Issued: July 26, 2005

CLIMAS
Southwest Climate Outlook

July Climate Summary

Hydrological Drought – Abnormally dry to moderate drought persists in the Southwest.

- Abnormally dry status was reintroduced in parts of central and southwestern New Mexico.
- Lake Powell is at 50 percent of capacity for the first time since August and September 2003.
- Reservoir storage in both Arizona and New Mexico remains above 2004 values.

Temperature – Water year temperatures are near to above average in the Southwest. The past 30 days were also above average for most of the Southwest.

Precipitation – Most of the Southwest, except portions of southeastern Arizona, remains wetter than average, while the past 30 days were anomalously dry.

Climate Forecasts – Long-lead outlooks indicate increased chances of above-average temperatures through January 2006 in Arizona and much of New Mexico. Models predict a weak, dry monsoon and below-average precipitation through October.

El Niño – Probabilistic forecasts show that the neutral ENSO conditions are most likely to continue through June 2006.

The Bottom Line – Abnormally dry conditions to moderate drought conditions are expected to deteriorate through October with a weak, dry monsoon.

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

Bring on the Monsoon

The monsoon has officially started across the desert Southwest! Tucson recorded three consecutive days of daily average dewpoints above 54 degrees F from July 18th through July 20th making July 18th the official 2005 start date for Tucson. Phoenix uses a slightly different dewpoint threshold (55 degrees F) to mark the beginning of the monsoon, but also recorded a start date of July 18th. The arrival of the monsoon was unusually late this year when compared with the average start dates of July 3rd in Tucson and July 7th in Phoenix. The July 18th monsoon start date was the second latest on record according to the National Weather Service Office in Tucson. The latest monsoon start on record was July 25th in 1987 for both Tucson and Phoenix.

See Monsoon Summary (page 12) for more details...

In this issue:

The Southwest Climate Outlook is jointly published each month by the Climate Assessment for the Southwest project and the University of Arizona Cooperative Extension.

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Inquiry into monsoon and global warming continues

Troublesome twist: Atmospheric variables make prediction tough for summer rain

BY MELANIE LENART

EDITOR'S NOTE:
This is the second in a two-part series about how the monsoon might change with global warming. This article focuses on some of the atmospheric influences on the North American monsoon. For last month's article visit http://www.ispe.arizona.edu/climas/forecasts/articles/monsoon_June2005.pdf.

Some circumstantial evidence points to the possibility that global warming will yield stronger monsoons. Increases in sea surface temperatures, land heating, and air temperatures suggest the potential for an increase in summer rainfall.

Mystery solved? Not quite. There's a plot twist: Atmospheric variability remains elusive when it comes to the North American monsoon, which funnels summer rainstorms into the Southwest. Because the description of atmospheric variability remains sketchy, climatologists are seeking more clues before they will guess how the monsoon will respond to climate change.

"There's not much out there in terms of climate change and the monsoon," noted Arizona State Climatologist Andrew Ellis, alluding to the scientific literature on the North American monsoon. "I don't think people have a great feel out there how (atmospheric) flow would be affected by climate change."

Figure 1. The U.S. region affected by monsoon is restricted to the Southwest. Graphic courtesy of Andrew Ellis.

The North American monsoon has remained unresponsive to warming—at least where it reaches into the southwestern United States (Figure 1). Ellis finds no evidence of a trend toward more rainfall during the southwestern U.S. monsoon season (Figure 2), even though the Earth's surface has been warming for many decades.

Lack of data complicates efforts to unravel the mystery behind North American Monsoon variability. In a way, the southwestern U.S. is akin to a mere bystander—the main monsoon action centers on Mexico's Sierra Madres. While reliable U.S. data describing atmospheric activity exists from about the mid-20th century, comparable data in Mexico remains sparse to this day.

Since early 2004, researchers with the North American Monsoon Experiment (NAME) have been launching weather balloons, analyzing data, and studying monsoonal thunderstorms in intensive bursts of coordinated activity in both Mexico and the Southwest, explained NAME project leader Wayne Higgins. The project runs through 2008.

Meanwhile, satellites help fill in some of the missing puzzle pieces, but they provide only a few decades of data—a short time frame compared to some of the decades-long fluctuations that can influence monsoon strength. Even U.S. climate station data is considered short by these standards.

Although climatologists traditionally turn to computer modeling for insight on future changes, the General Circulation Models (GCMs) used to represent global climate are not yet up to the challenge for the North American monsoon. "The current generation of models doesn't do a good job of representing the monsoon, for a whole variety of reasons," said Andrew Comrie, a Climate Assessment for the Southwest (CLIMAS) researcher. GCMs have trouble modeling clouds, convection, and precipitation in general, he noted, in addition to using a spatial scale with no relevance to the monsoon. "It's a recipe for not getting it right in the GCMs."

Thinking outside the box

From a process perspective, global warming may affect some of the underlying drivers of the monsoon—sea surface temperatures, land heating, and atmospheric moisture—as discussed last month. The circumstantial evidence regarding the response of these drivers to global warming suggests a strengthening of monsoons around the world.

Long-term records support such an interpretation, showing the Asian monsoon tended to strengthen during warm episodes of the past, and weaken during cool periods (For example, see *Nature*, January 23, 2003). On the other hand, the immense size and height of the Tibetan Plateau make the Asian monsoon somewhat more predictable than the North American monsoon.

