U.S. Climate Reference Network: Current Status and Future Directions

Sharon LeDuc

Michael Palecki

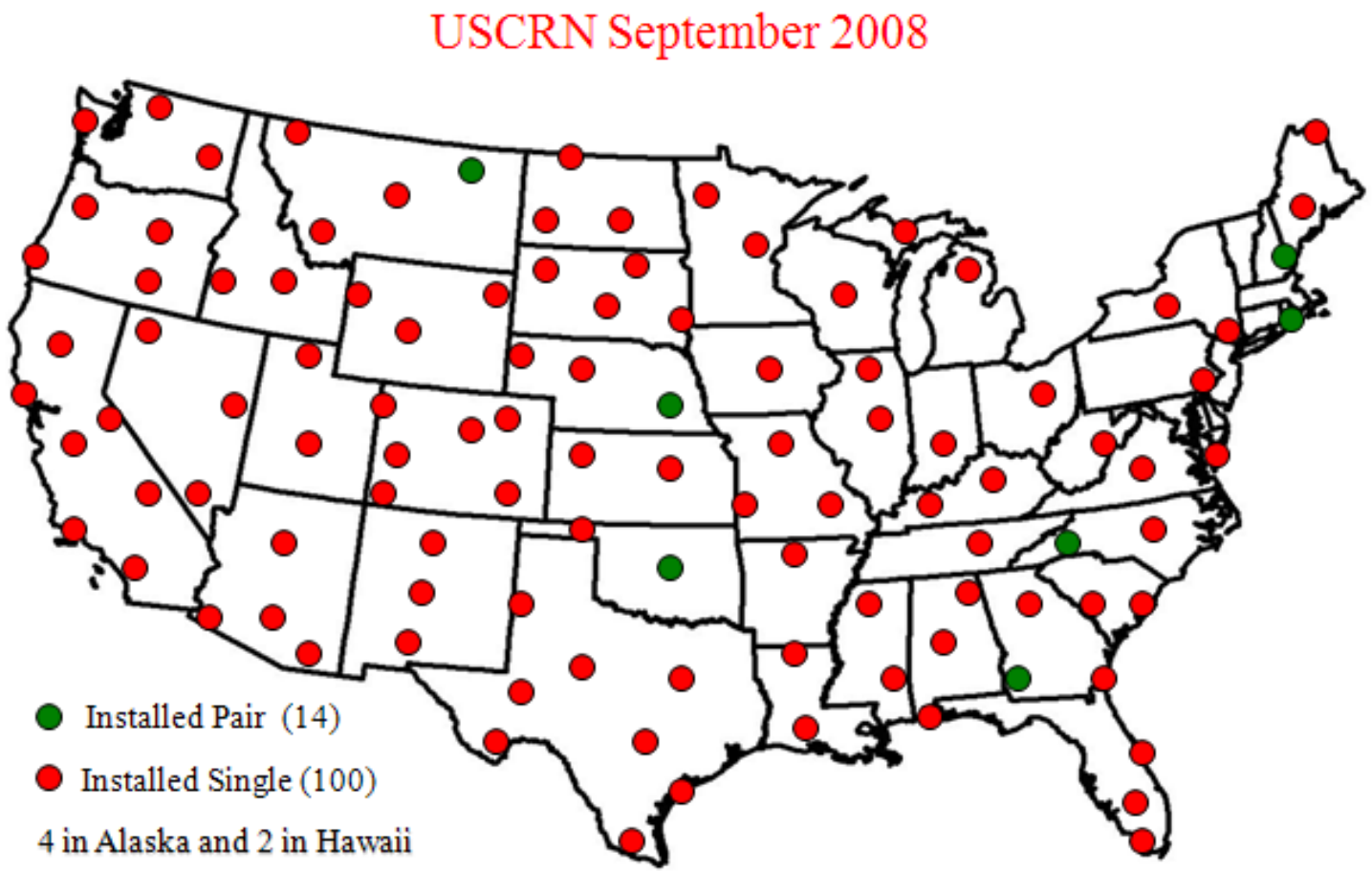
National Climatic Data Center

DOC/NOAA/NESDIS

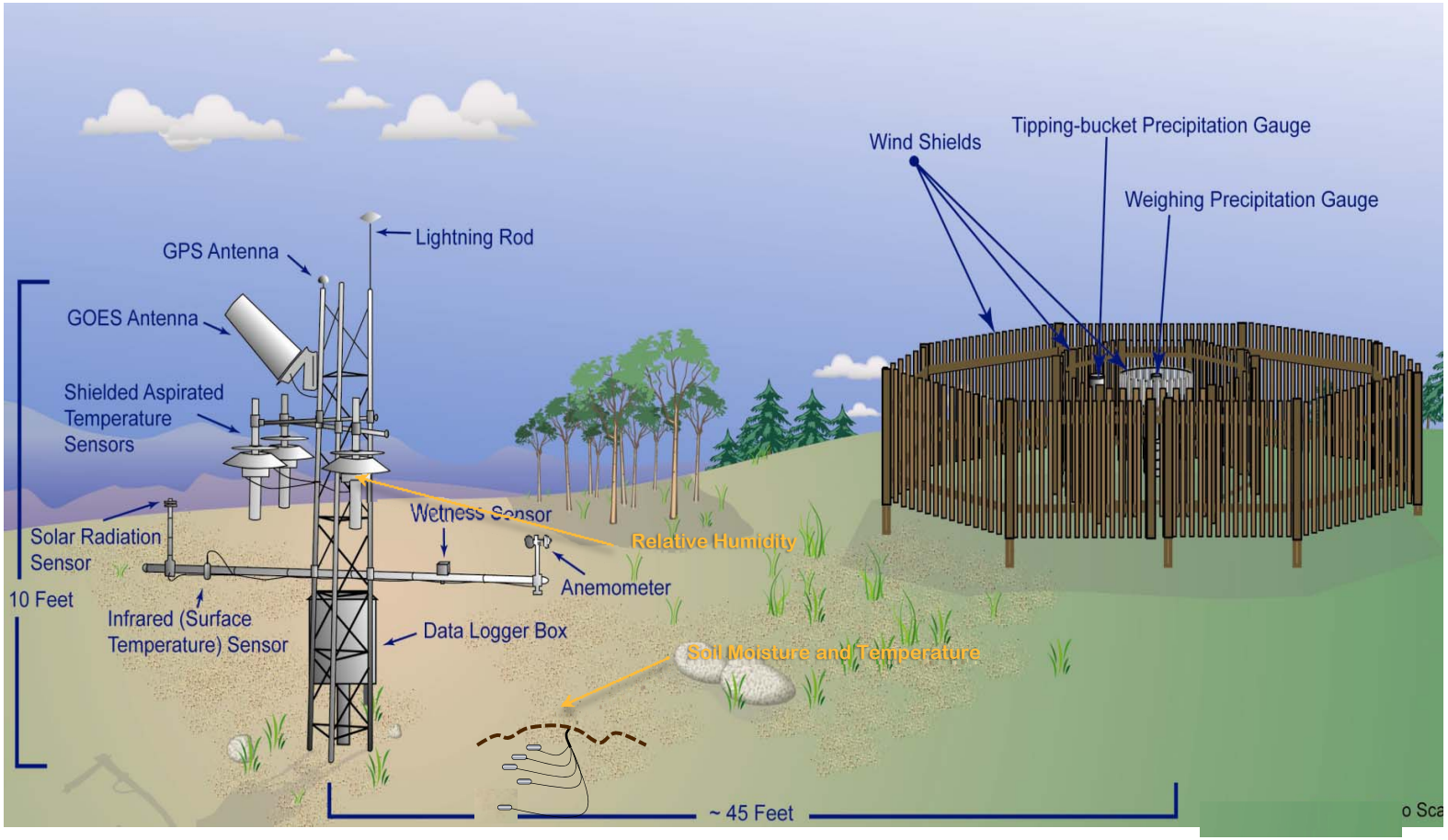
USCRN Goals

- **Making science quality climate observations adhering to the Ten Climate Monitoring Principles of GCOS, NRC/NAS, and CCSP**
- **Answering the question at mid-century: "How has the climate of the United States changed over the last 50 years?"**
