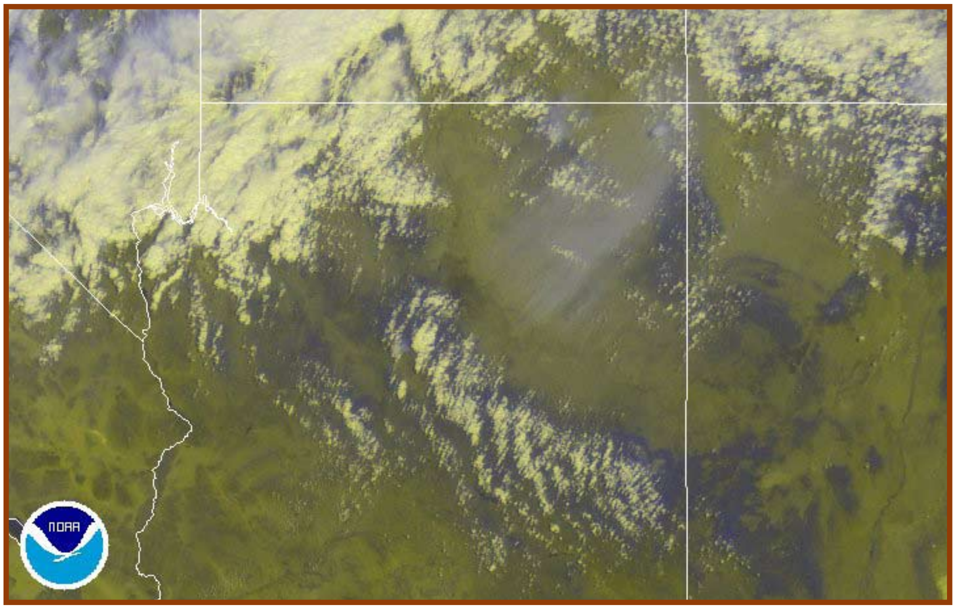
Issued: May 28, 2009

Southwest Climate Outlook

THE UNIVERSITY OF ARIZONA.
Arizona's First University.



Source: NOAA

Photo Description: Satellite photograph of a sandstorm emanating from Navajo Nation on April 3. Dust from the Colorado Plateau region is contributing to earlier snowmelt in the Rocky Mountains. The West was poised for a bad dust season this year when snow and rainfall all but stopped in the Colorado Plateau region in January—soils dampened by precipitation are not as easily transported by wind as dry soils, according to researchers.

Would you like to have your favorite photograph featured on the cover of the *Southwest Climate Outlook*? For consideration send a photo representing Southwest climate and a detailed caption to: macaulay@email.arizona.edu

In this issue...

Feature Article

page 3

When the globe's average temperature hit an all-time warm record in 2005, perceptions grew that global warming would cause a successively hotter future. But in the years since, the average temperature has been lower...

Temperature

page 6

The past 30 days brought only one significant storm to the Southwest as high pressure has dominated in the region, maintaining above-average temperatures. Both Arizona and New Mexico have been 2 to 8 degrees Fahrenheit warmer than average during the last month...

Fire Summary

page 14

Extremely dry conditions during the past few months have contributed to recent fire activity. The Southwest Coordination Center (SWCC), an interagency effort to share information and help coordinate fire support, reports 922 fires have started in Arizona and New Mexico...

CLIMAS

ARIZONA COOPERATIVE EXTENSION
THE UNIVERSITY OF ARIZONA • COLLEGE OF AGRICULTURE AND LIFE SCIENCES

NM STATE UNIVERSITY

May Climate Summary

Drought– All watersheds in Arizona are experiencing drought, with abnormally dry conditions present across northern and western parts of the state and moderate drought conditions across southeast Arizona. Drought conditions expanded in New Mexico, where 78 percent of the state is experiencing some level of drought.

Temperature– Arizona and New Mexico have been 2 to 8 degrees warmer than average during the last month, with some record-breaking temperatures.

Precipitation– In the 30 days prior to May 20, most of Arizona had received less than 5 percent of average precipitation. However, in the two days following May 20, significant precipitation fell in the Southwest.

ENSO– Sea surface temperatures warmed to near-average conditions across the equatorial Pacific. Forecasts suggest neutral conditions are 70 percent likely to continue through July, with an increasing chance of El Niño conditions developing by late summer.

Climate Forecasts– Forecasters believe that the monsoon will arrive early and deliver above-normal precipitation in the first half of the season, but the rains may taper off in the second half of the summer. Temperature forecasts for most of the West show a tilt in the odds toward warmer-than-normal temperatures.

The Bottom Line– Temperatures were 6 to 8 degrees F above average across the high country areas of Arizona and New Mexico in early May, which led to rapid melting of the remaining snowpack. In May, Phoenix had 14 consecutive days in which temperatures equaled or surpassed 100 degrees, setting a new record. Also, recent heavy precipitation in the Southwest between May 20 and 23 added much-needed rainfall to the driest time of year and helped reduce fire risk.

Monsoon

The 2009 monsoon in the Southwest is forecast to be early and wet. During a Web briefing Thursday, May 21, scientists from The University of Arizona; the National Weather Service (NWS); Servicio Nacional Meteorológico, Mexico's national weather service; and the National Center for Atmospheric Research emphasized the forecast applies to June and July but becomes more uncertain for August into September.

"The large-scale signal suggests the monsoon will arrive early and will be wet and strong," said Chris Castro, an assistant professor of atmospheric sciences at the UA. The days leading up to the rains, he said, are likely to be very hot and dry. However, recent rainfall during the third week of May was not caused by the monsoon.

The NWS forecasts a 33 to 45 percent chance of above-average rainfall in June, but the forecast becomes increasingly uncertain later in the summer, said Erik Pytlak, a NWS meteorologist in Tucson. One reason is that forecasts indicate a rapid development of an El Niño event this summer into fall, which can weaken the easterly winds characteristic of the monsoon and bring drier weather to the Southwest.

The Web briefing can be viewed online at: http://breeze.ltc.arizona.edu/p42239161/.

Disclaimer - This packet contains official and non-official forecasts, as well as other information. While we make every effort to verify this information, please understand that we do not warrant the accuracy of any of these materials. The user assumes the entire risk related to the use of this data. CLIMAS, UA Cooperative Extension, and the State Climate Office at Arizona State University (ASU) disclaim any and all warranties, whether expressed or implied, including (without limitation) any implied warranties of merchantability or fitness for a particular purpose. In no event will CLIMAS, UA Cooperative, and the State Climate Office at ASU or The University of Arizona be liable to you or to any third party for any direct, indirect, incidental, consequential, special or exemplary damages or lost profit resulting from any use or misuse of this data

Table of Contents:

SWCO Staff:

Mike Crimmins, *UA Extension Specialist*
Stephanie Doster, *Institute of the Environment Associate Editor*
Dan Ferguson, *CLIMAS Program Manager*
Gregg Garfin, *Institute of the Environment Deputy Director of Outreach*
Zack Guido, *CLIMAS Associate Staff Scientist*
Rebecca Macaulay, *Graphic Artist*
Nancy J. Selover, *Arizona State Climatologist*

This work is published by the Climate Assessment for the Southwest (CLIMAS) project and the University of Arizona Cooperative Extension; and is funded by CLIMAS, Institute for the Study of Planet Earth, and the Technology and Research Initiative Fund of the University of Arizona Water Sustainability Program through the SAHRA NSF Science and Technology Center at the University of Arizona.

A warming world interspersed with cooling periods

By Zack Guido

When the globe's average temperature hit an all-time warm record in 2005, perceptions grew that global warming would cause a successively hotter future. But in the years since, the average temperature has been lower, culminating in 2008 with a drop of roughly 0.2 degrees Fahrenheit—a decline of around 0.4 degrees F from the record high. These observations have now prompted some newspapers and Web sites to pose the question: has global warming stopped?

The resounding answer, presented in recent peer-reviewed journal articles, is no. Natural climate variability causes year-to-year fluctuations in temperature that can give the appearance of stable or cooling global temperatures during short intervals but do not constitute strong trends—a more trusted measure of climate change.

Indeed, climate variability is as natural to the climate system as thunder and lightning are to the Southwest monsoon and is experienced over many intervals. During the past 100 years, while the global temperature has generally increased, volcanic eruptions, El Niño Southern Oscillation (ENSO) events, and other natural occurrences have amplified global temperature at times but also have cooled the planet. Future climates will likely have similar short cool spells, some a few decades in duration, while the longer-term temperature trend continues to climb.

Recent temperature observations

The longer the trend, the more statistically powerful it is. A rising stock market for 12 consecutive weeks is more assuring than when the market has risen for only two successive weeks. It's the same with temperature patterns. Each year, NASA's Goddard Institute for Space Studies (GISS) and several other institutions such as the National Oceanic and Atmospheric Administration (NOAA) and Britain's Hadley Center compare the average global surface air temperature to all the years since 1880.

According to GISS, the global temperature in 2008 was about 0.75 degrees Fahrenheit warmer than the 1951–1980 average, continuing a trend of warmer-than-average years (Figure 1). The 30-year average, often referred to as the climatological period, is chosen as a baseline to compare years. This gives an indication of how warm or cold a given year is compared to what is considered normal. While the global temperatures were higher than normal in 2008, temperatures in the Southwest ranged between average and a few tenths of a degree F warmer than average.

The wide angle view, which focuses on the entire temperature record, puts in perspective the global warming trend that began around 1900. From this vantage point, 2008 was the ninth warmest year in the period of instrumental measurements, which extends back to 1880, around the time when widespread monitoring began. The 10 warmest years have occurred since 1997.

Focusing on this decade alone, however, captures a different picture. The average global temperature dipped in 2008 and was the coolest year since 2000. In comparison to 2007, 2008 was cooler by about a tenth of a degree Celsius, or two-tenths of a degree F; most yearly differences in average global temperature are less. Many climate scientists attribute the drop in mercury in part to the effect of La Niña, which is characterized by cooler tropical Pacific Ocean temperatures and often causes cooler global temperatures. This slight temperature dip is a seemingly small change. However, it is large enough to erase the warming trend of the last eight years. The natural climate variability plays a role in changing yearly temperatures, at times accentuating warming and at times dampening it.

continued on page 4

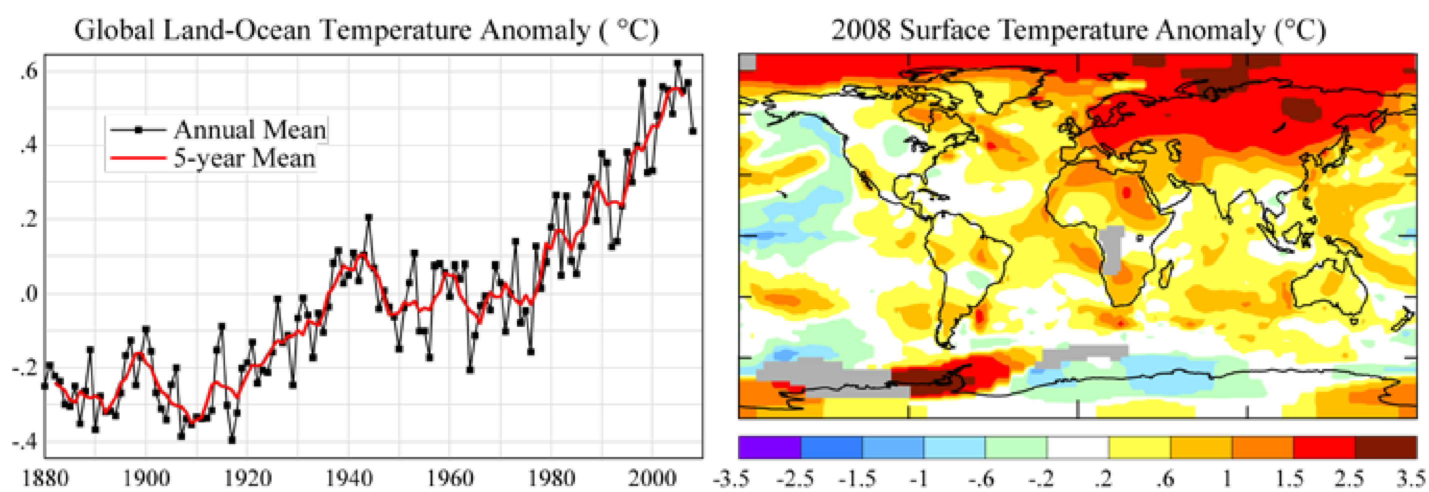


Figure 1. Global average temperature difference from the 1951–1980 average. Differences between 2008 and the 30-year average are expressed in degrees Celsius, which can be multiplied by 1.8 to obtain degrees F. This figure was created by GISS and has been slightly modified.

A Warming World, continued

Climate variability

In April the tropical Pacific Ocean's sea surface temperatures (SSTs) slightly warmed, shifting the existing La Niña event into a neutral state. The warmer ocean temperatures likely will release more heat to the atmosphere in 2009 than they did in 2008. If ENSO was the only contributor to natural variability, then 2009 would likely be warmer than 2008. But air temperatures are influenced by numerous other natural fluctuations in the climate system that occur over time intervals that impact climate on annual and decadal scales, as well as over thousands of years.

