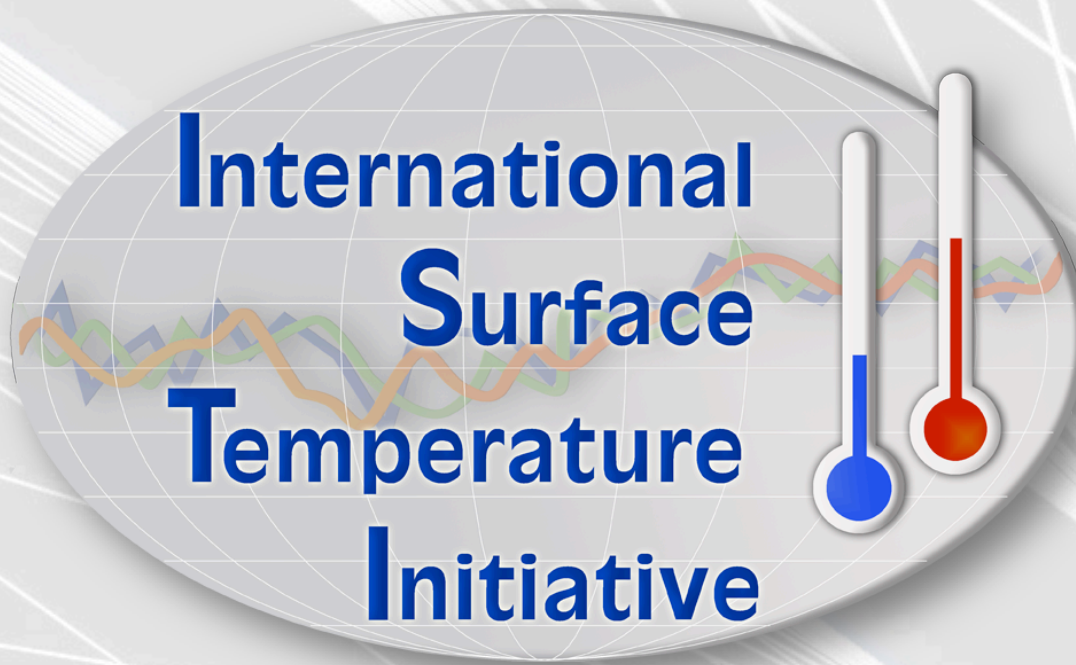# The International Surface Temperature Initiative: An Overview

International Surface Temperature Initiative

10/25/11

Peter Thorne, CICS-NC, on behalf of initiative participants

Background

- Several independent global estimates of Land Surface Air Temperatures
  - Independently produced
  - Gross agreement at hemispheric / global scales on all timescales, however …
    - Process metadata in some cases missing
    - Much of the work was undertaken in late 1980's/ early 1990's - technology and expectations have changed since then
    - Monthly large scale gridbox averages only (generally)
    - Many data issues in the raw data
   - Even more critiques (esp. in blogs)

International Surface Temperature Initiative
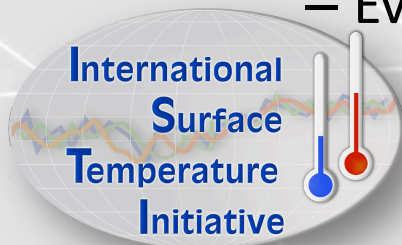
Inhomogeneities: annual mean minimum temperature at Reno, Nevada, USA

(Matt Menne and Claude Williams, NOAA National Climatic Data Center)
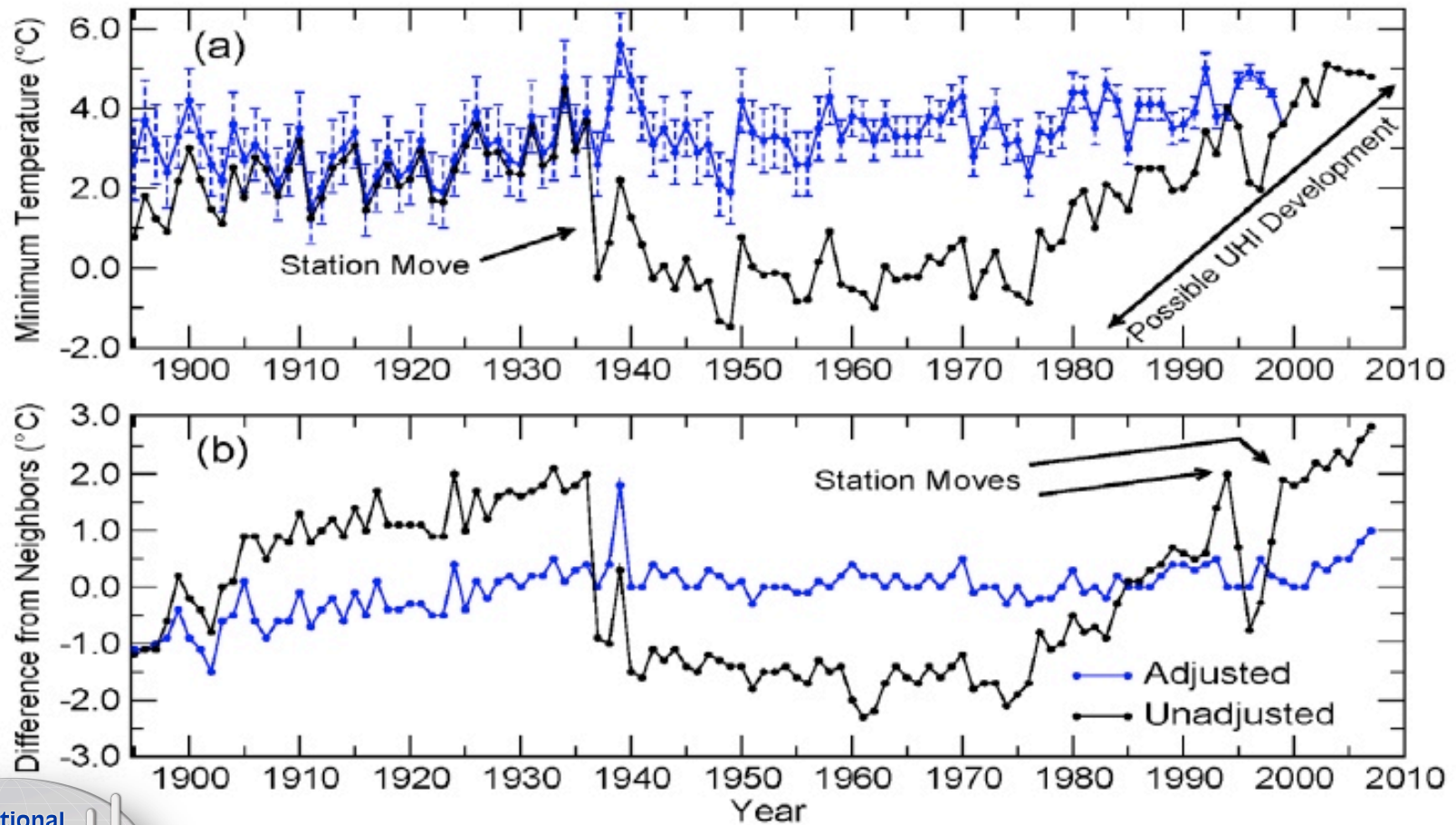
No doubt that it is warming – the rate and temporal / spatial details are the issue

