with that of COST HOME but go further to create fully global benchmark analogs and a repeated 3 year cycle of benchmark release, testing and assessment.

The third component of ISTI is the serving of all products developed from the databank in a common format. This portal will provide key information about each product (data incorporated, audit trail of methods, benchmarking assessment etc.) and be easily searchable for specific products or subsets thereof. Visualisation and intercomparison tools

will also be provided. These should be aligned with other similar efforts (GHRSST, ICOADS, etc.) to allow cross-overs with other variables/spheres.

Since September 2010 the Initiative has become a reality, led by a fully international and interdisciplinary Steering Committee with two working groups focussing on the specific aspects of databank creation (http://www.surfacetemperatures.org/databank) and the benchmarking programme (http://www.surfacetemperatures.org/benchmarking-and-assessment-working-group) with respective task teams. While largely completed peripherally in members' busy schedules, progress is ongoing with a prototype databank established at http://www.gosic.org/GLOBAL_SURFACE_DATABANK/GBD.html and research undertaken on benchmarking and assessment techniques. High priority has been given to communication of our aims and objectives and setting up association with as many relevant existing programmes as possible such as ACRE, COST HOME, MEDARE, IEDRO, Meteomet, the Surface Temperature Network etc. including those working towards similar aims in the marine community. Already at least one additional effort at product development, led by NIST statisticians, has begun as a direct consequence of the Initiative. It is hoped that further new efforts will be undertaken so that we can sample better the methodological solution space.

A detailed description of the ISTI aims and objectives can be found in the meeting report 'Guiding the creation of a Comprehensive Surface Temperature Resource for 21st Century Climate Science' now published by the Bulletin of the American Meteorological Society (doi: 10.1175/2011BAMS3124.1 http://journals.ametsoc.org/doi/pdf/10.1175/2011BAMS3124.1). There is also a concise governance document outlining the purpose of ISTI, a terms of reference for the Steering Committee and also for the working groups, and an overarching Implementation Plan documenting plans and deadlines. These are available online at www.surfactemperatures.org in addition to meetings minutes for the Steering Committee and working groups.

The Initiative has set itself an ambitious task that will be of great value to both the climate research community and society. To be successful it will need the support of all relevant bodies both large and small. Global bodies include: the WMO CCl; the BIPM and ISI-TIES. The ISTI also aligns strongly with the GCOS mission, specifically the AOPC scientific panel. The Steering Committee wish to ensure that the direction of ISTI has the best interests of its proposed users at heart and sees GCOS guidance and recognition as an essential part of this.

Finally, we note that the Exeter meeting also considered a possible independent verification route moving forwards which would fall naturally under the GCOS domain. Noting the decade old USCRN effort and the incipient GRUAN network, participants foresaw the potential value of a global surface reference network for climate monitoring. The network would have at its heart redundancy of measurements and traceability to metrological standards. Such very well characterised data would ensure that in future, at least for a subset of the network, trends would be well characterised. It was noted that to characterise global scale temperature changes several papers have suggested the need for of the order 150-250 well-spaced stations.