The sheer number and inherent variability of the factors affecting the North American monsoon make climatologists leery of predicting how it will respond to global warming. Comrie rattled off half a dozen influences on the North American monsoon during a July 14 interview in Tucson, when residents were still waiting for this year's monsoon to begin. The list includes sea surface temperature and land heating, but also the influence of mid-latitude westerly wind patterns, tropical easterly trade winds, and global-scale descent of tropical air.

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Monsoon, continued

"They're all connected and it's all fluid, so it's not like you're moving cogs in a machine. There are just too many feedbacks," Comrie said. "It may be that there will be a dramatic change in one of these that overrides everything else. We don't know."

Changes in El Niño regimes could impact the monsoon, for instance. El Niño tends to suppress monsoon strength in Mexico, Higgins said. El Niño's dampening of Arizona's monsoon season is less noticeable but still detectable statistically, noted Klaus Wolter, a meteorologist with the Climate Diagnostics Center in Boulder.

Still, the El Niño advantage in making skillful predictions of winter precipitation falls short when it comes to forecasts of summer rainfall, at least for the U.S. Southwest. What's more, climatologists are still debating how global warming might affect El Niño regimes.

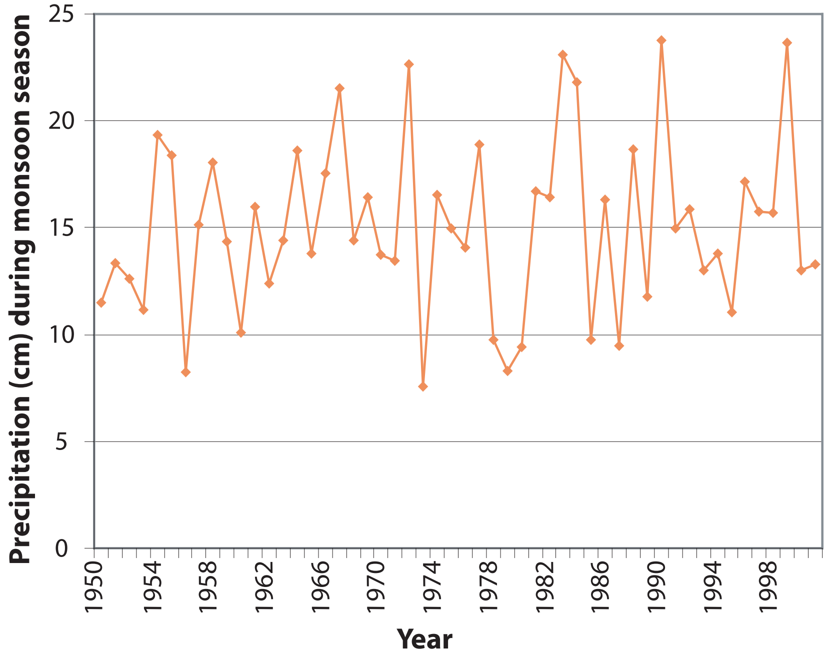

Figure 2. Annual precipitation in the monsoon region during the monsoon season fluctuates widely by year, but the fluctuations show no ongoing trend toward an increase in seasonal rainfall in recent years. Graphic based on 1950–2001 dataset accessible from Andrew Ellis' website at http://geography.asu.edu/azclimate/monsdat.htm.

Too many leads to follow

Predicting monsoon behavior on a seasonal scale poses a major challenge to climatologists, although experimental predictions by both Wolter and Ellis for a relatively dry season in Arizona this year seem to be panning out.

True, it's almost certain the seasonal cycle will kick in at some point with its accompanying thunderstorms. But rainfall rates fluctuate widely from year to year. In the southwestern U.S. dataset compiled by Ellis (Figure 2), average monsoon-season rainfall ranged from less than 8 inches in 1975 to about 24 inches in 1990.

Further, within that region, the distribution of rainfall typically ranges from abundant to sparse in the same year. In particular, New Mexico and Arizona often seem to follow different leads.

Tropical dynamics

Suspects in the investigation include anything that might influence the position of the signature monsoon "anticyclone" (Figure 3), including the climate features on Comrie's list of factors affecting monsoon variability. Year-to-year variability in southwestern summer rainfall relates in large part to the location and size of this anticyclone.

The anticyclone itself goes by a variety of aliases, including the Four Corners High. The high-pressure anticyclone is easier to define on weather maps (Figure 3), but its presence means a surface low exists below. The combination of a surface low and an upper-level high defines monsoon circulation.

These terms relate to how air flows in the atmosphere. Air may be invisible like a gas, but it flows in currents and moves in waves like fluid. While water will flow from mountaintop ridges to the low-lying valleys on the landscape, air will flow from areas of high pressure—often called atmospheric ridges—to "troughs" of low-pressure.

Surface lows allow moisture to rise more freely in the atmosphere, increasing their odds of forming the towering thunderclouds that can reach into the cooler heights needed to produce rainfall. Meanwhile, the descending air that characterizes highs generally limits precipitation.

At the global scale, heated air rises in the equatorial region and nearby tropics that take the brunt of the sun's incoming punch. The rising air loses steam and begins to descend by the time it reaches the subtropics—and to dry out as it warms on its way down, as descending air does. Climatologists call these global-scale ups and downs Hadley cell circulation.

This circulation pattern helps imprison the subtropics in dryness, as Hadley cell highs tend to suppress precipitation. It's no coincidence that the world's deserts—including the Southwest's Sonoran Desert—tend to be located in the subtropics, centered at around 30 degrees latitude North and South.

