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Southwest Climate Outlook

Published by the Climate Assessment for the Southwest project and the University of Arizona Cooperative Extension

January Climate Summary

Drought – Severe drought conditions now exist in southeast Arizona and southwest New Mexico. Drought or abnormally dry conditions have expanded to include nearly all of the Southwest, except for extreme northwestern Arizona.

- Drought conditions are expected to intensify throughout most of the Southwest, due to recent warmer and much drier-than-average conditions.
- The lack of snowpack in most of the river basins in Arizona and southern New Mexico has led to a streamflow forecast of well below average.
- Drought conditions are improved from last year, but many important reservoirs in New Mexico remain below average.

Temperature – Since the start of the water year on October 1, 2005, temperatures over most of the Southwest have been above average.

Precipitation – Almost all of the Southwest has been drier than average since the start of the water year, especially during the last two months.

Climate Forecasts – Experts predict increased chances of warmer-than-average temperatures through July, and below-average precipitation through May.

El Niño – La Niña or ENSO-neutral conditions are expected to prevail over the next three to six months.

The Bottom Line – Drought is likely to persist or intensify over most of the Southwest except for far western Arizona.

The climate products in this packet are available on the web:
http://www.ispe.arizona.edu/climas/forecasts/swoutlook.html

Lack of snow in the Southwest

Snow is important for more than just skiing or snowboarding—it is also a crucial part of the Southwest's water supply. Spring runoff from melting winter snow is essential for maintaining river volumes and reservoir levels throughout the Southwest. So far this winter, snowfall in the region has been far below average. In Flagstaff, less than an inch of snow has fallen since September 1, 2005—more than 41 inches below average. In New Mexico, snow water content at sites throughout the state ranges from 4 to 35 percent of average. Projections for spring runoff range from 30 to 48 percent of average for many rivers in Arizona. Fortunately, many reservoirs, including those which supply the Phoenix area, still have adequate water from above-average precipitation last winter.

See page 11 for more info on Southwest Snowpack...

In this issue:

SWCO Staff:
Ben Crawford, *CLIMAS Research Associate*
Mike Crimmins, *UA Extension Specialist*
Stephanie Doster, *ISPE Information Specialist*
Gregg Garfin, *CLIMAS Program Manager*
Alex McCord, *CLIMAS Technical Specialist*
Kristen Nelson, *ISPE Associate Editor*
Melanie Lenart, *CLIMAS Research Associate*

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THE UNIVERSITY OF ARIZONA

El Niño: a wild card for climate change impacts

Place your bets on El Niño's influence in the Southwest

By Melanie Lenart

The Southwest has always had its appeal for gamblers. In the Old West, gunslingers frequented saloons to play poker games like Three Card Monte, undaunted by the prospect of taking a bullet for a questionable winning streak. In modern times, Black Jack players from distant counties flock to the casinos sparkling through the night on tribal lands, praying for a reign at the table.

In the desert, there's another gamble that we all take: Will the rains that have sustained us in modern times continue to replenish our water supplies? Will global warming deal us a losing hand, with the coming decades bringing us more dry wells and shrinking lakes? Place your bets.

If climate is your strong suite, it will come as no surprise that the fate of southwestern water supplies rests largely in the hands of El Niño—and El Niño remains a wild card in the context of climate change. If El Niño events predominate, as they did during a wet period from about the mid-1970s through the mid-1990s, southwestern reservoirs and aquifers alike could benefit from the general boost to winter precipitation (Figure 1). But if La Niña events dominate as they did during the drought years 1998 until 2002, the growing population of the Southwest could be in for some dry times (Figure 2).

When trying to predict the general climate of the next several decades, arguments have been raised for a wide range of scenarios, including dominance by El Niño, an overall trumping by La Niña, stronger fluctuations between the two, and weaker events for both conditions.

Climate models conflict

"The bottom line is we don't know what climate change will do to El Niño," explained Henry Diaz, a climatologist with the National Oceanic and Atmospheric Administration's Climate Diagnostics Center. "Most general circulation models, in fact, don't have a good representation of the El Niño phenomenon—although the latest models are showing substantial improvements."

Modeling El Niño is particularly challenging because it requires "coupling" the ocean and atmosphere into an interactive system. Trade wind activity helps define El Niño, which is why climatologists prefer to call the linked ocean and atmospheric system by one phrase, the El Niño–Southern Oscillation (ENSO). The linkage is easier said than done in climate models.

Several climate models project an eventual dominance by El Niño events, but often for different reasons, as the Intergovernmental Panel on Climate Change noted in its latest report in 2001. This international consortium of scientists resisted reaching a conclusion about whether El Niño will hold sway. The panel pointed to more ambiguous models and an analysis by Mark Cane and his colleagues that showed the potential for a La Niña-like response from the warming temperatures for at least a few decades to come.

While considering how these patterns might fluctuate with global warming—a speculative venture in any case—it's useful to consider how the patterns work now. During El Niño events, the Peruvian side of the tropical Pacific Ocean tends to register higher-than-usual temperatures at the ocean surface along with a slackening off of easterly winds. During La Niña events, the sea surface temperatures in the same region tend to run even cooler than usual, with the associated strong easterly winds pushing away the warm surface layer and exposing the cooler waters below.

Warm sea surface temperatures tend to generate storm clouds, while anchoring winds direct where the clouds travel. Along with the tropical trade winds, which flow east to west near the equator, El Niño fluctuations influence the mid-latitude westerly winds. The westerlies flow from the Pacific across the continental United States, favoring the Pacific Northwest during La Niña years and the Southwest during El Niño years.

A shifty character

However, the degree to which El Niño influences specific regions can change in time, according to a 2001 International Journal of Climate paper by Diaz and two colleagues comparing ENSO impacts on many regions of the globe. Using the most reliable instrumental records for land (and thus going back only to 1948), they saw shifts in the character of El Niño impacts.

"It's not your grandfather's El Niño anymore," as Kevin Trenberth, an atmospheric scientist with the National Center for Atmospheric Research, put it. El Niño could undergo additional character changes as the climate warms, he suggested.

Diaz noted that it could take decades or more before El Niño settles into a mode characteristic of a global warming pattern. "We don't know the exact shape of the form that it will take," he added.

continued on page 3

El Niño, continued

In the meantime, the debate about how the ocean system will react in the next few decades to the ongoing global warming seems to revolve around two alternative lines of thinking: One is that stronger and/or more frequent El Niño events could predominate and serve as a means for cooling the planet in the long run, as much of the heat released from the ocean during El Niño years eventually makes it way out into space. The other is that a predominance of La Niña events could help the planet strive for equilibrium in the face of the global warming, with the ocean basically absorbing some of the incoming heat into deeper waters while presenting a cooler surface to the atmosphere.

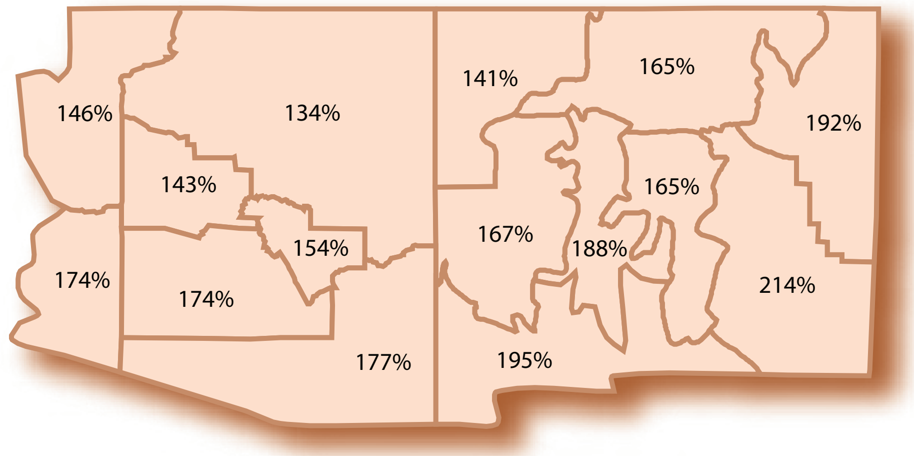


Figure 1. During El Niño years, all climate divisions in Arizona and New Mexico tend to receive above-average winter precipitation, as shown above. Values represent the percentage of December–March precipitation falling during El Niño years compared to non-El Niño years for the period 1895-1996. Source: adapted from NOAA Climate Predition Center material.

El Niño vs. La Niña

Saturday Night Live fans may remember a skit where Chris Farley played El Niño (translation: "The Ninyo") as a leotard-clad boxer ready to rule the ring. Images like this helped popularize the term in the 1990s—as did the dominance of the real El Niño in the Pacific between 1990 and 1995 and again in 1997 through 1998.

The predominance and strength and evolution of El Niño events since about 1976 has been highly unusual in the record since 1880, Trenberth argues. He and others made this case in papers released in 1997 and 1998, before the extreme El Niño event that spanned those years made the record books, and in a subsequent *Journal of Climate* paper in 2001.

Many view the mid-1970s as a turning point, a time when global warming from human activities such as burning petroleum products and forests really took root. Some call this turning point the 1976–1977 climate shift. The predominance in El Niño conditions since the mid-1970s might suggest an influence from human-launched global warming, Trenberth indicated. If so, this could imply that El Niño might remain dominant if the atmosphere continues to heat up as projected.

On the other hand, Mark Cane and others have argued that El Niño events in the late 19th century were on a par with recent decades.

"In many ways, the El Niño of 1877 was certainly far more destructive and had more serious consequences than any of the recent ones," explained Cane, a climatologist with Columbia University's Lamont-Doherty Earth Observatory. He noted that it appears to have contributed to the failure of the Indian monsoon that year, among other deadly disasters.

Cane points to evidence in records of fossil corals to argue that ENSO fluctuations have varied throughout the centuries and even millennia, with the latter based on spotty individual coral segments that date back as far as 130,000 years. Some of the century-scale results imply a predominance of La Niña events during previous warm periods, Cane suggests.

Will El Niño rule?

Several lines of analysis agree that El Niño serves to release heat from the ocean, with the short-term effect of warming the atmosphere but the long-term effect of cooling the planet.

