

June 2016 Extremes in the USCRN

The month of June 2016 started quietly for the U.S. Climate Reference Network (USCRN), but by the end of the month, extreme precipitation events were recorded in the central and eastern U.S., while a heatwave was experienced in the Southwest.

Southwest Heat Wave

After a period of cooler than normal conditions at mid-month, high pressure dominated the U.S. Southwest for most of the next two weeks, bringing about a heatwave that was related to the initiation of wildfires in Southern California and Arizona and heat related deaths and transportation issues in the Phoenix and Tucson metro areas. Daily maximum air temperatures ramped up quickly after the 17th at USCRN stations at Stovepipe Wells (Death Valley) California, and Yuma and Tucson, Arizona, and spread north to Mercury, Nevada, soon afterward (Figure 1). The heatwave reached peak intensity on June 19-20, with a second peak

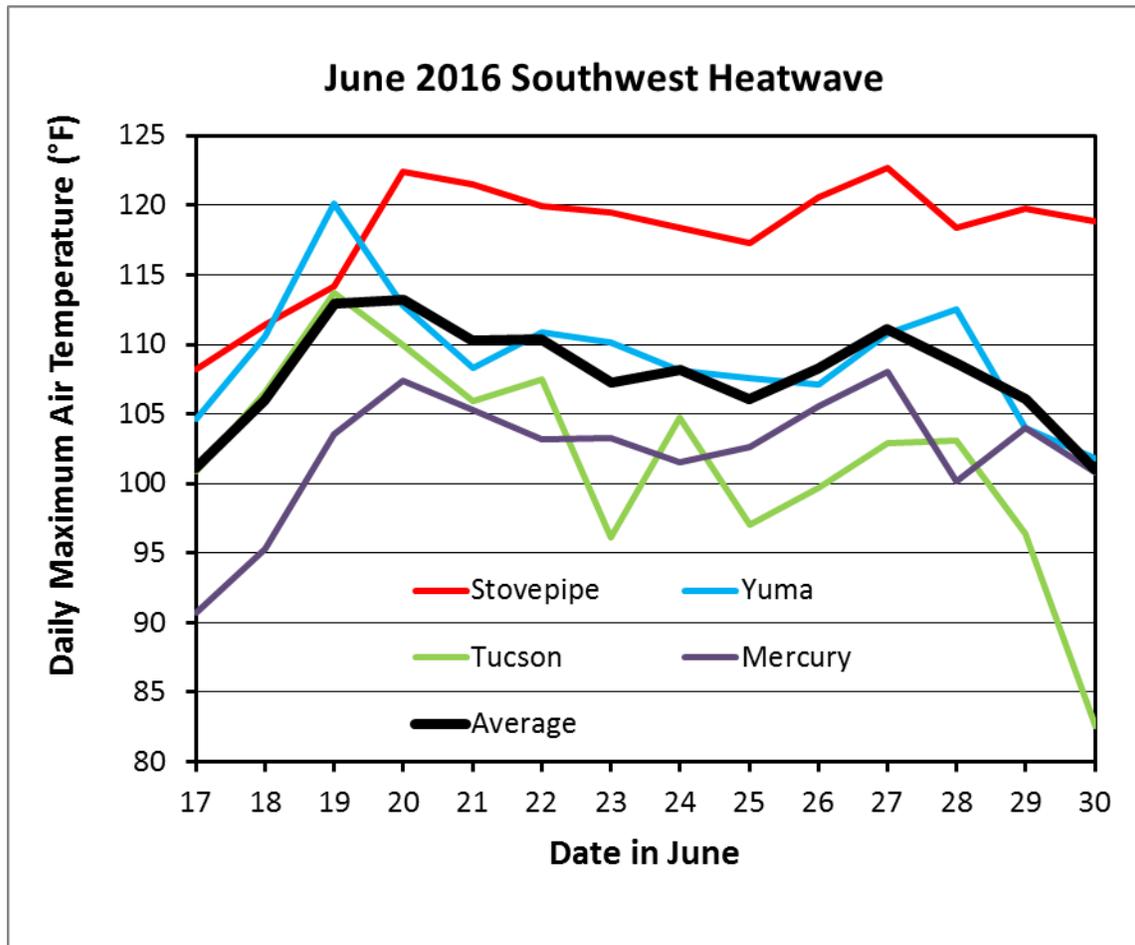


Figure 1. Daily maximum air temperature (°F) for the period June 17-30, 2016, at four USCRN stations in the Southwest. The bold line is the daily average of the four station maxima.

on June 27th, after which monsoon rains entered most of Arizona and broke the heat wave. Many locations in the area set new daily maximum air temperature records, most noteworthy being airports in Phoenix reaching 118°F and Yuma reaching 120°F on June 19th. Four people died hiking and biking outdoors in the heat in Arizona, despite extensive warnings distributed by officials through the local media. Some flights to Phoenix were cancelled due to concern about extreme temperatures on the tarmac.

In Death Valley, the long term station at Furnace Creek recorded a mean air temperature (maximum + minimum / 2) for June 2016 of 101.9°F, which is the highest in 105 years of records and 6.4°F above normal. The USCRN station at Stovepipe Wells in Death Valley had a similar mean air temperature of 101.3°F for the same period.

Gully-Washer Along the Canadian Border

During the night of June 21-22, the USCRN station at Northgate, North Dakota, recorded a new station precipitation event record of 4.79 inches. Within the almost 12-hour event, particularly heavy showers led to new station precipitation total records for time intervals of 1, 2, 3, 6, and 12 hours in length. The expected return period for each of these time periods ranged from once every 300 years to once every 800 years, making this a truly unusual event for this location.

Time Period (Hours)	Precipitation (Inches)	Return Period (Years)
1	2.99	500
2	3.75	800
3	3.80	400
6	4.51	400
12	4.79	300

The precipitation total for the event estimated by radar corresponded well with the station total (Figure 2). Unfortunately, the rain caused flooding of the only access road to the station, so a team of technicians was not able to reach the site for a previously scheduled annual maintenance visit, and will have to return at a later date. The June 2016 monthly precipitation total of 7.13 inches also set a new record for any month at the USCRN station at Northgate.