Those clear skies that distinguish the subtropics can cloud up during the

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Monsoon, continued

monsoon season, though. In monsoon circulation, subtropical surface air "balloons" up into higher reaches, mimicking the tropic's usual approach to promoting convective activity such as thunderstorms, Ellis explained.

"It just opens the door for some very light flow and accompanying moisture from the south," he added. As discussed last month, moist air tends to rush in from the Gulf of California to Arizona, and from the Gulf of Mexico to New Mexico.

Wrong side of the storm tracks

When mid-latitude weather patterns reign, in contrast, westerly winds can delay the advent of tropical dynamics that usher in the monsoon.

Going back to the water analogy, the westerlies act as a river of airflow that speed along several miles above the Earth's surface. The jet stream speeds along in their core, like swift-flowing water in the center of the river. Sometimes the westerlies follow a straight course, staying mostly in line from west to east. Other times they can meander from Alaska down to Arizona, trailing cool air in their wake.

Although refreshing in the short term, the latter pattern restricts the formation of the anticyclone. Basically, it takes the stifle out of the summer heat needed to draw in warm, moist air from the south.

"That is a really killer for the monsoon," Ellis said.

The absence of sweltering stillness may be welcome by humans and other life forms—until the lack of seasonal relief from the monsoons creates its own problems. The July fire that raged through Tucson's Santa Rita Mountains is one example of how society pays for a sputtering monsoon that doesn't quite catch. Hundreds of hotshot firefighters battled the blaze, mostly in vain, at high personal and financial cost. Meanwhile, air quality in the greater Tucson area also suffered during the event.

When westerly winds shift north, or surface heating manages to override their interference, the anticyclone can take shape. Although the anticyclone brings rainfall to those under its domain, its presence often signifies dry spells for those outside its province, especially the areas falling north and east of its sway.

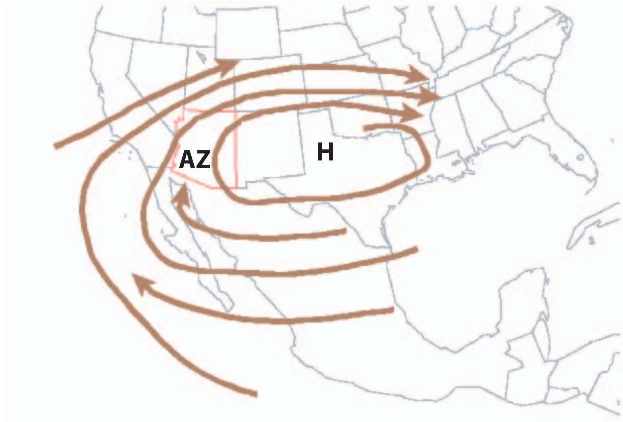


Figure 3. The air circulation patterns at 18,000 feet show the signature "anticyclone" that helps define the North American monsoon. Graphic courtesy of the National Weather Service, http://www.wrh.noaa.gov/twc/monsoon/mexmonsoon.php

"That monsoon anticyclone is huge, and it tends to suppress precipitation in the Great Plains," explained Higgins, whose October 1997, *Journal of Climate* research paper with colleagues first documented the see-saw action between the Southwest and Great Plains rainfall.

For the 30 years of data they averaged, the southwestern U.S. increase in rainfall coincided with a decline in summer rainfall in the Great Plains area between about 105 degrees and 85 degrees West. Monsoon circulation puts the Great Plains in the path of air descending from the heights of the anticyclone, creating a high pressure zone of dry air at the Earth's surface.

The correlation between summer rainfall in the Southwest vs. the Great Plains seems to indicate that stronger monsoon seasons do not represent an increase in overall U.S. rainfall, but merely a redistribution of regional rainfall. So it seems likely that whichever way the wind blows in a climate change scenario, some region of the country will suffer from a lack of moisture.

No solution in sight

Just how will the North American monsoon fare with global warming? It seems this case will be relegated among the great unsolved mysteries until more clues turn up to produce a coherent explanation for year-to-year monsoon variability.

Although global warming seems destined to affect some of the drivers influencing monsoons around the world, such as warming of land and sea, the atmospheric response to these drivers remains unclear when it comes down to considering the regional scale of the Southwest.

At this point, the plentiful cast of characters exerting influence on the monsoon and its characteristic anticyclone resembles the early stages of a game of Clue, when half a dozen or more suspects could be the culprit. Unlike this form of child's play, the real-world solution will probably involve a host of influences working together in a complex scheme that defies detection for many years, perhaps even decades.

One thing's certain: It will take continued dedicated effort by the many investigators now working diligently to solve the mystery. Until they do, the solution remains up in the air.

Melanie Lenart is a postdoctoral research associate with the Climate Assessment for the Southwest.

Temperature (through 7/20/05)

Sources: High Plains Regional Climate Center

Average water year temperatures range from the mid- to upper 30 degrees Fahrenheit in north-central Arizona and New Mexico to the lower 70s in extreme southwestern Arizona (Figure 1b). Most of the Southwest has been near to above average since October 2004 (Figure 1a). The largest positive anomalies are in northeastern Arizona and northwestern New Mexico, where temperatures are up to 3–4 degrees F above average. This area matches the location of the continuing moderate drought conditions depicted in Figure 3. Temperatures over the past 30 days have also been above average throughout the region with the largest departures (up to 6–8 degrees F) from southeastern Arizona to south-central New Mexico (Figures 1c–d).