- **Serving as a reference standard for other networks, while evaluating new technology**
- **Leveraging USCRN knowledge and infrastructure to support new missions**

USCRN Continental U.S. Deployment Completed in 2008



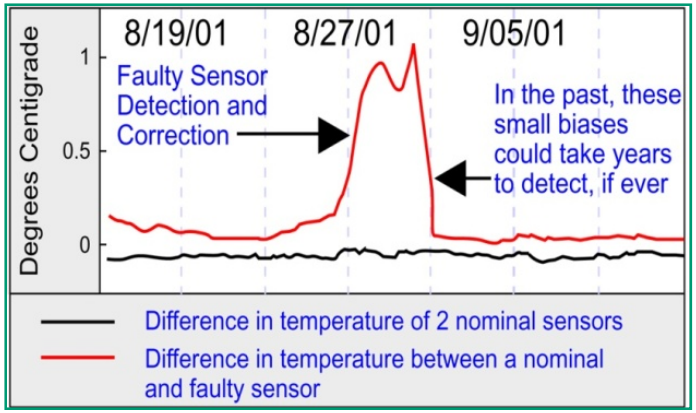
CRN Station Model

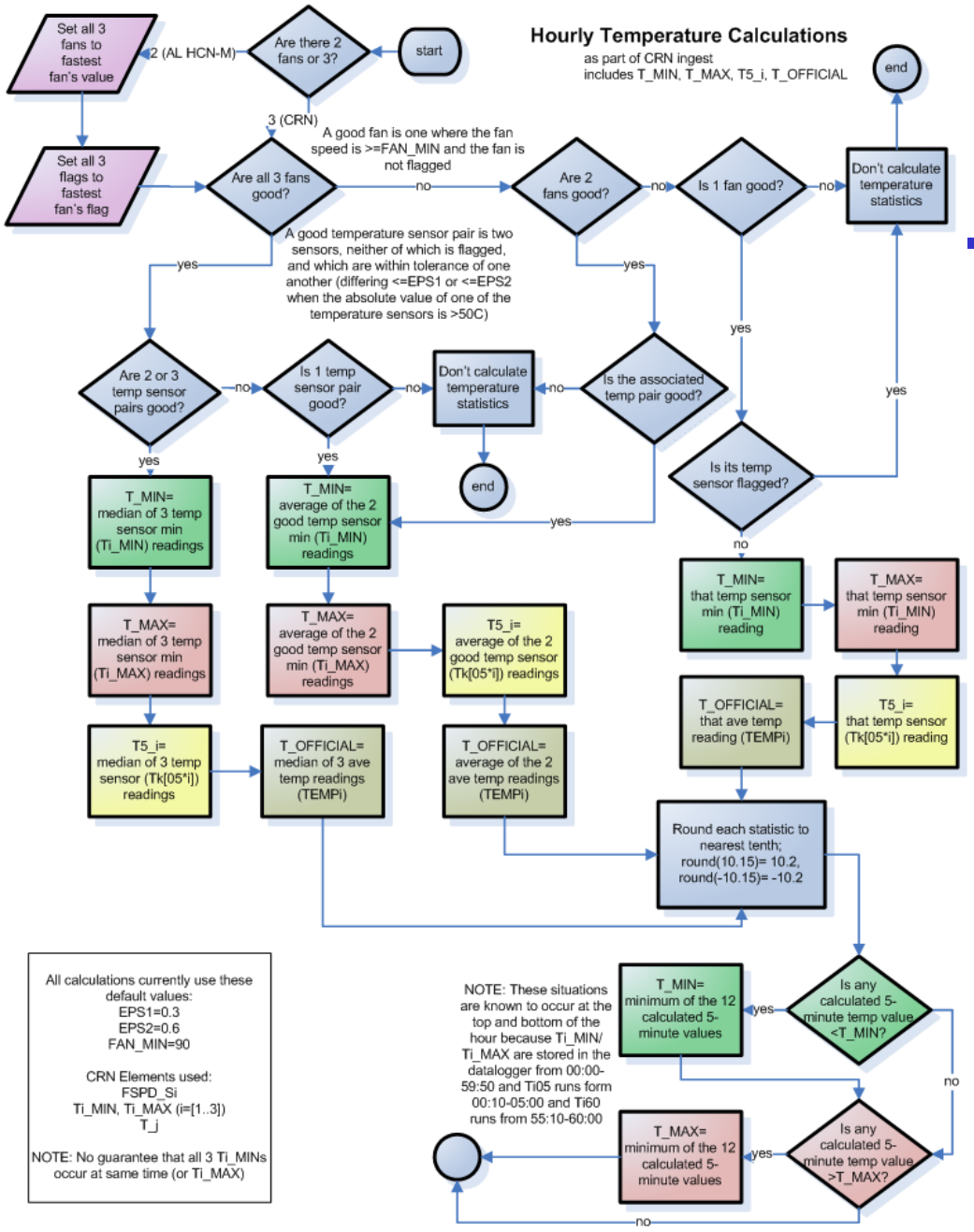


The Basics: How USCRN Works

Primary variables are measured with triplicate configurations that allow for intercomparisons:

- 3 PRTs measure T
- 3 wires measure P



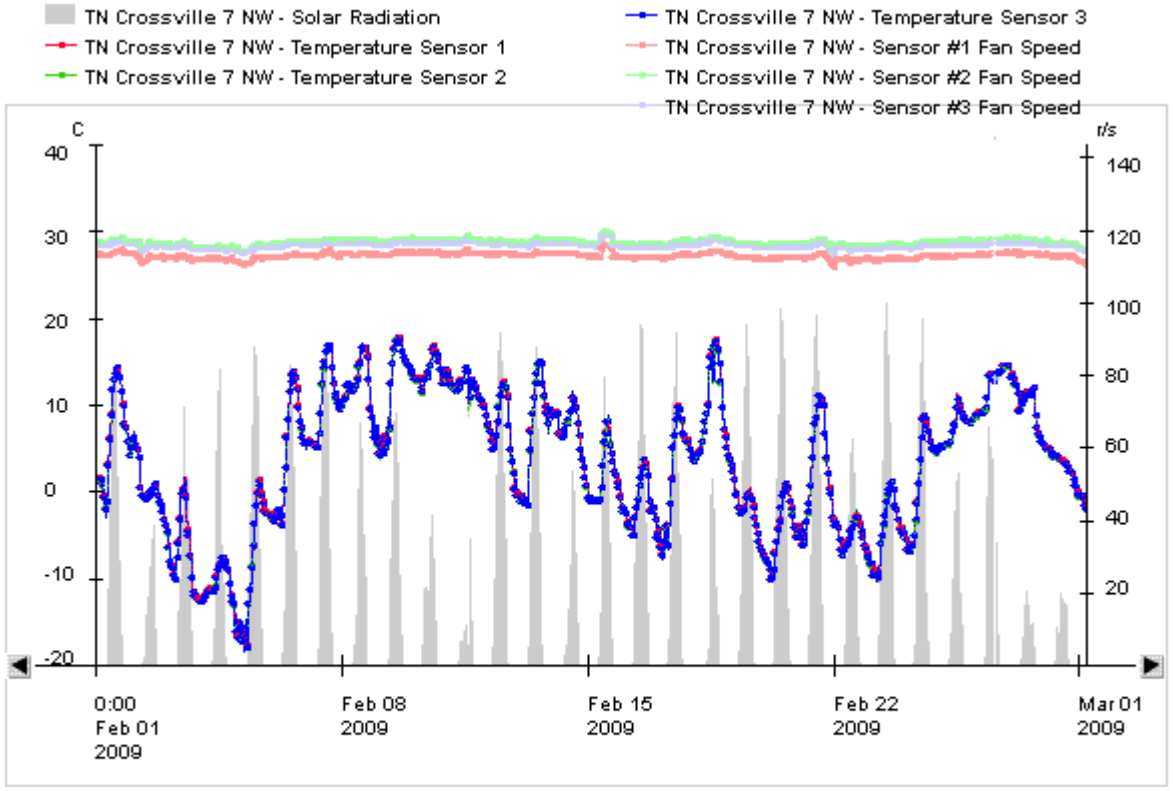


Triplicate Temperatures:

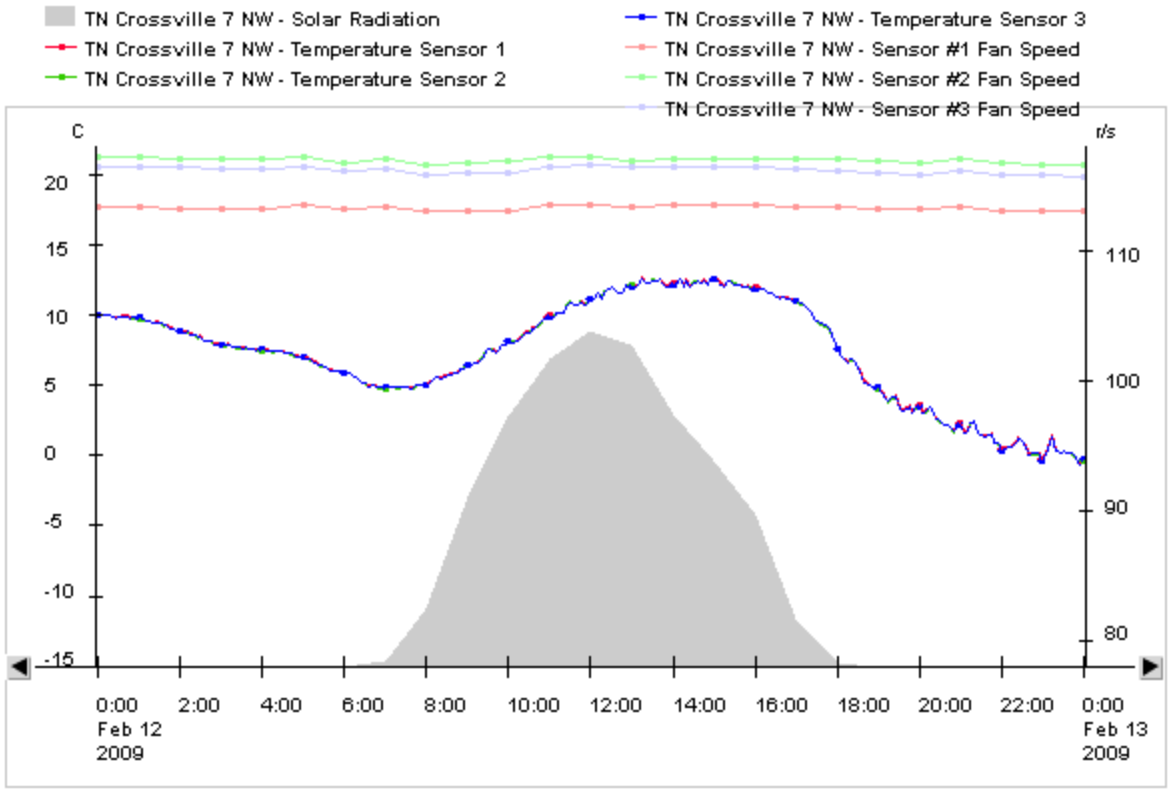
- 3 platinum resistance thermometers calibrated to NIST traceable standards
- 3 fan speeds
- equipment flags

are used to calculate the 5-minute and hourly temperatures with an accuracy of +/- 0.3°C