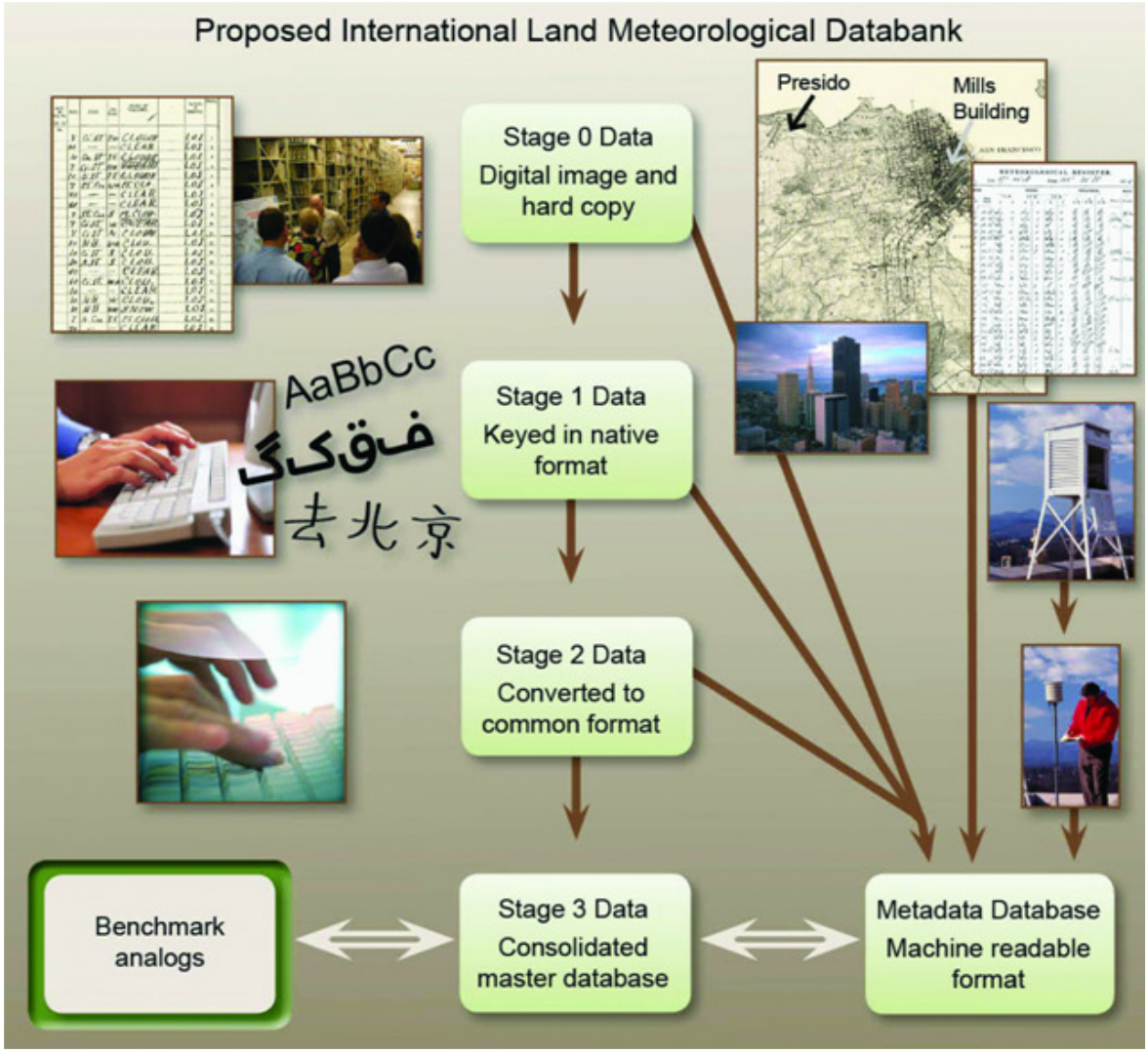


Figure 1. Conceptual diagram of the envisaged comprehensive databank structure and its relation to the benchmark analogs described in Figure 2. All stages of data are to be fully open access. Ideally any single observation should be fully traceable through all stages, have related metadata and a benchmark analog. Image courtesy of NCDC graphics team.