Scientists often separate natural climate variability into two categories: external and internal. External variability arises from changes in the amount of solar radiation striking the Earth (affected by 11–year sunspot cycles and longer-term changes in the Earth's orbit around the Sun), volcanic bursts that eject ash and other debris into the atmosphere, and greenhouse gases (GHGs). While the Sun provides energy to the system, volcanoes and GHGs adjust the amount of energy that is trapped within it. When Mount Pinatubo erupted in 1992, for example, a blanket of ash wafted in the upper atmosphere for about two years and slightly cooled global temperatures (Figure 2).

Against this backdrop of external variability, yet separate from it, internal variability arises when natural forces intrinsic to the climate system change temperatures on Earth, much like a thermostat. As long as solar radiation pumps energy into the atmosphere, the physical processes that move energy around the globe—such as ocean and wind currents—will create year-to-year changes in temperature. The Intergovernmental Panel on Climate Change (IPCC), an international consortium of scientists who synthesized the state of the climate in the latest assessment report in 2007, noted eight ocean temperature and air pressure fluctuations that influence internal variability. ENSO is one of these. Global temperature often has shot up during El Niño phases; indeed, one of the largest ENSO-related spikes occurred during the record-breaking year of 1998 (Figure 2). The average global temperature that year was about 1 degree F above the 30-year average; GISS stated that 0.2 degree F of the warming is attributed to the warming effect of El Niño.

While the temperature of any given year is influenced by natural variability, the longer term warming trend is likely the handiwork of GHGs emitted by burning fossil fuels. Instrumental and paleoclimate records of the past 1,000 years and results from climate models strongly suggest that the recent increase in global average temperature is beyond what is possible from natural variability. As a result, the IPCC stated it is extremely unlikely natural climate variability explains warming during the past half century.

continued on page 5

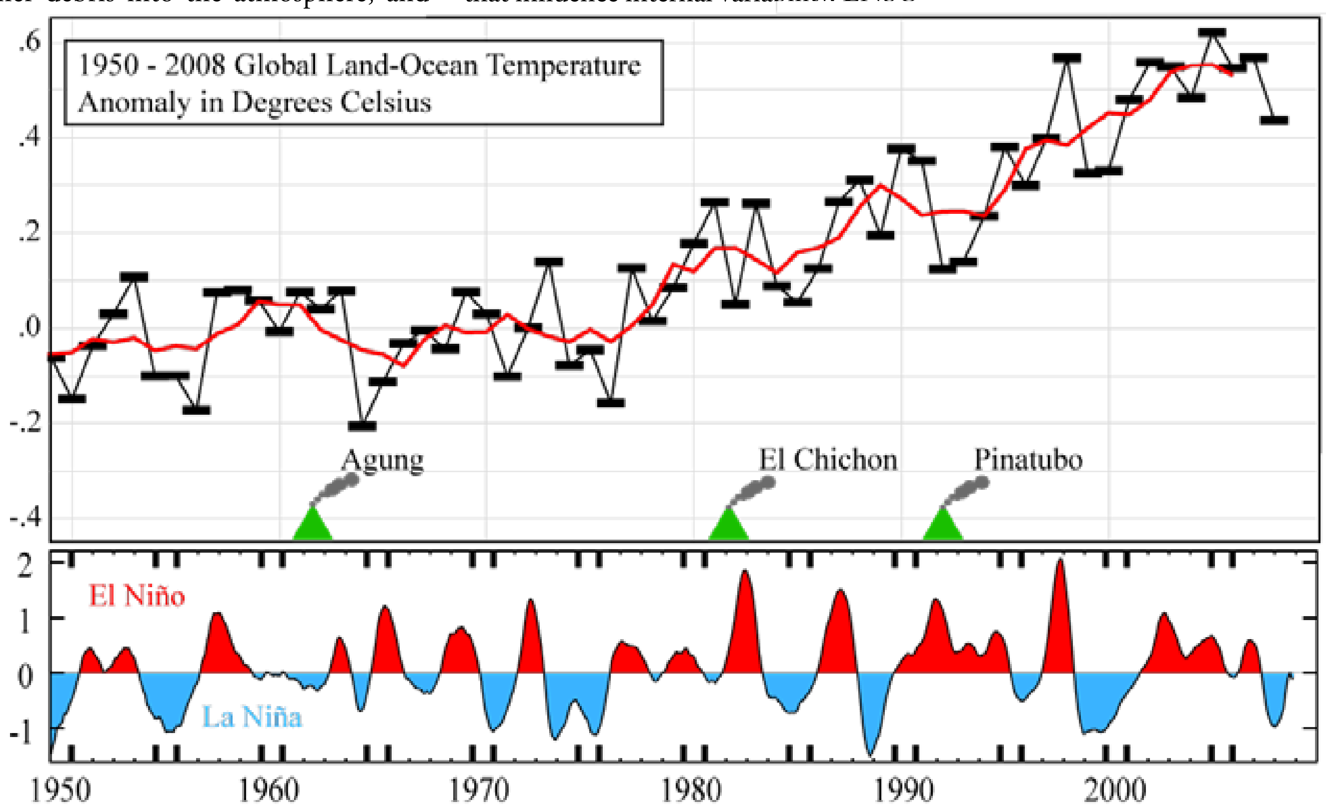


Figure 2. The global average temperature change between 1950 and 2008. El Niño Southern Oscillation and volcanic eruptions contribute to the year-to-year natural climate variability. This figures was created by GISS and slightly modified for this publication.

Future climate likely to have cooling periods

The phrase, "Lies, damn lies and statistics," popularized by Mark Twain, can be applied to temperature trends in terms of the ability of numbers to support different interpretations. Temperatures since 1900 have increased even with the inclusion of 2008, providing strong support for human-caused global warming. But no warming trend has been detected since 1998, which has been cited as evidence against global warming.

To clarify this discrepancy, researchers David Easterling and Michael Wehner dissected the global temperature record and combed simulations of future climates to assess the historical and future occurrences of stable or cooling periods. Their work, published in the peer-reviewed scientific journal *Geophysical Research Letters* in April, suggests that periods similar to the 10 years since 1998 will occur in the future, and the progression of global warming will be interspersed with cooler periods.

Climate scientists often extract trends in the data to smooth out yearly jumps and dips. Easterling and Wehner derived a five-year moving average—the average of two years prior to and after a given year—to minimize the effect of any one year. In the five-year average, warming since 1970 is nearly constant, with the two drops in temperature occurring after large volcanic eruptions (Figure 2).

Globally, average temperatures have been climbing since 1975, indicating the world is progressively warming. Nevertheless, temperatures remained steady or cooled slightly during several periods within the past 34 years. For example, Easterling and Wehner noted that no warming or cooling temperature trends stood out during 1977–1985 or 1981–1989 or since 1998. A factor in this lack of fluctuation is the temperature on the start and end date of a trend. For short periods, which are less scientifically meaningful than long ones, beginning the analysis in a warm year and ending it in a cool year can generate cooling trends. Over longer time periods, such as 100 years, the skewing effect of the first and last temperatures is diminished.

Easterling and Wehner also looked forward, using a climate model to assess the likelihood of future decadal cooling periods. Analyzing temperatures of the 21st century from simulations used in the IPCC's latest assessment report, the authors found a 5 percent chance for cooling trends during any 10-year interval, even in the absence of any simulated volcanic eruptions. From this, the authors stated that the natural variability of the real (as opposed to modeled) climate system will likely produce multi-year periods of sustained cooling or at least periods with no real trend, even in the presence of long-term human-caused warming.

What does this mean?

A disconnection often exists between the time periods discussed by climatologists and those useful in planning. Scientists typically present temperature scenarios for mid-century or 2100, all of which show some degree of warming globally and in the Southwest. But, for the public and private sectors, including agencies in charge of managing water resources and energy development, understanding climate change in decade-long periods is useful. During a cooler period, for example, the knowledge that temperature trends will fluctuate amid warming can prevent decision makers from second-guessing adaptation plans that prepare for a warmer world.

Although 2008 was the coolest year since 2005, warming is likely to return: according to GISS, it seems likely that, with the return of El Niño later this year or in 2010, a new global surface air temperature record will be set within the next one to two years.

For questions or comments, please contact Zack Guido, CLIMAS Associate Staff Scientist, at zguido@email.arizona.edu or (520) 882-0879.

Related Publications

Easterling, D.R. and M.F. Wehner. 2009. Is the climate warming or cooling? *Geophysical Research Letters*, 36, L08706, doi:10.1029/2009GL037810.

Keenlyside, N.S., M. Latif, J. Jungclaus, L. Kornblueh, and E. Roeckner. 2008. Advancing decadal-scale climate prediction in the North Atlantic sector. *Nature*, 453: 84–88.

Smith, D.M., Cusack, S., Colman, A.W., Folland, C.K., Harris, G.R., and Murphy, J.M. 2007. Improved Surface Temperature Prediction for the Coming Decade from a Global Climate Model. *Science*, 317:796-799.

A.A. Tsonis, J.B. Elsner, A.G. Hunt, and T.H. Jagger. 2005. Unfolding the relation between global temperature and ENSO. *Geophysical Research Letters*, 32, L09701, doi:10.1029/2005GL022875.

Trenberth, et al. 2007. Observations: Surface and Atmospheric Climate Change In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)].Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Temperature (through 5/20/09)

Source: High Plains Regional Climate Center

Temperatures in the Southwest since the water year began October 1 continue to reflect elevation differences, averaging between 60 and 70 degrees Fahrenheit in the lowland deserts of Arizona, 40 and 50 degrees F in the elevated Colorado Plateau, 30 to 40 degrees F in the mountain regions, and 50 and 60 degrees F in southern New Mexico (Figure 1a). These temperatures have been 1 to 4 degrees above average for the water year across both states (Figure 1b). Only the area near Bagdad, Ariz., has experienced cooler-than-average temperatures. Comparing current temperatures to the 30-year average at this station may be inaccurate, however, because the station changed locations since the average was calculated.

The past 30 days brought only one significant storm to the Southwest as high pressure dominated in the region, maintaining above-average temperatures (Figures 1c–d). Both Arizona and New Mexico generally have been 2 to 8 degrees F warmer than average during the last month, with some record breaking temperatures. These temperatures in the Southwest have led to an early snowmelt across the region. Temperatures in Phoenix passed the 100 degree F mark for the first time on April 21. Thus far in May, Phoenix has had 14 consecutive days in which temperatures equaled or surpassed 100 degrees, setting a new record. The warmest temperatures in New Mexico have been in the central region, extending between the southern and northern borders.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. Water year is more commonly used in association with precipitation; water year temperature can be used to measure the temperatures associated with the hydrological activity during the water year.

Average refers to the arithmetic mean of annual data from 1971–2000. Departure from average temperature is calculated by subtracting current data from the average. The result can be positive or negative.

The continuous color maps (Figures 1a, 1b, 1c) are derived by taking measurements at individual meteorological stations and mathematically interpolating (estimating) values between known data points. The dots in Figure 1d show data values for individual stations. Interpolation procedures can cause aberrant values in data-sparse regions.

These are experimental products from the High Plains Regional Climate Center.

On the Web:

For these and other temperature maps, visit:
http://www.hprcc.unl.edu/maps/current/

For information on temperature and precipitation trends, visit:
http://www.cpc.ncep.noaa.gov/trndtext.shtml

Figure 1a. Water year '08–'09 (through May 20, 2009) average temperature.

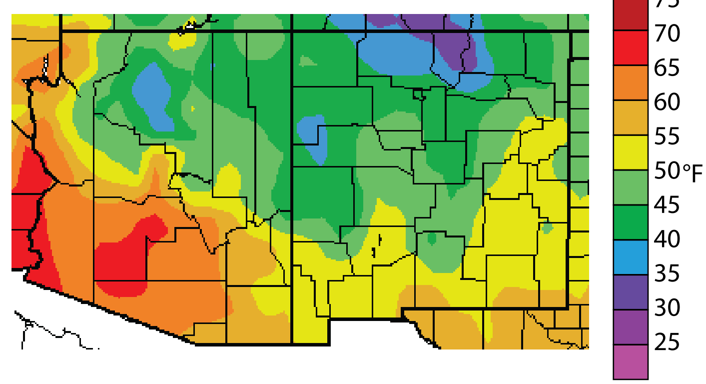


Figure 1b. Water year '08–'09 (through May 20, 2009) departure from average temperature.

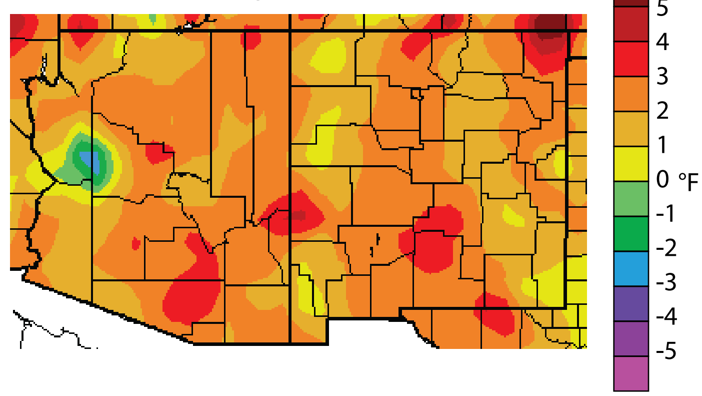


Figure 1c. Previous 30 days (April 21–May 20, 2009) departure from average temperature (interpolated).