Crossville, TN: February 2009



Crossville, TN: 12 February 2009

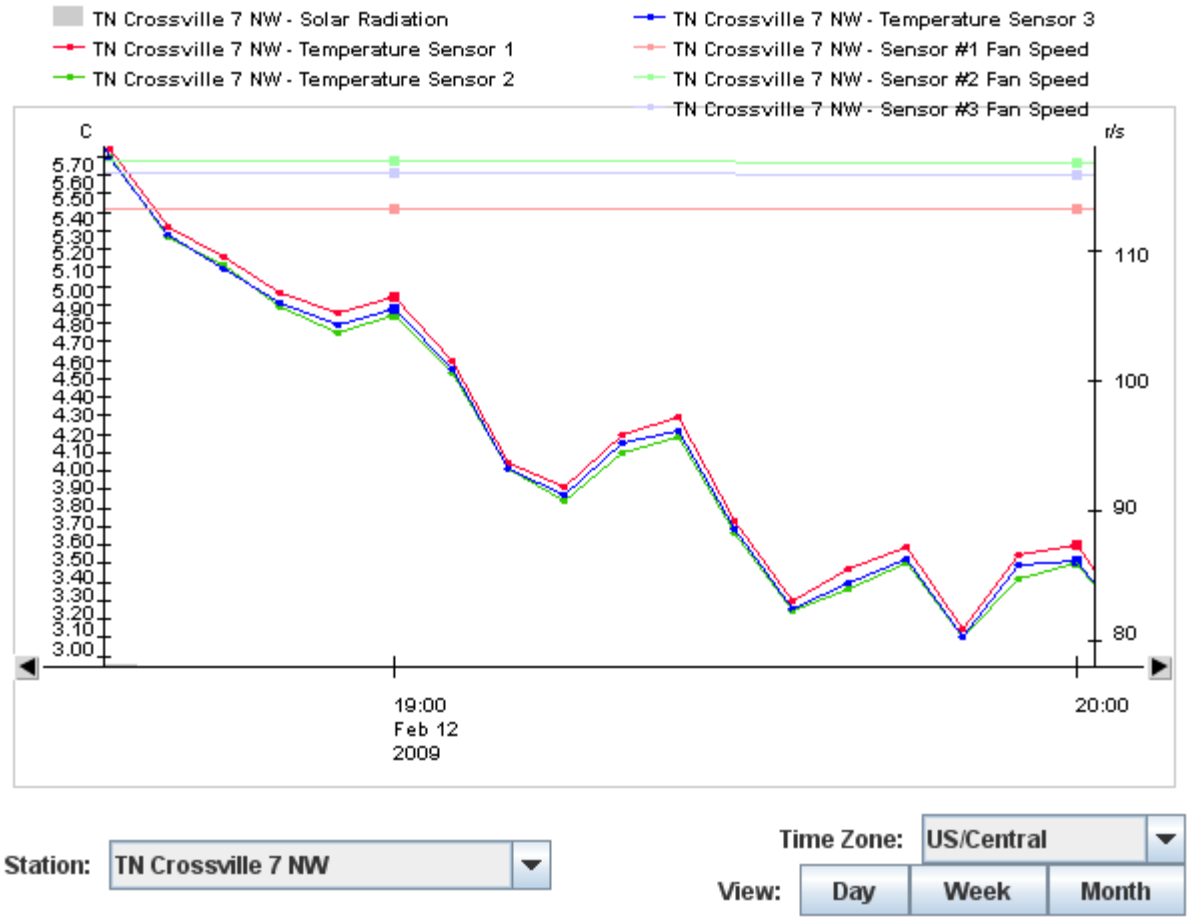


Station: TN Crossville 7 NW

Time Zone: US/Central

View: Day | Week | Month

Crossville, TN: 7 PM,12 February 2009



USCRN Temperature Extremes

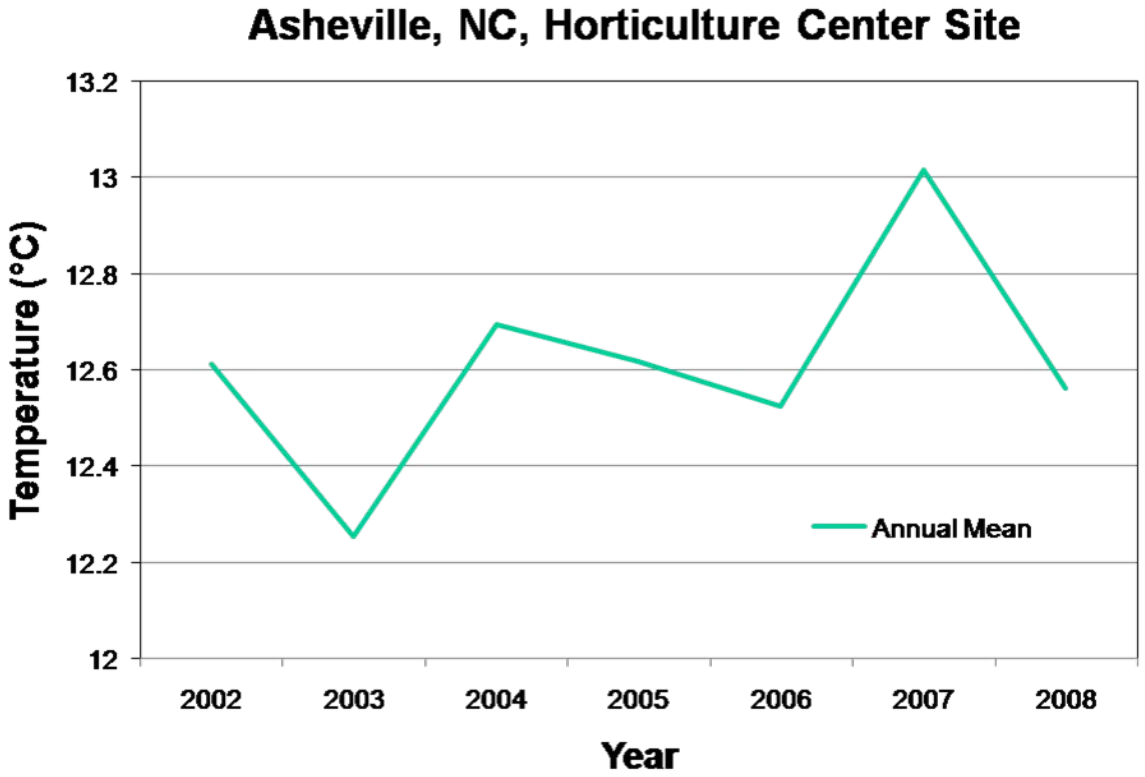
- Highest Air Temperature = 52.2°C
  Stovepipe Wells, CA; July 5, 2007