Like others before and after them, Diaz and colleagues found the tropics registered the most warming during El Niño events of the past half a century. The Tropics of Cancer and Capricorn delineate the 40 percent of the planet that seasonally faces the sun head-on, thus receiving the full blast of its power without any angling to soften the blow. Meanwhile, they found the "extratropical" regions showed more variability, typically registering either average or even cooler-than-average temperatures.

Trenberth has pointed out that the record-breaking temperatures of 1998 occurred as an El Niño event that started in 1997 and stretched into 1998 as well. The year 1998 was the warmest year on record globally, with 2005—which featured a weak atmospheric El Niño event—shaping up as a contender for either the top spot or second-hottest year in the instrumental record.

In the long run, though, El Niño eventually releases into space some of the heat that had been stored in the planet's oceans, climatologists agree. In fact,

continued on page 4

El Niño, continued

El Niño serves to dissipate heat in three apparently coordinated ways, noted Trenberth in a 1998 paper with lead author De-Zheng Sun, with NOAA's Climate Diagnostics Center. These include ocean dynamics that move warm water from the equator to the subtropics; atmospheric dynamics that export heat to the subtropics, sometimes in the shape of thunderstorms; and cloud cover that helps shield more of the eastern Pacific from direct sunlight.

"This raises the question of whether the very existence of El Niño arises from the need to move heat out of the equatorial Pacific," as Sun and Trenberth wrote in *Geophysical Research Letters*. The equatorial region within the tropics takes the most direct hits of sunlight of any region on the globe.

The case for La Niña

Some propose that La Niña conditions could become more prevalent as the climate warms, at least for several decades. Cane's 2004 review paper, *The evolution of El Niño, past and future*, notes some researchers have found an increase in La Niña events during warm periods.

In fact, an analysis he and others conducted found the eastern equatorial Pacific—the location that most clearly signals El Niño events—was one of the few places on Earth that did not register an overall warming during the past century, he said. This implies that upwelling from La Niña events helped counterbalance the global warming that registered almost everywhere else. However, he and others are still teasing out details that hint at differences in patterns that could actually be consistent with a more El Niño-like nature in the latter half of the century, he wrote in an email message.

During the past, ENSO seems to have served as a means for the Earth system to mitigate the effects of short-term warming or cooling from changes in incoming solar energy or volcanic activity. For instance, a Journal of Climate paper Cane wrote with lead author Michael Mann of the University of Virginia and others suggested El Niño events may have kept oceans warmer than expected in the late 17th Century, during the so-called Little Ice Age.

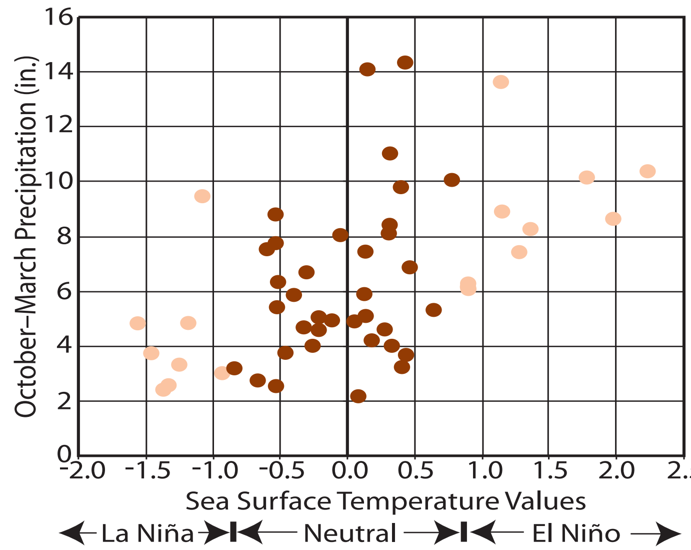


Figure 2: Arizona precipitation. Points represent October–March precipitation tallies, with values from 1951–2003.

Similarly, a predominance of La Niña events may have kept the ocean relatively cool during the late 12th and early 13th Centuries, during the so-called Medieval Warm Period, which appears to coincide with warmer European temperatures at various points during its time span of roughly 900 to 1300 A.D. Tree-ring records show that drought dominated in the West during this time frame, as documented by Edward Cook of Lamont-Doherty Earth Observatory and colleagues in a 2004 paper in *Science*. In fact, one of four lengthy droughts during this time frame centered on 1150, when the ancestors of the modern-day Pueblo Indians abandoned their sophisticated city in Chaco Canyon, New Mexico.

On the other hand, the period from 1950 to 2000 looks a bit different than the trend over the earlier part of the century, Cane acknowledged, making it difficult to draw firm conclusions about how modern climate compares to earlier climate regimes. The general warming during the late 12th and early 13th Century probably resulted from more solar heating combined with fewer volcanic eruptions, he indicated. Meanwhile, climatologists attribute the modern warming mainly to an increase in greenhouse gases like carbon dioxide from burning oil, coal, gas and forests.

"The question is, then, does greenhouse warming work the same way? Is heating just heating, or does it make a difference if it's solar heating or greenhouse heating?" Cane asked.

The fate of El Niño goes beyond a rhetorical question because of its huge impact on precipitation regimes in many regions of the world, including the southwestern United States. Yet there is little we can do to alter El Niño's uncertain fate in the short term. The global warming set in motion particularly since the mid-1970s won't be stopping anytime soon. Even if people changed their ways tomorrow, the extra heat already stored in the deep ocean would carry the warming out for many decades, analyses indicate.

So, what's in the cards for the El Niño, which generally dictates the Southwest's water future? Place your bets.

Melanie Lenart is a postdoctoral research associate with the Climate Assessment for the Southwest (CLIMAS). The SWCO feature article archive can be accessed at the following link: http://www.ispe.arizona.edu/climas/forecasts/swarticles.html

Temperature (through 1/18/06)

Source: High Plains Regional Climate Center

Since the water year began October 1, 2005, temperatures in most areas of the Southwest have been 0–6 degrees Fahrenheit warmer than average (Figures 1a–1b). Average temperatures in the region range from the 70 degrees F in southwest Arizona to the 30 degrees F in north-central New Mexico. The previous 30 days were exceptionally warm with areas in eastern New Mexico and northern Arizona experiencing temperatures up to 12 degrees F above average (Figure 1c–1d).

According to the Tucson National Weather Service, 2005 was the third warmest year on record in the city. Last year also saw a record high average minimum temperature in Tucson of 57.5 degrees F which broke the previous record of 57.0 degrees F set in 2003. The month of December was the 12th warmest ever recorded, and the Christmas Day high of 81 degrees F was among the warmest on record in Tucson, second only to 82 degrees F logged in 1933.

According to the Albuquerque National Weather Service, the 2005 New Mexico average state-wide temperature was 58.6 degrees F. This is 2.5 degrees F above average and the sixth warmest year on record. The average minimum temperature for the year was 46.9 degrees F—second warmest to 2003 (47.1 degrees F) and 3.7 degrees F above average. Interestingly, average maximum temperatures for 2005 were slightly cooler than the long-term average, suggesting warmer average temperatures were due to increased minimum temperatures.

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/products/current.html

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

Figure 1a. Water year '05–'06 (through January 18, 2006) average temperature.

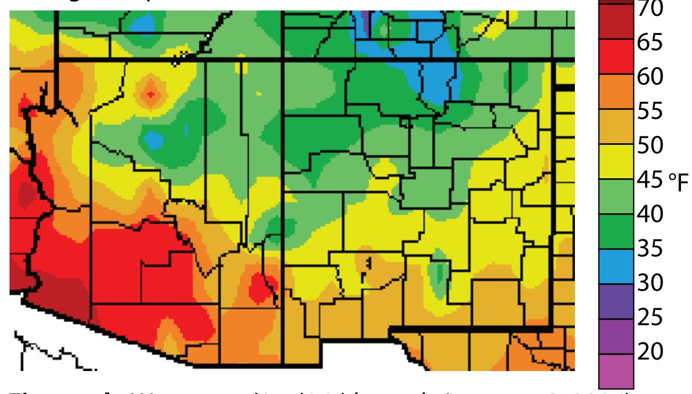


Figure 1b. Water year '05–'06 (through January 18, 2006) departure from average temperature.

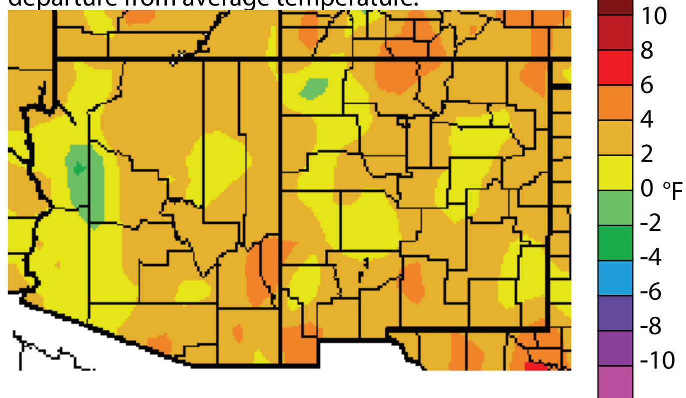


Figure 1c. Previous 30 days (December 20, 2005–January 18, 2006) departure from average temperature (interpolated).

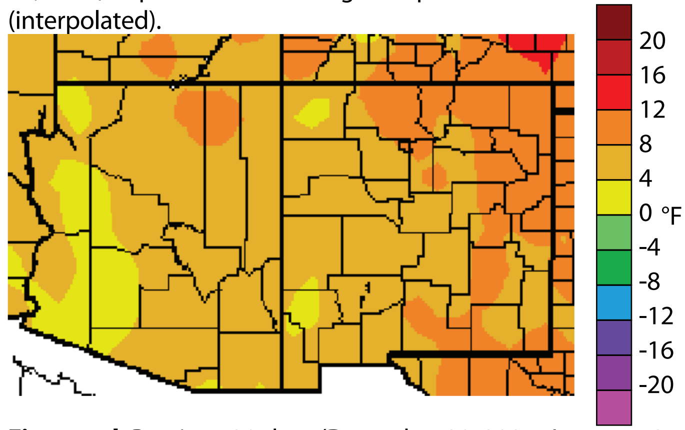
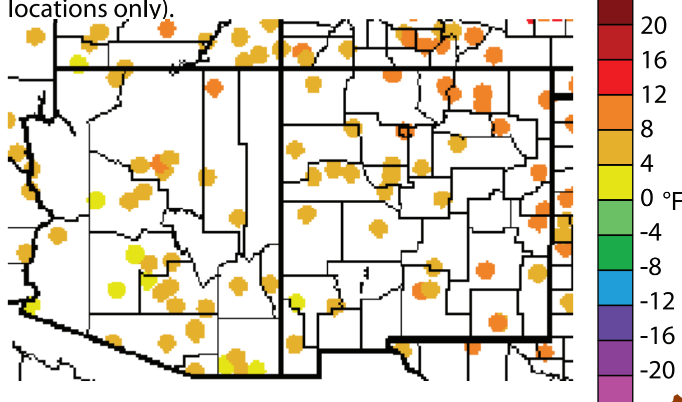


Figure 1d. Previous 30 days (December 20, 2005–January 18, 2006) departure from average temperature (data collection locations only).