(NCDC Graphics Team (above), John Kennedy, Met Office Hadley Centre (right))

**International Surface Temperature Initiative**
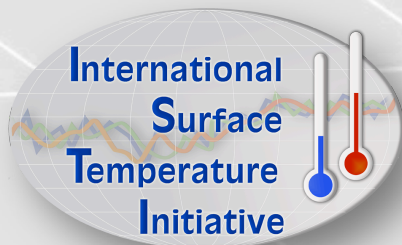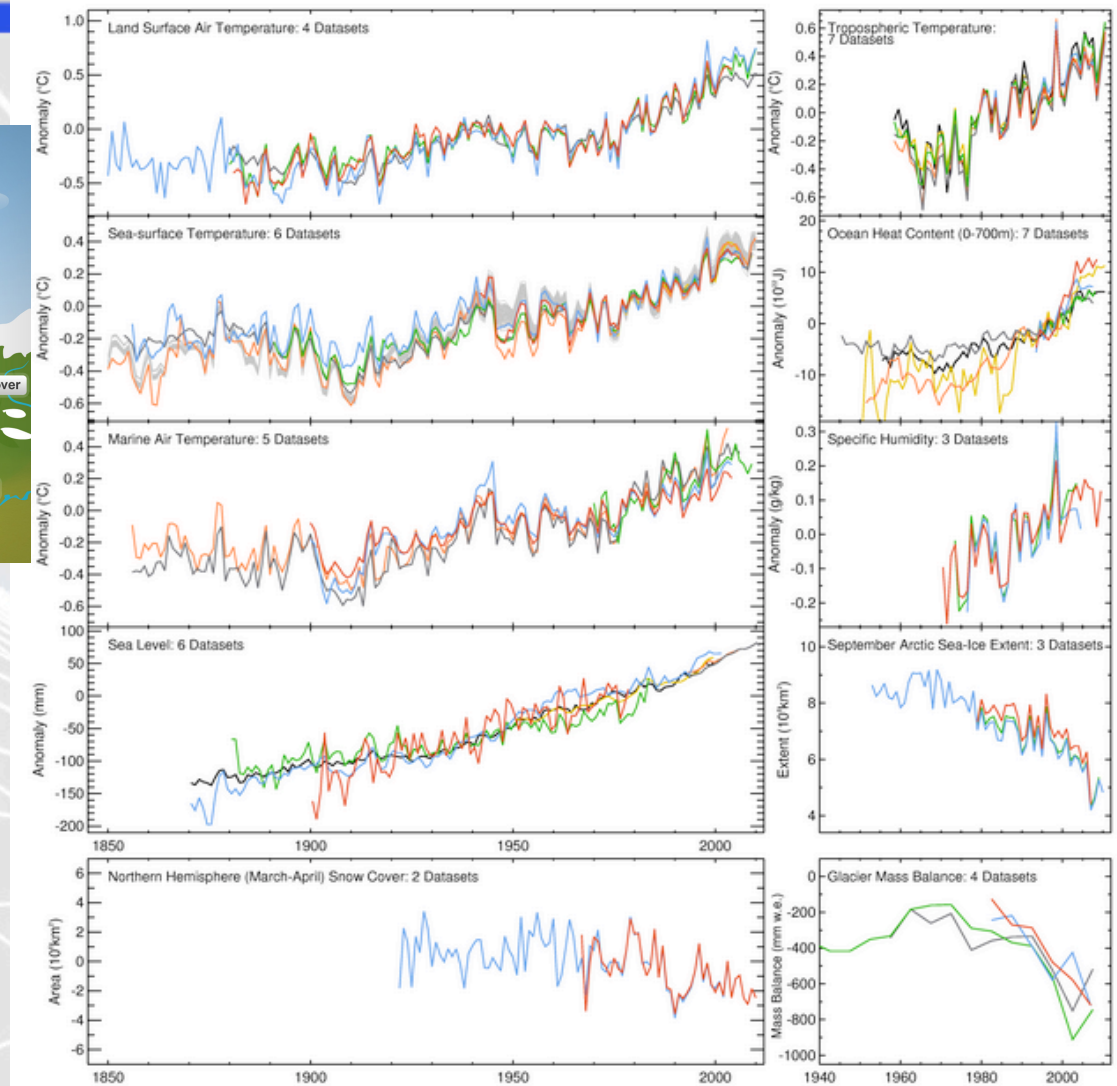
The big question

