

CONTRIBUTION OF USHCN AND GISS BIAS IN LONG-TERM TEMPERATURE RECORDS FOR A WELL-SITED RURAL WEATHER STATION

by David W. Schnare



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by David W. Schnare, Esq. Ph.D. | February 26, 2010

When Phil Jones suggested that if folks didn't like his surface temperature reconstructions, then perhaps they should do their own, he was right. The [SPPI analysis of rural versus urban trends](#) demonstrates the nature of the overall problem. It does not, however, go into sufficient detail. A close examination of the data suggests three areas needing address. Two involve the adjustments made by NCDC (NOAA) and by GISS (NASA). Each made their own adjustments and typically these are serial, the GISS done on top of the NCDC. The third problem is organic to the raw data and has been highlighted by Anthony Watts in his Surface Stations project. That involves the "micro-climate" biases in the raw data.

As Watts points out, while there are far too many biased weather station locations, there remain some properly sited ones. Examination of the data representing those stations provides a clean basis by which to demonstrate the peculiarities in the adjustments made by NCDC and GISS.

One such station is Dale Enterprise, Virginia. The Weather Bureau has reported raw observations and summary monthly and annual data from this station since 1891 through the present, a 119 year record. From 1892 to 2008, there are only 9 months of missing data during this 1,404 month period, a missing data rate of less than 0.64 percent. The analysis below interpolates for this missing data by using an average of the 10 years surrounding the missing value, rather than basing any back-filling from other sites. This correction method minimizes the inherent uncertainties associated with other sites for which there is not micro-climate guarantee of unbiased data.

The site itself is in a field on a farm, well away from buildings or hard surfaces. The original thermometer remains at the site as a back-up to the electronic temperature sensor that was installed in 1994.

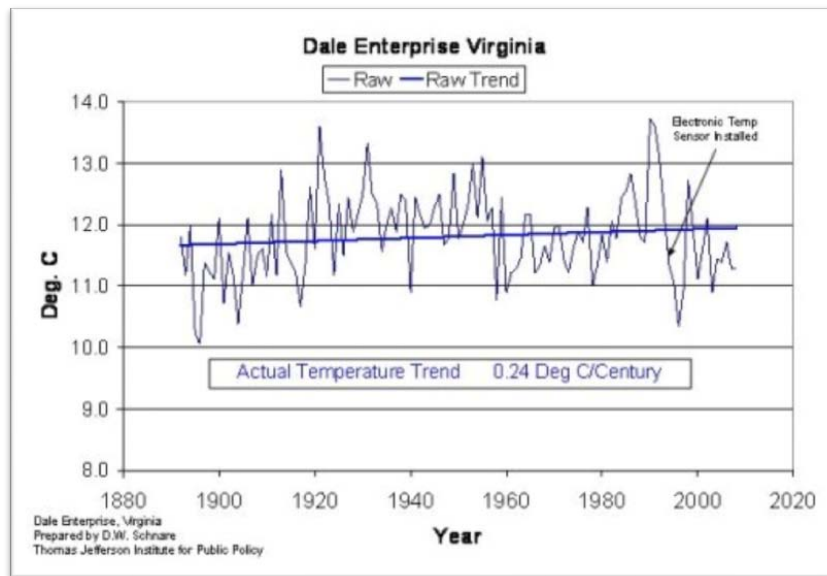


The Dale Enterprise station site is situated in the rolling hills east of the Shenandoah Valley, more than a mile from the nearest suburban style subdivision and over three miles from the center of the nearest “urban” development, Harrisonburg, Virginia, a town of 44,000 population.



Other than the shift to an electronic sensor in 1994, and the need to fill in the 9 months of missing reports, there is no reason to adjust the raw temperature data as reported by the Weather Bureau.

Here is a plot of the raw data from the Dale Enterprise station.