- Lowest Air Temperature = -49.2°C
  Barrow, AK; February 3, 2006

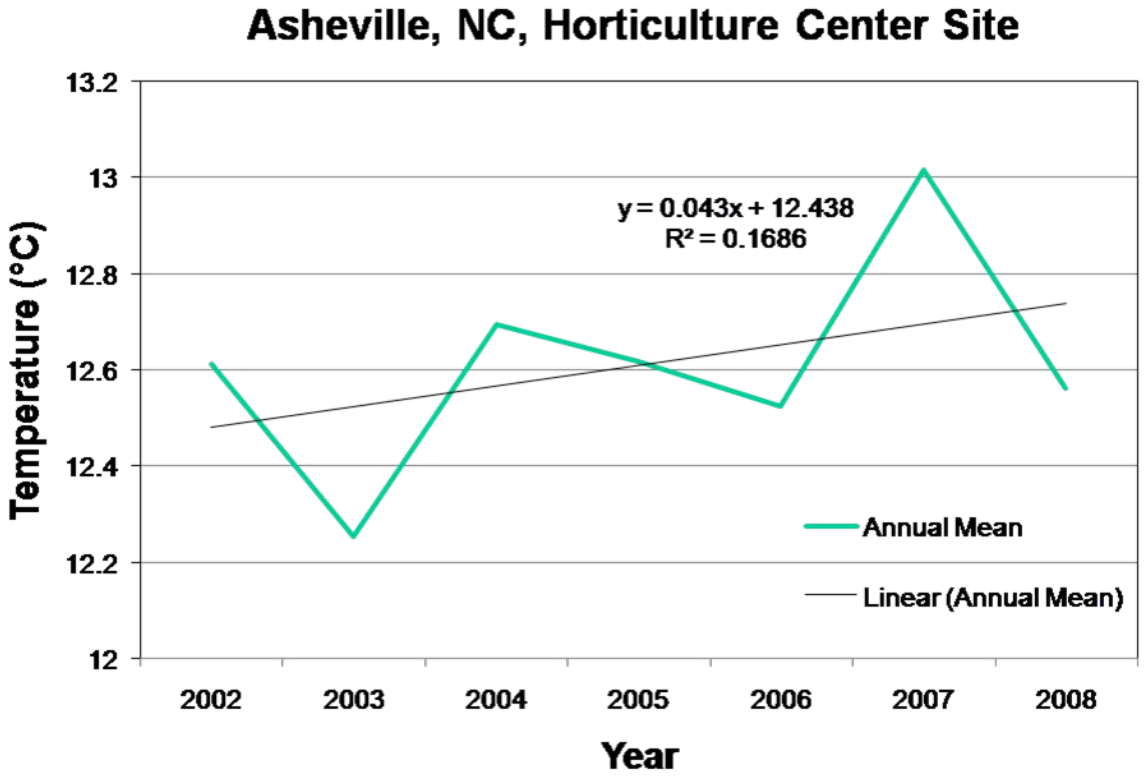
- Highest Ground Surface Temperature = 72.2°C
  Stovepipe Wells, CA; June 24, 2006

- Lowest Ground Surface Temperature = -49.9°C
  Barrow, AK; February 3, 2006

What is happening over time?



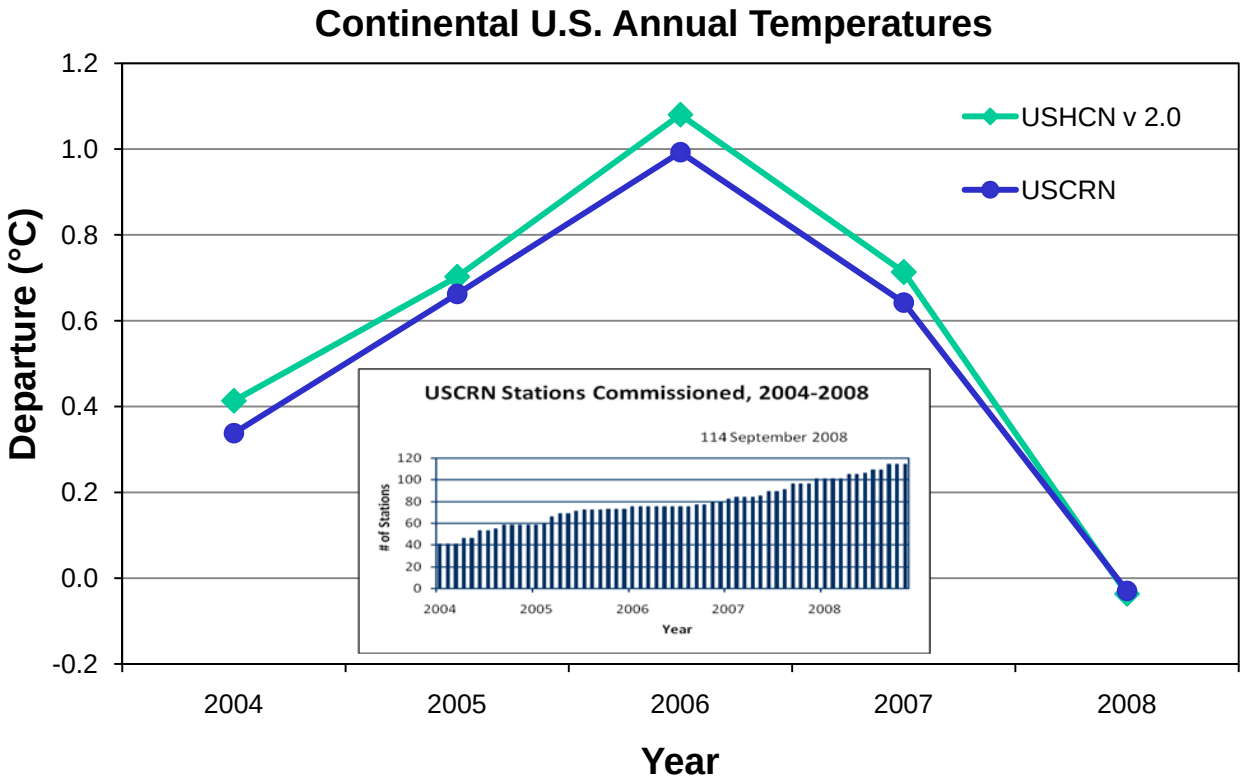
What is happening at Asheville CRN?



Taking a national look at climate

- Relationships between the USCRN observations and adjacent homogenized cooperative observer records were calculated and applied to the 1971-2000 coop data to construct pseudonormals for each USCRN station
- These pseudonormals are subtracted from each station's monthly mean to create departures for each that can be averaged together into national departures
- This same approach will be used to synthesize lengthy historical times series to thread to the future USCRN station records

A First Look at the USCRN National Air Temperature Departure Time Series



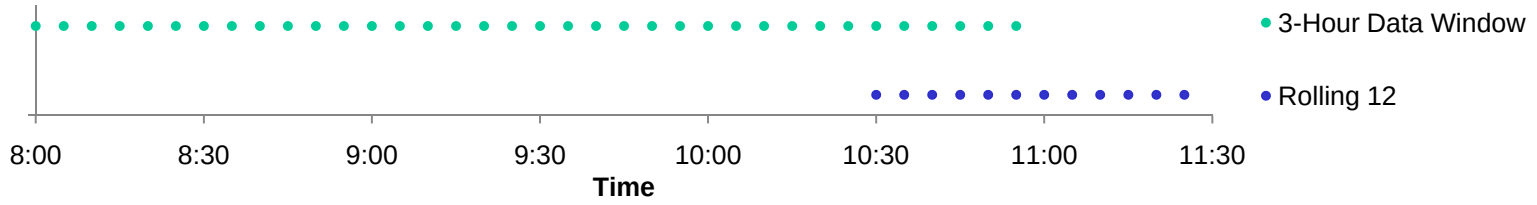
- The mean bias for the first 5 annual averages is -0.05°C compared to the US Historical Climate Network v.2.0