- Can we create a process that leads to a suite of well characterized estimates of land surface temperatures that can be used to answer scientific questions and societal demands of the 21st Century?
  - Open and transparent
  - Better understanding of fundamental instrument performance and measurement properties
  - Consistent performance evaluation of a larger suite of estimates to better explore methodological uncertainty
  - User tools
  - Not just monthly at the largest scales. Daily, sub-daily, regional and local

International
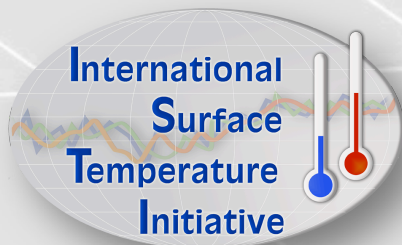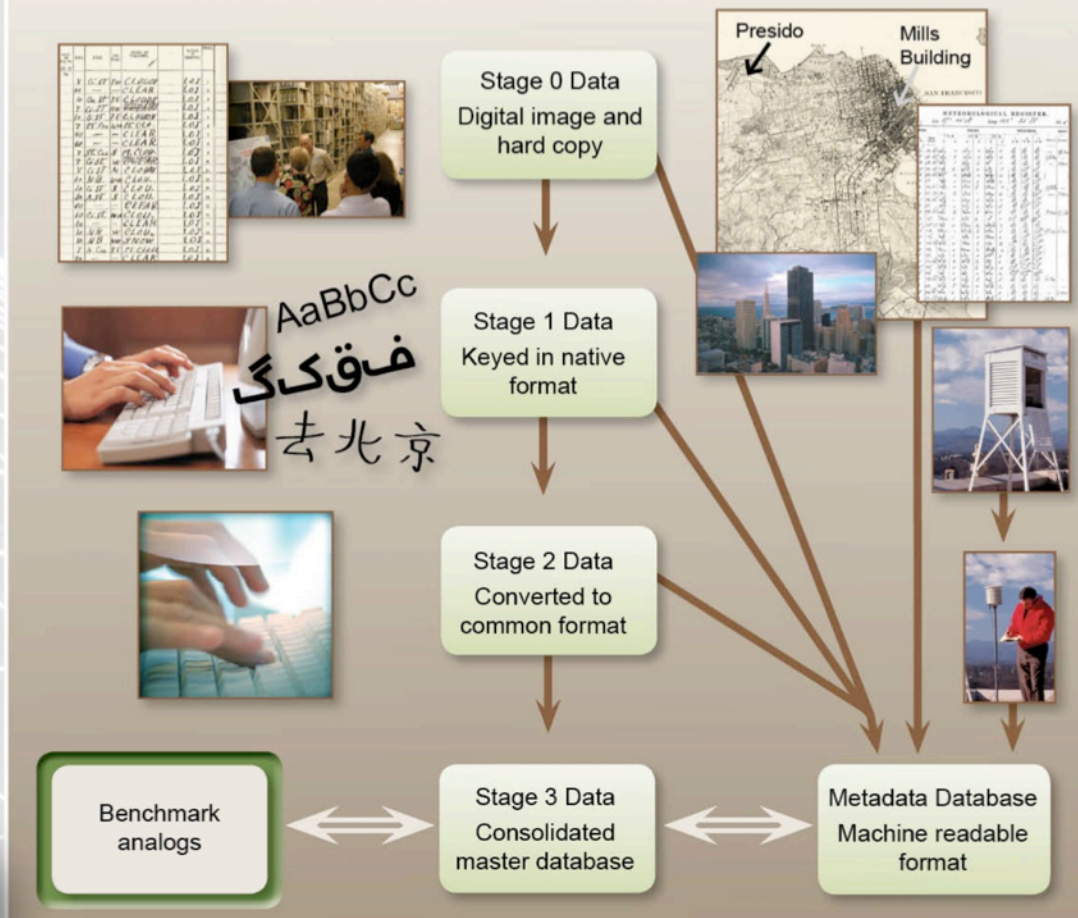**S**urface
Temperature
Initiative
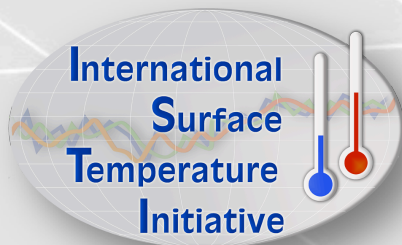
Who are 'we'?

- Initiative was started at a meeting at the UK Met Office in September 2010 including climate scientists, metrologists, statisticians, software engineers, citizen scientists

- Committees, working groups, and task teams include specialists from these fields and representation from every continent (excl. Antarctica) and relevant programs

- Include strong representation from several groups involved in the issue historically (e.g. NCDC, UKMO)
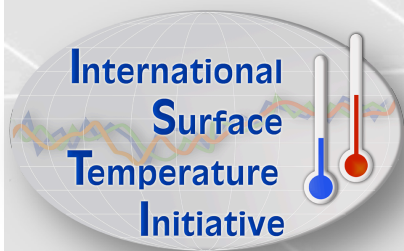
- Report to WMO, TIES, BIPM

International Surface Temperature Initiative
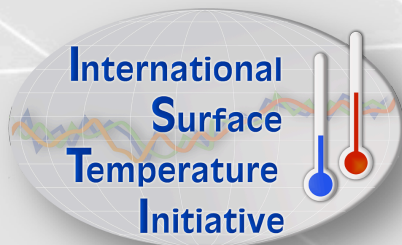
Data rescue and provision

Proposed International Land Meteorological Databank

www.iedro.org

International Surface Temperature Initiative

Imaged data

Stage 1 - Native format digitized

Stage 2 – common format

Provenance / version control flags

Stage 3

- Same format as stage 2
- One unique version for each station – recommended version for most users
- Forms basis for creation of analogs (see later)
- Protocols used in merging sources are as yet to be finalized
- Provenance tracking will ensure an unbroken chain to earlier stages

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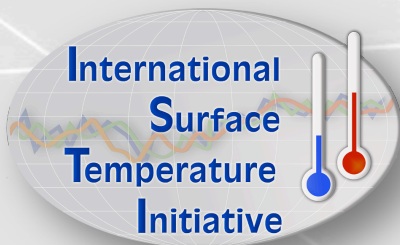
Databank Progress