There may be a step-wise drop in reported temperature in the post-1994 period. Virginia does not provide other rural stations that operated electronic sensors over a meaningful period before and after the equipment change at Dale Enterprise, nor is there publicly available data comparing the thermometer and electronic sensor data for this station. Comparison with urban stations introduces a potentially large warm bias over the 20 year period from 1984 to 2004. This is especially true in Virginia as most such urban sites are typically at airports where aircraft equipment in use and the pace of operations changed dramatically over this period.

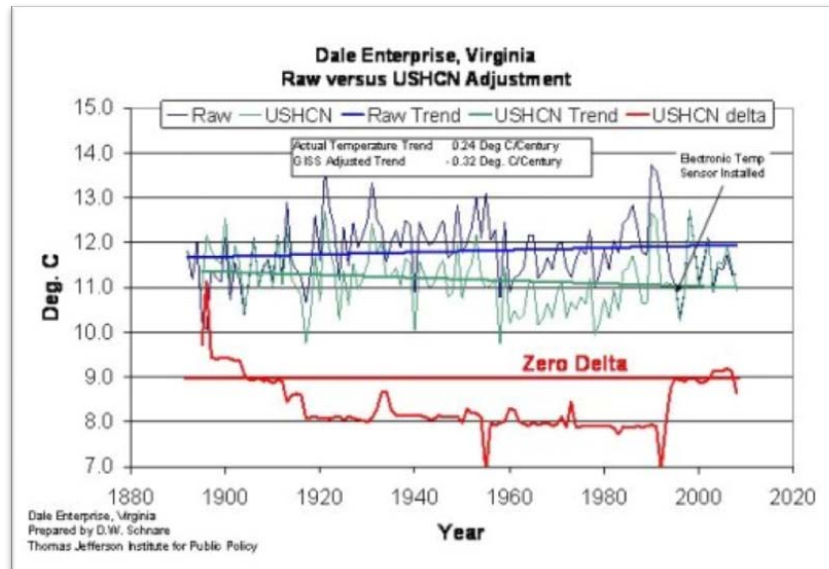
Notably, neither NCDC nor GISS adjusts for this equipment change. Thus, any bias due to the 1994 equipment change remains in the record for the original data as well as the NCDC and GISS adjusted data.

THE NCDC ADJUSTMENT

Although many have focused on the changes GISS made from the NCDC data, the NCDC “homogenization” is equally interesting, and as shown in this example, far more difficult to understand.

NCDC takes the originally reported data and adjusts it into a data set that becomes a part of the United States Historical Climatology Network (USHCN). Most researchers, including GISS

and the East Anglia University Climate Research Center (CRU) begin with the USHCN data set. Figure 2 documents the changes NCDC made to the original observations and suggests why, perhaps, one ought begin with the original data.



The red line in the graph shows the changes made in the original data. Considering the location of the Dale Enterprise station and the lack of micro-climate bias, one has to wonder why NCDC would make any adjustment whatever. The shape of the red delta line indicates these are not adjustments made for purposes of correcting missing data, or for any obvious other bias. Indeed, with the exception of 1998 and 1999, NCDC adjusts the original data in every year! [Note, when a 62 year old Ph.D. scientist uses an exclamation point, their statement is rather to be taken with some extraordinary attention.]

