



# Global Historical Climatology Network

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# GHCN- Daily

(<http://www.ncdc.noaa.gov/oa/climate/ghcn-daily/>)

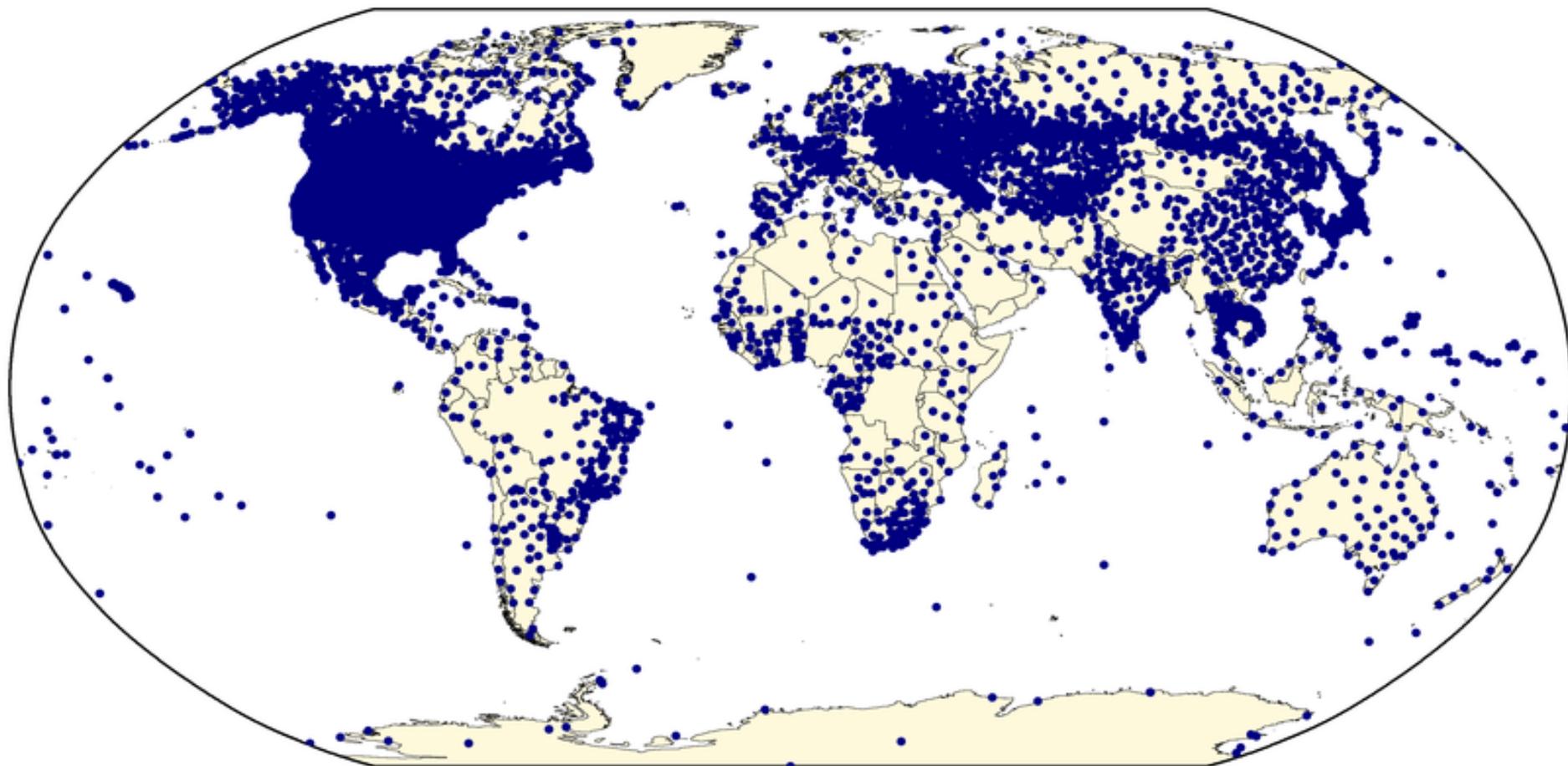
# Overview of GHCN- Daily

- **Goal:** Construct an Integrated Global Daily Dataset that is as comprehensive as possible and uniformly quality controlled