The hot weather in the Southwest continues to make national news. CNN reports that officials attribute 18 deaths in the Phoenix area to the heat (July 21). The victims were mainly homeless and the elderly. Temperatures in Phoenix have been above average since June. The Tucson National Weather Service reports that the city reached 39 consecutive days with a high temperature of 100 degrees F or above. This ties the longest streak on record originally set in 1987.

Figure 1a. Water year '04–'05 (through July 20, 2005) departure from average temperature.

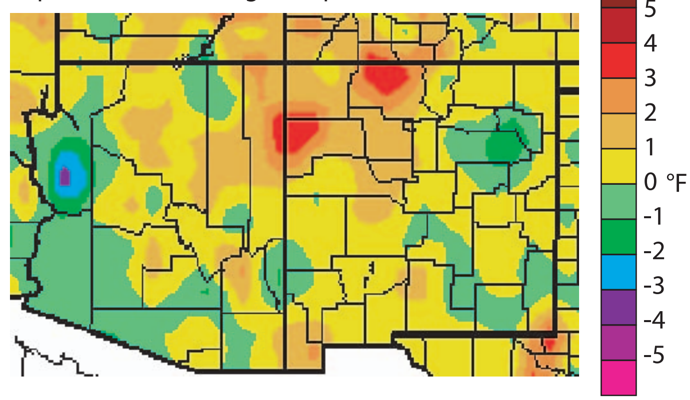


Figure 1b. Water year '04–'05 (through July 20, 2005) average temperature.

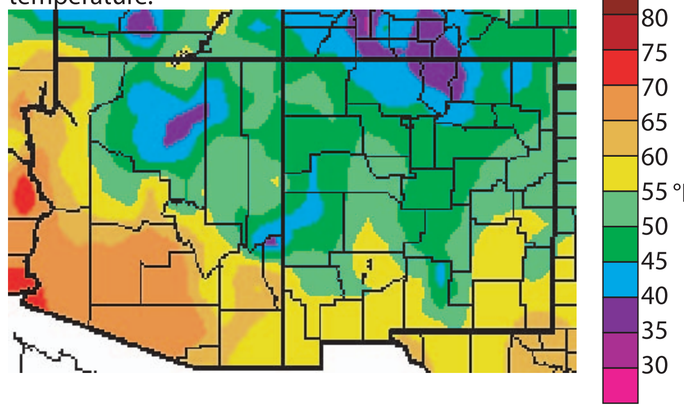


Figure 1c. Previous 30 days (June 21–July 20, 2005) departure from average temperature (interpolated).

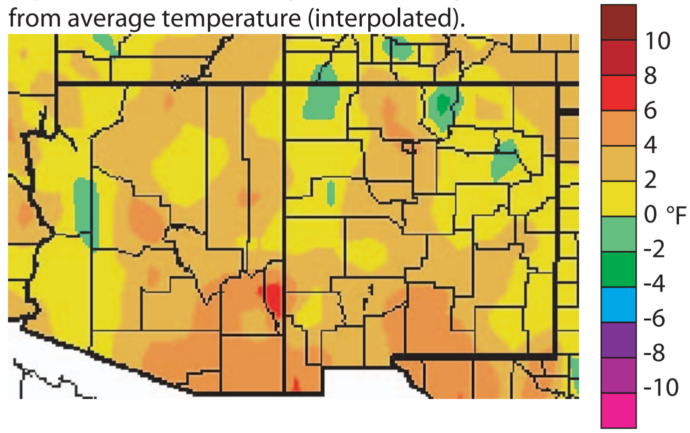
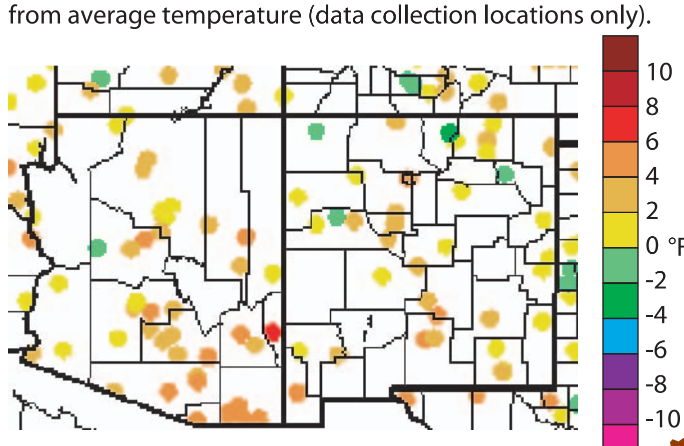


Figure 1d. Previous 30 days (June 21–July 20, 2005) departure from average temperature (data collection locations only).



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.htm

Precipitation (through 7/20/05)

Source: High Plains Regional Climate Center

Water year precipitation is near to above average for almost the entire Southwest (Figures 2a–b). The main exception is southeastern Arizona, where precipitation since October 2004 is generally from 50–90 percent of average. Moderate drought was re-introduced to this area in the past several months due to the precipitation deficit and continuing hot weather, which limited groundwater recharge and increased evaporation. The past 30 days were much different, as the Southwest was mainly much drier than average (Figures 2c–d). Most areas received less than 50 percent of average precipitation, and some areas had 5 percent or less. A major reason for these conditions was the position of a persistent ridge of high pressure that kept monsoon moisture out of the region. The official onset of the monsoon did not occur until July 18 in both Tucson and Phoenix, which is approximately 2 weeks later than average.

