There have been several very recent articles in the scientific literature that have examined various aspects of climate variability in and around Utah over the past 50 to 100 years. These new papers shed interesting light on variability and trends in temperature and precipitation and serve to further underscore what we understand about the climate of Utah and the American Southwest—it is primarily hot and dry. Any influence on these general characteristics from anthropogenic global warming appears minor, if even possible to discern at all.

First of all a little background on the climate history of Utah, as compiled and maintained by the U. S. National Climatic Data Center (NCDC).

The record of temperature and precipitation for Utah stretches back to 1895. Since that time (and through the end of the year 2009), there has been an overall warming trend of about 0.22°F/decade or a total change in statewide average temperature over the past 115 years of about 2.5°F. As can be seen in Figure 1, the first several decades of the 20th century were generally cooler than average, the decades in the mid-20th century were near-average, while the past two decades have generally been warmer than the long-term average.

![Figure 1. Statewide annual average temperature history for Utah, 1895-2009, as compiled by the U.S. National Climatic Data Center (data available from http://www.ncdc.noaa.gov/oa/climate/research/cag3/ut.html).](image-url)
When examining the temperature history of Utah, it is important to recognize that the entirety of the warming that appears in the compiled temperature history of the state may not be evidence of regional (or larger-scale) climate change, but instead may be caused by non-climatic influences on the local thermometers. Such influences may include changes in instrumentation, as well as changes in the local environment surrounding the thermometer location. That such changes have occurred which may impact the local temperature readings across the state has been documented in the report “Is the U.S. surface temperature record reliable?” by researcher Anthony Watts. Watts provides examples of some of the poor siting of the various “official” thermometers around the state, illustrating issues that may call into question the accuracy of the state’s long-term temperature history. A scientific study by Pielke et al. (2007) also documents problems with long-term U.S. temperature datasets that may give rise to anomalously high rates of warming.

![Figure 2. Examples of poor situated “official” temperature recording stations in Utah. The photograph shows the immediate surroundings of the thermometer and the graph below shows the temperature history from the observing location (source: Watts, 2009).](http://gallery.surfacestations.org/main.php?g2_itemId=251)

Figure 2 illustrates just two of many “official” temperature observing sites in Utah in which the temperature history may reflect influence other than large-scale climate variability. The surroundings of Utah’s other “official” observing stations are detailed at the website surfacestations.org (http://gallery.surfacestations.org/main.php?g2_itemId=251).
Utah’s precipitation history is depicted in Figure 3. Over the full 115 years of record there has been a slight increase in statewide precipitation amounting to about 1.5 additional inches of precipitation per year.

![Figure 3. Statewide annual average temperature history for Utah, 1895-2009, as compiled by the U.S. National Climatic Data Center (data available from http://www.ncdc.noaa.gov/oa/climate/research/cag3/ut.html).](image)

Now onto the results from the new research papers.

The first is by a team led by Greg McCabe of the Denver office of the U.S. Geological Survey. McCabe and colleagues examined the precipitation history of the Southwest (including Utah) looking for changes in the number of days without precipitation as well as the duration of rainless periods, to see if there were any long-term climate changes in the drought climate of the region, and if so, what may be the processes behind them. The researcher examined the period of time from 1951 through 2006 from 22 primary weather stations in the Southwest, including 4 from Utah.

In general, McCabe and colleagues found declines in the number of dry days (defined as days with less that one-tenth of precipitation) as well as in the frequency of dry periods. In other words, dry days/conditions were occurring less often. What variability that they did find in the precipitation record, they associated with patterns of the occurrence of El Niño conditions in the tropical Pacific Ocean.

The trends towards fewer dry days and less frequent dry periods were especially strong in Utah (Figure 4), and indicate that, as the statewide precipitation history depicted in Figure 3 would suggest, that there has been a tendency for wetter rather than drier conditions to prevail in Utah over the past 50 to 100 years.
The second recent paper to be published concerning Utah’s climate variability is by Carlos dos Santos and colleagues (including Christopher Neale, a researcher from Utah State University). These researchers focused on extreme temperature and precipitation occurrences, and were also looking to see if there were any long term trends in the frequency of various measures of these types of events.

These researchers used data from a network of 22 observing stations across the state for the period from 1930 to 2006. They found a tendency for their various measures of temperature extremes to be indicating a general decrease in extreme cold events and a general increase in warm extreme events (Figure 5). This is in keeping with the long-term temperature history of the state as depicted in Figure 1.
Figure 5. Spatial distribution of the trends of various measures of temperature extremes for Utah, USA. The symbol (+) for positive and (●) for negative trends, statistically significant at 95% level (p < 0.05), while the symbols (+) for positive and (−) for negative trends statistically nonsignificant. (Figure from dos Santos et al., 2010).
When it came to precipitation extremes, the researchers found a mixed bag of trends in the stations scattered across Utah (Figure 6), but a general tendency for more precipitation, and declines in the duration of dry spells. A result also in line with the results of McCabe et al. (2010) and the precipitation history of the state which shows an overall increase in annual precipitation totals (Figure 3).

**Figure 6.** Spatial distribution of the trends in various measures of precipitation extremes for Utah, USA. The symbol (+) for positive and (●) for negative trends, statistically significant at 95% level (p < 0.05), while the symbols (+) for positive and (●) for negative trends statistically nonsignificant. (Figure from dos Santos et al., 2010).
So the bottom line for Utah, is that temperatures across the state have been rising, producing more hot days and fewer cold ones. Utah’s precipitation has too been slowly rising, with the primary impact being a reduction in the number of dry days and in the frequency and duration of extended dry periods.

The trends and variability in the state’s precipitation have been linked to the patterns of El Niño occurrence, while the trends and variability in the state’s temperature history may in some part be from changes in surroundings local to each thermometer rather than a regional or even larger-scale variability or trend.

The degree to which anthropogenic changes to the earth’s greenhouse effect may explain any of these trends in Utah’s climate is simply impossible to ascertain, although after allowing for non-climatic influences, and patterns of natural variability, there likely is little left-over that needs any further explanation.

REFERENCES