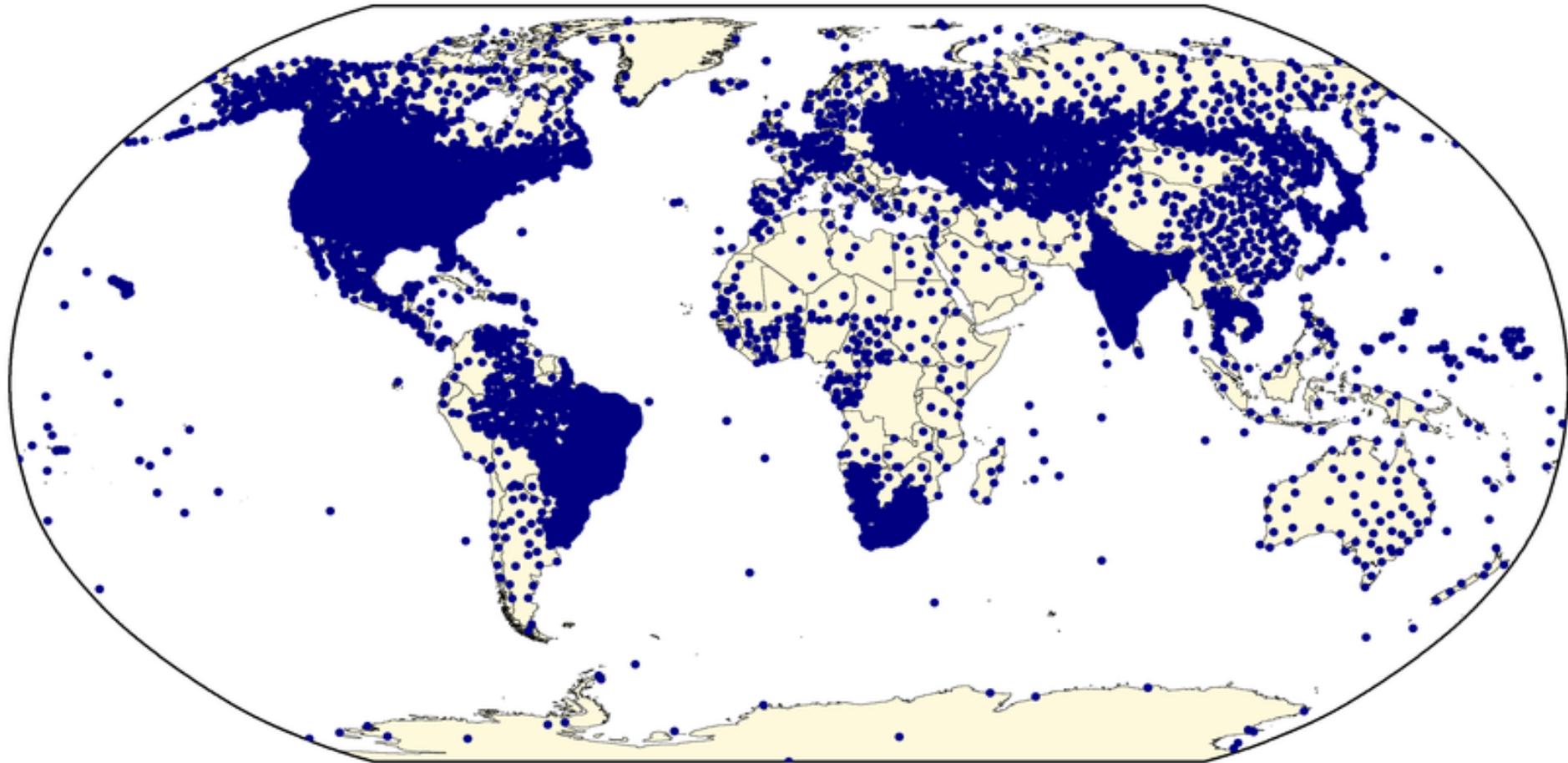
# Overview of GHCN- Daily

- Global *in situ* dataset derived from multiple sources of daily climate summaries (~11 sources for the U.S.)
  - ~25,000 temperature stations
  - ~44,000 precipitation stations
  - ~25,000 snowfall or snow depth stations
- Currently >1.6 billion daily observations
  - Earliest value from January 2, 1833
  - Latest value from yesterday
- Serves as the official GCOS Surface Network (GSN) archive