Precipitation (through 1/18/06)

Source: High Plains Regional Climate Center

Precipitation has been below average for most of the Southwest since the water year began on October 1, 2005 (Figures 2a–2b). Most areas have received less than 50 percent of average, with areas in central and southeastern Arizona receiving less than 5 percent. The previous month has been extremely dry, with most areas receiving less than 2 percent of average (Figure 2c). This has led to the elevation in drought status for much of the region (see Figures 3 and 4).

Despite heavy January and February 2005 rainfall, Phoenix precipitation in 2005 was 7.04 inches, 1.25 inches below average. According to the Phoenix National Weather Service, rainfall was last recorded at Phoenix Sky Harbor Airport on October 18, 2005. If no precipitation is received before January 27, a new record of 102 consecutive days without rain will be set. The previous record was 101 days, beginning September 23, 1999.

In 2005, Albuquerque received 11.42 inches of precipitation (1.95 inches above average) and was the 14th wettest year since 1892. This was mostly due to above-average precipitation from January through April and in September, as November and December ranked among the top five driest months on record.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2005 we are in the 2006 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/products/current.html

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 '05–'06 through January 18, 2006 percent of average precipitation (interpolated).

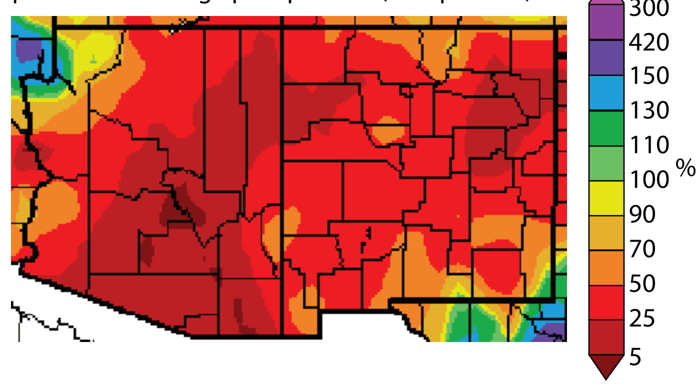


Figure 2b. Water year '05–'06 through January 18, 2006 percent of average precipitation (data collection locations only).

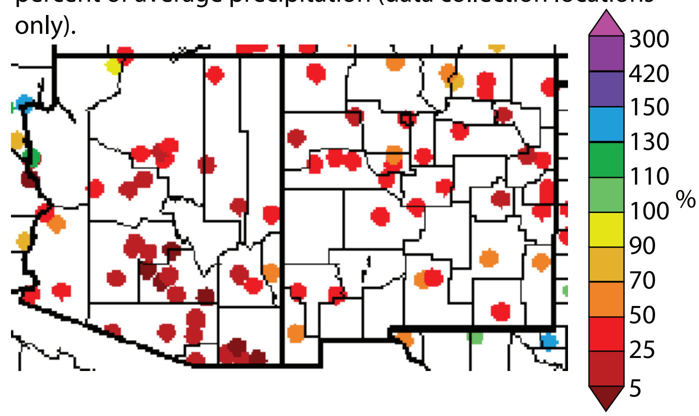


Figure 2c. Previous 30 days (December 20, 2005–January 18, 2006) percent of average precipitation (interpolated).

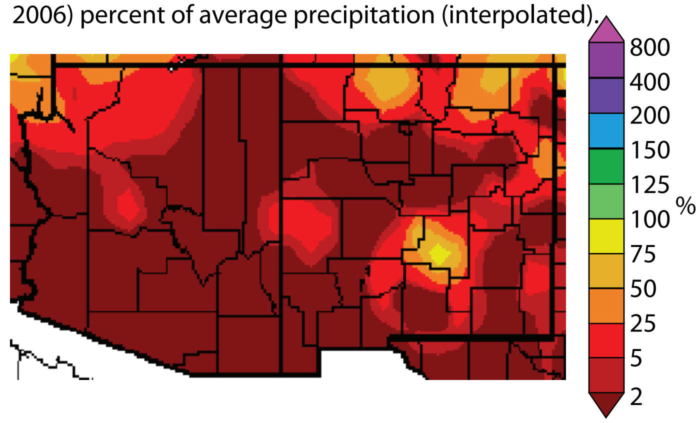
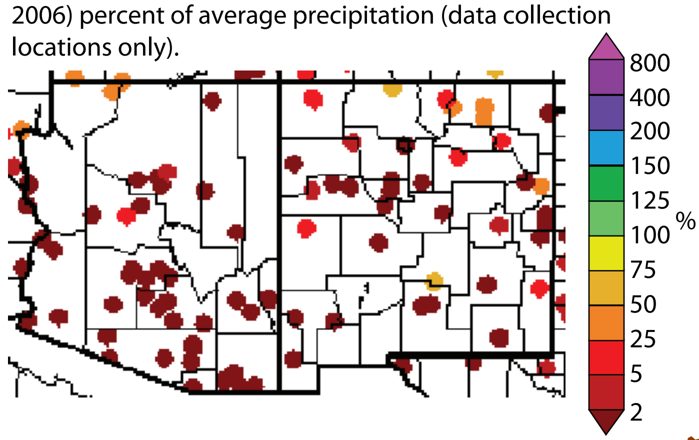


Figure 2d. Previous 30 days (December 20, 2005–January 18, 2006) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(released 1/19/06)

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

Drought conditions have deteriorated in the Southwest since this time last month (Figure 3). Severe drought conditions were introduced in southeast Arizona in early January, and have since expanded eastward into southwestern New Mexico. The entire region has had considerably below-average precipitation since the water year began on October 1, 2005, and most of Arizona and much of New Mexico have received less than 2 percent of average in the last 30 days (see Figures 2a–d).

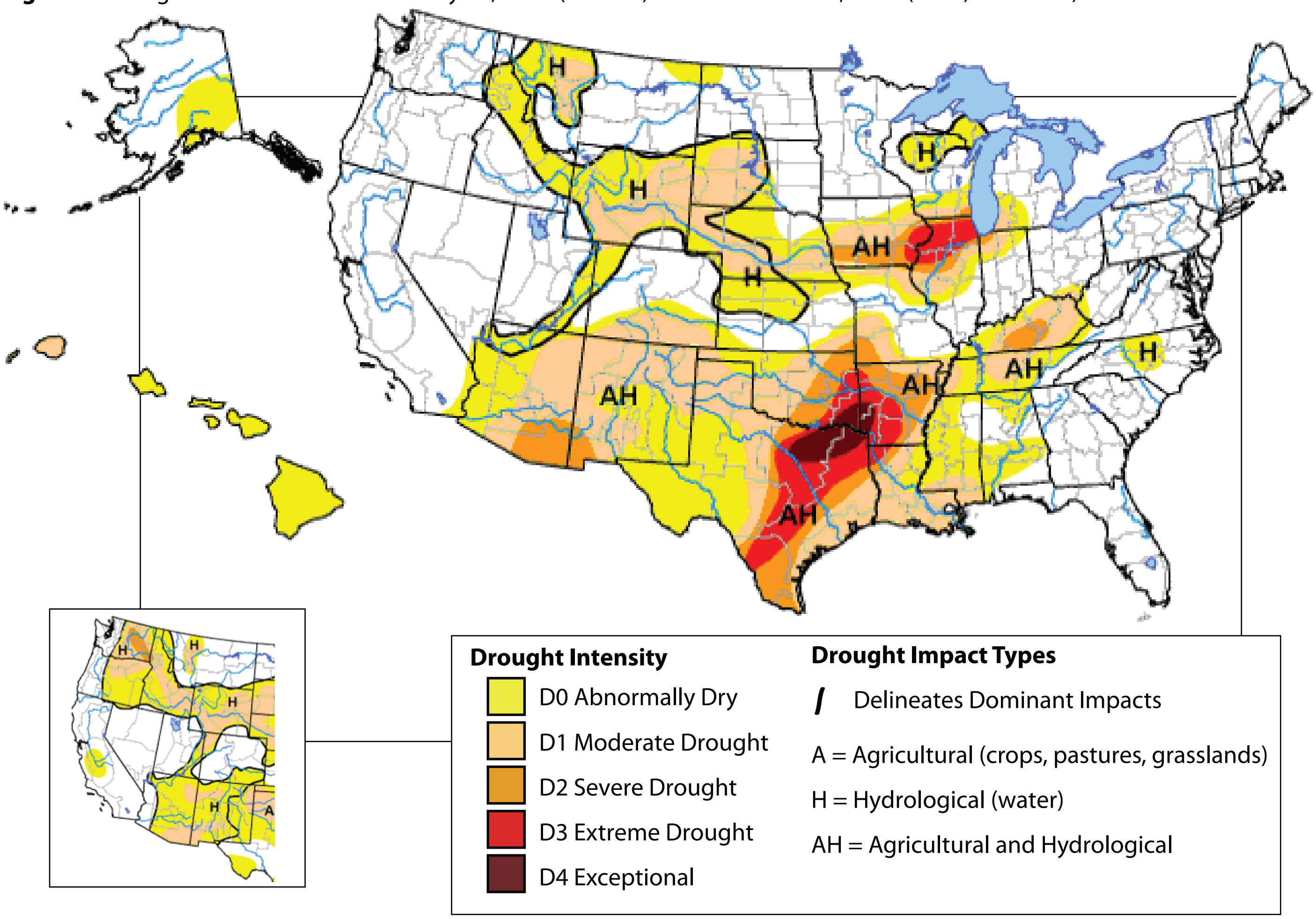
Moderate drought or abnormally dry conditions have expanded westward since last month, and now include all of the Southwest except for the extreme northwestern corner of Arizona. In New Mexico most of the eastern and northern portions of the state have progressed from abnormally dry to moderate drought. Like last month, most of the Southwest is still considered to be in hydrological drought, which leads to decreased river discharges and declining water levels in lakes and groundwater aquifers. Agricultural drought, which last month was only affecting eastern New Mexico, is now present throughout the Southwest except in northwest Arizona.

