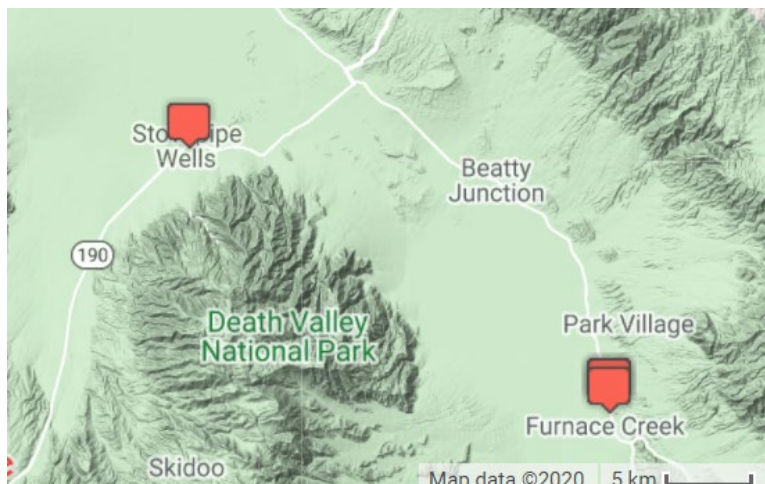


U.S. Climate Reference Network Observations of Heat in Death Valley, CA



On 16 August 2020, temperatures reached 54.4°C (129.9°F) at the Death Valley National Park observing station at Furnace Creek. This is a Cooperative Observer Program (COOP) Network station and the maximum temperature was reported as 130°F using the traditional rounding to the nearest whole digit, potentially being the highest temperature measured on earth with modern automated instruments and shielding. About 29 km (18 mi) to the north-northwest is the Stovepipe Wells U.S. Climate Reference Network (USCRN) station at an elevation about 85 m (278 ft) above that of Furnace Creek. That day, the USCRN station observed a maximum temperature of 51.5°C (124.7°F). Given the close proximity of the stations (see map), it is reasonable to examine this difference in a climatological context.



Map showing the locations of the USCRN station at Stovepipe Wells and the Death Valley COOP station at Furnace Creek.

The current temperature instrument at the Death Valley COOP station was installed during November 2015, and the daily time of observation was set to midnight like the USCRN site. An analysis of summer (June, July, and August) differences in daily maximum temperatures for 2016-2020 indicates that the USCRN station averages 1.1°C cooler than the COOP station, mainly due to the elevation difference and the fan aspiration of the USCRN instrument. Local topography and variations in winds and cloud cover cause many days to experience even larger differences in maximum temperatures. The distribution of these daily differences (Figure 1) ranges from -3.1°C (-5.6°F) to +3.9°C (+7.0°F). Within this distribution of differences, the 2.9°C (5.2°F) difference on 16 August 2020 is ranked 436 of 459 days with observations, making it unusual in the range of differences between the stations. The difference when standardized is 1.83 standard deviations above the normal difference, which is not quite significant at the $p = 0.05$ level. However, since the distribution of differences is slightly non-normal, the 16 August 2020 difference is at the 95th percentile of the empirical distribution. The USCRN station at Stovepipe Wells supports the unusual nature of the temperatures during the heat wave at the Death Valley COOP station, but does not by itself definitively verify or refute the accuracy of the observations on a given day.

