This is the print version of the Skeptical Science article 'It's microsite influences', which can be found at http://sks.to/microsite.

Microsite influences on the temperature record are minimal

What The Science Says:
Poor weather stations actually show a **cooler** trend compared to well sited stations. This is due to instrumentation changes. When this is taken into account, there's negligible difference between poor and well sited stations.

Climate Myth: It's microsite influences
U.S. weather stations have been located next to exhaust fans of air conditioning units, surrounded by asphalt parking lots, on blistering-hot rooftops, and near sidewalks and buildings that absorb and radiate heat. 89 percent of the stations fail to meet the National Weather Service's own siting requirements that stations must be 30 metres away from an artificial heating or radiating/reflecting heat source. (Watts 2009)

The website surfacestations.org enlisted an army of volunteers, travelling across the U.S. photographing weather stations. The point of this effort was to document cases of microsite influence - weather stations located near car parks, air conditioners and airport tarmacs and anything else that might impose a warming bias. While photos can be compelling, the only way to quantify any microsite influence is through analysis of the data. This has been done in On the reliability of the U.S. Surface Temperature Record (Menne 2010), published in the Journal of Geophysical Research. The trends from poorly sited weather stations are compared to well-sited stations. The results indicate that yes, there is a bias associated with poor exposure sites. However, the bias is not what you expect.

Weather stations are split into two categories: good (rating 1 or 2) and bad (ratings 3, 4 or 5). Each day, the minimum and maximum temperature are recorded. All temperature data goes through a process of homogenisation, removing non-climatic influences such as relocation of the weather station or change in the Time of Observation. In this analysis, both the raw, unadjusted data and homogenised, adjusted data are compared. Figure 1 shows the comparison of *unadjusted* temperature from the good and bad sites. The top figure (c) is the maximum temperature, the bottom figure (d) is the minimum temperature. The black line represents well sited weather stations with the red line representing poorly sited stations.

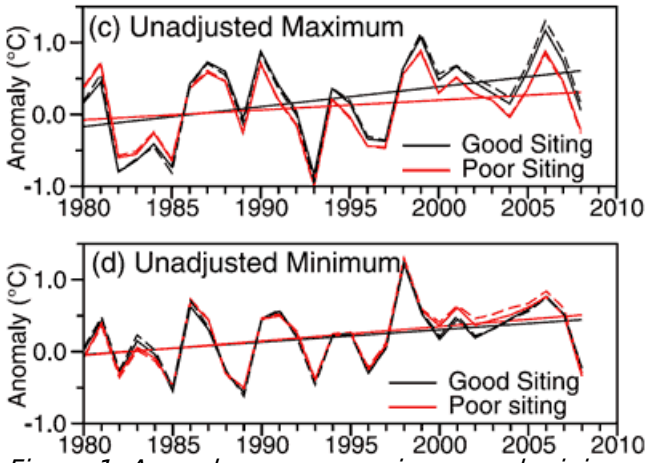

Figure 1. Annual average maximum and minimum unadjusted temperature change calculated

using (c) maximum and (d) minimum temperatures from good and poor exposure sites (Menne 2010).

Poor sites show a cooler maximum temperature compared to good sites. For minimum temperature, the poor sites are slightly warmer. The net effect is a cool bias in poorly sited stations. Considering all the air-conditioners, BBQs, car parks and tarmacs, this result is somewhat a surprise. Why are poor sites showing a cooler trend than good sites?

The cool bias occurs primarily during the mid and late 1980s. Over this period, about 60% of USHCN sites converted from Cotton Region Shelters (CRS otherwise known as Stevenson Screens) to electronic Maximum/Minimum Temperature Systems (MMTS). MMTS sensors are attached by cable to an indoor readout device. Consequently, limited by cable length, they're often located closer to heated buildings, paved surfaces and other artificial sources of heat.

Investigations into the impact of the MMTS on temperature data have found that on average, MMTS sensors record lower daily maximums than their CRS counterparts, and, conversely, slightly higher daily minimums (Menne 2009). Only about 30% of the good sites currently have the newer MMTS-type sensors compared to about 75% of the poor exposure locations. Thus it's MMTS sensors that are responsible for the cool bias imposed on poor sites.

When the change from CRS to MMTS are taken into account, as well as other biases such as station relocation and Time of Observation, the trend from good sites show close agreement with poor sites.

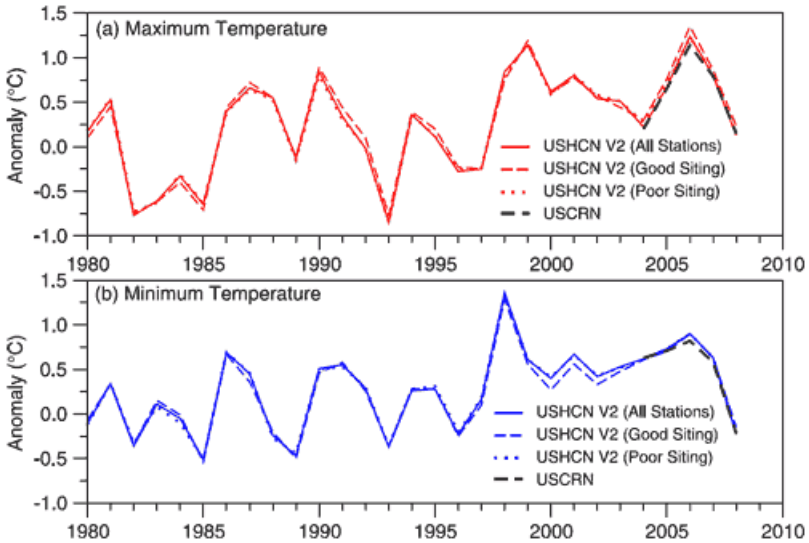

Figure 2: Comparison of U.S. average annual (a) maximum and (b) minimum temperatures calculated using USHCN version 2 adjusted temperatures. Good and poor site ratings are based on surfacestations.org.

Does this latest analysis mean all the work at surfacestations.org has been a waste of time? On the contrary, the laborious task of rating each individual weather station enabled Menne 2010 to identify a cool bias in poor sites and isolate the cause. The role of surfacestations.org is recognised in the paper's acknowledgements in which they *"wish to thank Anthony Watts and the many volunteers at surfacestations.org for their considerable efforts in documenting the current site characteristics of USHCN stations."* A net cooling bias was perhaps not the result the surfacestations.org volunteers were hoping for but improving the quality of the surface temperature record is surely a result we should all appreciate.

Intermediate rebuttal written by John Cook

Update July 2015:

Here is a related lecture-video from Denial101x - Making Sense of Climate Science Denial

[*see video at **this link**.*]

The Skeptical Science website by Skeptical Science is licensed under a Creative Commons Attribution 3.0 Unported License.

Skeptical Science explains the science of global warming and examines climate misinformation through the lens of peer-reviewed research. The website won the Australian Museum 2011 Eureka Prize for the Advancement of Climate Change Knowledge. Members of the Skeptical Science team have authored peer-reviewed papers, a college textbook on climate change and the book Climate Change Denial: Heads in the Sand. Skeptical Science content has been used in university courses, textbooks, government reports on climate change, television documentaries and numerous books.

The Skeptical Science website by Skeptical Science is licensed under a Creative CommonsAttribution 3.0 Unported License.