



NOAA Climate Services

July 6, 2009

Talking Points related to concerns about whether the U.S. temperature record is reliable

Q. Over the course of time have U.S. weather stations been exposed to local environmental conditions that could unduly influence temperature readings e.g., located close to growing trees, buildings, parking lots, etc.?

A. Yes. That is one reason why NOAA created the Climate Reference Network. These stations adhere to all of the Global Climate Monitoring Principles and are located in areas free of local human influences and have excellent site location characteristics. They are closely monitored and are subject to rigorous calibration procedures. It is a network designed specifically for assessing climate change. <http://www.ncdc.noaa.gov/oa/climate/uscrn/>. Additionally, an effort is underway to modernize the Historical Climatology Network (a network of over 1000 long-term weather and climate stations), though funds are currently available only to modernize and maintain stations in the Southwest. Managers of both of these networks work diligently to locate stations in pristine areas where the site characteristics are unlikely to change very much over the coming decades.

Q. How has the poor exposure biased local temperatures trends?

A. A peer-reviewed study specifically quantified the potential bias in trends caused by poor station exposure (Peterson, 2006). The analysis examined only a small subset of stations – all that had their exposure checked at that time – and found no bias in long-term trends.

Q. Does a station with good exposure read warmer than a station with poor exposure?

Not necessarily. Many local factors influence the observed temperature: whether a station is in a valley with cold air drainage, whether the station is a liquid-in-glass thermometer in a standard wooden shelter or an electronic thermometer in the new smaller and more open plastic shelters, whether the station reads and resets its maximum and minimum thermometers in the coolest time of the day in early morning or in the warmest time of the day in the afternoon, etc. But for detecting climate change, the concern is not the absolute temperature – whether a station is reading warmer or cooler than a nearby station over grass – but how that temperature changes over time.

Q. Over the years, stations move in location for a variety of reasons and the local environment changes. If the local environment around the station changes could this cause a bias in the temperature record? Can that bias be adjusted out of the record?

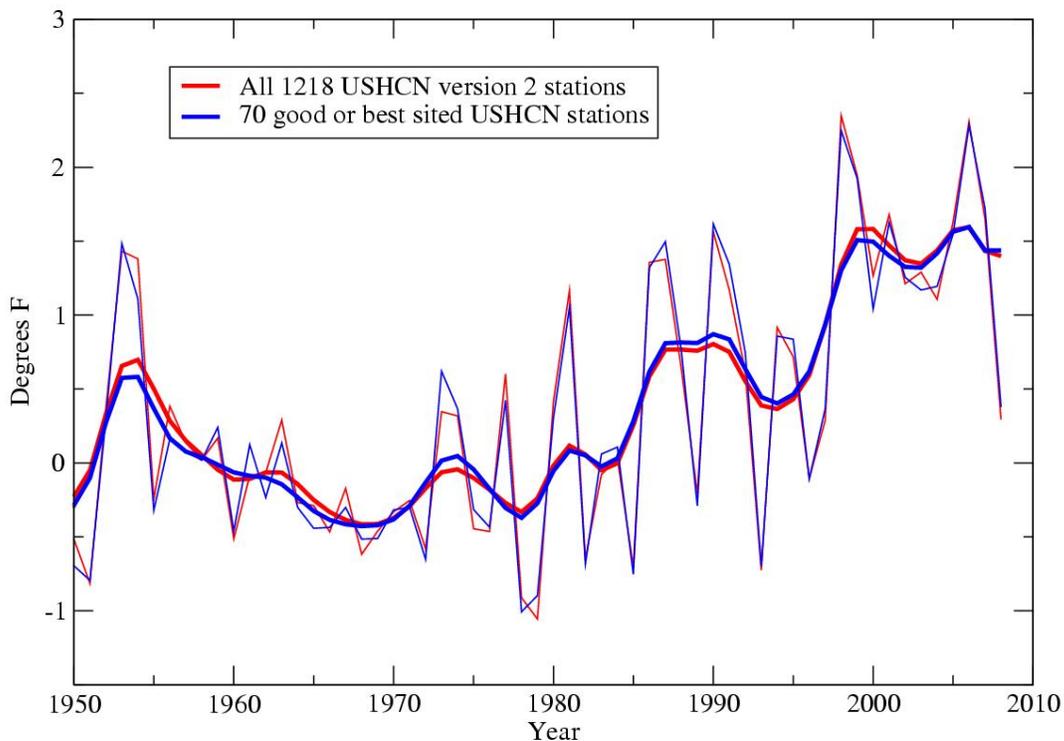
A. A great deal of work has gone into efforts to account for a wide variety of biases in the climate record, both in NOAA and at sister agencies around the world. Since the 1980s, scientists at NOAA's National Climatic Data Center have been at the forefront of this effort developing techniques to detect and quantify biases in station time series. When a bias associated with any change is detected, it is removed so that the time series is homogeneous with respect to its current instrumentation and exposure. The latest peer-reviewed paper which provides an overview the sources of bias and their removal (Menne et al., 2009 in press), including urbanization and nonstandard exposures. They evaluated urban bias and found that once the data were fully adjusted the most urban stations had about the same trend as the remaining more rural stations.

Q. What can we say about poor station exposure and its impact on national temperature trends?

A. Surfacestations.org has examined about 70% of the 1221 stations in NOAA's Historical Climatology Network (USHCN) (Watts, 2009). According to their web site of early June 2009, they classified 70 USHCN version 2 stations as good or best (class 1 or 2). The criteria used to make that classification is based on NOAA's Climate Reference Network Site Handbook so the criteria are clear. But, as many different individuals participated in the site evaluations, with varying levels of expertise, the degree of standardization and reproducibility of this process is unknown. However, at the present time this is the only large scale site evaluation information available so we conducted a preliminary analysis.

Two national time series were made using the same homogeneity adjusted data set and the same gridding and area averaging technique used by NOAA's National Climatic Data Center for its

annual climate monitoring. One analysis was for the full USHCN version 2 data set. The other used only USHCN version 2 data from the 70 stations that surfacestations.org classified as good or best. We would expect some differences simply due to the different area covered: the 70 stations only covered 43% of the country with no stations in, for example, New Mexico, Kansas, Nebraska, Iowa, Illinois, Ohio, West Virginia, Kentucky, Tennessee or North Carolina. Yet the two time series, shown below as both annual data and smooth data, are remarkably similar. Clearly there is no indication from this analysis that poor station exposure has imparted a bias in the U.S. temperature trends.



Q. Is there any question that surface temperatures in the United States have been rising rapidly during the last 50 years?

A. None at all. Even if NOAA did not have weather observing stations across the length and breadth of the United States the impacts of the warming are unmistakable. For example, lake and river ice is melting earlier in the spring and forming later in the fall. Plants are blooming earlier

in the spring. Mountain glaciers are melting. Coastal temperatures are rising. And a multitude of species of birds, fish, mammals and plants are extending their ranges northward and, in mountainous areas, upward as well.

References

Menne, Matthew J., Claude N. Williams, Jr. and Russell S. Vose, 2009: The United States Historical Climatology Network Monthly Temperature Data – Version 2. *Bulletin of the American Meteorological Society*, in press.

Peterson, Thomas C., 2006: Examination of Potential Biases in Air Temperature Caused by Poor Station Locations. *Bulletin of the American Meteorological Society*, 87, 1073-1080.

Watts, Anthony, 2009: *Is the U.S. Surface Temperature Record Reliable?* The Heartland Institute, Chicago. 29 pp.