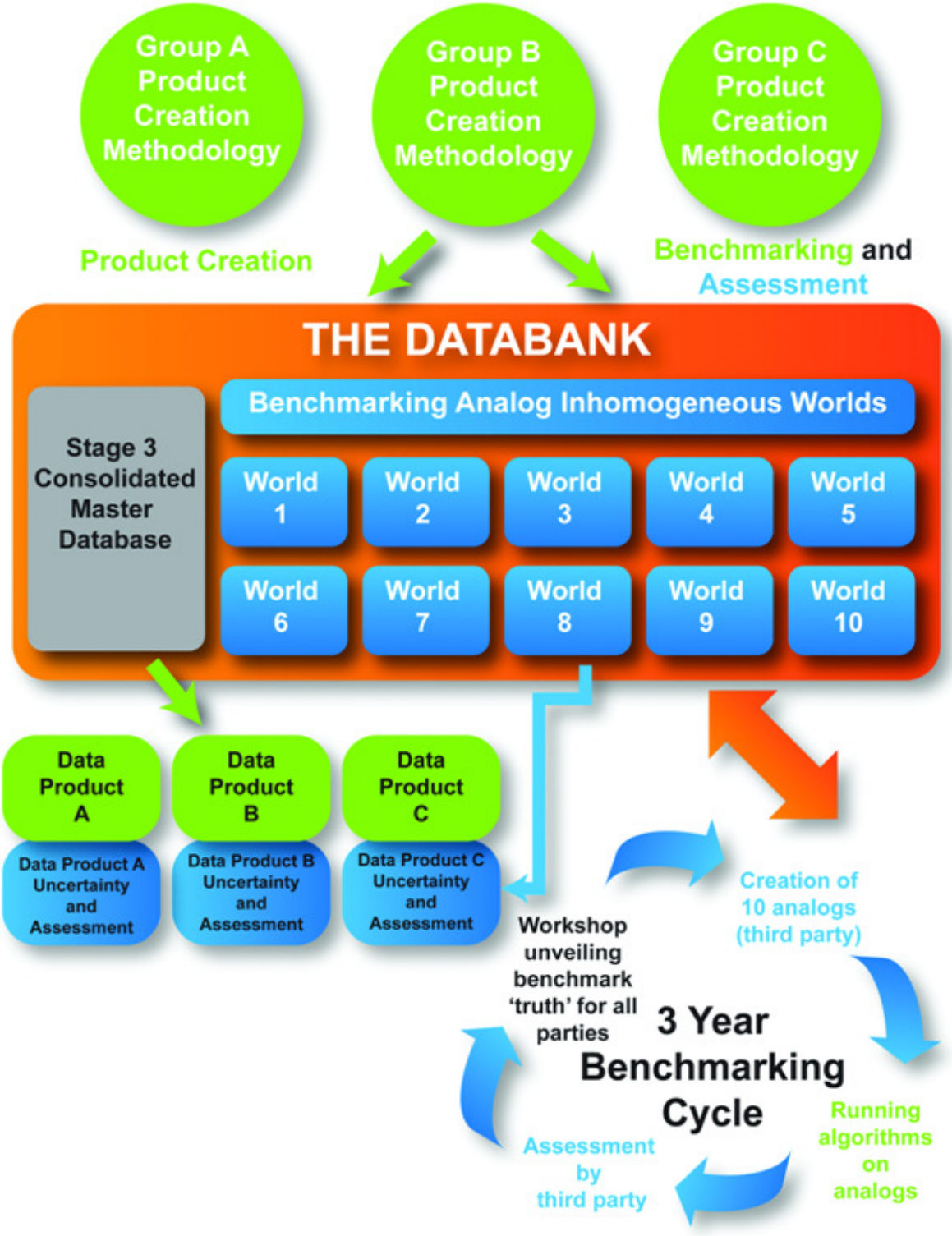


Figure 2. Conceptual flow diagram of the benchmarking and assessment programme for objectively testing methodologies used to create data-products (e.g. homogenisation algorithms to produce monthly mean time series for a region). Data-product creators can apply their methods to the benchmark analog data which will be identical to the comprehensive database (stage 3) but with known errors applied. The ability of the algorithms to remove various types of real-world inhomogeneities will be assessed and used to guide users in the level of uncertainty for a given product. Importantly, the specific details of these known errors will not be released initially to enable true blind testing of the algorithms and prevent over-tuning. Image courtesy of NCDC graphics team.