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 Mark Svoboda and Brian Fuchs NDMC.

Figure 3. Drought Monitor released January 19, 2006 (full size) and December 15, 2005 (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

New Mexico Drought Status

(through 1/13/06)

Source: New Mexico Natural Resources Conservation Service

Short-term drought conditions in New Mexico have deteriorated since this time last month, when much of the state was classified as normal or advisory. As of January 13 all of New Mexico is in either advisory or worse status (Figure 4a). In the north, alert (mild) to emergency (severe) conditions extend from McKinley County in the west to Union County in the northeast. In the south, emergency drought conditions prevail along the Arizona border, with warning to alert conditions extending eastward to Lincoln County. Long-term drought conditions have worsened in most of New Mexico's river basins. The lower Rio Grande, upper Gila, San Francisco, and Mimbres river basins are in warning drought conditions, while the Zuni and Bluewater basins are classified in emergency drought conditions (Figure 4b). The Pecos, Canadian, and upper Rio Grande basins, are in alert status.

Over the last 30 days much of New Mexico has received less than 2 percent of average precipitation. According to the National Weather Service's Albuquerque office, precipitation has averaged only 55 percent of average since the water year began on October 1, 2005. Snowpack ranges from only around 40 percent of average in the upper Rio Chama basin to less than 10 percent of average over most of the state. Last year's wet winter and spring produced abundant grass growth over eastern New Mexico. The curing of these fine fuels by the recent exceptionally dry weather is presenting a much higher-than-average fire danger for this time of year.

Notes:

The New Mexico drought status maps are produced monthly by the New Mexico Drought Monitoring Workgroup. When near-normal conditions exist, they are updated quarterly. 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 shortfalls (e.g., many months to years) on water supplies (i.e., streamflow, reservoir and lake levels, groundwater). This map is organized by river basins—the white regions are areas where no major river system is found.

On the Web:

For the most current New Mexico drought status map, visit:
http://www.nm.nrcs.usda.gov/snow/drought/drought.html

Information on Arizona drought can be found at:
http://www.azwater.gov/dwr/default.htm

Figure 4a. Short-term drought map based on meteorological conditions as of January 13, 2006.

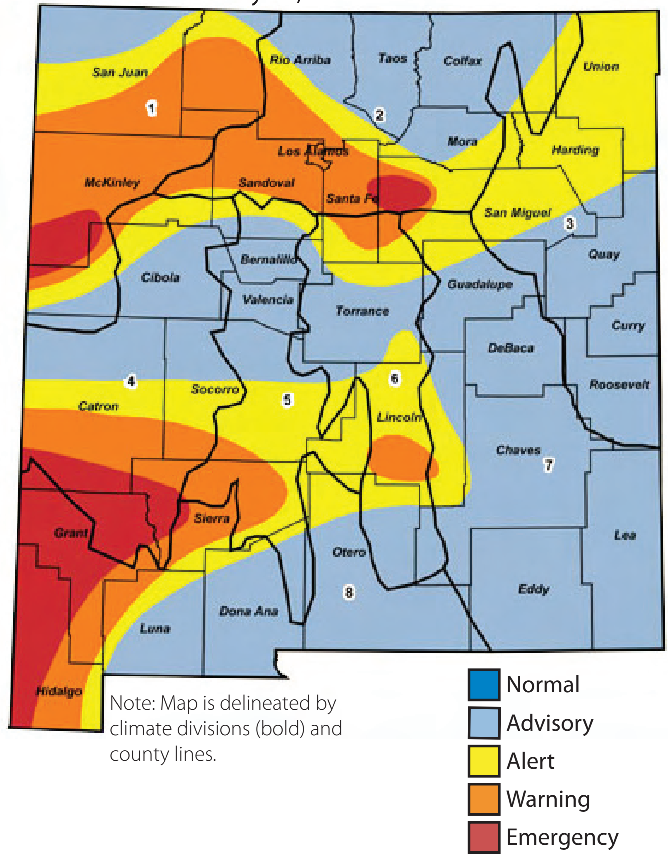
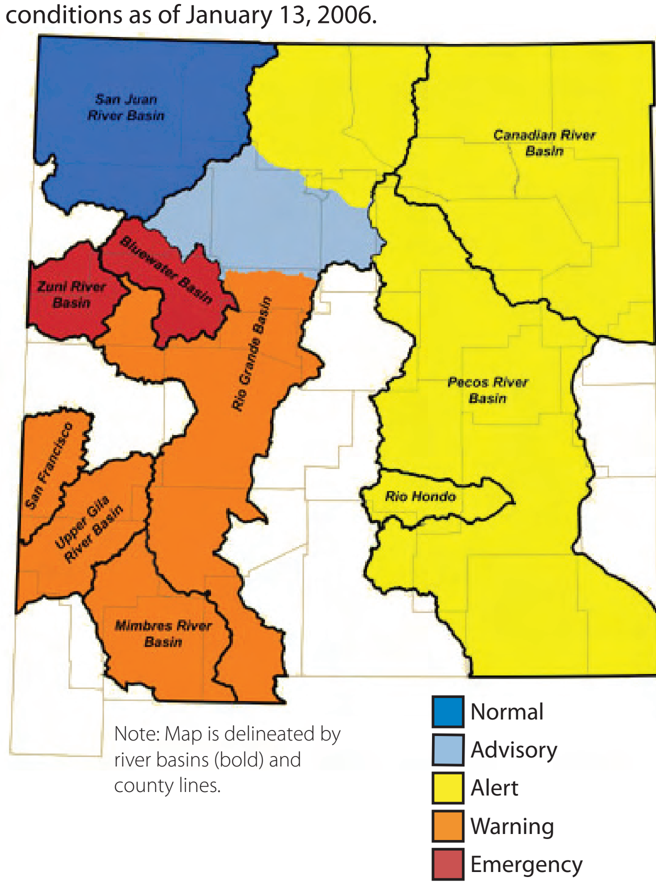


Figure 4b. Long-term drought map based on hydrological conditions as of January 13, 2006.



Arizona Reservoir Levels

(through 12/31/05)

Source: National Water and Climate Center

Arizona reservoir storage remained fairly steady over the last month. Lake Powell declined by one percent of capacity, while Lake Mead and Lake Mohave rose by one percent and 5 percent of capacity, respectively. San Carlos Reservoir fell by two percent of capacity. The rest of the reservoirs in the state changed by less than one percent of capacity. Reservoirs throughout Arizona have remained well below capacity for the past several months, except for the Salt River system (82 percent), Show Low Lake (100 percent), Lake Havasu (94 percent), and Lake Mohave (90 percent). Most reservoirs in the state are near to well above last year's levels, thanks to the wet winter and spring in 2005. The Salt River system currently holds nearly double the amount it did a year ago, up from only 43 percent of capacity last year. Lake Powell and Lake Mead, the two largest reservoirs in the state, are up by 12 percent and 3 percent of capacity, respectively, since last year. Both of those reservoirs remain well below their average levels, but the reservoirs on the Salt and Verde rivers are still above their average levels. The Salt and Verde river systems are at 143 percent and 108 percent of average, respectively.

Representatives of the seven western states that rely on the Colorado River for water and power announced late last month that they had reached a tentative agreement about how the river is to be managed during water shortages, according to the *Salt Lake Tribune* (January 7). Specifics of the agreement have not been released, but officials are optimistic that a final agreement can be reached on the plan, which is scheduled to be delivered to Secretary of the Interior Gale Norton in February. The seven Colorado River states are Arizona, New Mexico, Colorado, Utah, Wyoming, Nevada, and California.

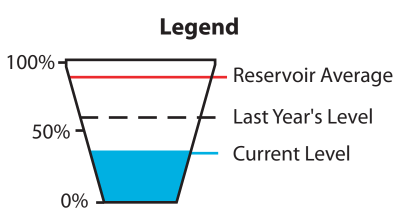
Notes:

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.

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. For additional information, contact Tom Pagano at the National Water Climate Center (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Larry Martinez, Natural Resource Conservation Service, 3003 N. Central Ave, Suite 800, Phoenix, Arizona 85012-2945; 602-280-8841; Larry.Martinez@az.usda.gov).

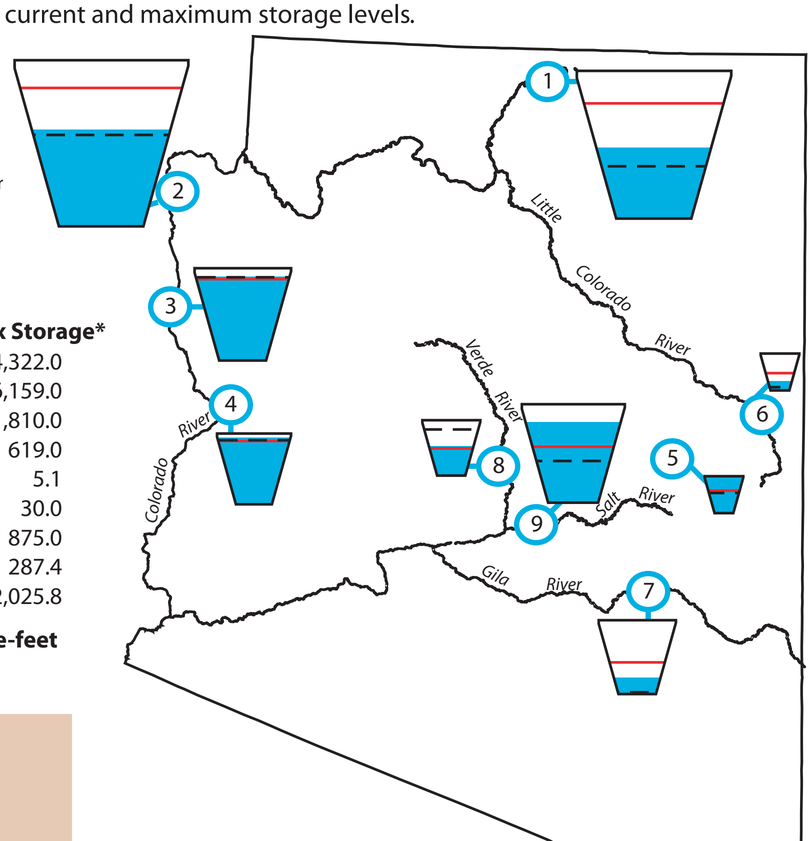
Figure 5. Arizona reservoir levels for December 2005 as a percent of capacity. The map also depicts the average level and last year's storage for each reservoir, while the table also lists current and maximum storage levels.



