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Redefining 'normal'

NCDC experiments with new climate standards

by Bob Henson

Climate was once viewed as being more or less stationary, with 30-year averages serving as an accepted guide to the future. Yet most of the United States has warmed significantly since the 1970s. And despite some intense regional droughts, large parts of the nation are considerably wetter on average than they were three decades ago.

To help its user groups get a better handle on such trends, NOAA's National Climatic Data Center (NCDC) is incorporating climate trends into an experimental set of averages that will evolve more quickly than the normals now cited on weathercasts and elsewhere.

"The official normals are now 23 years out of date," says NCDC's Anthony Arguez, who heads up the project. Under protocols recommended by the World Meteorological Organization, normals are calculated every decade for 30-year periods. Today's normals, which are based on data from 1971–2000 and thus centered on 1985–86, lag behind the climate itself, especially for particular U.S. regions and seasons (see graphic). And the next update, which will span 1981–2010, won't be available until at least 2011.

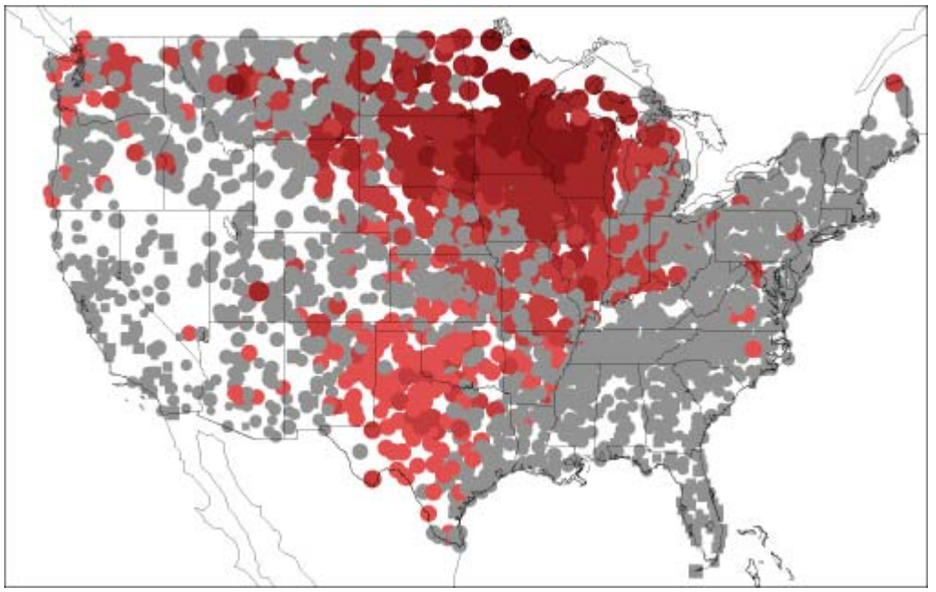
This spring NCDC will unveil three alternative sets of U.S. climatic normals:

- *Moving averages*. These will be similar to the current method's results, except the period of record will roll ahead each year. For example, users will be able to access normal values for the period 1979–2008 later this year, 1980–2009 next year, and so on. According to Arguez, the underlying data that go into the averages were processed by NCDC with new adjustments to reduce bias and enhance homogeneity.

- *Optimal climate normals* (OCN). The OCN technique has been used for many years at NOAA's Climate Prediction Center (CPC) to help keep long-range seasonal forecasts in tune with climate change. Using time series statistics, an "optimal" averaging period is determined. Generally, strong trends (either positive or negative) will lead to shorter averaging periods, and vice versa. For its seasonal predictions, CPC used averaging periods of 15 years for precipitation and 10 years for temperature. For its OCN climate products,

NCDC will tailor the averaging periods for each station and each month of the year, based on local trends.

- *Hinge-fit normals.* As noted in many studies, the mid-1970s marked a turning point as the globe and nation entered a period of pronounced warming. The hinge-fit technique accommodates this shift by splitting a long-term time series into two line segments—a stationary part (pre-1976) and a linear trend component (1976 onwards).



This graphic compares the difference in mean monthly minimum temperatures for Januarys in 2001–07 compared to 1971–2000. It shows that parts of the U.S. Midwest are now experiencing midwinter mornings more than 5°C (9°F) warmer than the average readings calculated in the traditional way. Circles (squares) indicated warmer (cooler) conditions, and symbols not colored gray are statistically significant at 90% confidence, based on a bootstrapped t-test. (Image courtesy Anthony Arguez, NOAA/NCDC.)

The need for improved normals was stressed in a 2007 paper in the *Journal of Applied Meteorology and Climatology* by CPC's Robert Livezey and colleagues. (Livezey retired in 2008, but is actively advising Arguez on the normals.) The paper examined the above alternatives and proposed the OCN technique now being adopted. Traditional normals "are no longer generally useful for the design, planning, and decision-making purposes for which they were intended," wrote Livezey. "It is crucial that climate services enterprises move quickly to explore and implement new approaches and strategies for estimating and disseminating normals and other climate statistics."

There are downsides to the new approaches, says Arguez. For instance, the significance of a given anomaly (say, +1.5°C) will change from year to year in the moving-average datasets. And a frequently updated set of normals, if presented without proper context, could make it harder for the public to discern that the climate itself is changing. However, users such as large utilities should find that the new normals help them gauge the actual climate more effectively. "We focused from the beginning on the energy industry," says Arguez. "That's where we get a lot of feedback."

The new products will be formally introduced this spring via a webcast to be co-hosted by the American Meteorological Society's Energy Committee and NCDC. The webcast will be advertised on NCDC's What's New page. Users will still be able to access the familiar 1971–2000 averages. For more details, contact Arguez.

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