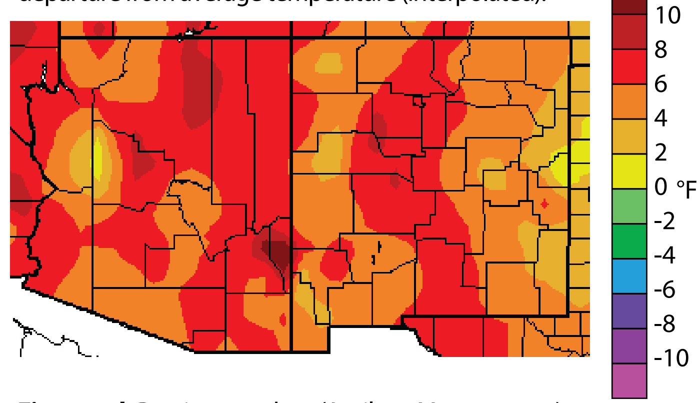
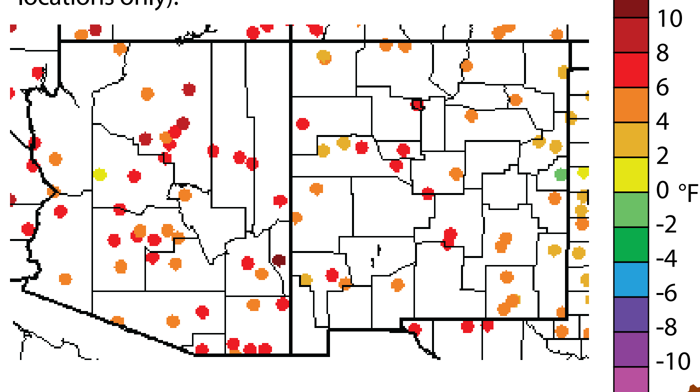


Figure 1d. Previous 30 days (April 21–May 20, 2009) departure from average temperature (data collection locations only).



Precipitation (through 5/20/09)

Source: High Plains Regional Climate Center

Precipitation since the water year began October 1 is well below average. In Arizona and the southern half of New Mexico, precipitation has been 25 to 90 percent of average (Figures 2a–b). South-central New Mexico has been even drier, with less than 25 percent of average. Precipitation has been 70 to 90 percent of average in northern New Mexico and 100 to 110 percent of average in the highest elevations of north-central New Mexico and northwestern Arizona.

The period from mid-February through mid-May has been much drier than average in the Southwest, with only a few weak storm systems moving through. Those systems generally stayed to the north, moving across Utah and Colorado, and missing most of Arizona and New Mexico.

In the past 30 days through May 20, most of Arizona has received less than 5 percent of average precipitation, mostly due to dry conditions in April, since May is historically one of the driest months in the Southwest (Figures 2c–d). Much of New Mexico has received less than 25 percent of its average precipitation, with the northwest at 50 to 70 percent of average and the southeast at 25 to 70 percent. Although a stream of moisture moved into Arizona and New Mexico in mid-May, few storms developed to generate significant precipitation until the third week of May.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2008, we are in the 2009 water year. The water year is a more hydrologically sound measure of climate and hydrological activity than is the standard calendar year.

Average refers to the arithmetic mean of annual data from 1971–2000. Percent of average precipitation is calculated by taking the ratio of current to average precipitation and multiplying by 100.

The continuous color maps (Figures 2a, 2c) are derived by taking measurements at individual meteorological stations and mathematically interpolating (estimating) values between known data points. Interpolation procedures can cause aberrant values in data-sparse regions.

The dots in Figures 2b and 2d show data values for individual meteorological stations.

On the Web:

For these and other precipitation maps, visit:
http://www.hprcc.unl.edu/maps/current/

For National Climatic Data Center monthly precipitation and drought reports for Arizona, New Mexico, and the Southwest region, visit: http://lwf.ncdc.noaa.gov/oa/climate/research/2003/perspectives.html#monthly

Figure 2a. Water year '08–'09 (through May 20, 2009) percent of average precipitation (interpolated).

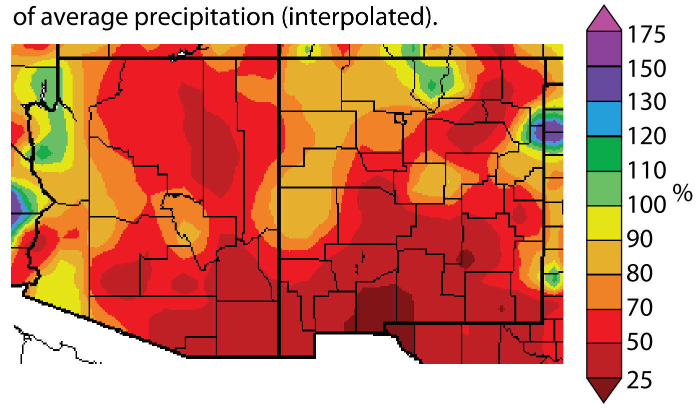


Figure 2b. Water year '08–'09 (through May 20, 2009) percent of average precipitation (data collection locations only).

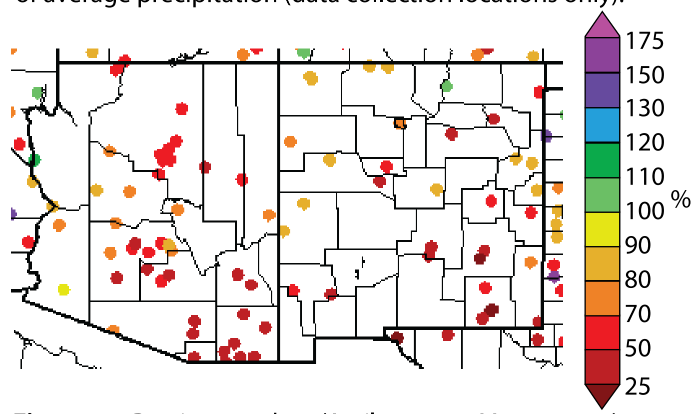


Figure 2c. Previous 30 days (April 21, 2009–May 20, 2009) percent of average precipitation (interpolated).

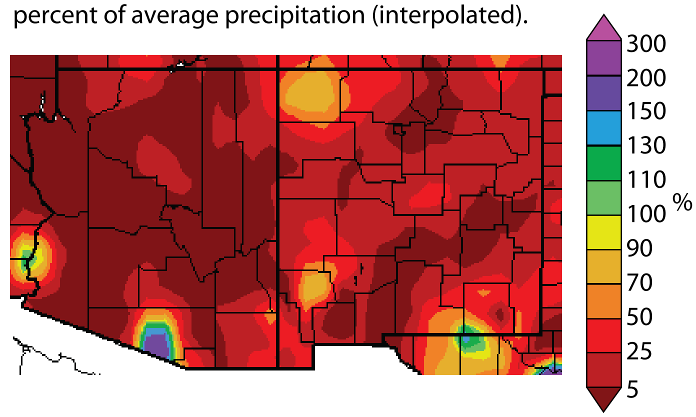
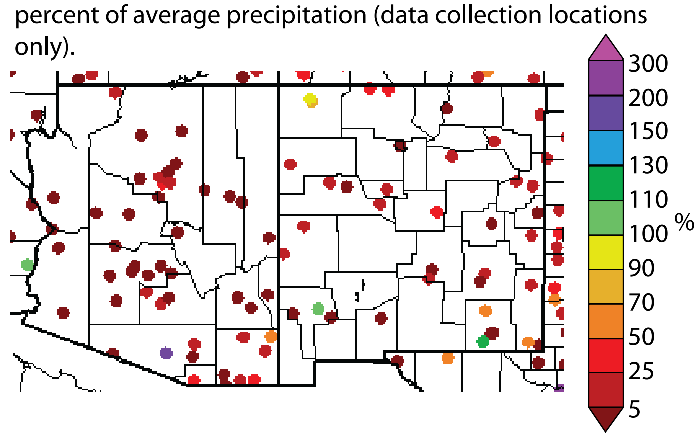


Figure 2d. Previous 30 days (April 21, 2009–May 20, 2009) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(released 5/19/09)

Sources: U.S. Department of Agriculture, National Drought Mitigation Center, National Oceanic and Atmospheric Administration

The U.S. Drought Monitor reports worsening drought conditions for the Arizona portion of the Four Corners region, southeastern Arizona, and southern New Mexico (Figure 3). Drought conditions have been influenced by extremely dry weather in the past 30 days. Precipitation totaling less than 25 percent of average has fallen in most of Arizona and New Mexico since April 21, with many regions receiving less than 5 percent. Moderate drought has expanded in southern Arizona and moderate and severe drought expanded in southern New Mexico.

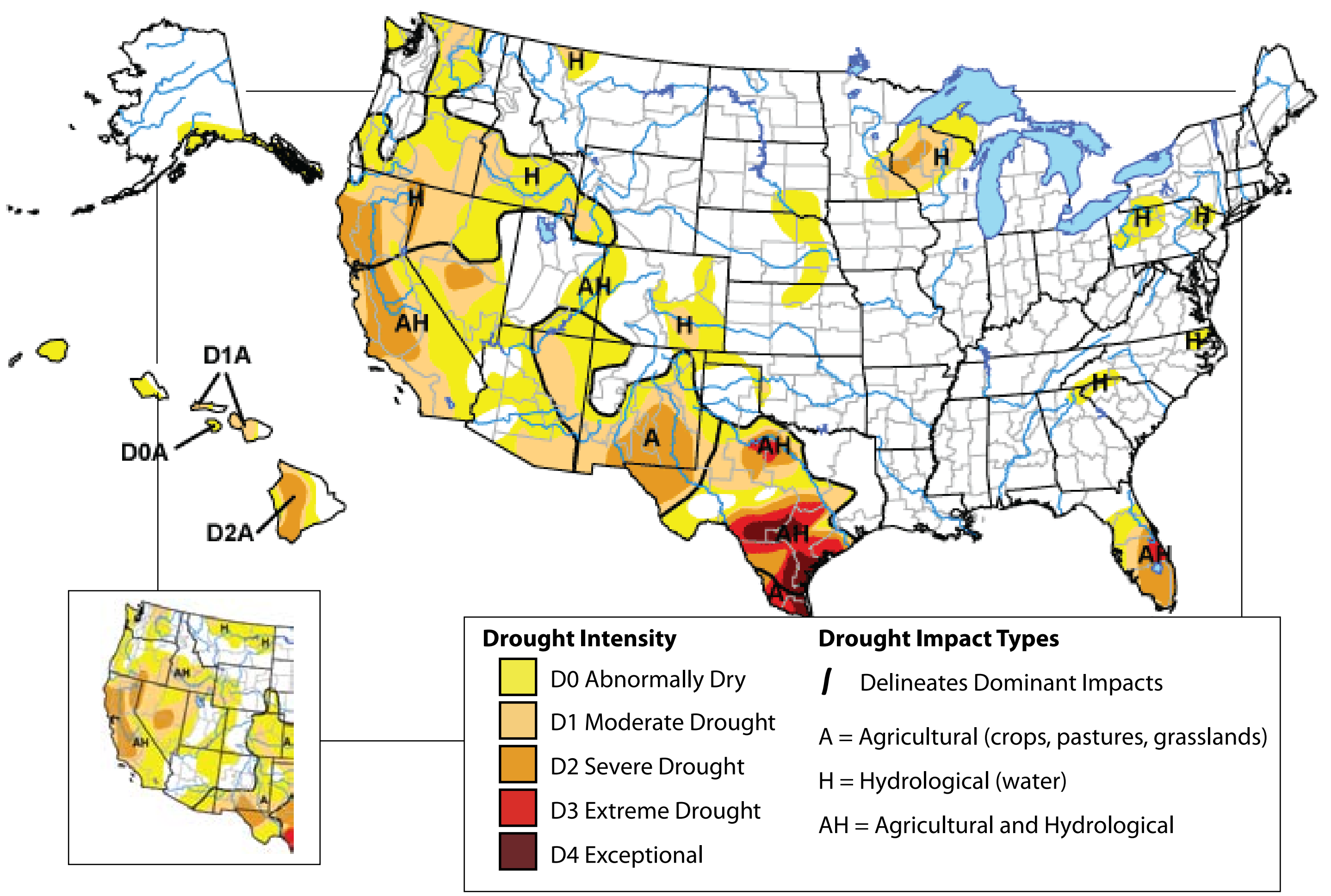
On May 19, approximately 78 percent of Arizona was abnormally dry or worse, representing an increase of about 26 percent from last month. In New Mexico, about 68 percent of the state was abnormally dry or worse on May 19; moderate drought conditions occupy about 24 percent of the state and 26 percent is classified with severe drought. In the past month, the total area of New Mexico with severe drought intensity increased by about 17 percent; nearly all of the southern counties, including Doña Ana, Otero, Eddy, Lincoln, and Chaves, have severe drought conditions.

Notes:

The U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. The inset (lower left) shows the western United States from the previous month's map.