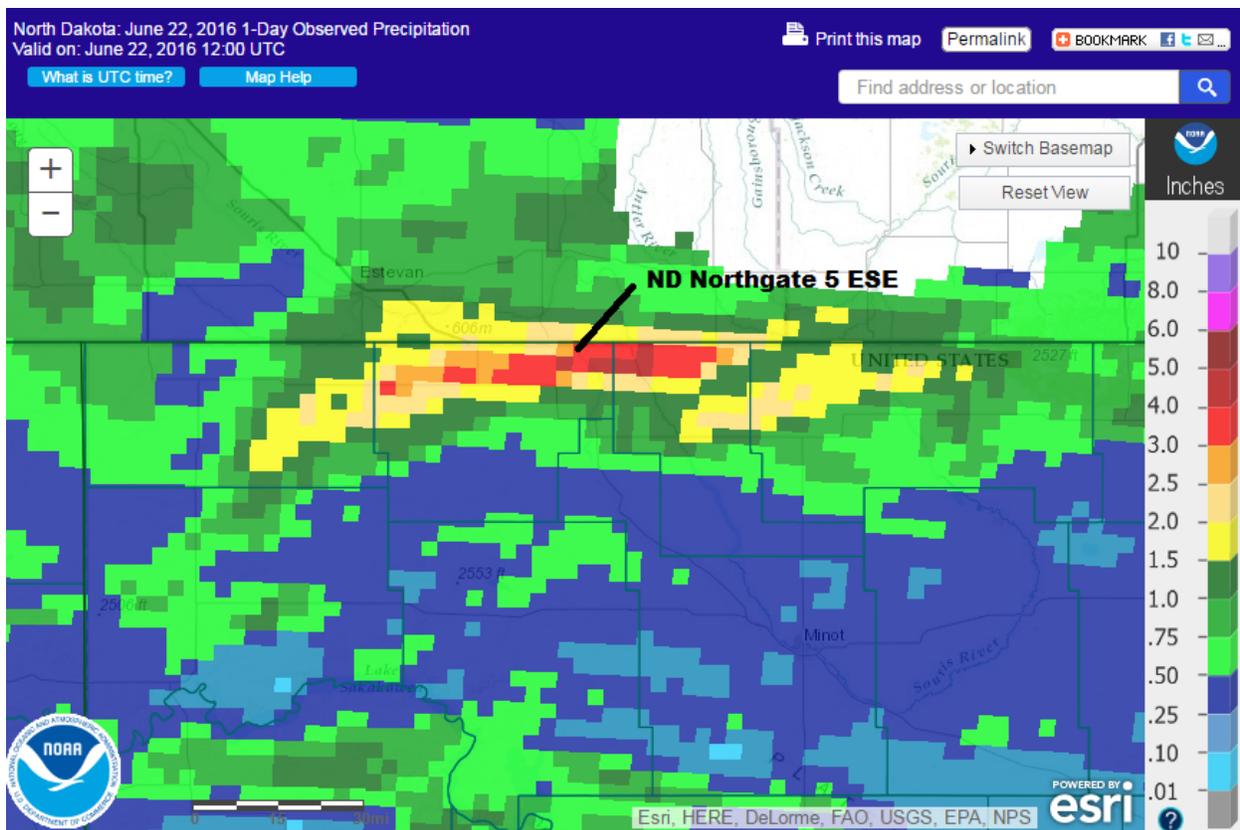


Figure 2. Heavy precipitation event at the USCRN station at Northgate, North Dakota. The station total was 4.79 inches for the 21-22 June 2016 event, similar to the radar based estimate.

Historic Rains in West Virginia

The most noteworthy weather/climate event in the United States in June was the flooding in West Virginia caused by torrential rains from storms training again and again over the same area. The heaviest precipitation fell on June 23-24, with some locations receiving over 8 inches of rain in 24 hours (Figure 3). The USCRN station in Elkins, WV, was northeast of the heaviest rain and flooding rivers, but helps to illustrate the issues faced further south. Figure 4 shows the accumulating precipitation totals at the USCRN station (blue line), and the state of soil moisture (brown line) during the peak of the event. Previous rains had led to the soil being saturated, and when the main rain event occurred, there was very little upward increase in soil moisture; all the precipitation reaching the ground was rapidly running off the ground surface into the local streams and rivers. In the counties southwest of Elkins, this runoff was accentuated by much more rain falling, 8-10 inches in places, and record flooding in the rivers of this mountainous terrain. The death toll reached 25 and a federal disaster declaration was approved shortly after the peak event occurred. Most rain totals would correspond to 500 to 1000 year return periods in the core area affected, with rivers also reaching 500 to 1000 year flood levels.