Current USCRN Activities

- Develop additional layers of quality control and network monitoring
- Provide improved access to hourly and daily USCRN observations
- Facilitate science applications of USCRN data
- Reduce data latency – the Rolling 12

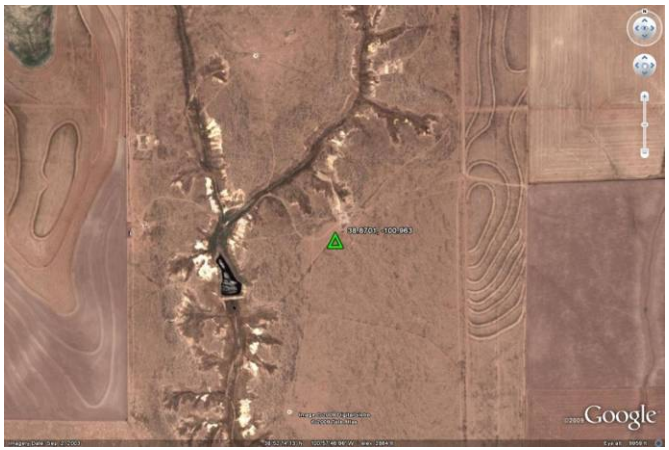
The Rolling 12

- A USCRN station transmission has consisted of a complete set of all raw variables for the three most recent clock hours, ending at the most recent complete clock hour (e.g., 11:28 transmission, 8:00-11:00 data)
- This data latency concerned real time data users, such as the National Weather Service
- To solve this, a new set of 12 five-minute calculated temperature and precipitation values are provided that extend to the most recent five-minute clock interval prior to the hourly transmission (e.g., 10:25-11:25 data)

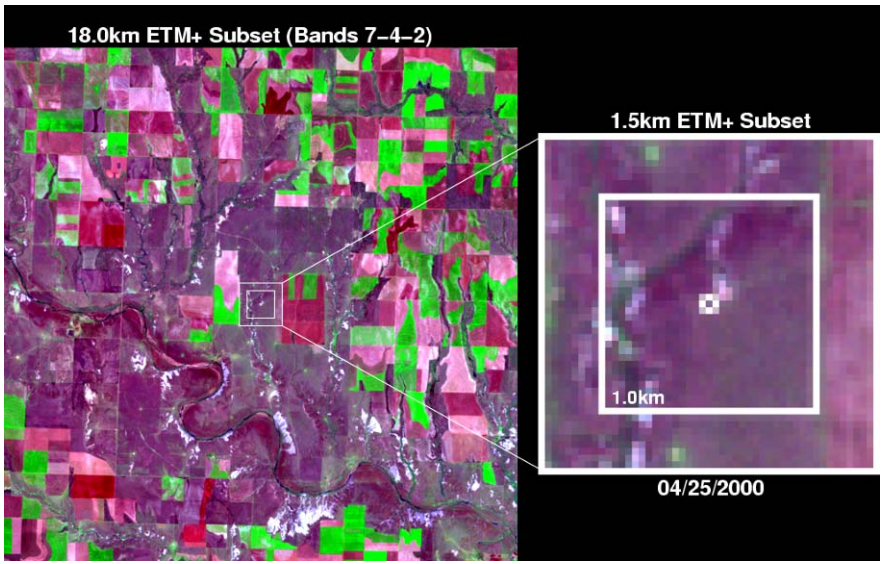


Science Application: Satellite Calibration/Validation

- USCRN has been cooperating with satellite climatology efforts that may benefit from observations of surface air temperature, surface skin temperature, and solar radiation
- Areal heterogeneity and station representativeness studies have begun to support this effort