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

Reservoir Name	Capacity Level	Current Storage*	Max Storage*
1. Lake Powell	48%	11,576.0	24,322.0
2. Lake Mead	58%	15,131.0	26,159.0
3. Lake Mohave	90%	1,634.0	1,810.0
4. Lake Havasu	94%	579.4	619.0
5. Show Low Lake	100%	5.1	5.1
6. Lyman Reservoir	26%	7.9	30.0
7. San Carlos	22%	191.5	875.0
8. Verde River System	53%	150.9	287.4
9. Salt River System	82%	1,652.6	2,025.8

*** 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 12/31/05)

Source: National Water and Climate Center

Most of New Mexico's reservoir levels changed only slightly last month. The largest change was at Sumner Reservoir, which rose by 8 percent of capacity following significant earlier declines. Heron declined by 4 percent of capacity, while Abiquiu rose by 3 percent. Other reservoirs either remained steady or rose or fell by one or two percent. Statewide storage increased slightly from 39 to 40 percent of capacity. Thanks to last year's abundant winter and spring precipitation, reservoir storage in New Mexico is considerably better than it was a year ago, when it stood at only 25 percent of capacity. Some of the reservoirs have reached levels higher than the long-term average. In the north, these include Navajo (118 percent of average), Abiquiu (126 percent), Costilla (190 percent), and El Vado (108 percent). In the east, Santa Rosa is at 130 percent of average. Other reservoirs are at well-below-average levels, including Caballo and Elephant Butte on the lower Rio Grande, which are at only 19 percent and 34 percent of average, respectively. The remaining reservoirs range from 54 to 79 percent of average.

According to the *Carlsbad Current-Argus* (January 12), Carlsbad had gone almost 90 days without measurable rain as of January 12. The dry conditions have not yet affected ranchers, but if the current warm conditions continue beyond February, rangeland grasses could be negatively impacted. The rangeland fire potential is likely to become very high in the next couple of months, and because of the lack of snowpack in the northern mountains near Las Vegas, water allotments for farmers in the Carlsbad Irrigation District may be as low as 2 acre-feet per acre, only about half of what it was last year. An acre-foot of water is 326,000 gallons.

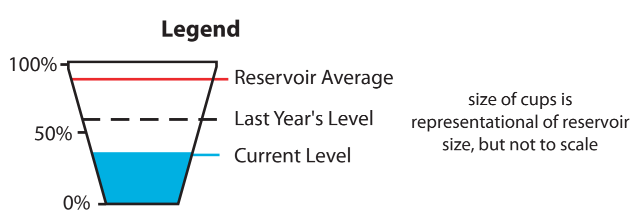
Notes:

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.

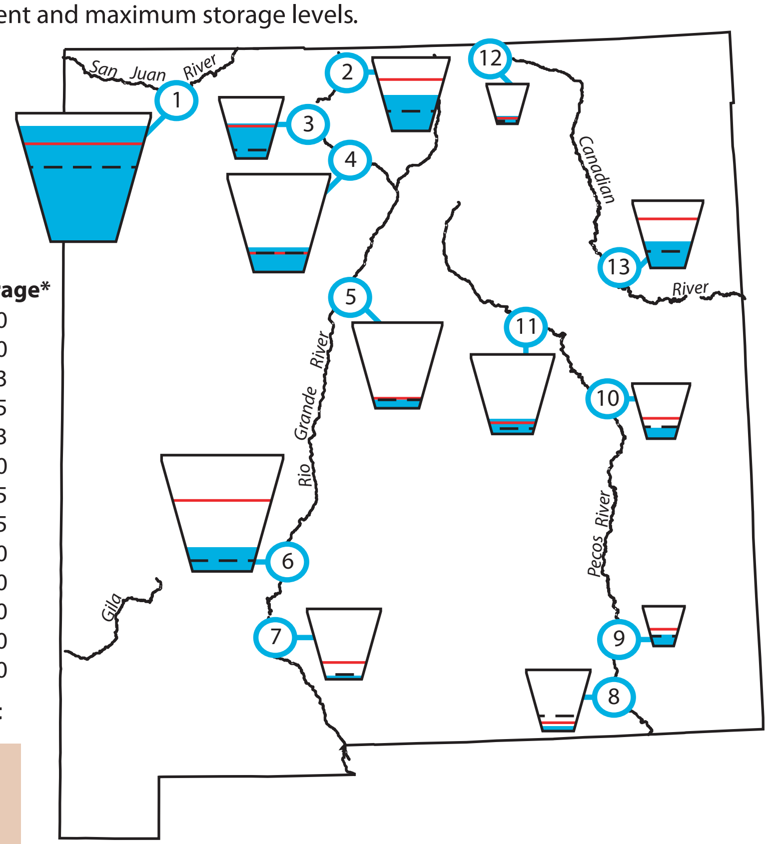
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service. For additional information, contact Tom Pagano at the National Water Climate Center (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Dan Murray, NRCS, USDA, 6200 Jefferson NE, Albuquerque, NM 87109; 505-761-4436; Dan.Murray@nm.usda.gov).

Figure 6. New Mexico reservoir levels for December 2005 as a percent of capacity. The map also depicts the average level and last year's storage for each reservoir, while the table also lists current and maximum storage levels.



Reservoir Name	Capacity Level	Current Storage*	Max Storage*
1. Navajo	90%	1,533.2	1,696.0
2. Heron	49%	196.3	400.0
3. El Vado	57%	106.3	186.3
4. Abiquiu	25%	137.5	554.5
5. Cochiti	10%	48.4	502.3
6. Elephant Butte	21%	425.9	2,065.0
7. Caballo	5%	15.5	331.5
8. Brantley	8%	11.5	147.5
9. Lake Avalon	28%	1.7	6.0
10. Sumner	20%	20.4	102.0
11. Santa Rosa	19%	83.5	447.0
12. Costilla	59%	9.5	16.0
13. Conchas	39%	99.5	254.0

*** 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

Southwest Snowpack

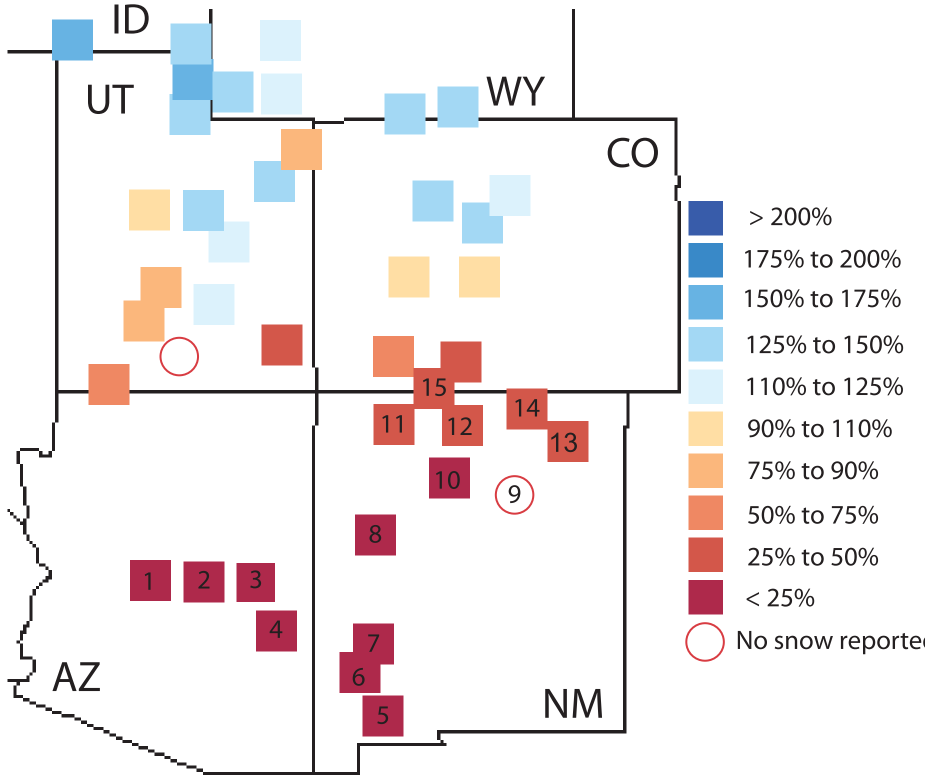
(updated 1/19/06)

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

Like last month, snowpack in the Southwest has been well below average so far this season, with all SNOTEL sites in Arizona and New Mexico reporting less than 50 percent of average snow water content (SWC) as of January 19 (Figure 7). All of the basins in Arizona and southeastern New Mexico have recorded less than 10 percent of average SWC, and ski resorts in Arizona still have not opened due to lack of snow. Basins in far northern New Mexico have somewhat more snow, with the San Miguel, Dolores, Animas, and San Juan river basins, the Sangre de Cristo Mountain Range Basin, Rio Chama River Basin, Cimarron River Basin, and the San Juan River headwaters all reporting between 25 and 50 percent of average SWC. Above-average temperatures and below-average precipitation in the region since the start of the water year, along with the extremely dry conditions over the last 30 days, have contributed to the below-average basin SWC in the Southwest (see Figures 1–2).