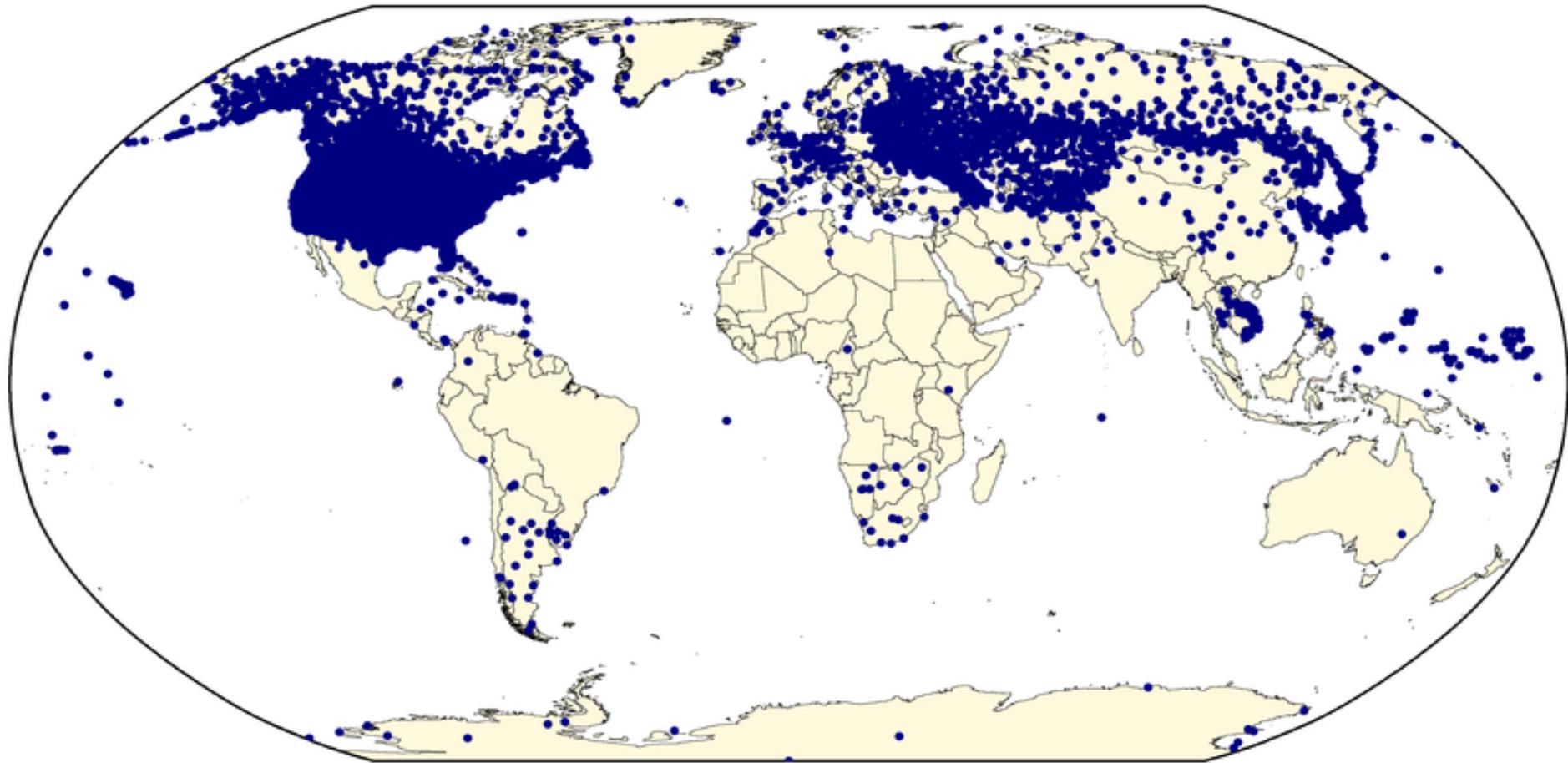
# Stations with Temperature



## Stations with Precipitation



## Stations with Snowfall or Snow Depth



# Results/Accomplishments

- **Addition of new data sources**
  - e.g., Climate Reference Network and U.S. Forts data (increase from 8 to 14 sources since 2007)
- **Addition of new elements (and QC)**
  - Snow fall, snow depth (many others to appear shortly)
- **Documentation of QC Approach**
  - Durre, I., M. J. Menne, B. E. Gleason, T. G. Houston, and R. S. Vose, 2009: Comprehensive automated quality assurance of daily surface observations. *Journal of Applied Meteorology and Climatology*, in review.
  - Durre, I., M.J. Menne, and R.S. Vose, 2008: Strategies for evaluating quality control procedures. *Journal of Applied Meteorology and Climatology*, 47, 1785-1791