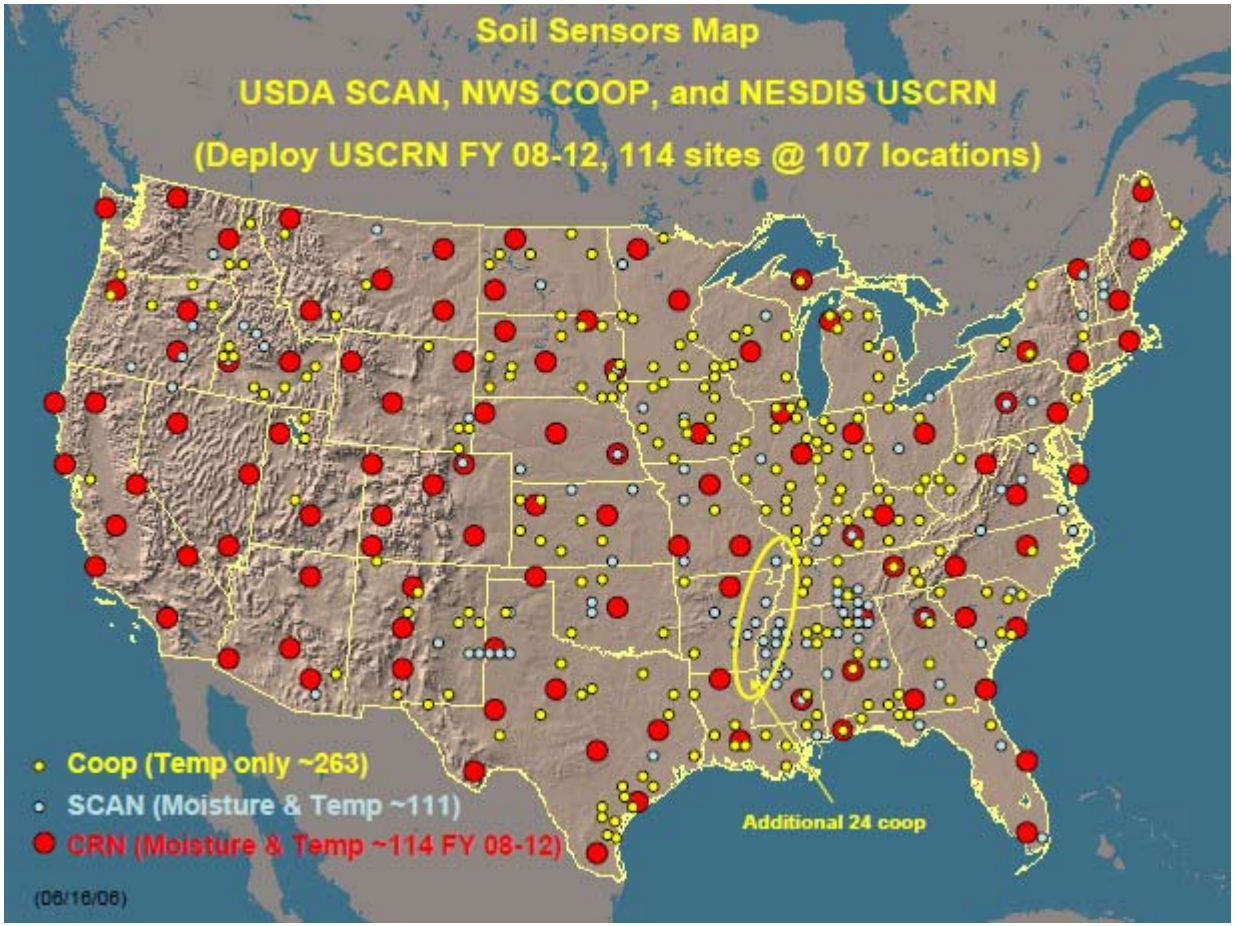
KS_Oakley_19_SSW: Homogeneous Grass



New Directions for USCRN

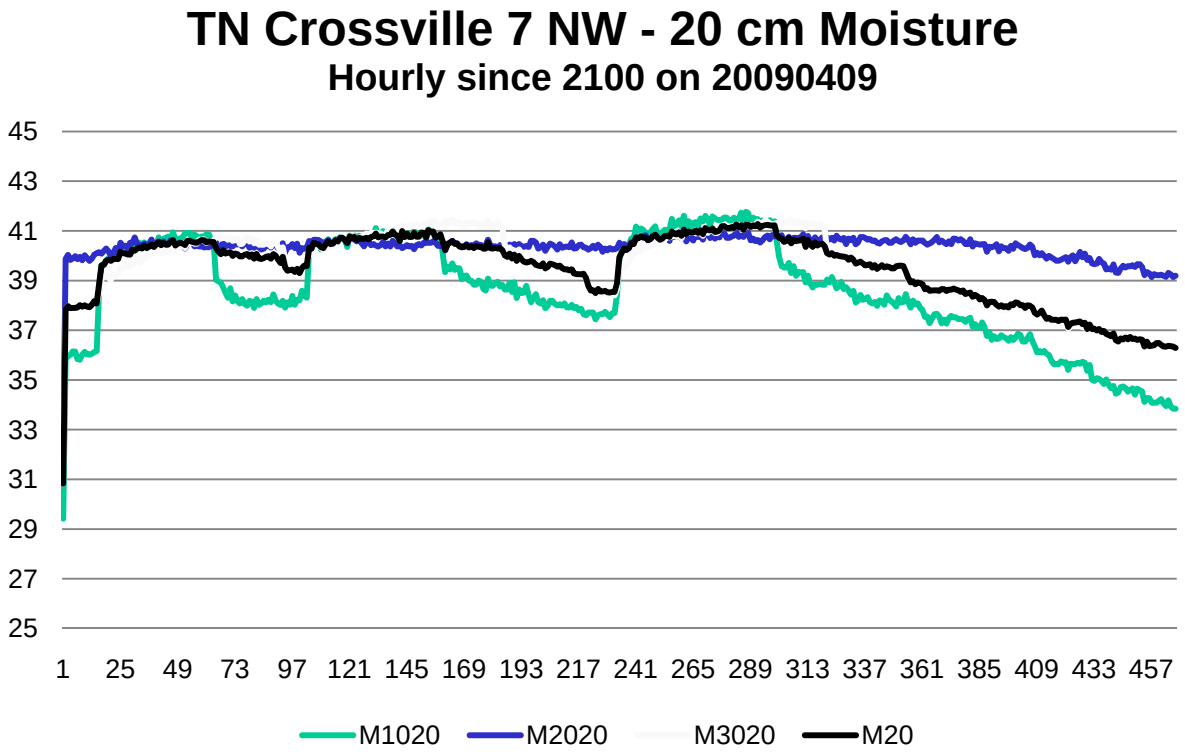
- Deployment of soil moisture / temperature probes and RH instruments across the USCRN network in cooperation with the National Integrated Drought Information System (NIDIS) program
  - Probes will be installed at 5 cm, 10 cm, 20 cm, 50 cm, and 100 cm depths in three separate locations around the USCRN station tower
- Build out the USCRN in Alaska over the next 5 years and collaborate with GCOS in placing instruments in underrepresented areas
- Assist the US Historical Climatology Network – Modernization Program by leveraging the USCRN experience and infrastructure

USCRN Soil Climate Network



Crossville, TN, first official USCRN installation of soil probes, April 2009

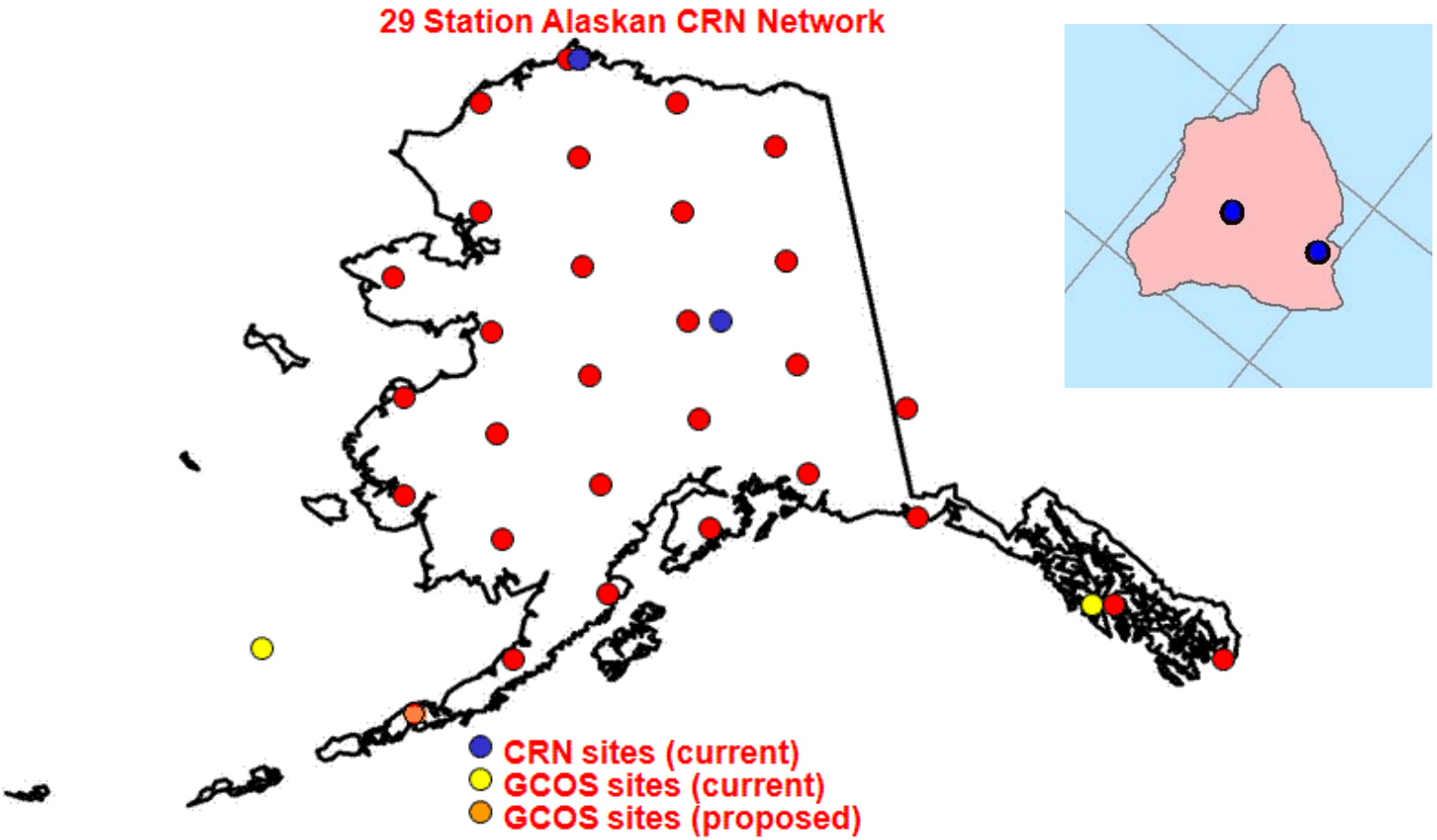
Crossville, TN: 3 soil moisture measurements at 20 cm depth