The U.S. Drought Monitor maps are based on expert assessment of variables including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts. It is a joint effort of the several agencies; the authors of this monitor are M. Rosencrans, D. Miskus and A. Artusa, CPC/NOAA.

Figure 3. Drought Monitor released May 19, 2009 (full size), and April 16, 2009 (inset, lower left).



On the Web:

The best way to monitor drought trends is to pay a weekly visit to the U.S. Drought Monitor website: http://www.drought.unl.edu/dm/monitor.html

Arizona Drought Status

(data through 3/31/09)

Source: Arizona Department of Water Resources

Short-term drought conditions worsened across all of Arizona, according to the April Arizona Drought Monitor Report (Figure 4a). All watersheds are observing some type of drought, with abnormally dry conditions present across the northern and western parts of the state and moderate drought conditions across southeast Arizona. This is a marked increase in the coverage and intensity of drought conditions from March, when only the Santa Cruz, Willcox Playa, and White Water Draw watersheds were in moderate drought and several other watersheds in southeast and northern Arizona were observing abnormally dry conditions. Most of Arizona observed precipitation amounts of less than 50 percent of average during April, with southeast Arizona seeing even less—25 percent of average. These dry conditions helped push worsening short-term drought conditions. The April update of long-term drought status also showed drought conditions across all of Arizona (Figure 4b). All watersheds reported at least abnormally dry long-term conditions, with the Little Colorado, Bill Williams, Agua Fria, and San Simon River watersheds observing moderate drought.

The Tonto National Forest has enacted fire restrictions as of May 14 (*Arizona Silver Belt*, March 20). Worsening drought conditions and above-average temperatures have increased wildfire danger across the national forest in east-central Arizona. The fire restrictions prohibit any fire use in the forest; violations carry fines of up to $5,000.

Figure 4a. Arizona short-term drought status for April 2009.

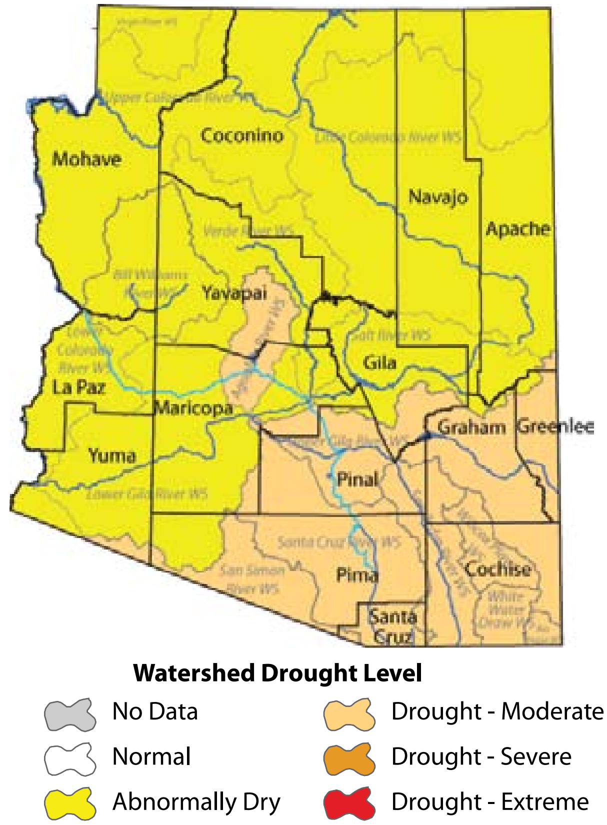
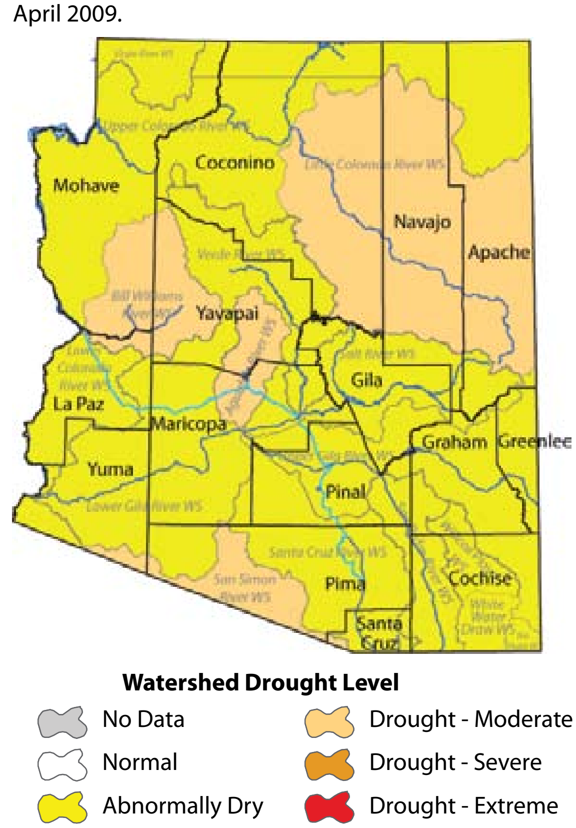


Figure 4b. Arizona long-term drought status for April 2009.



Notes:

The Arizona drought status maps are produced monthly by the Arizona Drought Preparedness Plan Monitoring Technical Committee. The maps are based on expert assessment of variables including, but not limited to, precipitation, drought indices, reservoir levels, and streamflow.

Figure 4a shows short-term or meteorological drought conditions. Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) over a relatively short duration (e.g., months). Figure 4b refers to long-term drought, sometimes known as hydrological drought. Hydrological drought is associated with the effects of relatively long periods of precipitation shortfall (e.g., many months to years) on water supplies (i.e., streamflow, reservoir and lake levels, and groundwater). These maps are delineated by river basins (wavy gray lines) and counties (straight black lines).

On the Web:

For the most current Arizona drought status maps, visit:
http://www.azwater.gov/dwr/drought/DroughtStatus.html

New Mexico Drought Status

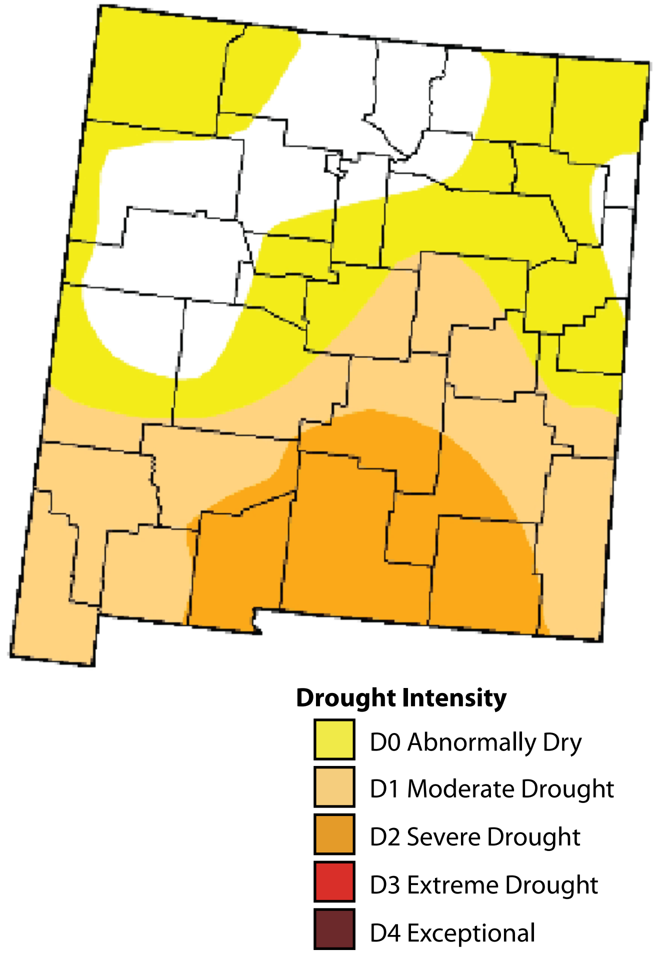
(released 5/14/09)

Source: New Mexico State Drought Monitoring Committee

Drought conditions expanded again this past month across New Mexico, with 78 percent of the state experiencing some level of drought. Moderate and severe drought conditions expanded north, covering much of the southern half of the state (Figure 5). More than 50 percent of New Mexico is experiencing moderate drought conditions or worse, up from 30 percent in mid-April. Abnormally dry conditions cover the remainder of the northern part of the state, with normal conditions confined to the southern Rocky Mountains in north-central New Mexico. Below-average precipitation and above-average temperatures plagued New Mexico this past winter, exacerbating short-term drought conditions.

Drought conditions across New Mexico are significantly impacting an already stressed agricultural sector. A volatile commodity market and high feed costs, along with poor production due to drought conditions, are increasing the need for agricultural loans across New Mexico (*The Dow Jones Newswire*, March 18). Drought conditions are also forcing ranchers to liquidate herds and pushing an increase in the lease rate for irrigated lands.

Figure 5. New Mexico drought map based on data through May 12, 2009.



Notes:
The New Mexico section of the U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. The maps are based on expert assessment of variables including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts. It is a joint effort of the several agencies.

This summary contains substantial contributions from the New Mexico Drought Working Group.

On the Web:

For the most current drought status map, visit:
http://www.drought.unl.edu/dm/DM_state.htm?NM,W

For the most current Drought Status Reports, visit:
http://www.nmdrought.state.nm.us/MonitoringWorkGroup/wk-monitoring.html

Arizona Reservoir Levels

(through 4/30/09)

Source: NRCS, National Water and Climate Center

Combined reservoir storage in Lakes Powell and Mead declined by 502,000 acre-feet during April (Figure 6). As of April 30, the combined storage of the two massive reservoirs is 48.4 percent of capacity. Powell and Mead combined storage is more than 780,000 acre-feet greater than it was the same time last year. During April, combined storage in the Salt-Verde reservoir system decreased by 26,400 acre-feet. San Carlos reservoir storage decreased by more than 45,000 acre-feet during April; current storage, however, is far greater than the alarmingly low levels observed during 2003–2004.

In order to address concerns about population growth, increased demand for water, potential future declines in Colorado River flow, and shortages in Tucson's Central Arizona Project allocation, Tucson Water and the Arizona Water Bank have stored 270,000 acre-feet of CAP water (*Arizona Daily Star*, May 6). This volume is enough to supply nearly all of the Tucson residents with water for one year.

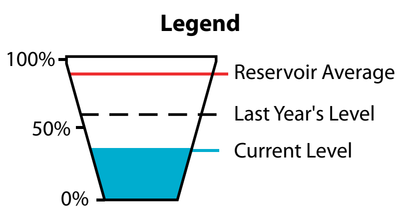
Notes:

The map gives a representation of current storage levels for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total capacity. Note that while the size of each cup varies with the size of the reservoir, these are representational and not to scale. Each cup also represents last year's storage level (dotted line) and the 1971–2000 reservoir average (red line).

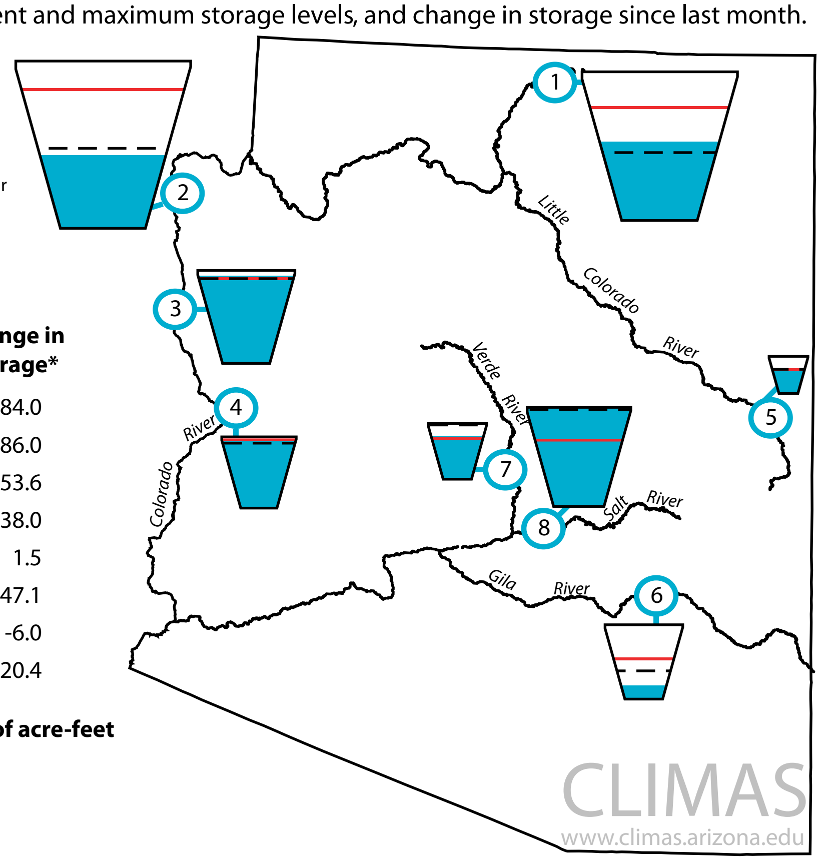
The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). On average, 1 acre-foot of water is enough to meet the demands of 4 people for a year. The last column of the table list an increase or decrease in storage since last month. A line indicates no change.

