CLIMATE

Present Weather and Climate: Evolving Conditions

"'Exceptionally warm' aptly describes temperatures in the Southwest during the first decade of the twenty-first century."

The bulk of the region's precipitation falls at high elevations as illustrated by this thunderstorm over the plains east of Denver.

Key Messages

1

The decade 2001–2010 was the warmest and the fourth driest in the Southwest of all decades from 1901 to 2010, and the period since 1950 has been warmer in the Southwest than any comparable period in at least six hundred years.

2

The areal extent of drought over the Southwest during 2001–2010 was the second largest observed for any decade between 1901 and 2010. However, the most severe and sustained droughts during 1901–2010 were exceeded in severity and duration by several drought events in the preceding two thousand years.

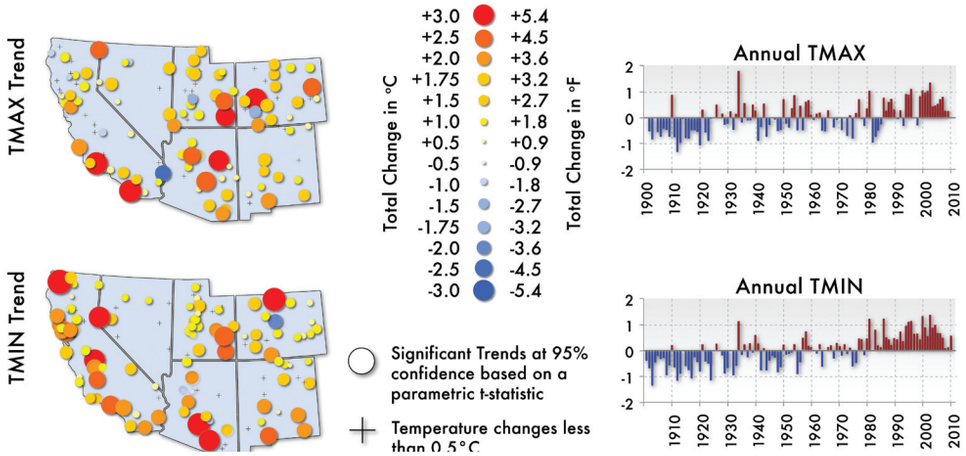
3

Streamflow and snowmelt in many snowmelt-fed streams of the Southwest trended toward earlier arrivals from 1950–1999. Streamflow totals in the four major drainage basins of the Southwest were 5 to 37 percent lower during 2001–2010 than their average flows in the twentieth century.

The fifth chapter of the *Assessment of Climate Change in the Southwest United States* assesses weather and climate variability and trends in the Southwest, using observed climate and paleoclimate records. "Present Weather and Climate: Evolving Conditions" analyzes the last one hundred years of climate variability in comparison to the last one thousand years and links the important features of evolving climate conditions to river flow variability in four of the region's major drainage basins.

As the twenty-first century unfolds, a key concern is that the annual demand for water in the Southwest—especially from the Colorado River, which supplies water to each of the region's states—has risen to an amount that nearly matches the natural annual flow in the Colorado River. There is a small margin between supply and demand—both of which are sensitive to climate variability and change.

For more information about *Assessment of Climate Change in the Southwest United States*, see: www.swcarr.arizona.edu, www.cakex.org, www.islandpress.org/NCAreports.
This fact sheet developed by Institute of the Environment, University of Arizona.



The 1901–2010 trends in annually averaged daily maximum temperature (TMAX, top) and daily minimum temperature (TMIN, bottom). Units are the change in °C/110yrs. The magnitude of trends is indicated by a station circle's size, with warming trends denoted by red shades and cooling trends denoted by blue shades.

Temperature

Annual temperatures for 2001–2010 were warmer than during any decade of the twentieth century, both for the Southwest as a whole and for each state in the region, with greater warming occurring during the spring and summer seasons. The recent rapid increase in late winter and early spring minimum temperatures are very unlikely due to natural variability alone, but are consistent with a regional sensitivity to increased greenhouse gases and aerosols. Annual average surface temperatures during 1901–2010 increased by around 1.6°F over the Southwest region. Long-term weather stations across the region show warming trends in both daytime high temperatures and nighttime low temperatures. Cold waves have been especially rare since about 1990, while the frequency of heat waves has increased.

