FORECASTERS' FORUM

Climate Normals: Are They Always Communicated Correctly?

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1. Introduction

The term "climate normal" has been used since the nineteenth century and by the World Meteorological Organization since 1950 (WMO 2017). Climate normals are calculated for a particular range of years, usually 30 years, and they are updated every 10 years, so that the latest normal values given by the National Weather Service are for 1991–2020. How the previous normals over 1981–2010 were calculated is described in detail in Arguez et al. (2012). Normals are slightly different from straight average values to ensure that the mean of the daily normals in each month average to the relevant monthly normal value. However, Table 2 of Arguez et al. (2012) labels the first category of temperature, precipitation, and snowfall as "averages." In my opinion, there is a real downside to using the word "normal," which is that it can be interpreted as "usual," rather than as its correct climate interpretation.

2. Results

In the 4 months September–December 2021, the observed high temperature in Denver, which is taken at the international airport, was within ±2°F of the normal high on 18 out of the 122 days, which is 15%. The high was within ±3°F on 24 days, which is 20%.

I also looked at the Denver high temperatures on 4 specific days over the 30 years, 1991–2020, which are used to calculate the latest normals. On 23 November, 30 November, 25 December, and 1 January, the high temperature was within ±2°F of the normal in 13 of the 120 years, which is 11%. The high temperature was within ±3°F in 20 out of the 120 years, which is 17%. The histogram of the 30 November maximum temperatures is shown in Fig. 1. The range is 18°–68°F, and in only 3 years was the maximum within 3°F of the normal value of 47°F.

Therefore, whether looking across a particular period of time or across the 30 years used to make the normal values, the Denver high temperature is only close to the normal value a small percentage of the time. In fact, one might conclude that it is "quite unusual" for the high temperature to be close to the normal value.

3. Commentary

On the television weather forecasts in the Denver area, it is occasionally said that these normal values are the "usual" highs. In my opinion, this word is used because these high values are listed as the normal values. I think that the word normal is interpreted as the usual value, instead of its correct interpretation as the average value over 30 years. I might add that the Denver Channels 7 and 9 do use the word average to describe these values, but Channel 4 uses the word normal. In a recent email from a Channel 4 meteorologist he replied, "We have gone around and around on this topic for many years. The day NOAA/NWS drops normal and moves to average, we'll immediately follow suit in terms of our terminology."

In addition, I quite frequently hear the phrase "where we should be" in the context of today we were 15° above "where we should be," to indicate that the observed Denver high temperature was 15°F higher than the average value. The implication of this phrase is that the high and low observed temperatures always "should be" close to the average or normal values. In a chaotic fluid such as the atmosphere, there is no requirement or expectation that the daily high and low temperatures be close to their average values. In fact, in Denver they are often far from the average values, which is indicated by the record high and low values for a particular day frequently being ±30°F, or more, from the average values, especially in winter; see Fig. 1 for example. If the implication of "where we should be," that the highs and lows are always near their average values, were correct, then temperature forecasts could be made weeks, months, and even years ahead. We all know this is impossible: remember the old adage, "climate is what one expects, weather is what one gets."

It is not clear to me whether the phrase "where we should be" is used by other TV meteorologists around the country, but I am not the first to suggest that its use is inappropriate. Holder et al. (2006) say "to present this normal temperature as 'where we usually are at this time of year' or 'where we should be' often gives the public the wrong impression of current weather as compared to past weather." Both Holder et al. (2006) and Lupo et al. (2003) looked at far more data than I did in that they analyzed data from the entire 30-yr period

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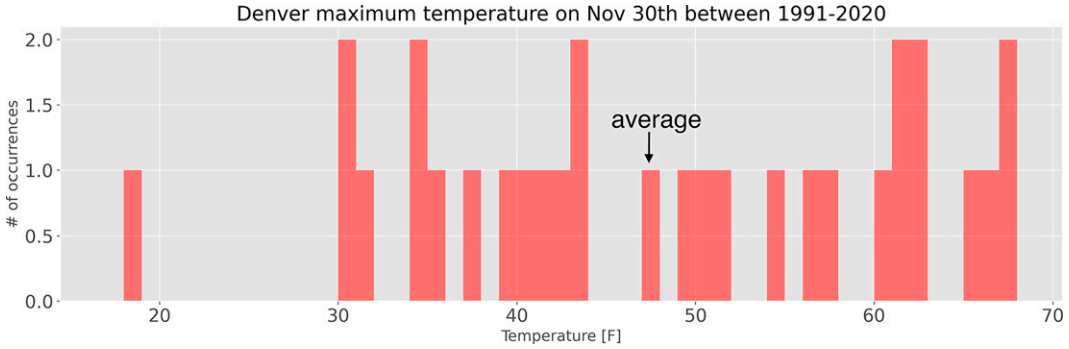

FIG. 1. Histogram of the Denver maximum temperature on 30 Nov between 1991 and 2020.

1971–2000 at stations in North Carolina and Missouri, respectively. They both suggest that TV weather forecasts should show the daily temperature standard deviation over 30 years, so that the audience can be informed whether the observed daily value was to be expected, or really was quite unusual. This could be applied to many other meteorological quantities as well, such as monthly precipitation or snowfall, or to annual average values such as the Colorado snowpack.

4. Summary

In my opinion, the word "normal" for temperature high and low values is often incorrectly interpreted as "usual," rather than the correct interpretation as the average over a specific 30 years. I think that the general public knows what an average value is, so that it would be much less confusing for the National Weather Service to use "average" rather than "normal."

The quite frequent use of the phrase "where we should be" on the Denver TV channels leads me to think that it is often used elsewhere around the country. It is not clear to me where this phrase comes from. However, many TV meteorologists are AMS approved, so I think there is an opportunity to make clear that this phrase is inappropriate in the AMS material and courses that are provided for this group of weather forecasters.

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