These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Dino DeSimone, Dino.DeSimone@az.usda.gov.

Figure 6. Arizona reservoir levels for April 2009 as a percent of capacity. The map depicts the average level and last year's storage for each reservoir. The table also lists current and maximum storage levels, and change in storage since last month.



size of cups is representational of reservoir size, but not to scale



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Lake Powell	53%	12,858.0	24,322.0	84.0
2. Lake Mead	44%	11,578.0	26,159.0	-586.0
3. Lake Mohave	94%	1,708.3	1,810.0	53.6
4. Lake Havasu	96%	594.5	619.0	38.0
5. Lyman Reservoir	62%	18.6	30.0	1.5
6. San Carlos	18%	154.0	875.0	-47.1
7. Verde River System	77%	220.6	287.4	-6.0
8. Salt River System	99%	1,999.5	2,025.8	-20.4

*** thousands of acre-feet**

On the Web:

Portions of the information provided in this figure can be accessed at the NRCS website:
http://www.wcc.nrcs.usda.gov/wsf/reservoir/resv_rpt.html

New Mexico Reservoir Levels

(through 4/30/09)

Source: NRCS, National Water and Climate Center

The total reservoir storage increased in some of New Mexico's northern reservoirs (Navajo, El Vado, Heron, Costilla, Eagles Nest). Elephant Butte Reservoir is now at 26 percent of capacity, which is greater than last year at this time (Figure 7). Navajo Reservoir, which currently has the largest volume of water in New Mexico, is at 78 percent of capacity—down slightly from last year. Storage in Pecos River reservoirs (reservoirs 9–12) increased during the last month.

Elephant Butte Reservoir storage is expected to increase during the next month as spring snow melts in the Rocky Mountains; U.S. Bureau of Reclamation projections show the reservoir's level at around three feet higher than last year by Memorial Day (*Silver City Sun-News*, May 11). However, projections also suggest the reservoir level will decline substantially during the course of the summer and will be lower than last year's level by Labor Day.

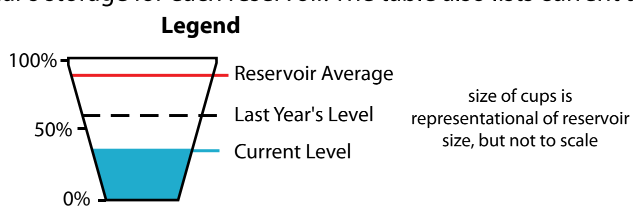
Notes:

The map gives a representation of current storage levels for reservoirs in New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total capacity. Note that while the size of each cup varies with the size of the reservoir, these are representational and not to scale. Each cup also represents last year's storage level (dotted line) and the 1971–2000 reservoir average (red line).

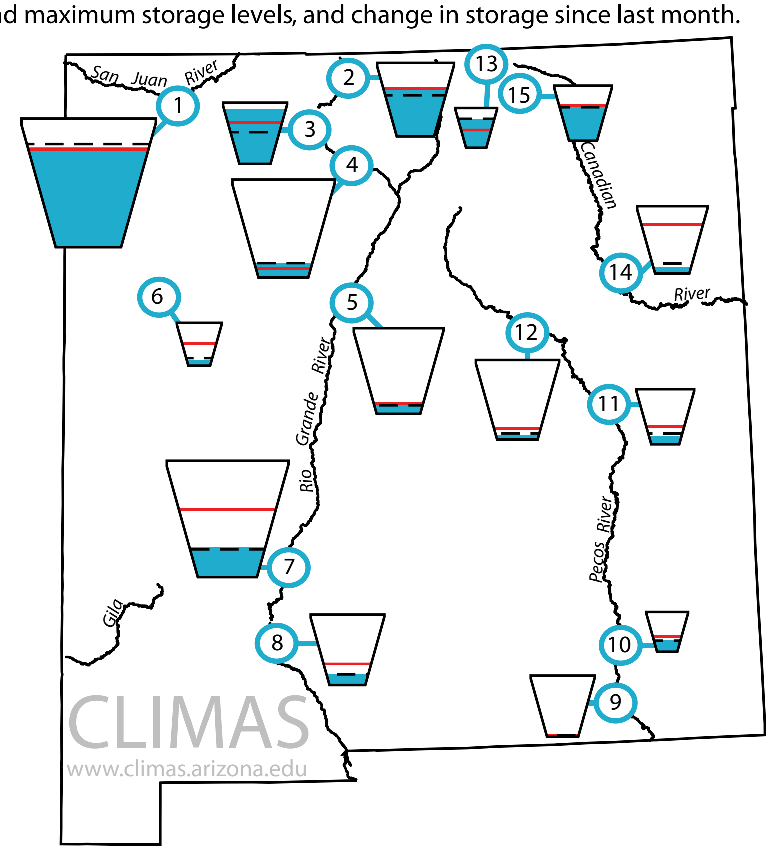
The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). On average, 1 acre-foot of water is enough to meet the demands of 4 people for a year. The last column of the table list an increase or decrease in storage since last month. A line indicates no change.

These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Richard Armijo, Richard.Armijo@nm.usda.gov.

Figure 7. New Mexico reservoir levels for April 2009 as a percent of capacity. The map depicts the average level and last year's storage for each reservoir. The table also lists current and maximum storage levels, and change in storage since last month.



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Navajo	78%	1328.1	1,696.0	41.0
2. Heron	67%	266.2	400.0	17.7
3. El Vado+	90%	170.6	190.3	11.3
4. Abiquiu+	15%	179.5	1192.8	-1.5
5. Cochiti	10%	49.6	491.0	-1.0
6. Bluewater	13%	4.9	38.5	1.9
7. Elephant Butte	26%	580.4	2,195.0	-46.2
8. Caballo	16%	52.2	332.0	12.7
9. Brantley	2%	23.7	1008.2	-6.0
10. Lake Avalon	30%	1.2	4.0	-0.3
11. Sumner	15%	15.0	102.0	-0.7
12. Santa Rosa	6%	27.1	438.3	3.7
13. Costilla	72%	11.5	16.0	1.1
14. Conchas	10%	24.2	254.2	3.6
15. Eagle Nest	64%	50.5	79.0	1.1



+The storage capacity of El Vado and Abiquiu has been increased and now reflects the storage capacities reported by the NRCS.

On the Web:

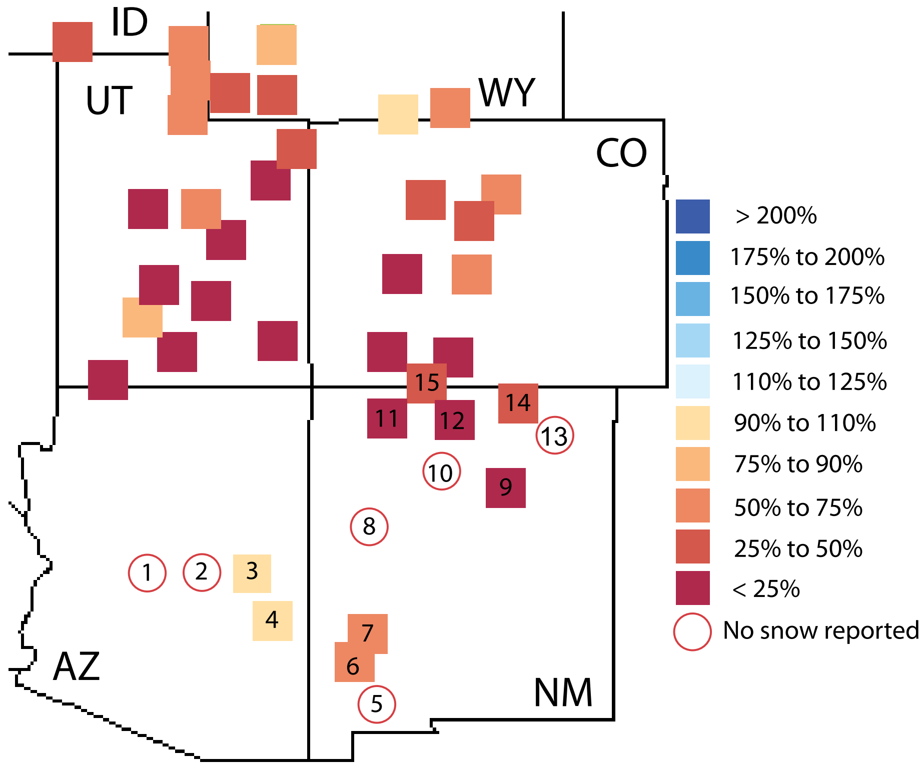
Portions of the information provided in this figure can be accessed at the NRCS website:
http://www.wcc.nrcs.usda.gov/wsf/reservoir/resv_rpt.html

Southwest Snowpack
(updated 5/21/09)

Sources: National Water and Climate Center, Western Regional Climate Center

The snow season is just about over for Arizona and New Mexico. Most SNOTEL (snowpack telemetry) sensors across both states are reporting snow depth levels close to zero (Figure 8). This translates into snow water content (SWC) values of less than 25 percent of average for this time of year. Snowpack levels fell quickly in April and were just about finished off in early May due to record high temperatures across the Southwest. Temperatures were 6 to 8 degrees F above average across the high country areas of Arizona and New Mexico in early May, leading to rapid melting of the remaining snow. Officials with the Bureau of Reclamation in New Mexico remarked that the rapid snowmelt occurred a month earlier than last year but helped fill several reservoirs. The spring peak in streamflows has passed in many watersheds across Arizona and New Mexico. With little remaining snowpack, streamflow levels will continue to decline into the early summer period.

Figure 8. Average snow water content (SWC) in percent of average for available monitoring sites as of May 21, 2009.



Arizona Basins
1 Verde River Basin
2 Central Mogollon Rim
3 Little Colorado - Southern Headwaters
4 Salt River Basin

New Mexico Basins
5 Mimbres River Basin
6 San Francisco River Basin
7 Gila River Basin
8 Zuni/Bluewater River Basin
9 Pecos River
10 Jemez River Basin
11 San Miguel, Dolores, Animas, and San Juan River Basins
12 Rio Chama River Basin
13 Cimarron River Basin
14 Sangre de Cristo Mountain Range Basin
15 San Juan River Headwaters

Notes:
Snowpack telemetry (SNOTEL) sites are automated stations that measure snowpack depth, temperature, precipitation, soil moisture content, and soil saturation. A parameter called snow water content (SWC) or snow water equivalent (SWE) is calculated from this information. SWC refers to the depth of water that would result by melting the snowpack at the SNOTEL site and is important in estimating runoff and streamflow. It depends mainly on the density of the snow. Given two snow samples of the same depth, heavy, wet snow will yield a greater SWC than light, powdery snow.

Figure 8 shows the SWC for selected river basins, based on SNOTEL sites in or near the basins, compared to the 1971–2000 average values. The number of SNOTEL sites varies by basin. Basins with more than one site are represented as an average of the sites. Individual sites do not always report data due to lack of snow or instrument error. CLIMAS generates this figure using daily SWC measurements made by the Natural Resource Conservation Service.

On the Web:
For color maps of SNOTEL basin snow water content, visit:
http://www.wrcc.dri.edu/snotelanom/basinswe.html

For NRCS source data, visit:
http://www.wcc.nrcs.usda.gov/snow/

For a list of river basin snow water content and precipitation, visit:
http://www.wrcc.dri.edu/snotelanom/snotelbasin

Southwest Fire Summary
(updated 5/20/09)

Source: Southwest Coordination Center

Extremely dry conditions during the past few months have contributed to recent fire activity. The Southwest Coordination Center (SWCC), an interagency effort to share information and help coordinate fire support, reports 922 fires have started in Arizona and New Mexico between January 1 and May 20 (Figure 9a). Of these, natural causes such as lightning ignited only 94 fires; human actions caused the others. The area burned in Arizona as of May 20 totaled about 43,000 acres, while about 166,000 acres in New Mexico have been charred. The number of fires that burned more than 100 acres is a small fraction of the total fires but cause the most damage. In Arizona, 16 fires greater than 100 acres started between January 1 and May 5, costing more than $3 million. Only one of these fires stated from lightning. New Mexico has seen 29 large fires in this time period, burning slightly more than 100,000 acres and costing nearly $1.5 million.

Three large fires have occurred recently in Arizona and New Mexico. The Bear fire, located southwest of Flagstaff, Ariz., has burned 350 acres (Figure 9b). The Mule Pass fire near Bisbee, Ariz., has burned 122 acres. In New Mexico, the Flying V fire near Glenwood is 100 percent contained and has burned 520 acres (Figure 9c).

On May 20, the SWCC reported that the 1,000-hour fuel moisture, a measure of the water content in large-sized fuels like trees, was less than 10 percent in nearly all of Arizona and New Mexico. Precipitation in parts of the Southwest around May 21, however, will increase the fuel moisture as well as reduce the fire risk. This precipitation will help moderate the fire hazard typically caused by increased lightning strikes during the early part of the monsoon.