Precipitation

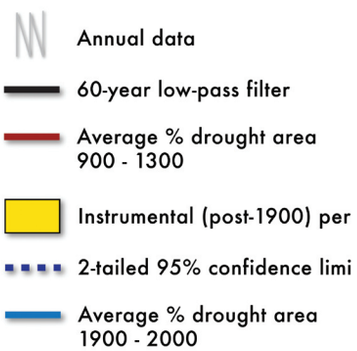
For 2001–2010, annual precipitation, averaged across the entire Southwest, ranked the fourth driest of all decades since 1901. It is likely that most of the recent dryness over the Southwest is associated with a natural, decadal coolness in tropical Pacific sea-surface temperatures and is mostly unrelated to influences of increased greenhouse gases and aerosols. The strongest percentage declines occurred during spring and summer, which were 11 percent and 8 percent below average, respectively. The winter season experienced a small increase relative to twentieth-century averages. Although the decade 2001–2010 was relatively dry for the Southwest, regional annual precipitation computed for the entire 1901–2010 period reveals little change in trend.

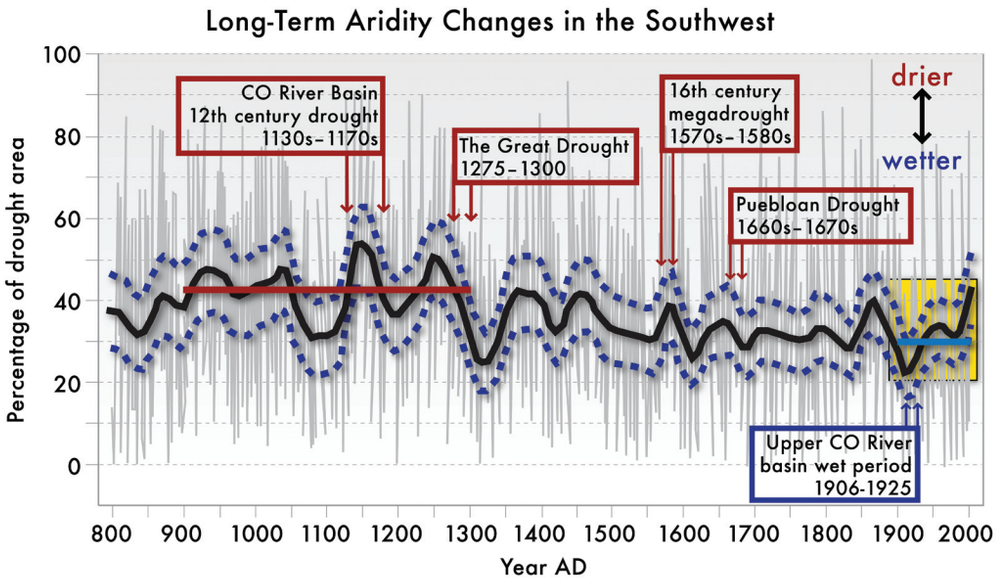
Snow

Observed regional snow-related changes include trends toward earlier snowmelt runoff in California and across the West, earlier onset of spring snowmelt-runoff pulses, declines in mountain snowpack, general shifts in hydroclimatic seasons, trends toward more late winter precipitation falling as rain instead of snow, and declines in late-winter snowpack in the northern Sierra Nevada. During 1950–1999 as much as 60 percent of the climate-related trends in wintertime minimum temperatures, snowpack water content as a fraction of total precipitation, and snow-fed streamflow timing were human-induced. These changes reflect temperature influences more than precipitation effects.

Drought

In the decade 2001–2010, the Sacramento-San Joaquin, Humboldt, Colorado, and Rio Grande river systems all showed lower-than-average measured flows in response to warm, dry conditions. Observed flows for 2001–2010 in the Rio Grande at El Paso were about 23 percent lower than the period from 1941 to 2000, even though overall precipitation in the basin was 3 percent above average. The Southwest was the only region in the continental United States to experience a widespread declining trend in annual peak streamflow rates from 1901 to 2008.





History of drought in the West.
Percentage of area affected by drought across the western United States, as reconstructed from tree-ring data.

Information from: Hoerling, M. P., M. Dettinger, K. Wolter, J. Lukas, J. Eischeid, R. Nemani, B. Liebmann, and K. E. Kunkel. 2013. "Present Weather and Climate: Evolving Conditions." In *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*, edited by G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, 74–100. A report by the Southwest Climate Alliance. Washington, DC: Island Press.