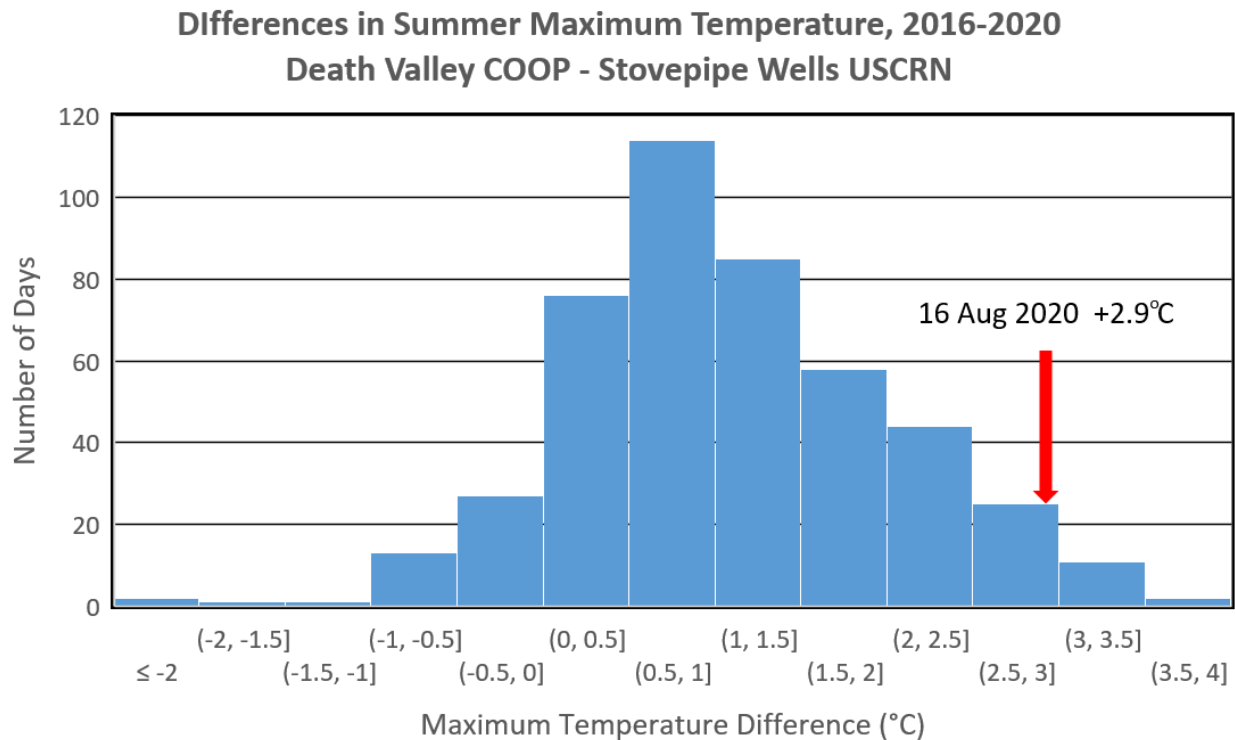


Figure 1. Distribution of the difference in summer daily maximum temperature between the Death Valley COOP station and the Stovepipe Wells USCRN station during the period when both stations have operated (2016-2020). Mean = 1.1°C. Median = 1.0°C.

The next day the station difference in maximum temperature was only 0.7°C (1.2°F), at the 34th percentile of the distribution. On this day, 17 August 2020, the USCRN reached its second highest maximum temperature in station history, 52.1°C (125.8°C), while the COOP station was 52.8°C (127.0°F). There were considerable differences during this week in maximum temperature from day-to-day (Figure 2); in fact the difference was 3.1°C (97th percentile) on August 14. While the period is unusual (Figure 3), there is no indication of a trend in differences or other indicators of systematic instrument issues.

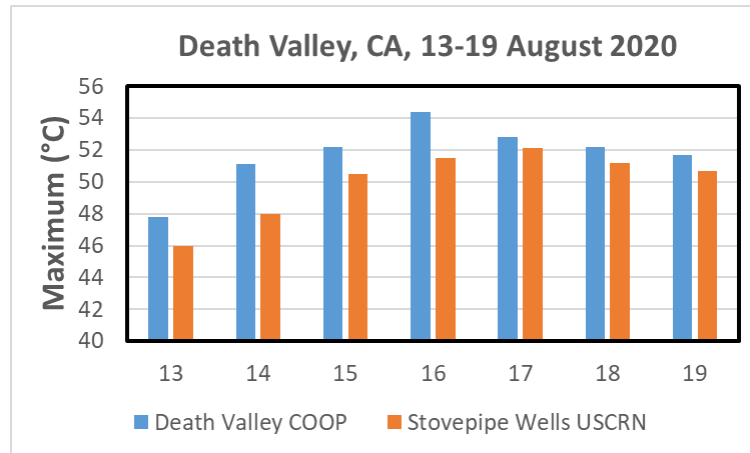


Figure 2. The daily maximum temperatures at the Death Valley COOP station (blue) and Stovepipe Wells USCRN station (orange) for 13-19 August 2020.

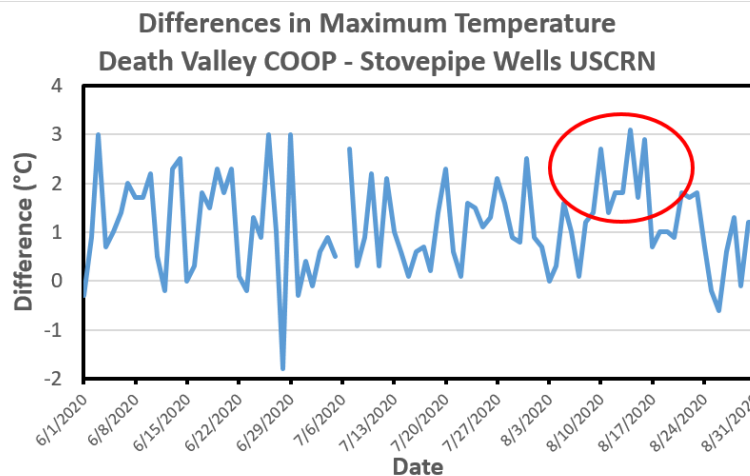


Figure 3. Daily maximum temperature differences between Death Valley COOP and Stovepipe Wells USCRN during Summer 2020; the red circle was the heat wave period.

In conclusion, the extreme conditions in Death Valley, CA, express the limits of U.S. climate observations; perhaps there are warmer places that have not yet been measured. An international committee will be examining this event in more detail in coming months.