While the past 30 days were anomalously dry in the Arizona and New Mexico, the wet winter is still benefiting many states in the southwestern United States. Orders for water from the Central Arizona Project are lower than in recent years (*Arizona Republic*, June 24). According to the article, officials predict that Arizona will be capable of leaving up to 200,000 of its allotted 2.8 million acre-feet in Lake Mead.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2004 we are in the 2005 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 '04–'05 through July 20, 2005 percent of average precipitation (interpolated).

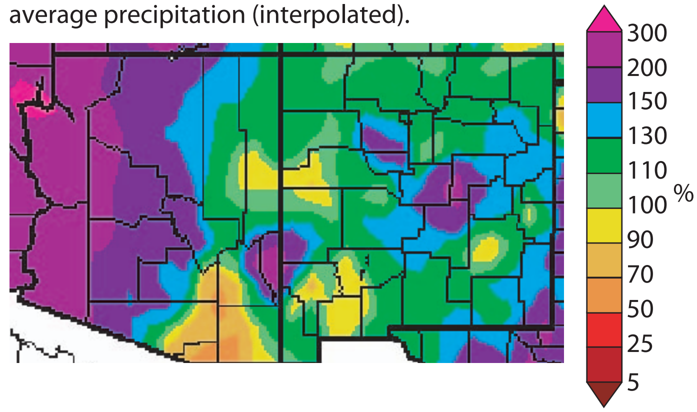


Figure 2b. Water year '04–'05 through July 20, 2005 percent of average precipitation (data collection locations only).

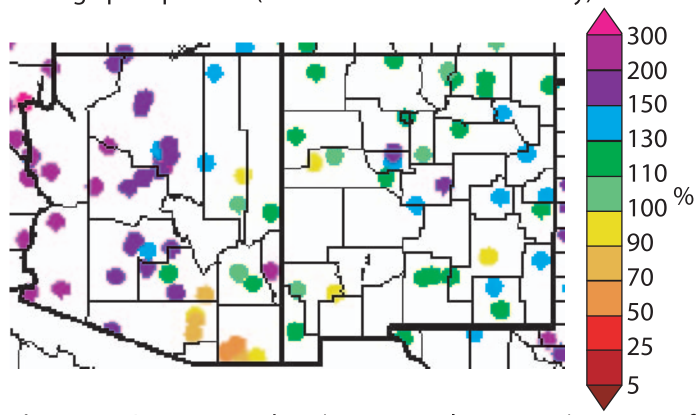


Figure 2c. Previous 30 days (June 21–July 20, 2005) percent of average precipitation (interpolated).

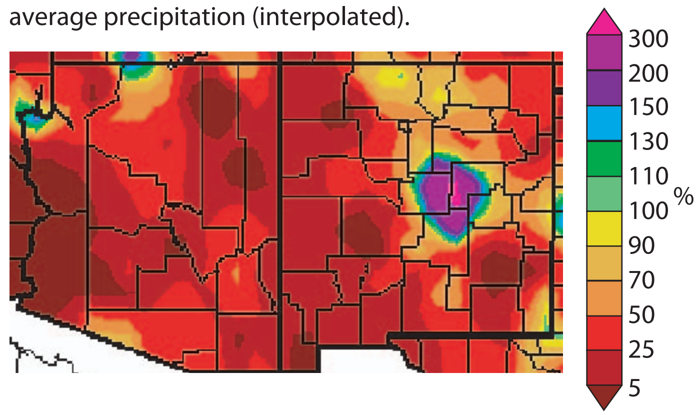
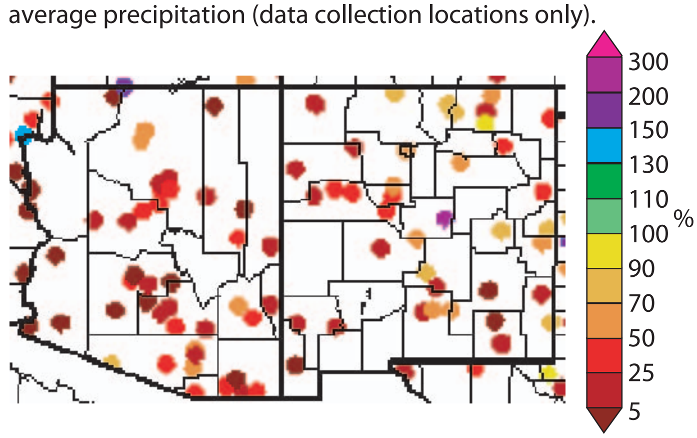


Figure 2d. Previous 30 days (June 21–July 20, 2005) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(released 7/21/05)

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

There has been no change in drought status in Arizona in the past month (Figure 3), despite warmer-than-average conditions (Figure 1) and a late onset to the monsoon (Figure 8a–c). Abnormally dry hydrological impact remains along the Colorado River due to low storage in lakes Powell and Mead. Abnormally dry conditions were re-introduced in portions of central and southwestern New Mexico.