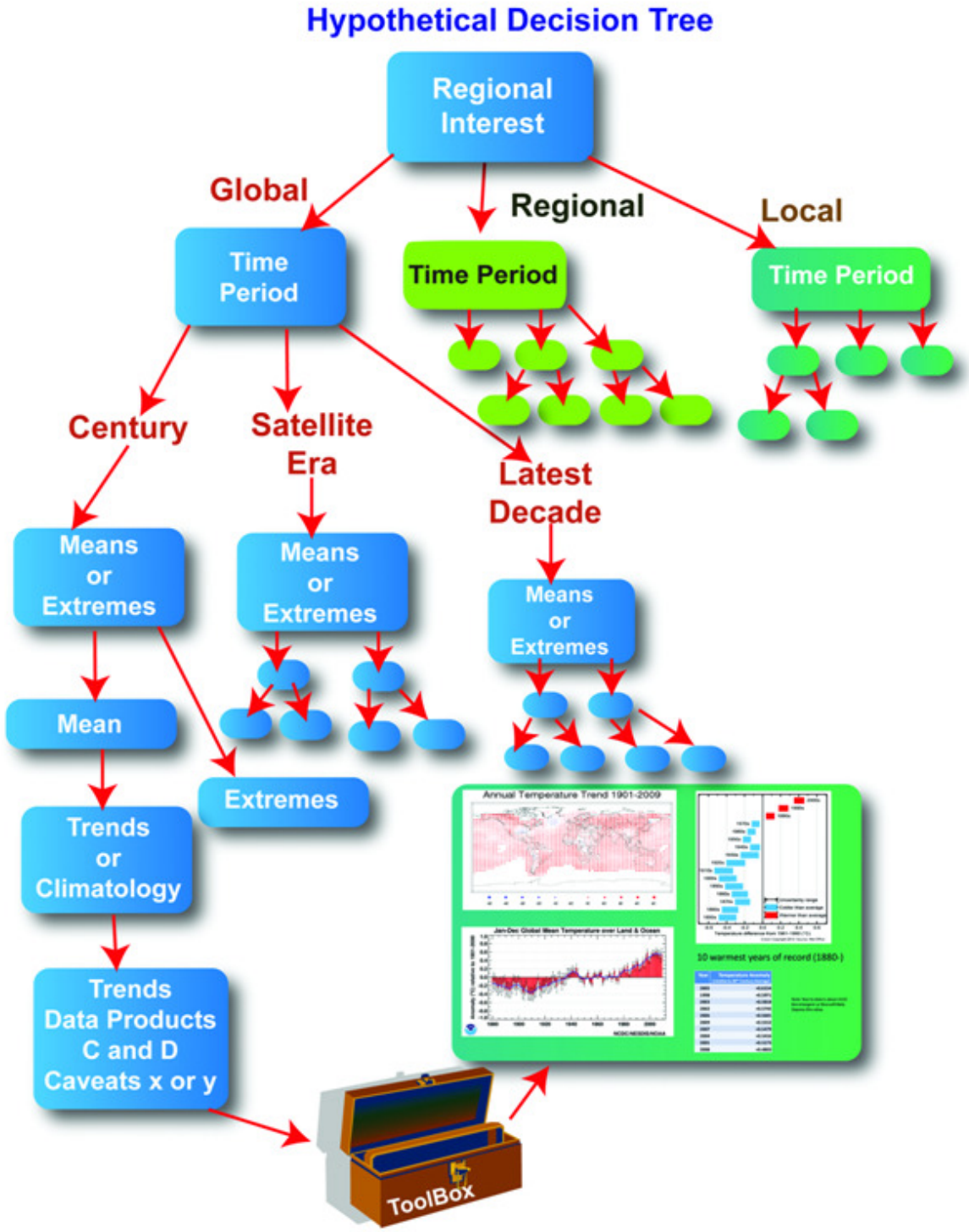


Figure 3. Example of a type of decision tree that could help end users and some of the user tools which may be available to them. The decision tree may start by asking the user the geographical region of interest to narrow the candidate data-products down then the period of interest, whether interested in mean, variability, trend, seasonality etc. Once user requirements are ascertained an optimal set of products and easy to understand guidance and caveats along with visualisation and tabulation tools would be made available. Image courtesy of NCDC graphics team.