USCRN Expansion and Ongoing USGCOS Collaboration

- The Global Climate Observing System has provided support for two USCRN stations in Alaska, with two more in FY09
- GCOS is also collaborating with USCRN to improve Arctic region climate observations by placing a CRN-design station at Tiksi in Siberia
- NOAA FY10 Budget requests $1.3 M to deploy USCRN stations in Alaska
- GCOS is providing support to prepare site surveys in preparation for the FY10 deployment

USCRN Alaska and Hawaii sites (including 2009-2015 Alaska plans)



Future GCOS / USCRN Work

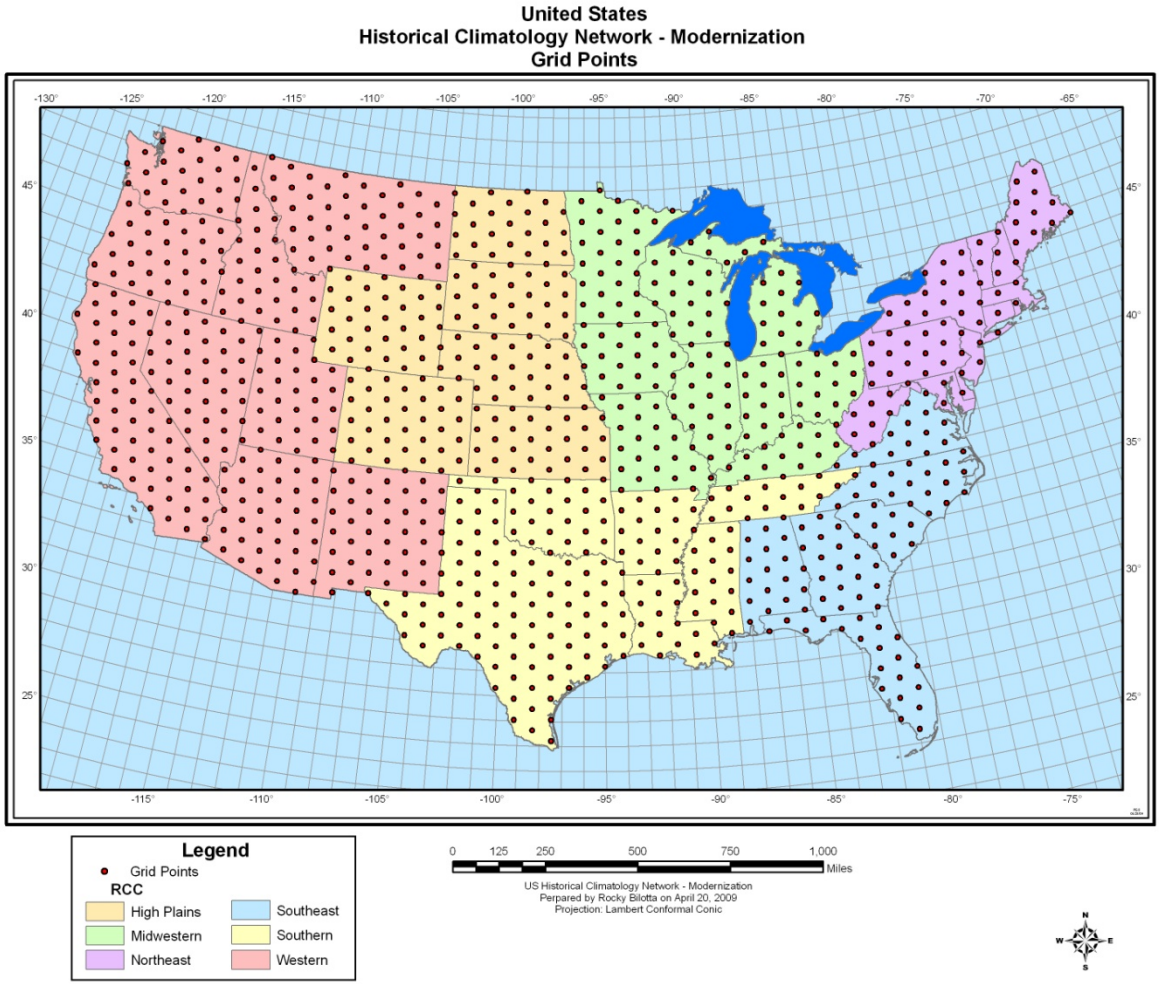
Tiksi, Siberia

Smithsonian Tropical Research Institute

U.S. Historical Climate Network Modernization (USHCN-M)

- USCRN instrument science, logistics, and computer processing experience are leveraged to provide the basis for USHCN-M development and deployment
- Experience gained by USCRN with the Alabama USHCN-M prototypes proved very useful in planning for the design and maintenance of regional UCHCN-M deployments
- A goal of 1000 stations for the continental U.S. would provide sufficient spatial resolution to resolve regional climate trends in the continental U.S. within a decade of their start

USHCN-M National Deployment: 1000 Stations



USCRN: Meeting the Needs of Climate Stakeholders in the U.S.

- Accurate, real time, climate science quality observations of temperature and precipitation
- Unique triplicate measurements of soil moisture and temperature will be invaluable to operational needs (weather prediction, drought monitoring, agriculture, horticulture), and scientific needs (satellite calibration/validation, soil moisture modeling, soil moisture/temperature trend detection)
- Good quality global solar radiation measurements for users and engineers of passive solar devices

http://www.ncdc.noaa.gov/oa/climate/uscrn/