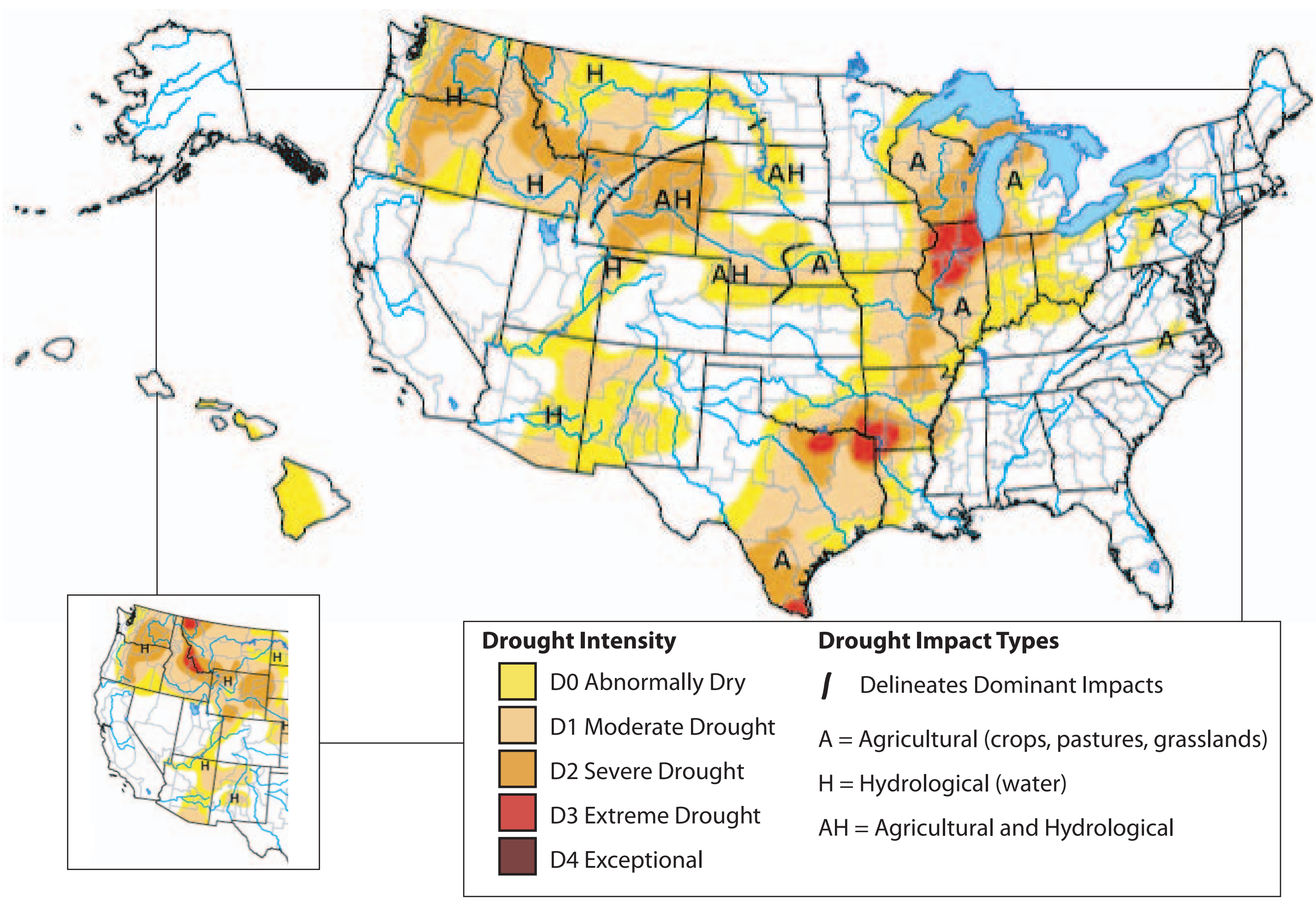
The Albuquerque National Weather Service reports that most of the state had below-average precipitation, with larger deficits in southwestern New Mexico (June 2005 Weather Highlights for New Mexico). While drought status returned to or worsened in parts of the Southwest during the past few months, conditions are better than early 2005 and the start of the current water year. Drought conditions have deteriorated in the Northwest and from the Texas-Mexico border to the Great Lakes over the same periods. In Arizona, 12 percent of pasture and range land are in good or excellent condition and 60 percent in poor or very poor condition , while New Mexico shows 22 and 33 percent for those categories, respectively. Compared to 2004, these values are 10 percent higher in Arizona and 26 percent lower in New Mexico.

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 Richard Heim and Jesse Enloe, NOAA/NESDIS/NCDC.

Figure 3. Drought Monitor released July 21, 2005 (full size) and June 16, 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 7/15/05)

Source: New Mexico Natural Resources Conservation Service

Northeastern, central, and far southern New Mexico remain in normal conditions (Figure 4a). Meteorological drought conditions have deteriorated in parts of southern and northwestern New Mexico since mid-May. Advisory and alert status now exist in Sierra, McKinley, San Juan, and Sandoval counties, while warning or moderate drought extends from western San Miguel County to northwestern Rio Arriba County. This deterioration resulted from a drier- and warmer-than-average June across most of the state.

Long-term conditions have also deteriorated over the past month, mainly in portions of central and southwestern New Mexico (see Figure 3). The recent precipitation deficits, hot temperatures, and continued low storage in reservoirs were sufficient to introduce abnormally dry hydrological drought status in these areas.

One-third of pasture and range lands in New Mexico is in poor to very poor condition as of July 17. This represents worsening conditions since early May. It is, however, an improvement over 2004, when nearly 60 percent of pasture and range lands were in poor to very poor condition. As the monsoon supplies the area with more moisture and precipitation, conditions may improve, but the outlook for August–October from the NOAA-Climate Predictions Center indicates increased chances of below-average precipitation for much of the state (see Figure 15a).

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.