- Working Group instigated
  - Data rescue task team
  - Provenance and version control task team
- Development version posted
  - http://www.gosic.org/ GLOBAL_SURFACE_DATABANK/GBD.html
- First version release and accompanying documentation / paper to be submitted spring 2012

International
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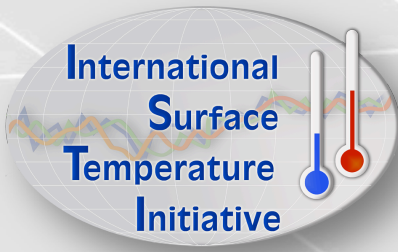
Partnerships essential

- Bring together existing efforts, augment and ensure pull through. e.g. ACRE ("Atmospheric Circulation Reconstructions over the Earth") project (http://www.met-acre.org/), International Environmental Data Rescue Organisation (www.iedro.org) and other national / international programs.

- Pursue innovative approaches (crowdsourcing building upon success of www.oldweather.org etc.)

- Build on ICOADS model for sea surface temperatures (http://icoads.noaa.gov/) – easy submission and access to data

- And you can also help ...

  data.submission@surfacetemperatures.org
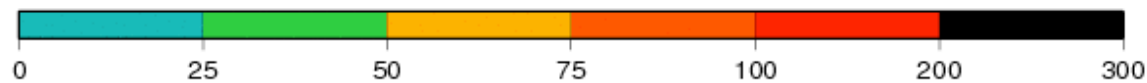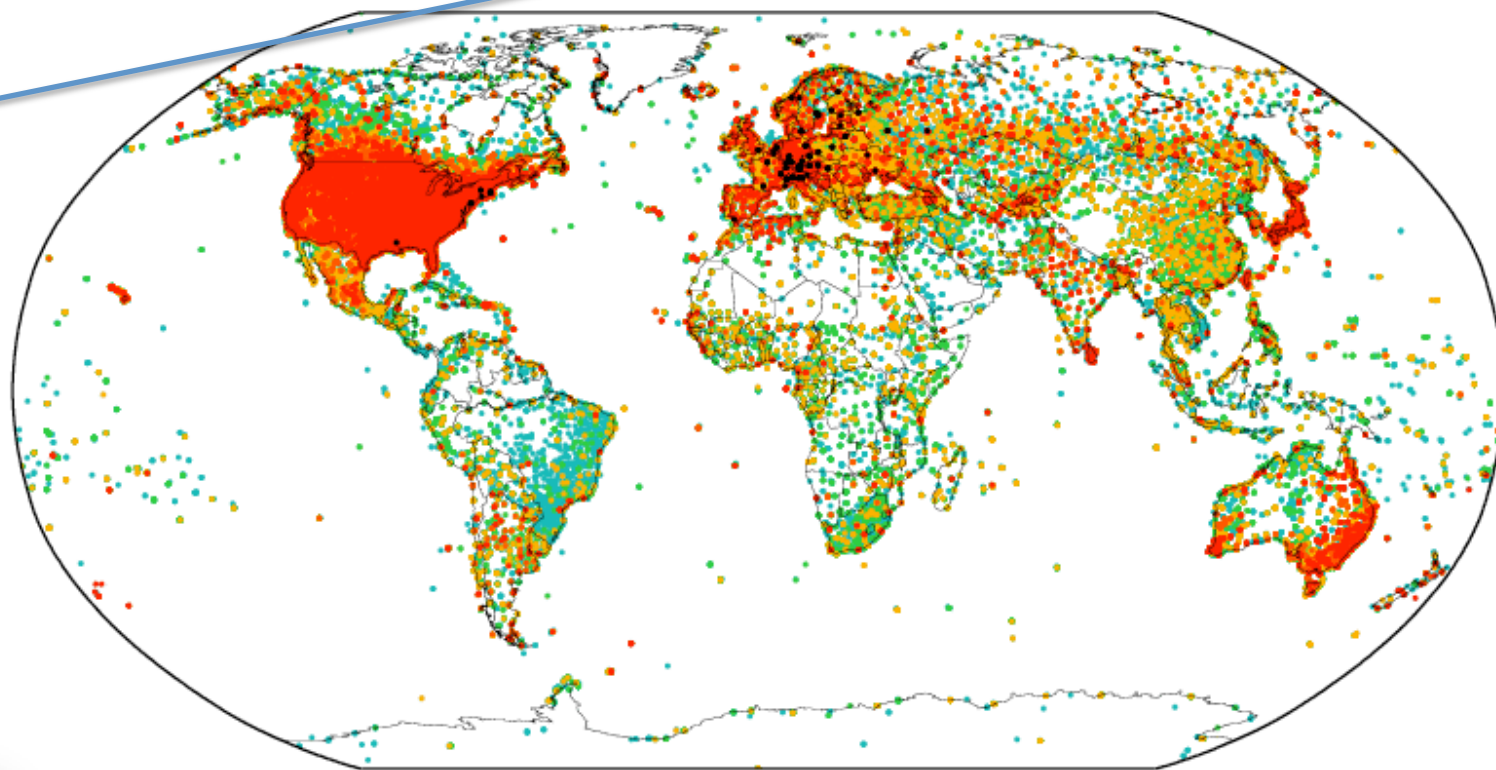
International Surface Temperature Initiative
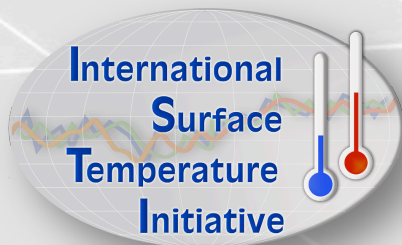
To date … Stage 2 holdings