# Updates and Maintenance

- **Data are updated twice each day**
  - for ~9000 stations from several sources (HPRCC/DSI-3201; ASOS; Environment Canada; and Global Summary Of the Day gleaned from SYNOP messages)
- **All historic sources are “refreshed” weekly**
  - Dataset is completely reassembled each week from primary sources to maintain consistency between each archive source and the integrated dataset
- **QC checks are applied to entire period of record with each refresh**

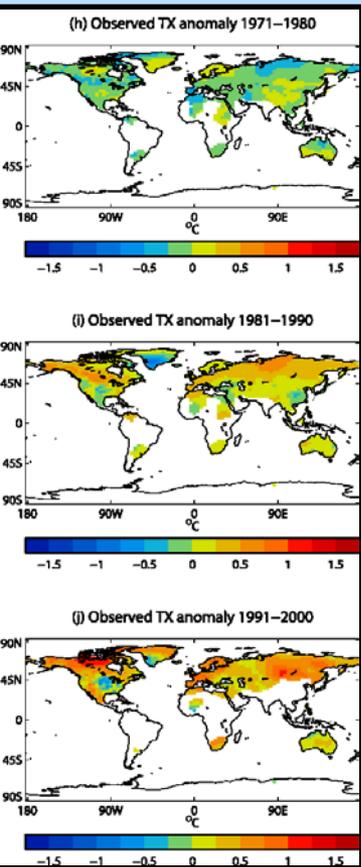
# Check in

- **The Future (as seen from two years ago):**
  - Write overview and QA description papers
  - Merge GHCN-Daily with NCDC's Global Summary of the Day dataset (synoptically derived data for 20,000 locations worldwide)
  - Adding snowfall and snow depth records (and QA) in support of climate monitoring
  - QA Evaluation approach and GHCN-Daily basic checks to be the foundation of operational QA of daily data at NCDC and its partners (e.g., RCC's, NWS)
  - GHCN-Daily will likely become NCDC's "official" global daily dataset