According to the National Weather Service in Albuquerque, the snowpack in the north is generally less than at any time since 1996, and in the south it is less than it has been since 1981 or 1982. In Arizona, according to an analysis done by the National Resources Conservation Service, 64 percent of snow measurement sites were snow-free as of January 15—the highest percentage since 1966, when 13 of 16 sites were snow-free. Currently, 35 of the 36 sites have less than 0.4 inches of SWC, a record low since 1940.

Figure 7. Average snow water content (SWC) in percent of average for available monitoring sites as of January 19, 2006.



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

On the Web:

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

For a numeric version of the map, visit: http://www.wrcc.dri.edu/snotelanom/basinswen.html

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

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 7 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.

Temperature Outlook

(February–July 2006)

Source: NOAA Climate Prediction Center (CPC)

The NOAA-CPC long-lead temperature outlooks indicate increased chances of above-average temperatures for the Southwest and much of the adjacent parts of the country through July 2006 (Figure 8a–d). Forecasts indicate the highest probabilities centered over western Arizona from February–July. The area of greater chances (50 percent or greater) of above-average temperatures includes southern and western New Mexico, most of Arizona, and adjacent parts of California, Nevada, and Utah. Parts of the far northern U.S. are forecasted to be cooler than average. The CPC outlooks agree closely with the outlooks issued by the International Research Institute for Climate Prediction (IRI, not shown), except for some minor differences in the placement of the forecast anomalies.

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 the reliability (i.e., 'skill') of the forecast is poor; 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 8a. Long-lead national temperature forecast for February–April 2006.

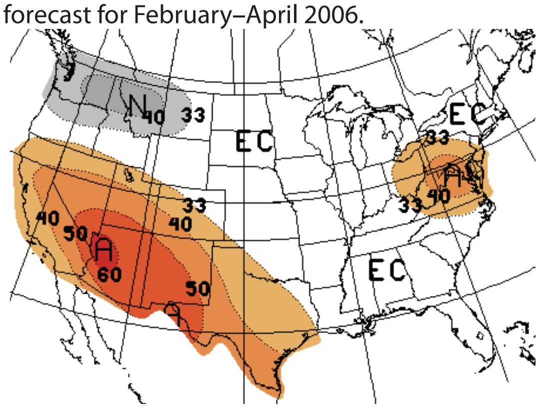


Figure 8b. Long-lead national temperature forecast for March–May 2006.

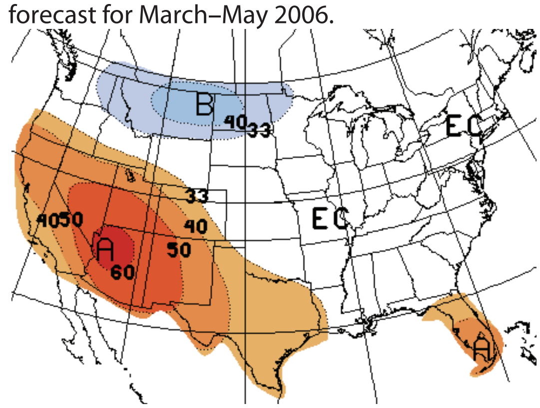


Figure 8c. Long-lead national temperature forecast for April–June 2006.

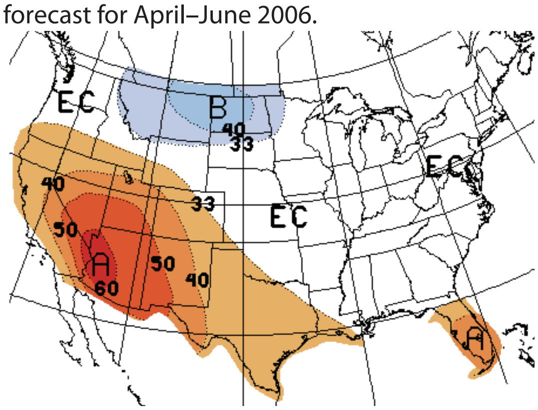
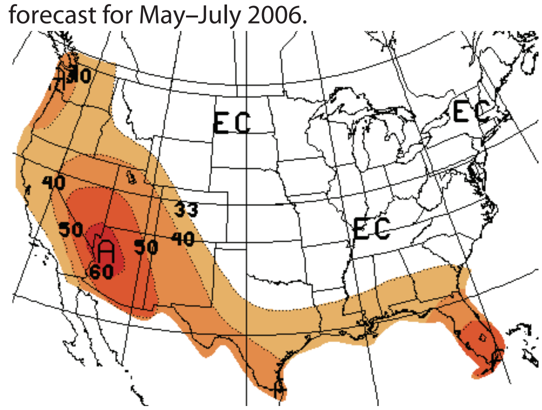


Figure 8d. Long-lead national temperature forecast for May–July 2006.



A= Above
- 60.0–69.9%
- 50.0–59.9%
- 40.0–49.9%
- 33.3–39.9%

B= Below
- 40.0–49.9%
- 33.3–39.9%

N= Near Normal
- 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.html
(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
(February–July 2006)
Source: NOAA Climate Prediction Center (CPC)

Long-lead precipitation outlook from NOAA-CPC calls for increased chances of below-average precipitation for most of the Southwest and portions of the extreme Southeast through May 2006 (Figure 9a–d). The areas of highest probabilities in the Southwest (40 percent or greater) are centered over southern Arizona, southwestern New Mexico, and Southern California through May. Parts of the Ohio Valley and the southern Appalachians are forecasted to be wetter than average from February–May, and a small area in the upper Midwest near the Canadian border is predicted to be wetter than average from April–July. The CPC outlooks agree closely with the outlooks issued by the International Research Institute for Climate Prediction (IRI, not shown), except for some minor differences in the placement of the forecast anomalies.

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 the reliability (i.e., 'skill') of the forecast is poor; 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 9a. Long-lead national precipitation forecast for February–April 2006.

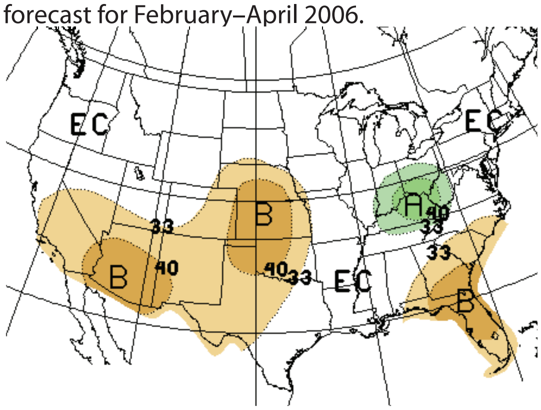


Figure 9b. Long-lead national precipitation forecast for March–May 2006.

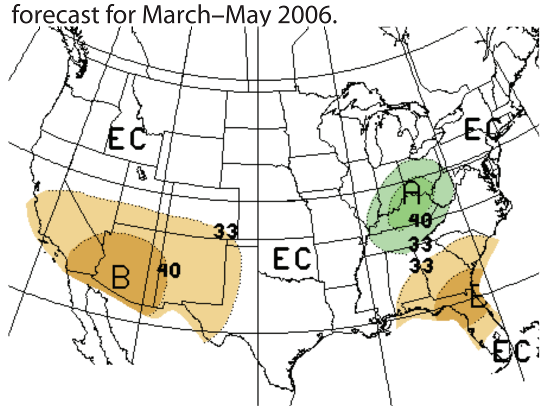


Figure 9c. Long-lead national precipitation forecast for April–June 2006.

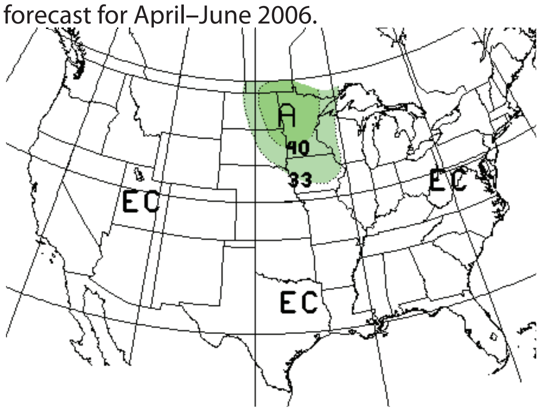
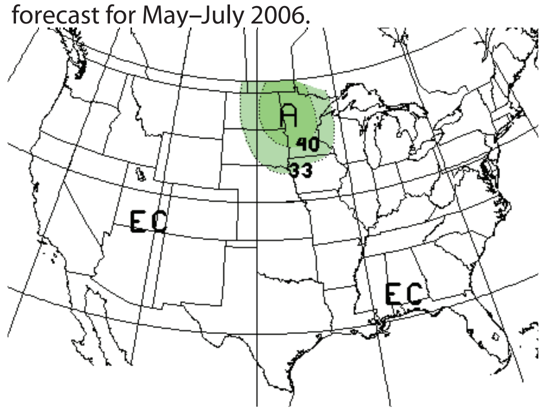


Figure 9d. Long-lead national precipitation forecast for May–July 2006.