Notes:

The fires discussed here have been reported by federal, state, or tribal agencies during 2008. The figures include information both for current fires and for fires that have been suppressed. The top figure shows a table of year-to-date fire information for Arizona and New Mexico. Prescribed burns are not included in these numbers. The bottom two figures indicate the approximate locations of past and present "large" wildland fires and prescribed burns in Arizona and in New Mexico. A "large" fire is defined as a blaze covering 100 acres or more in timber or 300 acres or more in grass or brush. The name of each fire is provided next to the symbol.

On the Web:

These data are obtained from the Southwest Coordination Center website:
http://gacc.nifc.gov/swcc/predictive/intelligence/daily/ytd_wf_daily_state.pdf

http://gacc.nifc.gov/swcc/predictive/intelligence/maps/wf/swa_fire_combined.htm

Figure 9a. Year-to-date wildand fire information for Arizona and New Mexico as of May 20, 2009.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	500	42,221	30	1,174	530	43,395
NM	328	80,429	64	85,301	392	165,730
Total	828	122650	94	86,475	922	209,125

Figure 9b. Arizona large fire incidents as of May 21, 2009.

Figure 9c. New Mexico large fire incidents as of May 21, 2009.

Temperature Outlook

(June–November 2009)

Source: NOAA Climate Prediction Center (CPC)

The NOAA-Climate Prediction Center (CPC) long-lead temperature forecasts for the continental U.S. show a fairly significant tilt in the odds toward a warm summer for much of the West through at least September. Through the summer and into early fall, the forecasts call for increasing chances for conditions to be similar to those during the warmest 10 years of 1971–2000 for much of the Southwest (Figures 10a–d). Nearly all of the forecast tools, which include long-term trends, El-Niño Southern Oscillation (ENSO) conditions, and various models, call for an increased likelihood for extra warmth across the Southwest.

Notes:

These outlooks predict the likelihood (chance) of above-average, average, and below-average temperature, but not the magnitude of such variation. The numbers on the maps do not refer to degrees of temperature.

The NOAA-CPC outlooks are a 3-category forecast. As a starting point, the 1971–2000 climate record is divided into 3 categories, each with a 33.3 percent chance of occurring (i.e., equal chances, EC). The forecast indicates the likelihood of one of the extremes—above-average (A) or below-average (B)—with a corresponding adjustment to the other extreme category; the "average" category is preserved at 33.3 likelihood, unless the forecast is very strong.

Thus, using the NOAA-CPC temperature outlook, areas with light brown shading display a 33.3–39.9 percent chance of above-average, a 33.3 percent chance of average, and a 26.7–33.3 percent chance of below-average temperature. A shade darker brown indicates a 40.0–50.0 percent chance of above-average, a 33.3 percent chance of average, and a 16.7–26.6 percent chance of below-average temperature, and so on.

Equal Chances (EC) indicates areas where no forecast skill has been demonstrated or there is no clear climate signal; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 10a. Long-lead national temperature forecast for June–August 2009.

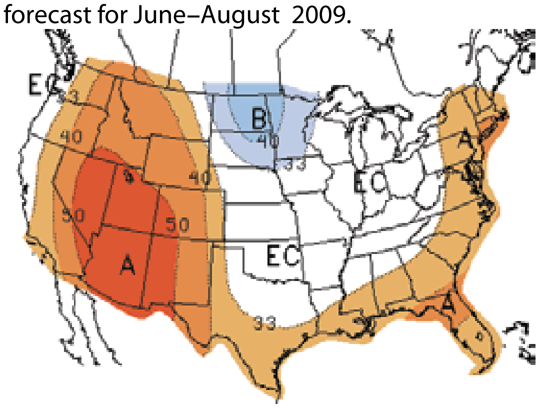
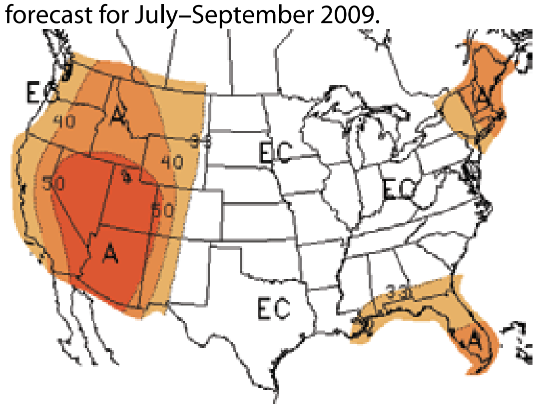


Figure 10b. Long-lead national temperature forecast for July–September 2009.



A= Above: 50.0–59.9% / 40.0–49.9% / 33.3–39.9%

B=Below: 40.0–49.9% / 33.3–39.9%

Figure 10c. Long-lead national temperature forecast for August–October 2009.

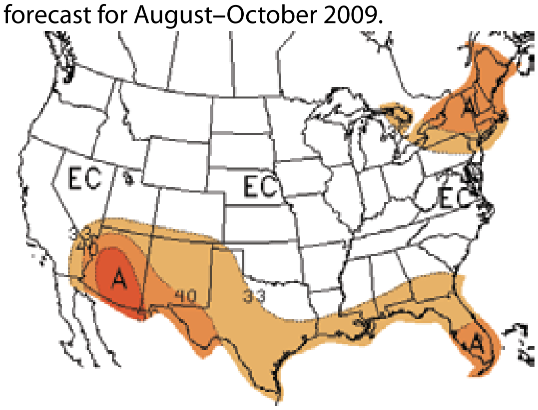
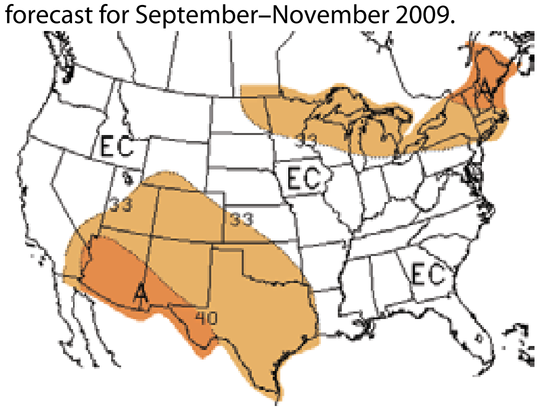


Figure 10d. Long-lead national temperature forecast for September–November 2009.



EC= Equal chances. No forecasted anomalies.

On the Web:

For more information on CPC forecasts, visit:
http://www.cpc.ncep.noaa.gov/products/predictions//multi_season/13_seasonal_outlooks/color/churchill.php
(note that this website has many graphics and may load slowly on your computer)

For IRI forecasts, visit:
http://iri.columbia.edu/climate/forecast/net_asmt/

Precipitation Outlook
(June–November 2009)
Source: NOAA Climate Prediction Center (CPC)

The NOAA-Climate Prediction Center (NOAA–CPC) long-lead precipitation forecasts for the Southwest show equal chances for precipitation to be similar to the wettest, driest, and average conditions for Arizona and New Mexico through the entire 2009 monsoon season (Figures 11a–d). This indicates that for this period no forecast skill has been demonstrated or there is no clear, historical precipitation pattern during these periods. However, NOAA-CPC monsoon forecasts for June indicate increased likelihood for an above-average monsoon. Forecasters believe that the monsoon will arrive early and have above-normal rainfall in the first half of the season, but the rains may taper off in the second half if, as predicted, an El Niño event develops later this summer. El Niño development is the main reason why NOAA-CPC forecasts designate equal chances for the entire summer.

Notes:
These outlooks predict the likelihood (chance) of above-average, average, and below-average precipitation, but not the magnitude of such variation. The numbers on the maps do not refer to inches of precipitation.

The NOAA-CPC outlooks are a 3-category forecast. As a starting point, the 1971–2000 climate record is divided into 3 categories, each with a 33.3 percent chance of occurring (i.e., equal chances, EC). The forecast indicates the likelihood of one of the extremes—above-average (A) or below-average (B)—with a corresponding adjustment to the other extreme category; the "average" category is preserved at 33.3 likelihood, unless the forecast is very strong.

Thus, using the NOAA-CPC precipitation outlook, areas with light green shading display a 33.3–39.9 percent chance of above-average, a 33.3 percent chance of average, and a 26.7–33.3 percent chance of below-average precipitation. A shade darker green indicates a 40.0–50.0 percent chance of above-average, a 33.3 percent chance of average, and a 16.7–26.6 percent chance of below-average precipitation, and so on.

Equal Chances (EC) indicates areas where no forecast skill has been demonstrated or there is no clear climate signal; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 11a. Long-lead national precipitation forecast for June–August 2009.

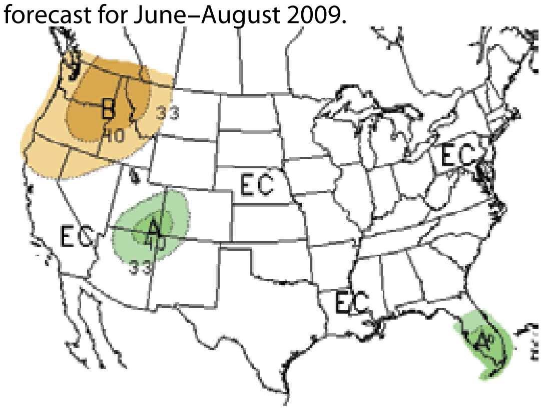


Figure 11b. Long-lead national precipitation forecast for July–September 2009.

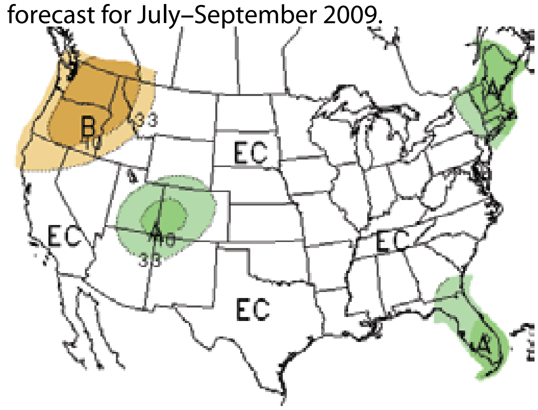


Figure 11c. Long-lead national precipitation forecast for August–October 2009.

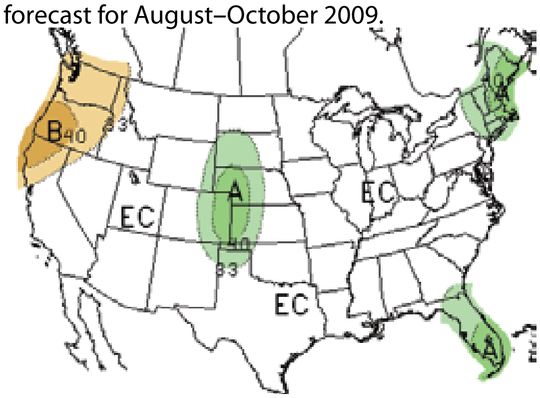
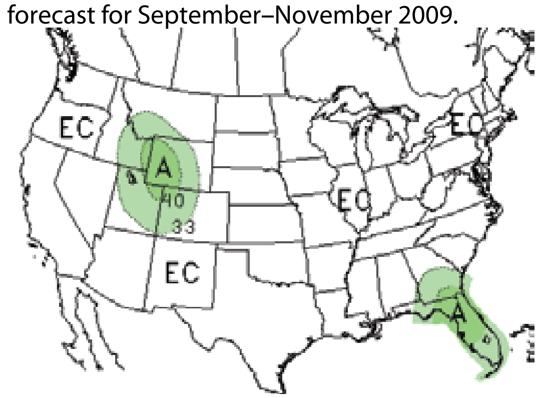


Figure 11d. Long-lead national precipitation forecast for September–November 2009.



B= Below: 33.3–39.9%, 40.0–49.9%

A=Above: 40.0–49.9%, 33.3–39.9%

EC= Equal chances. No forecasted anomalies.

On the Web:
For more information on CPC forecasts, visit:
http://www.cpc.ncep.noaa.gov/products/predictions//multi_season/13_seasonal_outlooks/color/churchill.php
(note that this website has many graphics and may load slowly on your computer)

For IRI forecasts, visit:
http://iri.columbia.edu/climate/forecast/net_asmt/

Seasonal Drought Outlook
(through August 2009)

Source: NOAA Climate Prediction Center (CPC)

The NOAA Climate Prediction Center (CPC) reports that drought conditions for May 21 through August will generally persist or intensify throughout California, parts of southern and eastern Oregon, and the western half of Nevada (Figure 12). Drought conditions are predicted to ease slightly through southeast Arizona, the southern half of New Mexico into West Texas, and along the southern tip of Florida. South Texas along the Rio Grande and Gulf Coast are predicted to see some improvement, although drought conditions are expected to persist.

The improving drought conditions for the Southwest are generally based on climatology, with an expectation that the onset of the monsoon will improve soil moisture, grassland conditions, and fire danger. The somewhat unusual recent wet weather in the Southwest, combined with monsoon forecasts predicting a relatively early onset with a good potential for heavy rains, provides forecasters with high confidence in the drought outlook for Arizona, New Mexico, Colorado, and West Texas.