Records, NOT stations, there will be a lot of station duplicates or even entire record duplicates!
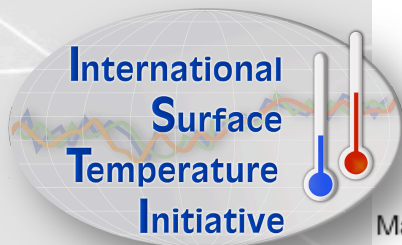
Jared Rennie, CICS-NC / NOAA NCDC

International Surface Temperature Initiative

ALL Stage2 monthly (20111021)
Number of NON–UNIQUE Station Records: 133806

Number of Years

Map generated on 20111021

Multiplicity of data products

- Structural uncertainty is the key
  - Raw data is far from traceable to international measurement standards.
  - Data artifacts are numerous and have myriad causes
  - Metadata is patchy at best
  - Data is discrete in both space and time
  - No "how to" … rather very many cases of "it may work …"
  - Multiple subjective decisions required even in automated procedures (thresholds, periods, test type etc.)
  - Different approaches may have different strengths and weaknesses
  - No single dataset can answer all user needs

International Surface Temperature Initiative
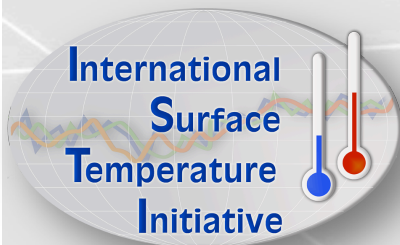
Benchmarking and assessment

- With real world data we do not have the luxury of knowing the truth – we CANNOT measure performance of a specific method or closeness to real world truth of any one data-product.

- We CAN focus on performance of underlying algorithms

- Consistent synthetic test cases, simulating real world noise, variability and spatial correlations potentially enable us to do this

International Surface Temperature Initiative
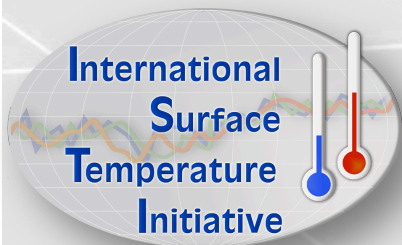
Benchmarking cycle
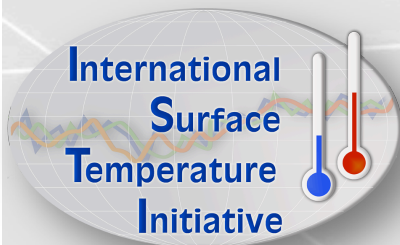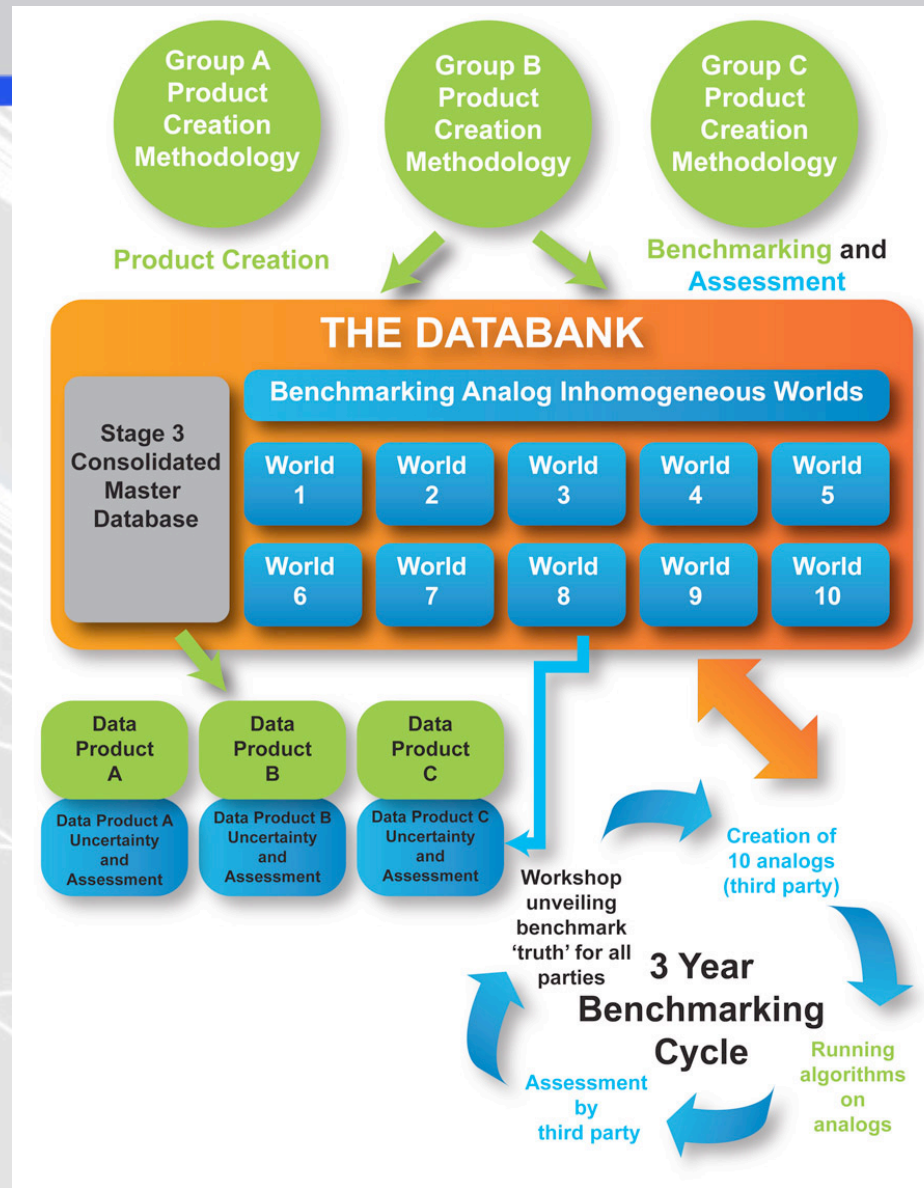
Benchmarking example

- For USHCN (lower 48 states)