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# Applications

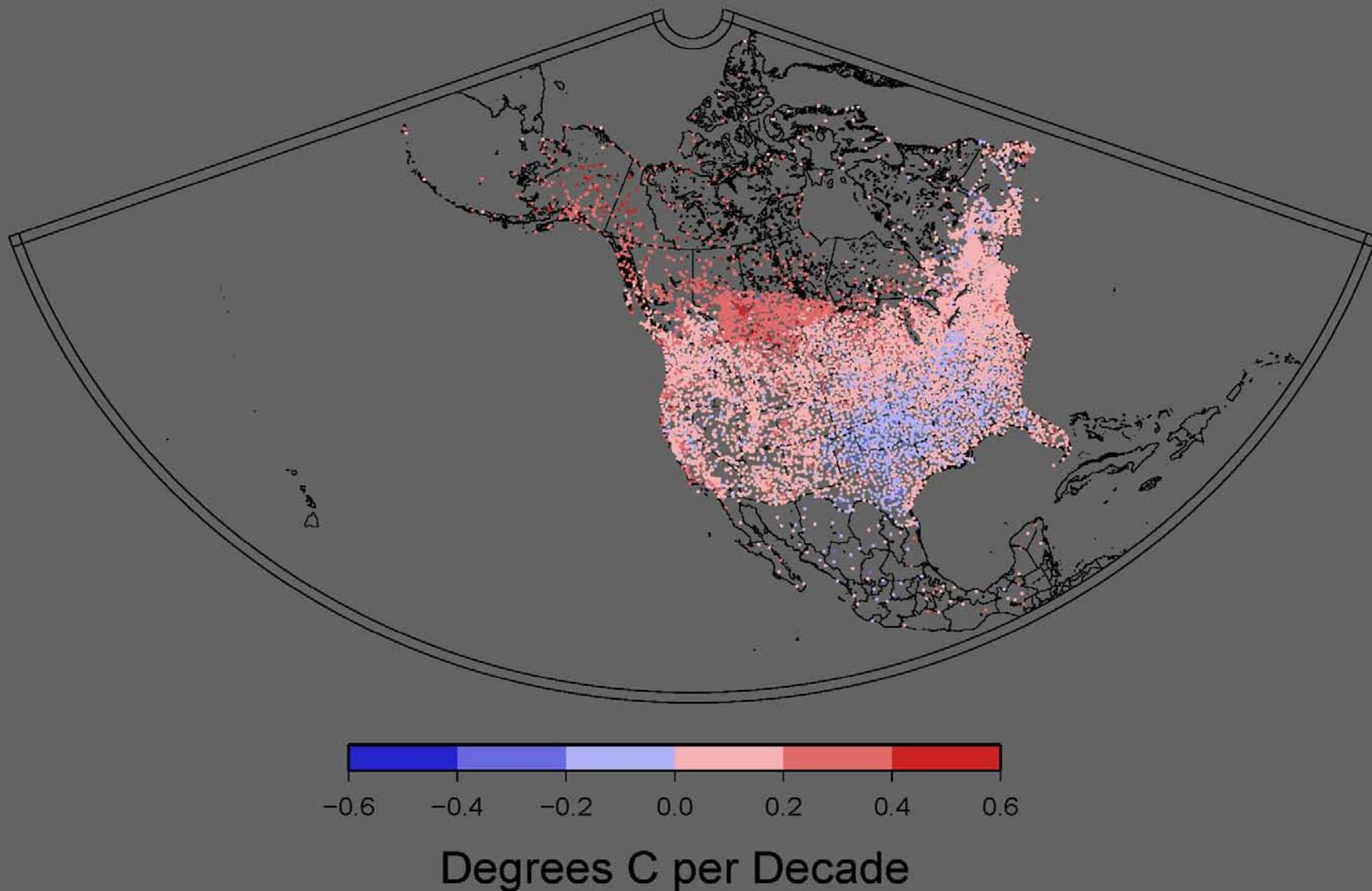


- HadGHCND (Caesar et al. 2006). GHCN-Daily originally used to create gridded anomaly fields for the period 1945-2000. The grids were then used to assess large-scale changes in maximum and minimum temperature. (Changes in winter and spring were larger than in other seasons.) Updates to present are available from:

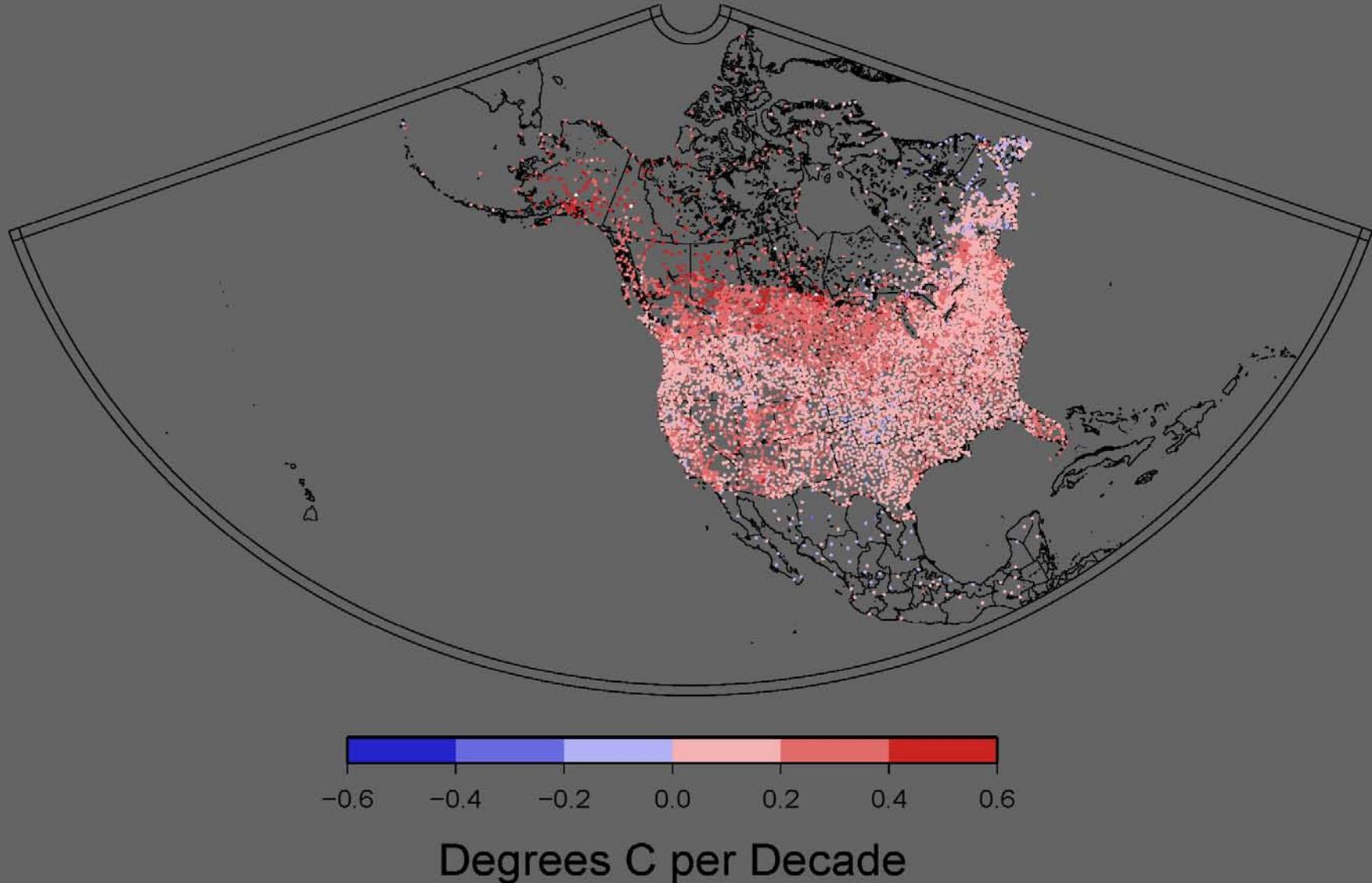
<http://hadobs.metoffice.com/hadghcnd>

- Regional snowfall impact scale calculations (based on NESIS)
- Regional homogenized products (experimental)

# Maximum Temperature Trends – Homogenized (1950 to 2005)



# Minimum Temperature Trends – Homogenized (1950 to 2005)



# Schedule

- Finish adding non “core” elements
- Transition away from current U.S. daily data processing system to GHCN-Daily
- Focus on adding non U.S. sources
  - E.g.
    - Formerly quarantined African data
    - Australia climate database
    - Data from Mexico
    - GSOD data
- Homogenization (Monthly to daily)

# GHCN- Monthly

(<http://www.ncdc.noaa.gov/oa/climate/ghcn-monthly/>)