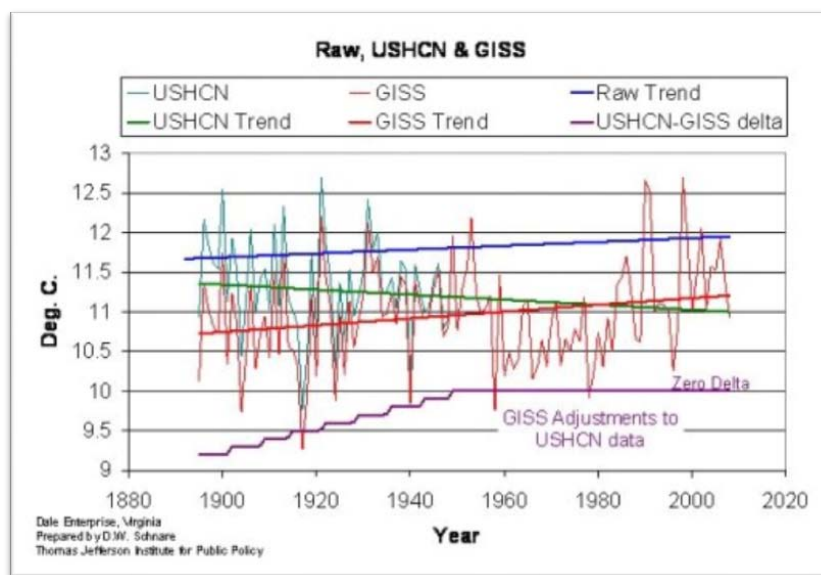
This graphic makes clear the need to “push the reset button” on the USHCN. Based on this station, alone, one can argue the USHCN data set is inappropriate for use as a starting point for other investigators, and fails to earn the self-applied moniker as a “high quality data set.”

THE GISS ADJUSTMENT

GISS states that their adjustments reflect corrections for the urban heat island bias in station records. In theory, they adjust stations based on the night time luminosity of the area within which the station is located. This broad-brush approach appears to have failed with regard to the Dale Enterprise station. There is no credible basis for adjusting station data with no

micro-climate bias conditions and located on a farm more than a mile from the nearest suburban community, more than three miles from a town and more than 80 miles from a population center of greater than 50,000, the standard definition of a city. Harrisonburg, the nearest town, has a single large industrial operation, a quarry, and is home to a medium sized (but hard drinking) university (James Madison University). Without question, the students at JMU have never learned to turn the lights out at night. Based on personal experience, I'm not sure most of them even go to bed at night. This raises the potential for a luminosity error we might call the "hard drinking, hard partying, college kids" bias. Whether it is possible to correct for that in the luminosity calculations I leave to others. In any case, the layout of the town is traditional small town America, dominated by single family homes and two and three story buildings. The true urban core of the town is approximately six square blocks and other than the grain tower, there are fewer than ten buildings taller than five stories. Even within this "urban core" there are numerous parks. The rest of the town is quarter-acre and half-acre residential, except for the University, which has copious pervious open ground (for when the student union and the bars are closed).

Despite the lack of a basis for suggesting the Dale Enterprise weather station is biased by urban heat island conditions, GISS has adjusted the station data as shown below. Note, this is an adjustment to the USHCN data set. I show this adjustment as it discloses the basic nature of the adjustments, rather than their effect on the actual temperature data.



While only the USHCN and GISS data are plotted, the graph includes the (blue) trend line of the unadjusted actual temperatures.

The GISS adjustments to the USHCN data at Dale Enterprise follow a well recognized pattern. GISS pulls the early part of the record down and mimics the most recent USHCN records, thus imposing an artificial warming bias. Comparison of the trend lines is somewhat difficult to see in the graphic. The trends for the original data, the USHCN data and the GISS data are: 0.24, -0.32, and 0.43 degrees C. per Century, respectively.

If one presumes the USHCN data reflect a “high quality data set”, then the GISS adjustment does more than produce a faster rate of warming, it actually reverses the sign of the trend of this “high quality” data. Notably, compared to the true temperature record, the GISS trend doubles the actual observed warming.

This data presentation constitutes only the beginning analysis of Virginia temperature records. The Center for Environmental Stewardship of the Thomas Jefferson Institute for Public Policy plans to examine the entire data record for rural Virginia in order to identify which rural stations can serve as the basis for estimating long-term temperature trends, whether local or global. Only a similar effort nationwide can produce a true “high quality” data set upon which the scientific community can rely, whether for use in modeling or to assess the contribution of human activities to climate change.



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Source: <http://wattsupwiththat.com/2010/02/26/contribution-of-ushcn-and-giss-bias-in-long-term-temperature-records-for-a-well-sited-rural-weather-station/>.