- 100 member perturbed ensemble of the NCDC pairwise algorithm was run on 8 analogs (Williams et al., submitted)

- Consideration solely of timeseries and trends

- Analyses that follow are for the hardest analog with frequent predominantly small breaks added
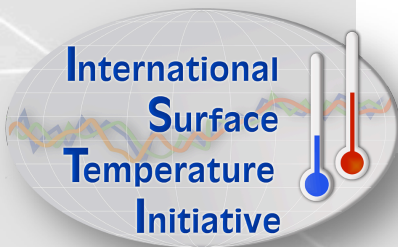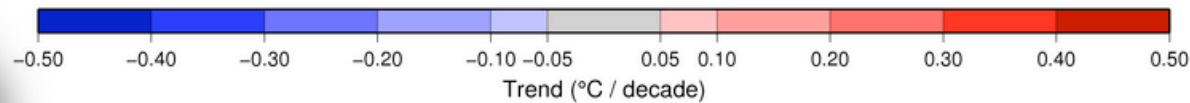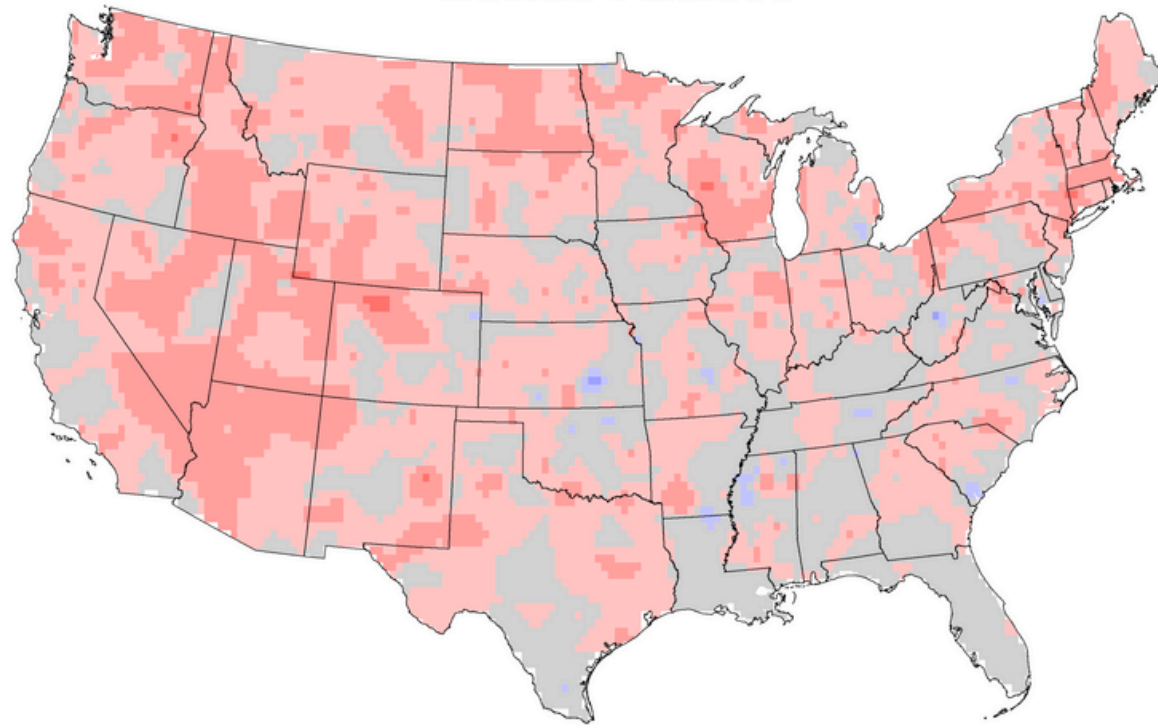
International Surface Temperature Initiative
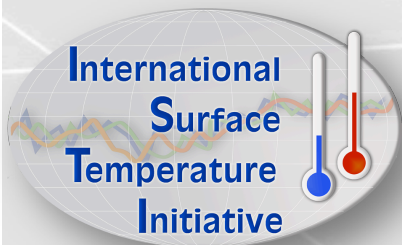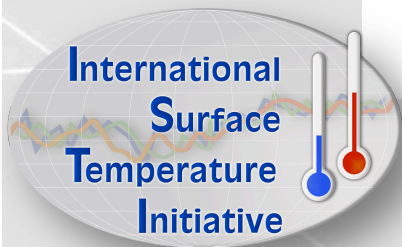
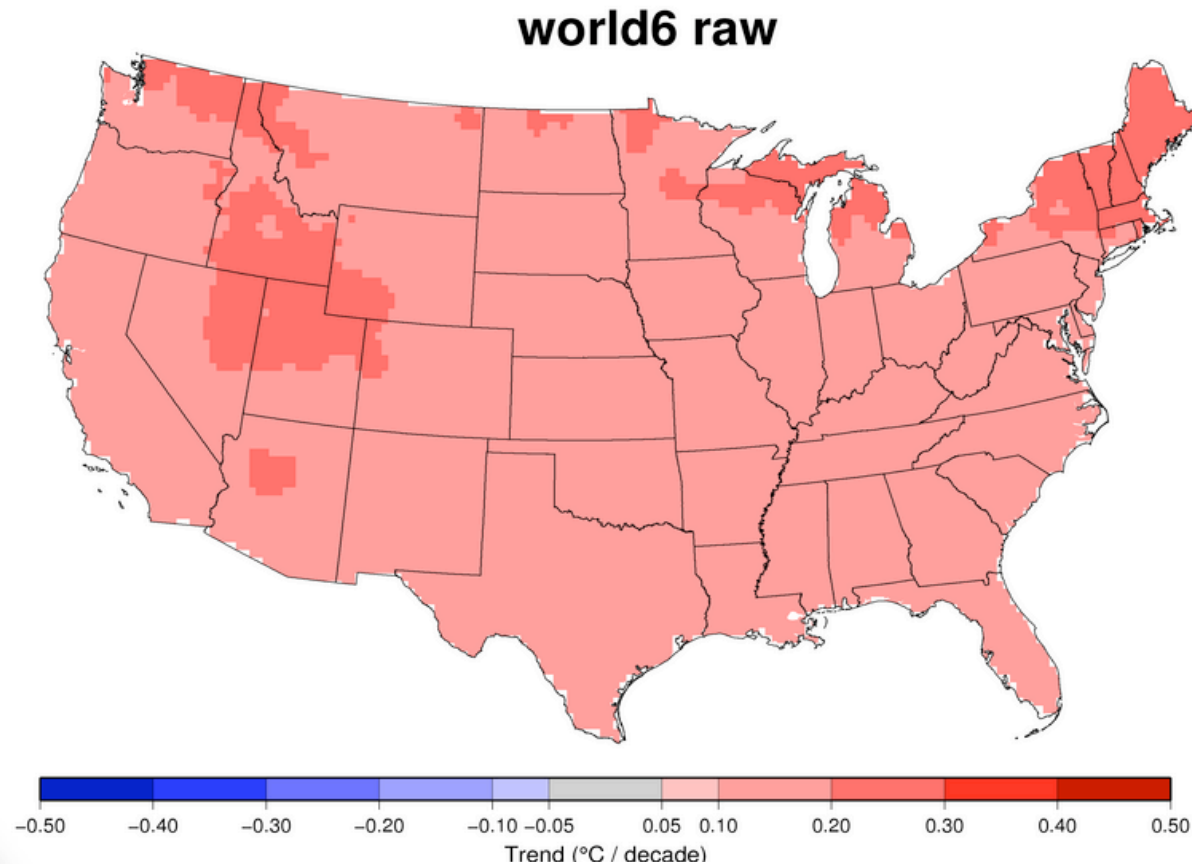# Synthetic data with added nastiness