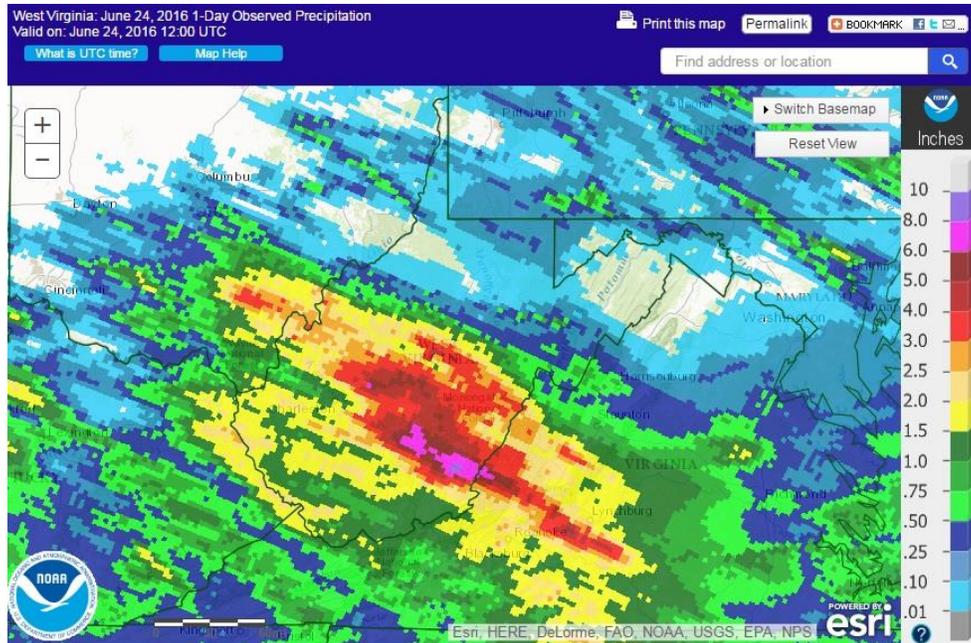


Figure 3. Radar precipitation estimates for the West Virginia area for June 23-24, 2016. The USCRN station at Elkins, West Virginia, received 2.07 inches in 3 hours the morning of the 23rd.

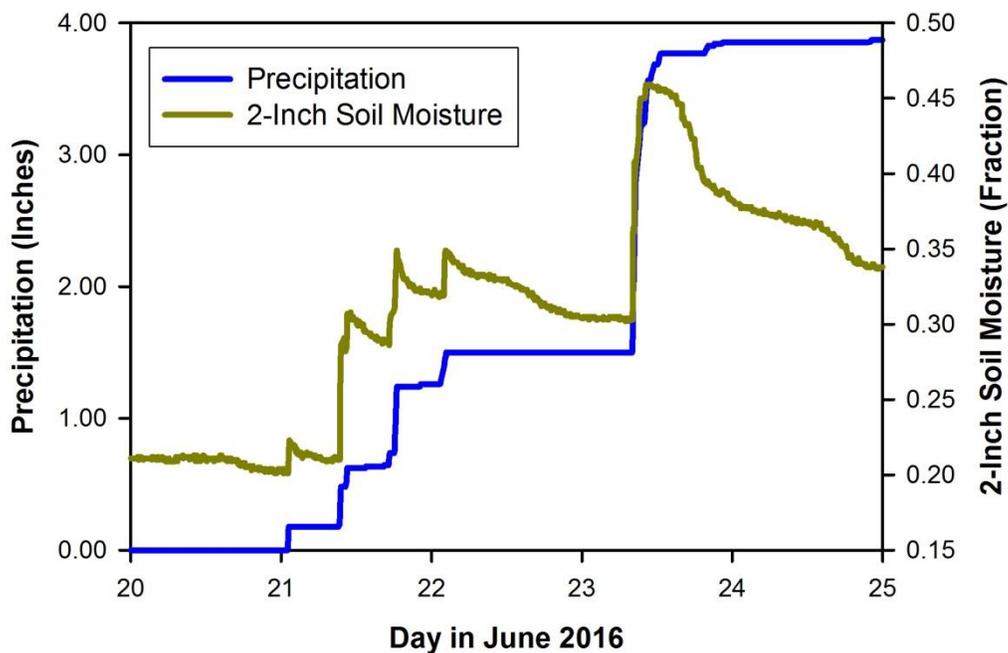


Figure 4. Cumulative precipitation (inches) and soil moisture (fraction by volume) at the USCRN station near Elkins, WV, June 20-25, 2016. Soil moisture quickly reached saturation when the main rain event occurred on the 23rd, allowing most of the rain to run off and add to floods.