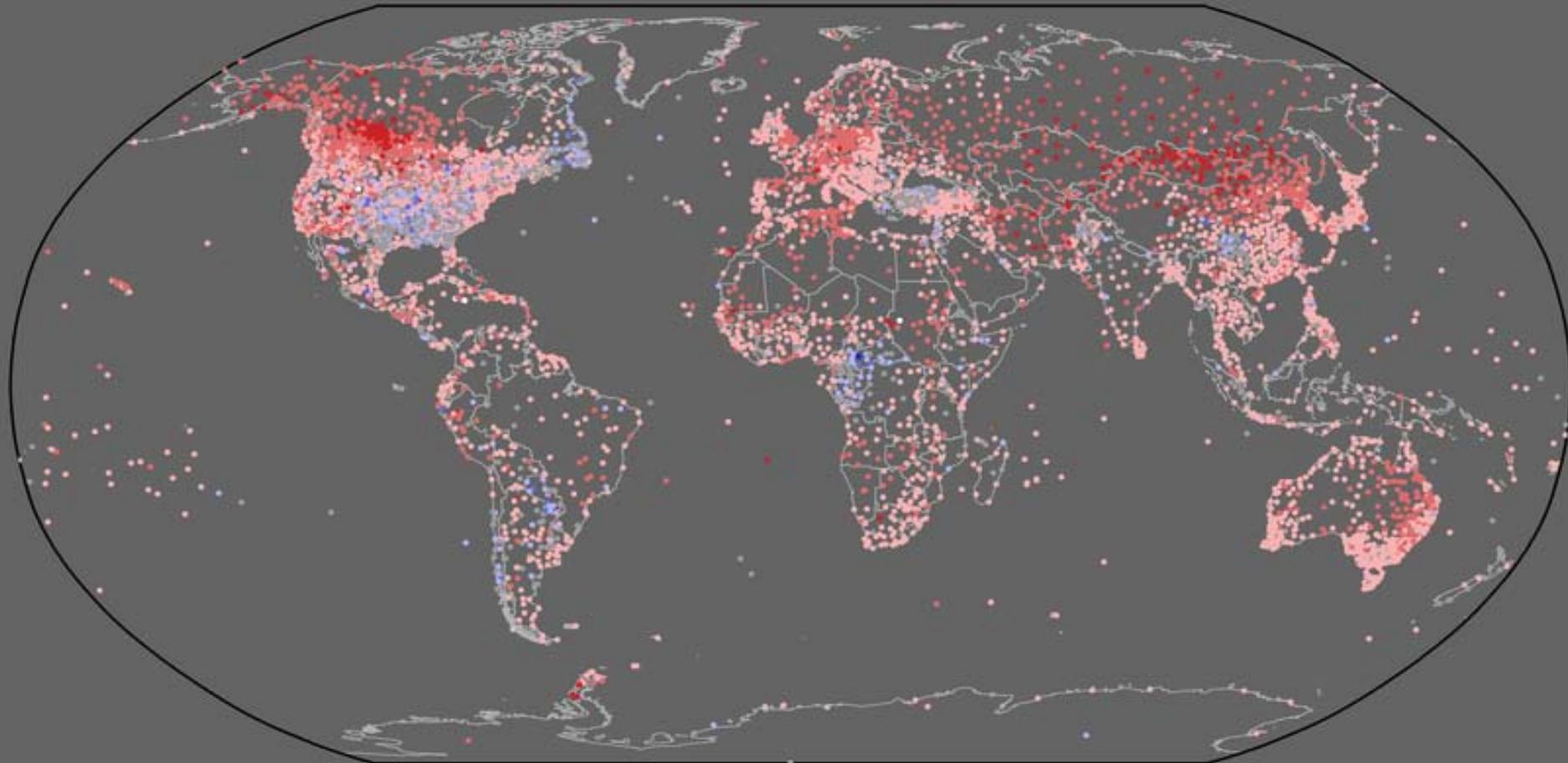
## Near- term Goals for Improvement

- Enhance update system to ingest more real-time reports for climate monitoring
- Regularly homogenize monthly mean temperature series with the method used to produce U.S. HCN version 2
- Quantify structural uncertainty in approach to data homogenization

## Medium- term Goals for Improvement

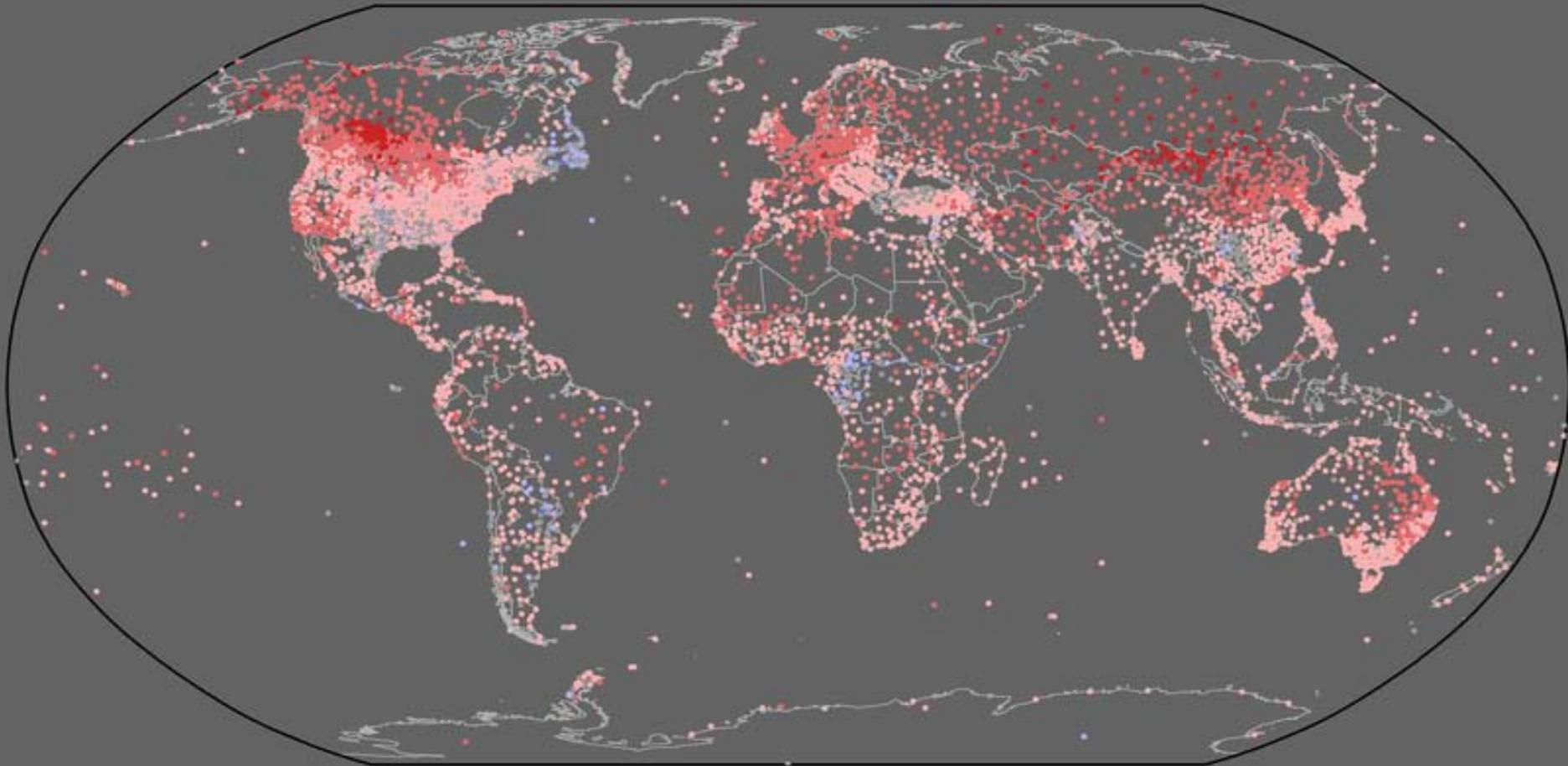
- Add additional historical records of mean monthly max/min temperature and total precipitation