world6 p01

Trend (°C / decade)
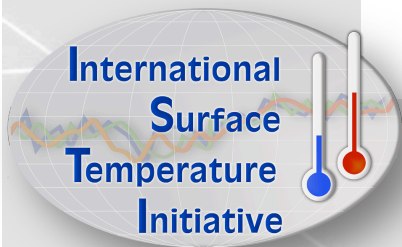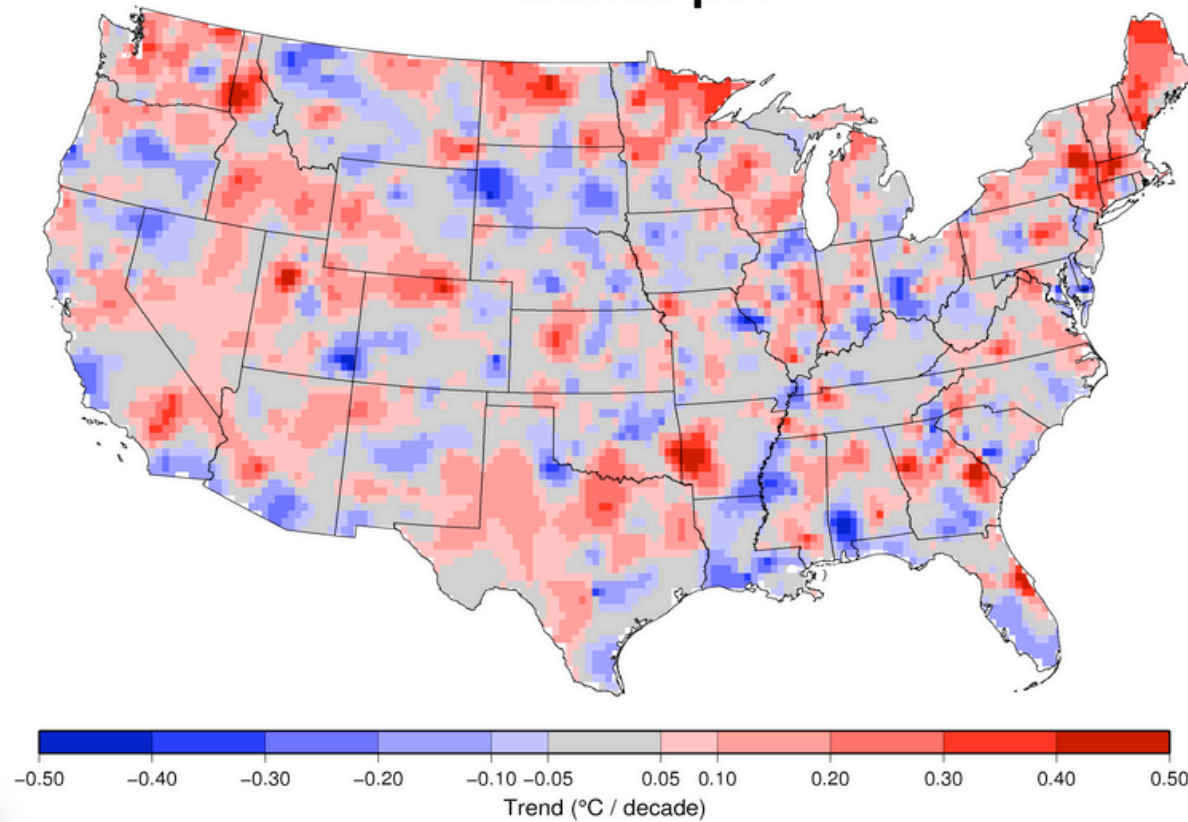
Operational algorithm estimate

world6 FLs.c00

Trend (°C / decade)

# Synthetic data without nastiness

world6 raw

Trend (°C / decade)

Implication when applied to real-world observed record that current dataset underestimates rate of historical warming within the United States, particularly for Tmax.