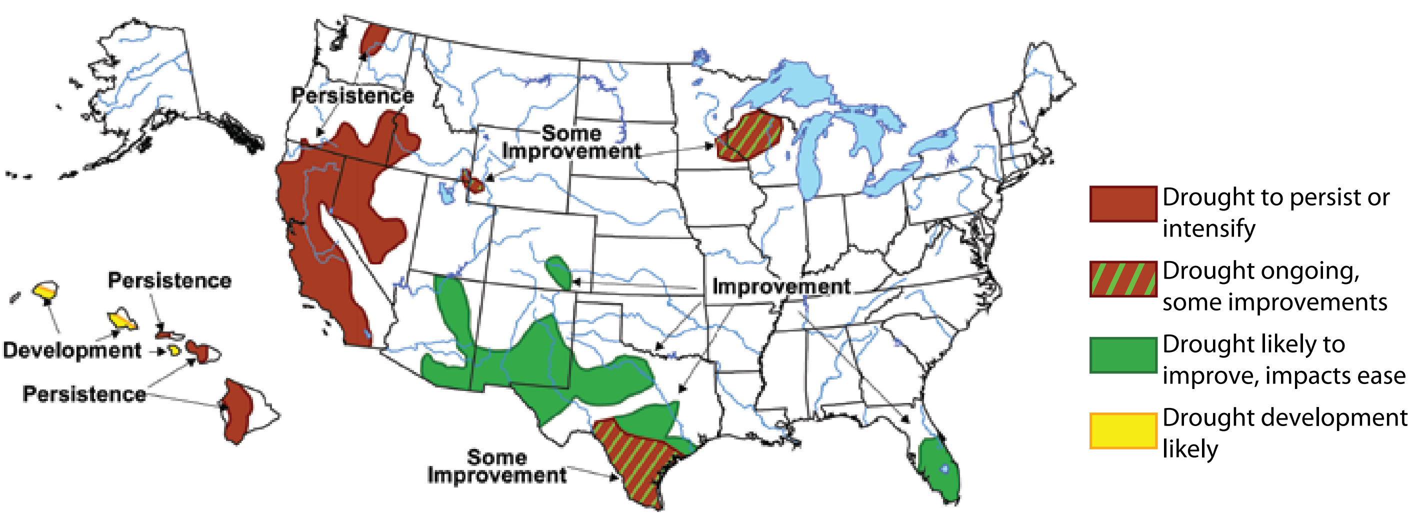
The situation in southern Texas is somewhat climatologically ambiguous. The demise of the recent La Niña, the onset of ENSO-neutral conditions, and the likelihood of an El Niño developing over the coming months would seem to suggest improved drought conditions over the coming months (see Figures 15a–b). However, historically analogous conditions do not paint a very clear picture, and recent models show some chance of a wet summer, but with low confidence. For these reasons, forecasters do not have very high confidence in the drought outlook for south Texas.

Conditions in Florida have improved substantially in recent weeks, as heavy rains fell across much of the peninsula. Precipitation outlooks for the state also indicate good chances for a wet summer, so Florida's drought outlook is significantly improved, with high forecaster confidence in this outlook.

Notes:

The delineated areas in the Seasonal Drought Outlook are defined subjectively and are based on expert assessment of numerous indicators, including the official precipitation outlooks, various medium- and short-range forecasts , models such as the 6-10 day and 8-14 day forecasts, soil moisture tools, and climatology.

Figure 12. Seasonal drought outlook through August 2009 (released May 21, 2009).



On the Web:

For more information, visit:
http://www.drought.gov/portal/server.pt

For medium- and short-range forecasts, visit:
http://www.cpc.ncep.noaa.gov/products/forecasts/

For soil moisture tools, visit:
http://www.cpc.ncep.noaa.gov/soilmst/forecasts.shtml

Streamflow Forecast

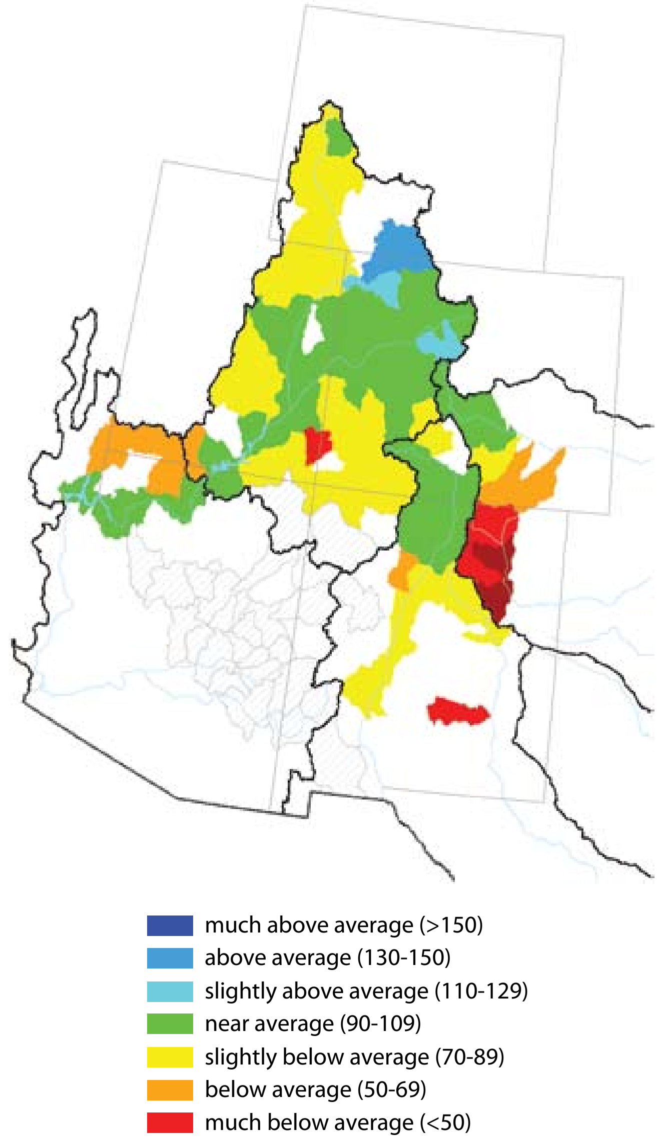
(for spring and summer)

Source: National Water and Climate Center

The May 1 streamflow forecast for the Southwest projects mostly below-average flows for basins in northern New Mexico (Figure 13). Forecasts for the Upper Rio Grande show at least a 50 percent chance of near or somewhat below-average flows; flows into El Vado Reservoir are predicted to be slightly above average. Below-average flows are predicted for the San Juan River, and inflows to the Navajo Reservoir along the San Juan have at least a 50 percent chance of delivering a water volume of 85 to 90 percent of average. Canadian and Rio Hondo river basin flows are expected to be well below average. Arizona and southern New Mexico seasonal streamflows are not forecast by the USDA-NRCS after April 1.

In water-related news, ongoing scientific research shows increasing negative effects of Colorado Plateau dust on central Rocky Mountain snowpack (*New York Times*, May 14). Several years of drought conditions and elevated temperatures in the arid Four Corners region have parched and killed desert vegetation, resulting in less soil retention, shifting sand dunes, and a greater propensity for dust to be transported from the region to the snowfields at upper elevations in the central Rocky Mountains. The darker color and lower reflectivity of the dust hastens snowmelt and reduces the spring snowpack, which is essential for streamflows in major rivers originating in the Colorado Rocky Mountains.

Figure 13. Spring and summer streamflow forecast as of May 1, 2009 (percent of average).



On the Web:

For state river basin streamflow probability charts, visit: http://www.wcc.nrcs.usda.gov/cgibin/strm_cht.pl

For information on interpreting streamflow forecasts, visit: http://www.wcc.nrcs.usda.gov/factpub/intrpret.html

For western U.S. water supply outlooks, visit: http://www.wcc.nrcs.usda.gov/wsf/westwide.html

Notes:

The forecast information provided in Figure 12 is updated monthly by the National Water and Climate Center, part of the U.S. Department of Agriculture's Natural Resources Conservation Service. Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences, such as reservoirs and diversions. The USDA-NRCS only produces streamflow forecasts for Arizona between January and April, and for New Mexico between January and May.

The NWCC provides a range of forecasts expressed in terms of percent of average streamflow for various statistical exceedance levels. The streamflow forecast presented here is for the 50 percent exceedance level, and is referred to as the most probable streamflow. This means there is at least a 50 percent chance that streamflow will occur at the percent of average shown in Figure 12.

Wildland Fire Outlook

Sources: National Interagency Coordination Center, Southwest Coordination Center

The Southwest Coordination Center predicts above-normal fire potential for the southern half of the region for May (Figure 14a). The forecast cites factors such as underlying drought and well-cured fuels (Figure 14b). The northern half of the region is expected to have normal fire potential during May. The June–August seasonal fire potential prediction shows decreasing potential in the eastern half of New Mexico, due primarily to forecasts for an increased likelihood of above-average precipitation as the North American monsoon arrives in the region. Fire potential is expected to persist or increase through much of the southern half of the region until the monsoon arrives. The aforementioned forecasts were made prior to mid-May precipitation generated by a low pressure system that was isolated from the jet stream (a so-called "cut off low"), which entrained moisture from the eastern Pacific and tropical latitudes over Mexico. This recent moisture will probably diminish fire potential across parts of our region. Fire potential is defined as the need for additional firefighting resources from outside the region to meet fire suppression needs.

Figure 14a. National wildland fire potential for fires greater than 100 acres (valid June–August 2009).

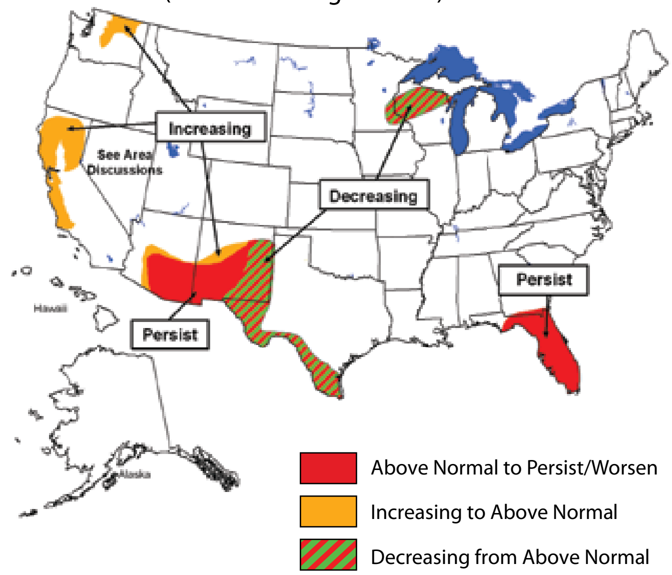


Figure 14b. Current fine fuel condition in the Southwest as of April 30, 2009.

Current Fine Fuels						
Grass Stage	Green	**	Cured	X		
New Growth	Sparse		Normal	X	Above Normal	
** Many RAWS reporting geen-up has occurred in their areas. Some additional stations in the northern portion of the area will report greenup in May. Curing will increase significantly in the central / southern portion of the Area through May						

On the Web:

National Wildland Fire Outlook web page:
http://www.nifc.gov/news/nicc.html

Southwest Coordination Center web page:
http://gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces seasonal wildland fire outlooks each month. The forecasts (Figure 13) consider observed climate conditions, climate and weather forecasts, vegetation health, and surface-fuels conditions in order to assess fire potential for fires greater than 100 acres. They are subjective assessments, that synthesize information provided by fire and climate experts throughout the United States.

El Niño Status and Forecast

Sources: NOAA Climate Prediction Center (CPC), International Research Institute for Climate and Society (IRI)

The NOAA Climate Prediction Center (CPC) ended the La Niña advisory in early May, signaling an official end to the recent La Niña event of 2008–09. Sea surface temperatures (SSTs) warmed to near-average conditions across much of the equatorial Pacific through late April and early May. The International Research Institute for Climate and Society (IRI) reports that the easterly winds responsible for driving upwelling and below-average SSTs in the equatorial east Pacific Ocean relaxed in recent weeks. This has allowed warm water in the western Pacific to move eastward, leading to the emergence of above-average SSTs in the eastern Pacific. The Southern Oscillation Index (SOI), a measure of the air pressure fluctuations in the equatorial Pacific Ocean, rose from -0.1 to 0.7, indicating the trade winds are strengthening and shifting to neutral conditions (Figure 15a). Overall, subsurface ocean temperatures are above average across the entire equatorial Pacific, hinting at the possible development of El Niño conditions sometime this summer or fall.

Forecasts produced by IRI indicate that ENSO-neutral conditions are likely (70 percent chance) to continue through the remainder of the spring season (May–July), with an increasing chance of El Niño conditions developing by late summer (Figure 15b). That chance exceeds 40 percent and is almost equal to the chance of continuing ENSO-neutral conditions. The chance of La Niña conditions returning remains very low, at less than 10 percent through next fall. The development of an El Niño event this summer would have major implications for precipitation forecasts across Arizona and New Mexico. It could lead to a weaker monsoon system and below-average precipitation in the second half of the monsoon season. It may also increase chances of above-average precipitation in the fall and winter due to enhanced tropical and early winter storm activity. Stay tuned to seasonal precipitation forecasts through the summer for updates.

Notes:

Figure 14a shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through March 2009. The SOI measures the atmospheric response to SST changes across the Pacific Ocean Basin. The SOI is strongly associated with climate effects in the Southwest. Values greater than 0.5 represent La Niña conditions, which are frequently associated with dry winters and sometimes with wet summers. Values less than -0.5 represent El Niño conditions, which are often associated with wet winters.