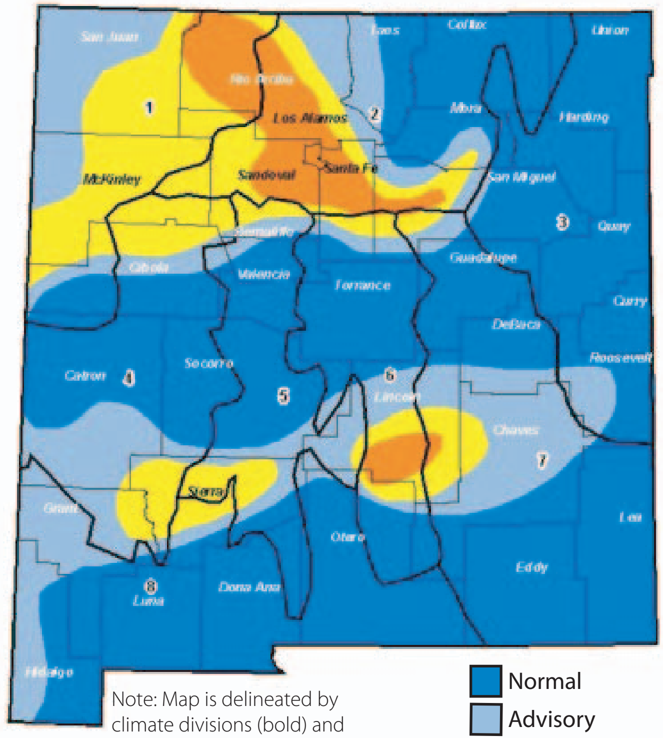
Figure 4a shows short-term or *meteorological* drought conditions. Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) over a relatively short duration (e.g., months). Figure 4b refers to long-term drought, sometimes known 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.water.az.gov/gdtf/

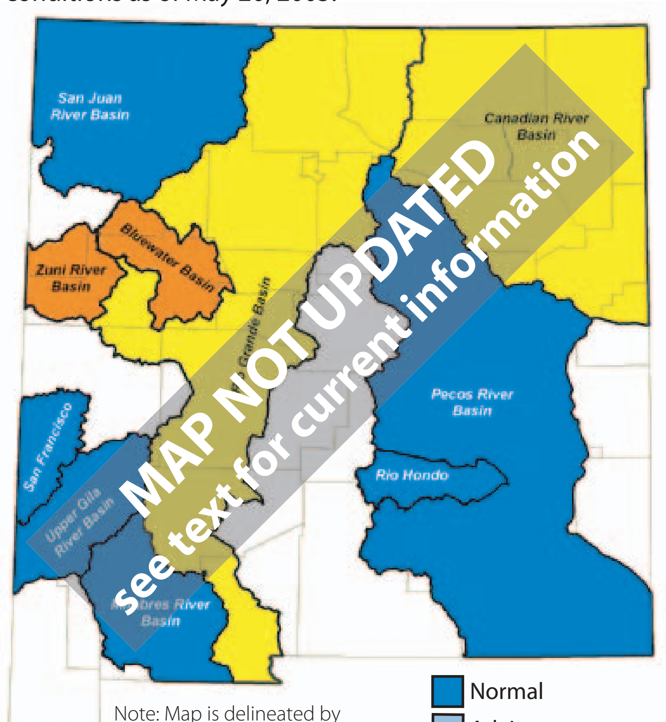
Figure 4a. Short-term drought map based on meteorological conditions as of July 15, 2005.



Note: Map is delineated by climate divisions (bold) and county lines.

Normal
Advisory
Alert
Warning
Emergency

Figure 4b. Long-term drought map based on hydrological conditions as of May 20, 2005.



Note: Map is delineated by river basins (bold) and county lines.

Normal
Advisory
Alert
Warning
Emergency

Arizona Reservoir Levels

(through 6/30/05)

Source: National Water and Climate Center

Arizona reservoirs ranged from 35 percent of capacity at Lyman Reservoir to 100 percent at Show Low Lake at the end of June (Figure 5). Storage decreased in most reservoirs throughout the state from May to June, which is typical of this dry, hot period. The decrease results from a lack of recharge from water use and evaporation and due to little rainfall. The Salt River Project (SRP) reports that evaporation rates exceeded 800 acre-feet on some days in June in the Salt-Verde System (SRP Daily Water Reports). The largest decrease (14 percent) occurred in the Verde River Reservoir System. Despite the drops, all lakes are near to above 2004 storage, with statewide storage 117 percent of last year. The exceptions to the decreases are Show Low Lake, which remained steady, and Lake Powell, which rose by 8 percent of capacity and is now at 51 percent of capacity. This marks Powell's highest capacity since July 2003 and the first time it has been at 50 percent or higher since August and September of 2003.

The U.S. Bureau of Reclamation has proposed a new regulated reservoir with a 300,000 acre-foot capacity just west of Yuma in Imperial County, California (*Yuma Sun*, July 14). The reservoir would be used to hold excess Colorado River water while still meeting regulations for flow into Mexico. Elsewhere along the Colorado River, officials continue to consider options for the Las Vegas water supply. Reports place the city's population at 1.7 million with an 80,000 resident increase each year. Patricia Mulroy, general manager of the Southern Nevada Water Authority, believes that the water supply problem arose, in part, because the Colorado River Compact of 1922 was developed with agriculture in mind, not large urban areas (*San Francisco Gate*, July 17).