Benchmarking progress

- Working group and task teams instigated
- Create c.10 analog-error-worlds
  - Climate model basis (maintains plausible far field correlation structure) tweaked with real station climate characteristics
  - Add random and systematic errors to approximate real world error structures which may exist
  - Algorithm assessment based upon ability to recover original data
  - Error structures should enable answering a range of questions / assumptions regarding the true error to avoid over-tuning

International Surface Temperature Initiative
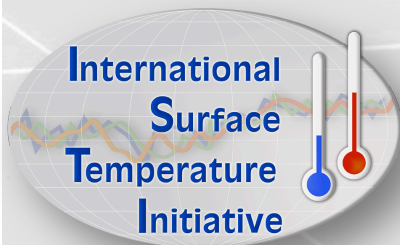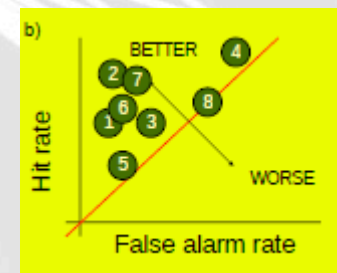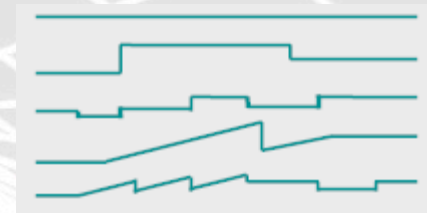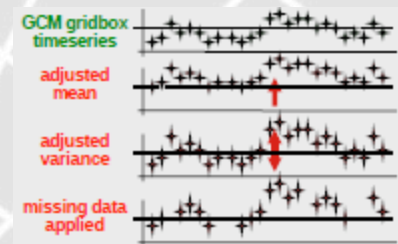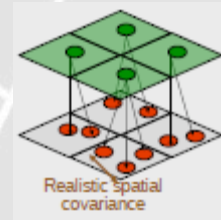
Analogs to be made available November 2012 based upon version 1 release of databank

Serving products and aiding users

Hypothetical Decision Tree
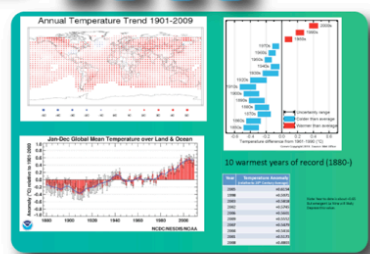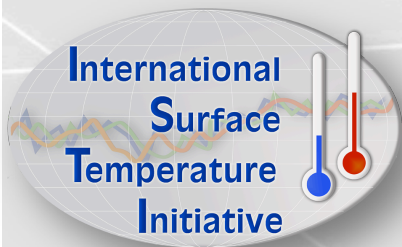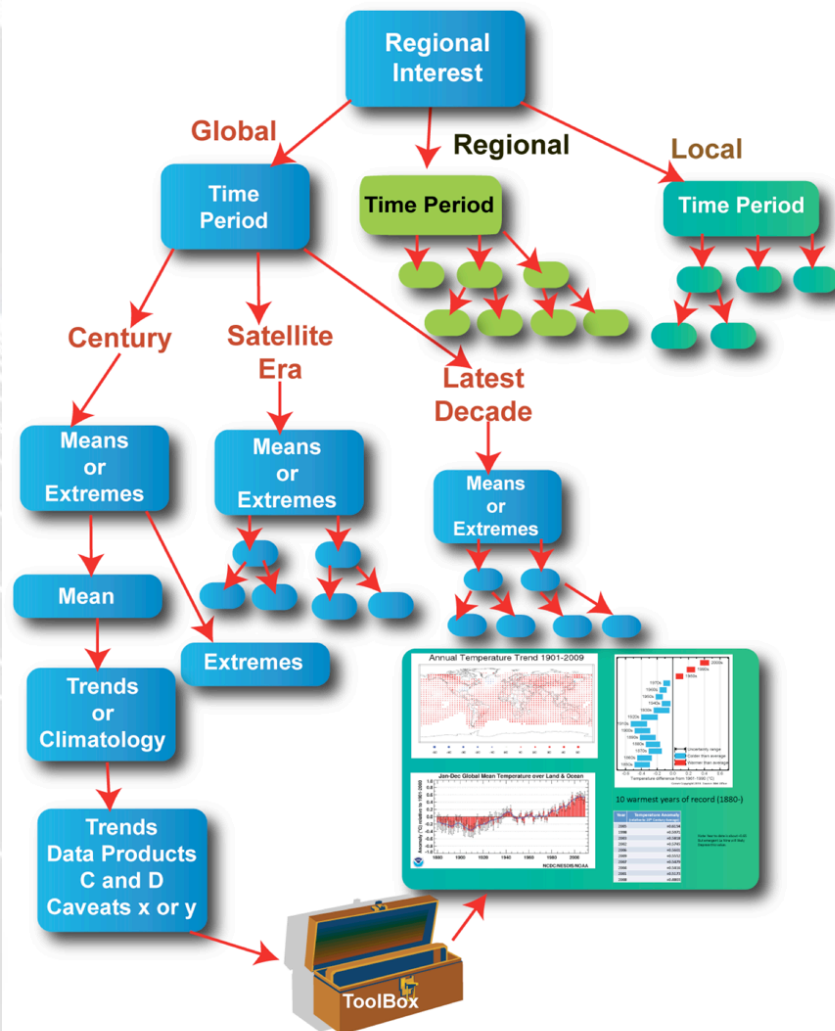
You can help make this a success

- Help to find raw data sources
- Come up with novel ways of analyzing the data
- Use the databank to create data-products
- Partake in the benchmarking exercise
- Help to make a data product portal a reality
- Provide constructive feedback

International Surface Temperature Initiative
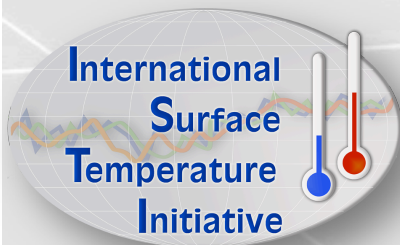
Questions and Answers

www.surfacetemperatures.org

Bull. Amer. Met. Soc. doi: 10.1175/2011BAMS3124.1

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