Figure 14b shows the International Research Institute for Climate and Society (IRI) probabilistic El Niño-Southern Oscillation (ENSO) forecast for overlapping three month seasons. The forecast expresses the probabilities (chances) of the occurrence of three ocean conditions in the ENSO-sensitive Niño 3.4 region, as follows: El Niño, defined as the warmest 25 percent of Niño 3.4 sea-surface temperatures (SSTs) during the three month period in question; La Niña conditions, the coolest 25 percent of Niño 3.4 SSTs; and neutral conditions where SSTs fall within the remaining 50 percent of observations. The IRI probabilistic ENSO forecast is a subjective assessment of current model forecasts of Niño 3.4 SSTs that are made monthly. The forecast takes into account the indications of the individual forecast models (including expert knowledge of model skill), an average of the models, and other factors.

On the Web:

For a technical discussion of current El Niño conditions, visit: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

For more information about El Niño and to access graphics similar to the figures on this page, visit: http://iri.columbia.edu/climate/ENSO/

Figure 15a. The standardized values of the Southern Oscillation Index from January 1980–April 2009. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red) respectively. Values between these thresholds are relatively neutral (green).

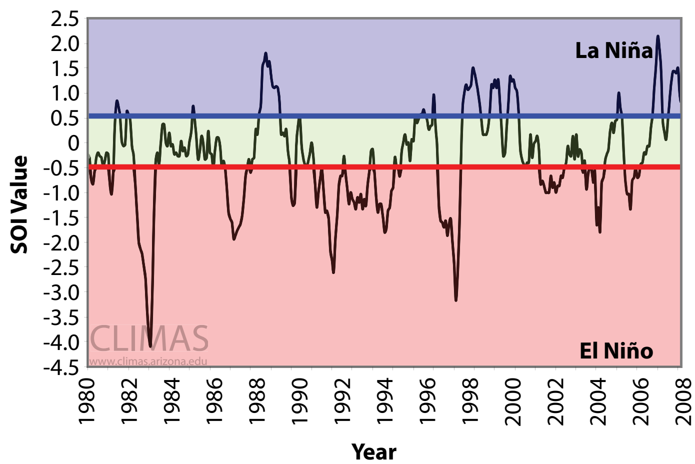
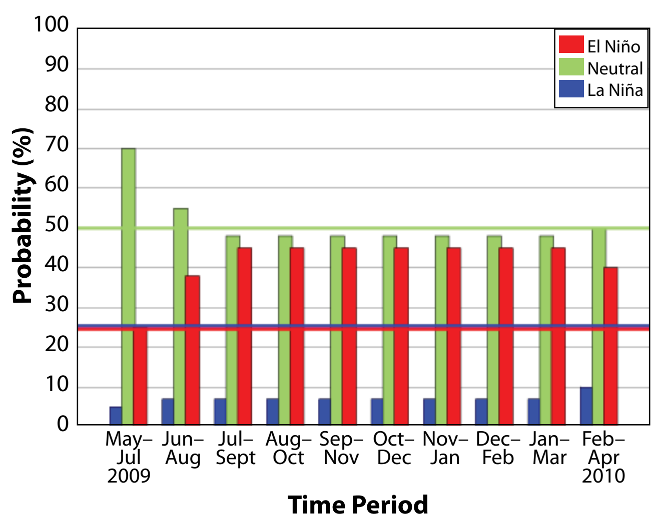


Figure 15b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released May 21, 2009). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Temperature Verification
(June–November 2009)

Source: Forecast Evaluation Tool

CLIMAS seeks feedback on these new highlights. Please email zguido@email.arizona.edu or call 520-882-0870.

The NOAA-Climate Prediction Center (CPC) forecasts show increased chances for temperatures in the Southwest and predominantly in Arizona to be similar to the warmest 10 years of the 1971–2000 climatological record. Comparisons of all the forecasts issued in May for the one-, two-, three-, and four-month lead times and the actual weather give reason to believe these forecasts for Arizona. All regions in this state show a bluish color for each lead time, indicating that the NOAA–CPC forecasts historically have been more accurate than a climatological forecast (Figures 16a–d). In New Mexico, the forecasts have only been slightly more accurate then the climatological forecast. Stakeholders should be leery of basing decisions on forecasts with reddish colors.

Notes:

These maps evaluate the historical performance of the one- to four-month long-lead forecasts made by NOAA's Climate Prediction Center (CPC). The maps convey the historical accuracy of the CPC forecasts in relation to the reference forecast, which assigns a 33 percent chance to the three CPC categories, "above," "below," and "neutral." These categories indicate whether conditions are predicted to be similar to the wettest, driest, or normal precipitation for 1971 to 2000. The maps are generated from the Forecast Evaluation Tool, which was developed by The University of Arizona in partnership with NOAA, NASA, NSF, and the University of California-Irvine.

The maps display the Ranked Probability Skill Score (RPSS). The more the forecasts and actual weather match, the bluer the color. A bluish or reddish RPSS indicates the forecast is more accurate or less accurate, respectively, than assigning a 33 percent chance to each of the three CPC categories.

The RPSS is calculated by comparing all the forecasts made since December 1994 for particular seasons and specified lead times to the actual weather of the season.

Figure 16a. RPSS for June–August 2009

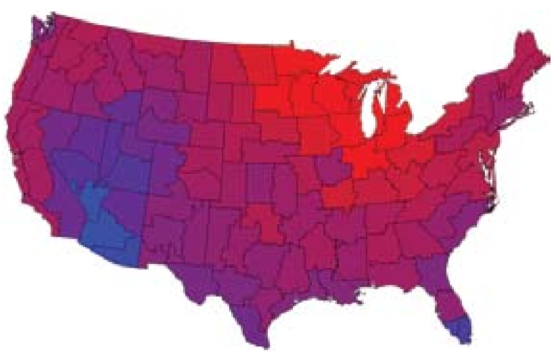


Figure 16b. RPSS for July–September 2009

Figure 16c. RPSS for August–October 2009

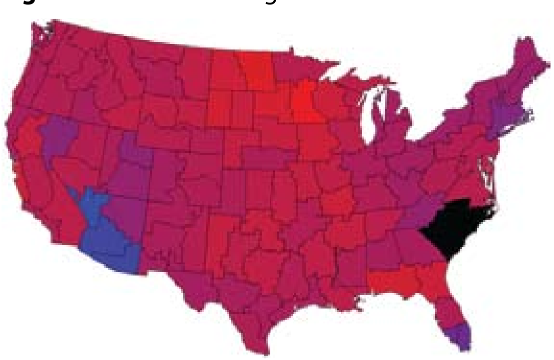
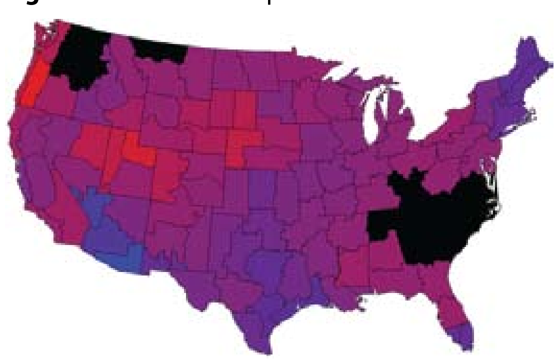
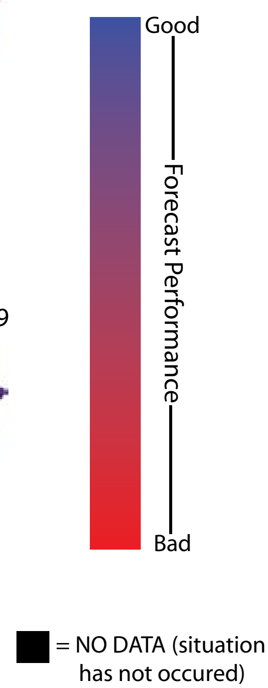


Figure 16d. RPSS for September–November 2009





On the Web:

For more information on the Forecast Evaluation Tool, visit http://fet.hwr.arizona.edu/ForecastEvaluationTool/

For a CLIMAS publication that explains how to use the Forecast Evaluation Tool, visit http://www.climas.arizona.edu/forecasts/articles/FET_Nov2005.pdf

Precipitation Verification

(June–November 2009)

Source: Forecast Evaluation Tool

The NOAA-Climate Prediction Center (NOAA–CPC) forecast for June through August shows equal chances for precipitation to be similar to the wettest, driest, and average conditions of the 1971–2000 climatological record. Comparisons of all the forecasts issued in May for this time period and the actual weather suggest that this forecast has been slightly more accurate than the climatological forecast (Figure 17a). NOAA–CPC also issued a slightly enhanced change for wetter-than-normal conditions for the one-, two-, and three-month lead times in the Four Corners region. Comparisons of all the forecasts for these time periods and lead times with the historical records indicate that these forecasts also have been slightly more accurate than the climatological forecasts (Figures 17b–d). For the two-month lead time pertaining to July through September, the NOAA–CPC forecasts have not been very accurate (Figure 17b). Stakeholders should be leery of basing decisions on forecasts with reddish colors.

Notes:

These maps evaluate the historical performance of the one- to four-month long-lead forecasts made by NOAA's Climate Prediction Center (CPC). The maps convey the historical accuracy of the CPC forecasts in relation to the reference forecast, which assigns a 33 percent chance to the three CPC categories, "above," "below," and "neutral." These categories indicate whether conditions are predicted to be similar to the warmest, coolest, or normal temperatures for 1971 to 2000. The maps are generated from the Forecast Evaluation Tool, which was developed by The University of Arizona in partnership with NOAA, NASA, NSF, and the University of California-Irvine.

The maps display the Ranked Probability Skill Score (RPSS). The more the forecasts and actual weather match, the bluer the color. A bluish or reddish RPSS indicates the forecast is more accurate or less accurate, respectively, than assigning a 33 percent chance to each of the three CPC categories.

The RPSS is calculated by comparing all the forecasts made since December 1994 for particular seasons and specified lead times to the actual weather of the season.

Figure 17a. RPSS for June–August 2009

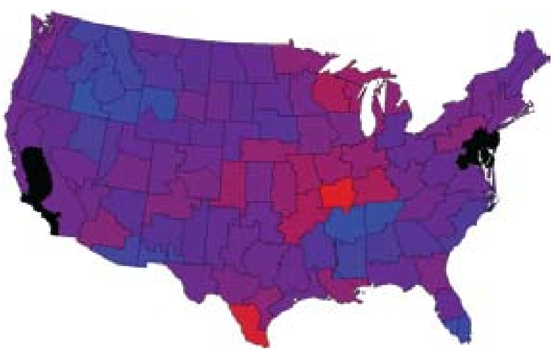


Figure 17b. RPSS for July–September 2009

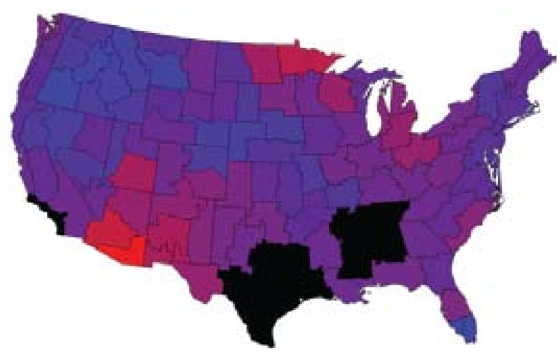


Figure 17c. RPSS for August–October 2009

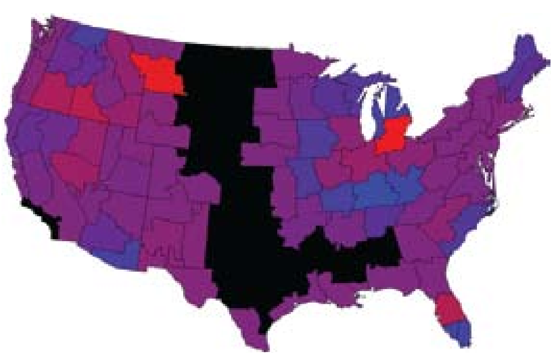
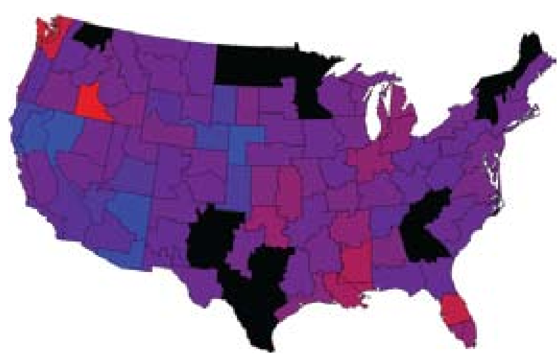


Figure 17d. RPSS for September–November 2009



= NO DATA (situation has not occured)

On the Web:

For more information on the Forecast Evaluation Tool, visit
http://fet.hwr.arizona.edu/ForecastEvaluationTool/

For a CLIMAS publication that explains how to use the Forecast Evaluation Tool, visit
http://www.climas.arizona.edu/forecasts/articles/FET_Nov2005.pdf