A= Above: 40.0–49.9%; 33.3–39.9%

B= Below: 33.3–39.9%; 40.0–49.9%

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.html
(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 April 2006)

Source: NOAA Climate Prediction Center (CPC)

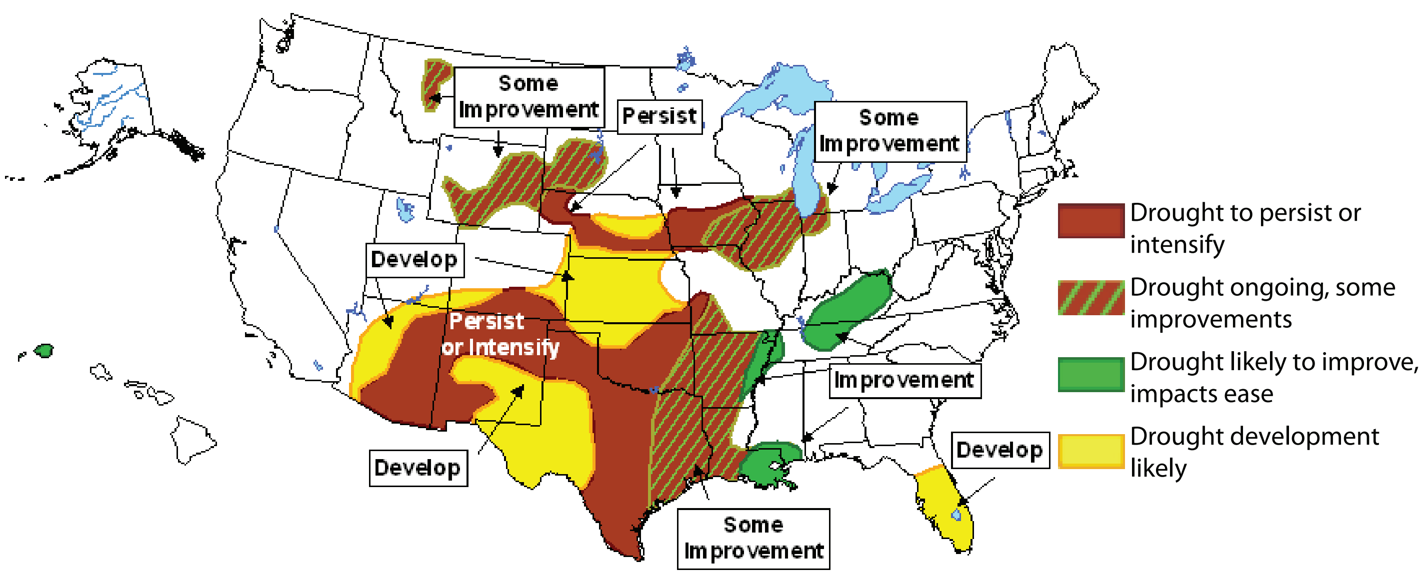
The seasonal drought outlook from the NOAA-CPC calls for drought to persist or intensify in most of southern and eastern Arizona, and in northern and southwestern New Mexico (Figure 10). Drought is likely to develop in the rest of New Mexico, and in all but the far western part of Arizona. The extremely dry conditions over the last month or so, following generally below-average precipitation since last spring, have contributed to the moisture deficits in the Southwest. Continued above-average temperatures have also led to the intensification of drought in the region. Despite the prediction of nearly equal chances for La Niña or ENSO-neutral conditions in early 2006 (see Figure 12b), lowering confidence in seasonal forecasting, both the CPC prediction and the outlooks issued by the International Research Institute for Climate Prediction indicate that the rest of the winter is likely to be drier than average. In addition, the outlooks call for above-average temperatures throughout the Southwest, making drought intensification more likely.

According to the *Arizona Republic* (January 12), the worsening drought conditions are likely to have widespread negative impacts in Arizona, including risk to water supplies, forest damage, and increased wildland fire risk. The virtual lack of snowpack, which normally begins to accumulate by Thanksgiving, is contributing to well-below-average runoff forecasts of 50 percent or less of the long-term average. Water supply in Phoenix and the central valley area is adequate, due to replenished reservoir storage on the Salt and Verde Rivers, but continuing drought is likely to adversely affect water supply in Arizona's rural communities that depend on shallow wells. Poor range conditions could impact ranchers, and farmers who draw on smaller rivers and reservoirs could also face shortages. The threat of wildfire is becoming worse in Arizona's forests and rangelands, where trees are losing moisture rapidly, and the abundant grass produced by last year's wet winter and spring will provide plenty of fine dry fuel to carry fire on the ground.

Notes:

The delineated areas in the Seasonal Drought Outlook (Figure 10) are defined subjectively and are based on expert assessment of numerous indicators, including outputs of short- and long-term forecasting models.

Figure 10. Seasonal drought outlook through April 2006 (release date January 19, 2006).



On the Web:

For more information, visit:
http://www.drought.noaa.gov/

Streamflow Forecast
(for spring and summer)
Source: National Water and Climate Center

The forecast for the Colorado River Basin shows that streamflow in southwestern rivers is expected to be well below average during the spring and summer (Figure 11), while flow in the Lower Colorado River is expected to be slightly above average. Streamflow values are expected to be less than 50 percent of average in most of Arizona and New Mexico's rivers, due to the virtual lack of snowpack in the region caused by above-average temperatures and much-below-average precipitation since the start of the water year on October 1, 2005. There is slightly more snowpack in the northern mountains of New Mexico (see Figure 7), where streamflow is expected to be somewhat better but still well below average. Many of the basins in Arizona and New Mexico are predicted to produce only 30 to 40 percent of their average streamflow amounts.

The situation is much better along the Colorado River in Arizona. The Upper Colorado River Basin has received above-average precipitation this winter, and the snowpack is generally well above average for this time of year. Colorado River inflow to Lake Powell is expected to be about 110 percent of average.

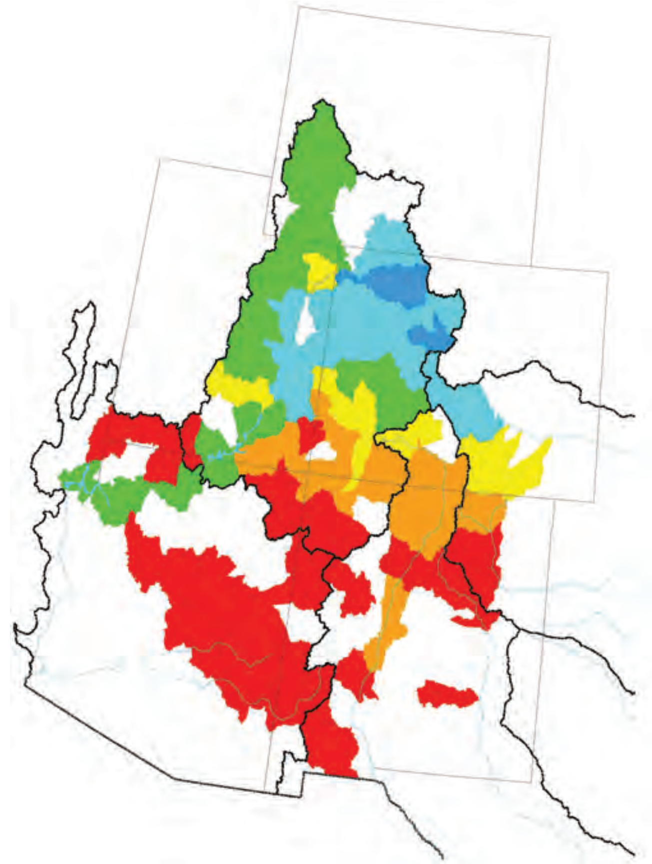
Since much of the water in western rivers is from snowmelt, the amount of snowfall in the coming months will greatly influence the actual streamflow. Also tied to the streamflow forecast are temperature and precipitation forecasts. The long-lead outlook for the Southwest is for continued below-average precipitation and above-average temperatures over the next few months. Continued measurement of these factors that influence runoff leads to improved streamflow forecasts later in the season. The Natural Resources Conservation Service, which produces the forecasts, therefore cautions that early forecasts generally undergo greater changes than late-season forecasts.

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/water/quantity/westwide.html

Figure 11. Spring and summer streamflow forecast as of January 1, 2006 (percent of average).



- much above average (>150)
- above average (130-150)
- slightly above average (110-129)
- near average (90-109)
- slightly below average (70-89)
- below average (50-69)
- much below average (<50)

Notes:
The forecast information provided in Figure 11 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 11..

El Niño Status and Forecast

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

According to the NOAA-CPC, sea surface temperature (SST) conditions and atmospheric pressure remain near average across the equatorial Pacific Ocean, but signs of developing La Niña conditions are beginning to appear. SSTs across most of the eastern tropical Pacific Ocean are slightly cooler than average (by less than 0.5 degrees Celsius), while persistent stronger-than-average, low-level equatorial easterly winds are being observed over the central Pacific. Although the Southern Oscillation Index (SOI) remains in the ENSO-neutral range, the SOI has shown a moderate but steady increase since last spring, until decreasing slightly in the last month (Figure 12a). Collectively, these and other conditions in the Pacific Ocean are consistent with the development of La Niña conditions, according to the experts at CPC. Probabilistic forecasts issued by the IRI predict there is a 50 percent chance that La Niña conditions will develop through March, becoming less likely later on in the spring and summer when ENSO-neutral conditions will become increasingly likely (Figure 12b).

There is considerable variability in the outlooks from different prediction models (not shown). Experts think that current conditions and recent trends favor either the development of a weak La Niña or a continuation of ENSO-neutral conditions. Historically, La Niña conditions tend to favor below-normal precipitation and above-normal temperatures in the Southwest during the winter months, while ENSO-neutral conditions have little effect on Southwest climate. Given the late onset of La Niña conditions, there is considerable uncertainty about whether the Southwest will experience typical La Niña impacts during the remainder of the winter, according to the CPC.

Figure 12a. The standardized values of the Southern Oscillation Index from January 1980–December 2005. 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).