US Annual Average FLs.raw (1950–2008) DTAG–20090520



Degrees C per Decade

US Annual Average FLs.52d (1950–2008) DTAG–20090520



Degrees C per Decade

# Validation Strategy

- Evaluate structural uncertainty in NCDC's automated pairwise homogenization algorithm
  - Using
    - surrogate Cooperative Observer temperature series extracted from GCM output (8 versions)
    - small European surrogate networks carefully simulated to match observed record
  - Quantify fidelity of the extracted climate signal from the “messed up” surrogate data using 100 different versions of the homogenization algorithm

# Product Maturity

Maturity	Sensor Use	Algorithm stability	Metadata & QA	Documentation	Validation	Public Release	Science & Applications
1	Research Mission	Significant changes likely	Incomplete	Draft ATBD	Minimal	Limited data availability to develop familiarity	Little or none
2	Research Mission	Some changes expected	Research grade (extensive)	ATBD Version 1+	Uncertainty estimated for select locations/times	Data available but of unknown accuracy; caveats required for use.	Limited or ongoing
3	Research Missions	Minimal changes expected	Research grade (extensive); Meets international standards	Public ATBD; Peer-reviewed algorithm and product descriptions	Uncertainty estimated over widely distribute times/location by multiple investigators; Differences understood.	Data available but of unknown accuracy; caveats required for use.	Provisionally used in applications and assessments demonstrating positive value.
4	Operational Mission	Minimal changes expected	Stable, Allows provenance tracking and reproducibility; Meets international standards	Public ATBD; Draft Operational Algorithm Description (OAD); Peer-reviewed algorithm and product descriptions	Uncertainty estimated over widely distribute times/location by multiple investigators; Differences understood.	Data available but of unknown accuracy; caveats required for use.	Provisionally used in applications and assessments demonstrating positive value.
5	All relevant research and operational missions; unified and coherent record demonstrated across different sensors	Stable and reproducible	Stable, Allows provenance tracking and reproducibility; Meeting international standards	Public ATBD, Operational Algorithm Description (OAD) and Validation Plan; Peer-reviewed algorithm, product and validation articles	Consistent uncertainties estimated over most environmental conditions by multiple investigators	Multi-mission record is publicly available with associated uncertainty estimate	Used in various published applications and assessments by different investigators
6	All relevant research and operational missions; unified and coherent record over complete series; record is considered scientifically irrefutable following extensive scrutiny	Stable and reproducible; homogeneous and published error budget	Stable, Allows provenance tracking and reproducibility; Meeting international standards	Product, algorithm, validation, processing and metadata described in peer-reviewed literature	Observation strategy designed to reveal systematic errors through independent cross-checks, open inspection, and continuous interrogation	Multi-mission record is publicly available from Long-Term archive	Used in various published applications and assessments by different investigators

# Research- to- Operations or Delivery Plan

- Both GHCN-Monthly and GHCN-Daily are operationally updated at NCDC

# Resources

- Number of personnel employed for project
  - ~six (part-time)
- Key equipment or observatories used
  - NOAA Linux servers
- Key collaborating projects or personnel
  - GCOS data collection efforts
- NOAA points-of-contact or collaborators, as applicable
  - M. Menne, NCDC (GHCN-Daily); R. Vose, NCDC (GHCN-Monthly Precipitation); J. Lawrimore, NCDC (GHCN-Monthly Temperature)
- Target NOAA Data Center (We're here)