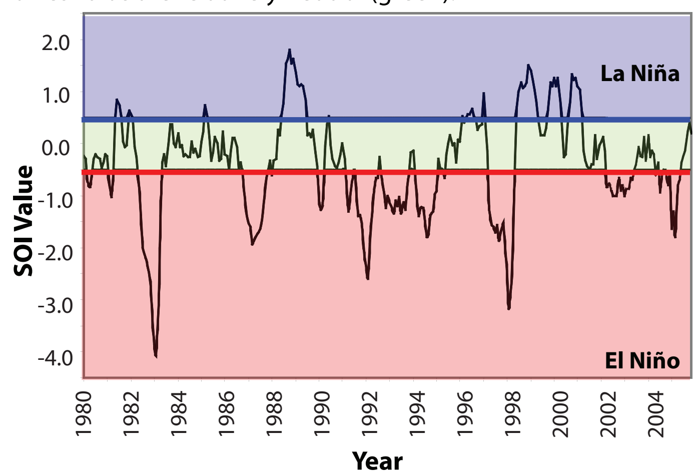
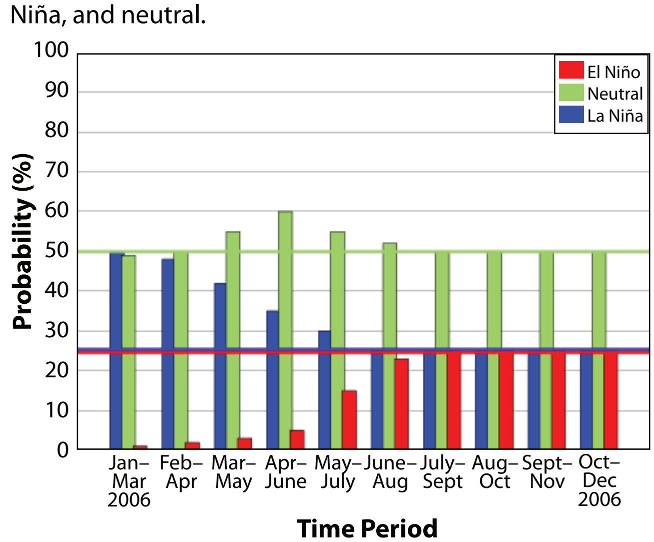


Figure 12b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released January 20, 2006). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Notes:

Figure 12a shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through December 2005. 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 12b shows the International Research Institute for Climate Prediction (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/

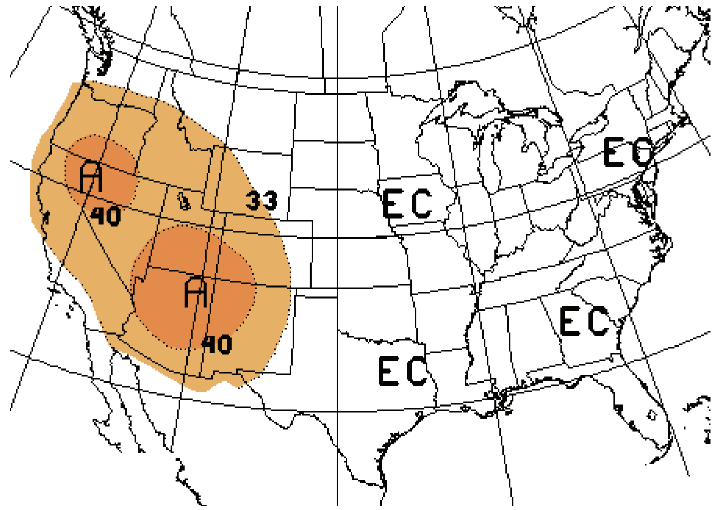
For more information about El Niño and to access graphics similar to the figures on this page, visit:
http://iri.columbia.edu/climate/ENSO/

Temperature Verification
(October–December 2005)

Source: NOAA Climate Prediction Center (CPC)

The long-range forecast for October–December 2005 from the NOAA-CPC predicted increased chances of above-average temperatures throughout most of the Southwest, and in much of the West from California and parts of the Pacific Northwest to parts of Wyoming and Utah (Figure 13a). One of the two areas of highest probability of above-average temperatures was centered over northern Arizona and extended into northwest New Mexico, southern Utah and southwest Colorado. A smaller area of high probability was centered over northwest Nevada and adjacent parts of California and Oregon. No probabilities for cooler-than-average temperatures were forecast. Observed temperatures across most of the nation ranged from 0–4 degrees Fahrenheit above average, with areas of 0–2 degrees F below-average temperatures in the Pacific Northwest and in the eastern U.S. (Figure 13b). Generally, the forecast performed well in predicting above-average temperatures in the Southwest and surrounding states, but did not do very well in the Pacific Northwest, where below-normal temperatures prevailed.

Figure 13a. Long-lead U.S. temperature forecast for October–December 2005 (issued September 2005).



A= Above 40.0–49.9% 33.3–39.9%

EC= Equal chances. No forecasted anomalies.

Notes:

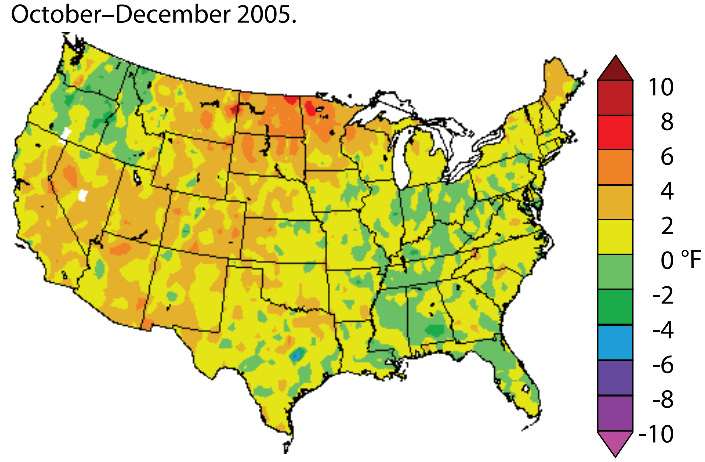
Figure 13a shows the NOAA Climate Prediction Center (CPC) temperature outlook for the months October–December 2005. This forecast was made in September 2005.

The outlook predicts 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.

Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3 percent chance of above-average, a 33.3 percent chance of average, and a 33.3 percent chance of below-average temperature. Thus, using the NOAA CPC likelihood forecast, in areas with light brown shading there is 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. Equal Chances (EC) indicates areas where reliability (i.e., the skill) of the forecast is poor and no prediction is offered.

Figure 13b shows the observed departure of temperature (degrees F) from the average for the October–December 2005 period. Care should be exercised when comparing the forecast (probability) map with the observed temperature maps. The temperature departures do not represent probability classes as in the forecast maps, so they are not strictly comparable. They do provide us with some idea of how well the forecast performed. In all of the figures on this page, the term average refers to the 1971–2000 average. This practice is standard in the field of climatology.

Figure 13b. Average temperature departure (in degrees F) for October–December 2005.



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.html

Precipitation Verification

(October–December 2005)

Source: NOAA Climate Prediction Center (CPC)

The long-range outlook from the NOAA-CPC for October-December 2005 predicted increased chances of below-average precipitation in most of the Southwest, with the area of highest probability centered over Arizona, extending into adjacent parts of California, Nevada, Utah, Colorado, and western New Mexico (Figure 14a). Above-average precipitation was predicted in east Texas and parts of Louisiana, Arkansas, and Oklahoma. Precipitation across the country during the period was generally well below average in most of the southern tier states, but generally above average in the Northwest and North, along the East Coast, and in west Texas and eastern Colorado. Precipitation in most of the Southwest ranged from 5 to 50 percent of average, although parts of far northwestern Arizona and extreme southeastern New Mexico received above-average precipitation. The forecast performed well predicting the dry conditions in the Southwest, but did poorly in predicting wet conditions in east Texas, where below-average precipitation occurred.

Figure 14a. Long-lead U.S. precipitation forecast for October –December 2005 (issued September 2005).

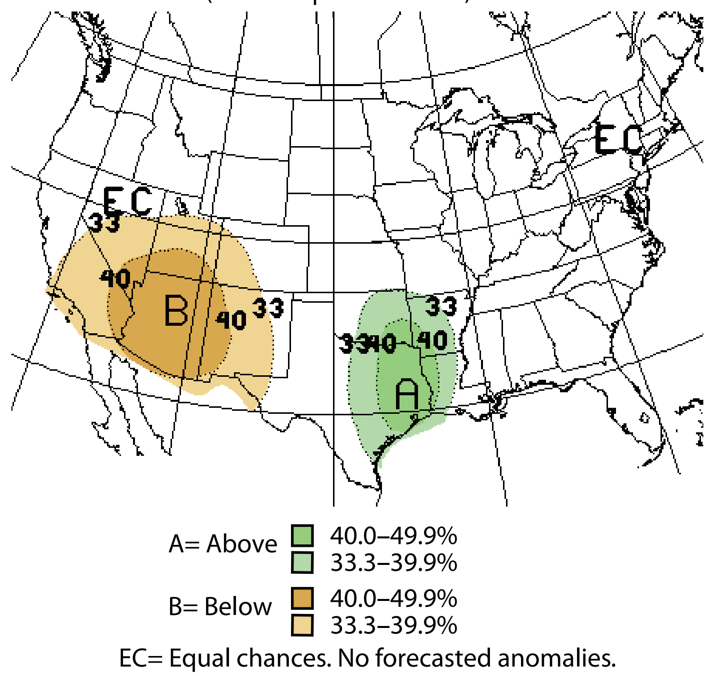
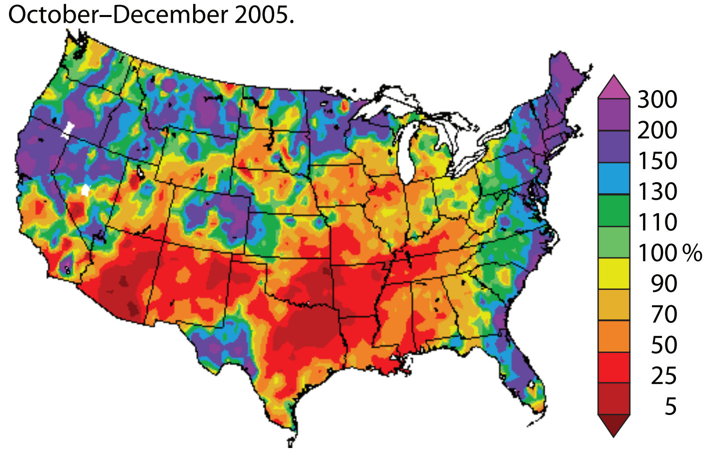


Figure 14b. Percent of average precipitation observed from October–December 2005.



Notes:

Figure 14a shows the NOAA Climate Prediction Center (CPC) precipitation outlook for the months October–December 2005. This forecast was made in September 2005.

The outlook predicts 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. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3 percent chance of above-average, a 33.3 percent chance of average, and a 33.3 percent chance of below-average precipitation. Thus, using the NOAA CPC likelihood forecast, in areas with light brown shading there is 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. Equal Chances (EC) indicates areas where reliability (i.e., the skill) of the forecast is poor and no prediction is offered.

Figure 14b shows the observed percent of average precipitation for October–December 2005. Care should be exercised when comparing the forecast (probability) map with the observed precipitation maps. The observed precipitation amounts do not represent probability classes as in the forecast maps, so they are not strictly comparable, but they do provide us with some idea of how well the forecast performed.

In all of the figures on this page, the term average refers to the 1971–2000 average. This practice is standard in the field of climatology.

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.html