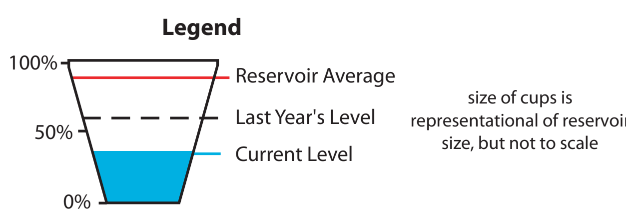
Notes:

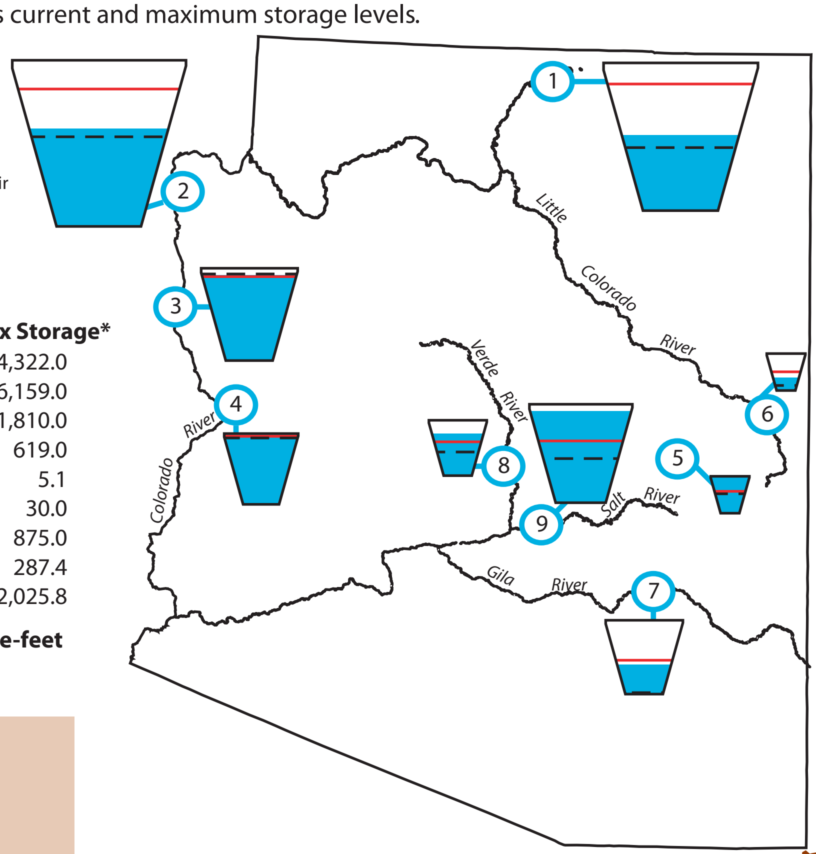
The map gives a representation of current storage levels for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total 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 June 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. Lake Powell	51%	12,360.0	24,322.0
2. Lake Mead	59%	15,441.0	26,159.0
3. Lake Mohave	93%	1,684.3	1,810.0
4. Lake Havasu	94%	581.7	619.0
5. Show Low Lake	100%	5.1	5.1
6. Lyman Reservoir	35%	10.5	30.0
7. San Carlos	40%	351.7	875.0
8. Verde River System	76%	217.7	287.4
9. Salt River System	93%	1,877.8	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 6/30/05)

Source: National Water and Climate Center

Most reservoirs throughout New Mexico remain well below capacity as of the end of June (Figure 6). Many lakes in the Pecos River and Rio Grande basins are near or below 25 percent. Costilla, Navajo, and El Vado reservoirs are among the fullest in the state at 108, 92, and 84 percent of capacity, respectively. Conchas and Heron reservoirs are the only other lakes at or above 50 percent. More than half the lakes increased in storage since May, with the largest rises at Costilla (25 percent) and El Vado (22 percent). Most decreases were under 5 percent of capacity, except at Abiquiu (11 percent). While statewide storage is 160 percent of last year, it remains below average and is less than 50 percent of capacity.

In late June, the Senate approved a $31.2 billion appropriations bill to fund the Department of Energy and water-related programs managed by the Army Corps of Engineers and the Bureau of Reclamation (*New Mexico Business Weekly*, July 1). According to the article, funds allotted to New Mexico will be used for projects related to endangered species, the Albuquerque metropolitan area water reclamation and reuse, Rio Grande Bosque restoration, water infrastructure in Bernalillo, Valencia, and Sandoval counties, and flood control in Albuquerque's South Valley. Officials in northern New Mexico expect the Los Alamos Reservoir recreation area to reopen in summer 2007 at the earliest (*Los Alamos Monitor*, July 8). The lake was filled with over 40,000 cubic yards of debris after the Cerro Grande fire in May 2000. In Texico, officials are re-evaluating the city's participation in the Ute Water pipeline project (*Portales News-Tribune*, July 20). Tucumcari recently withdrew from the project, leaving only 8 of the original 12 groups still involved.

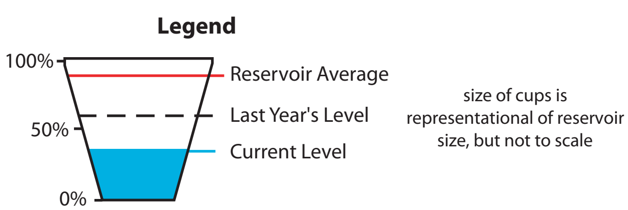
Notes:

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.

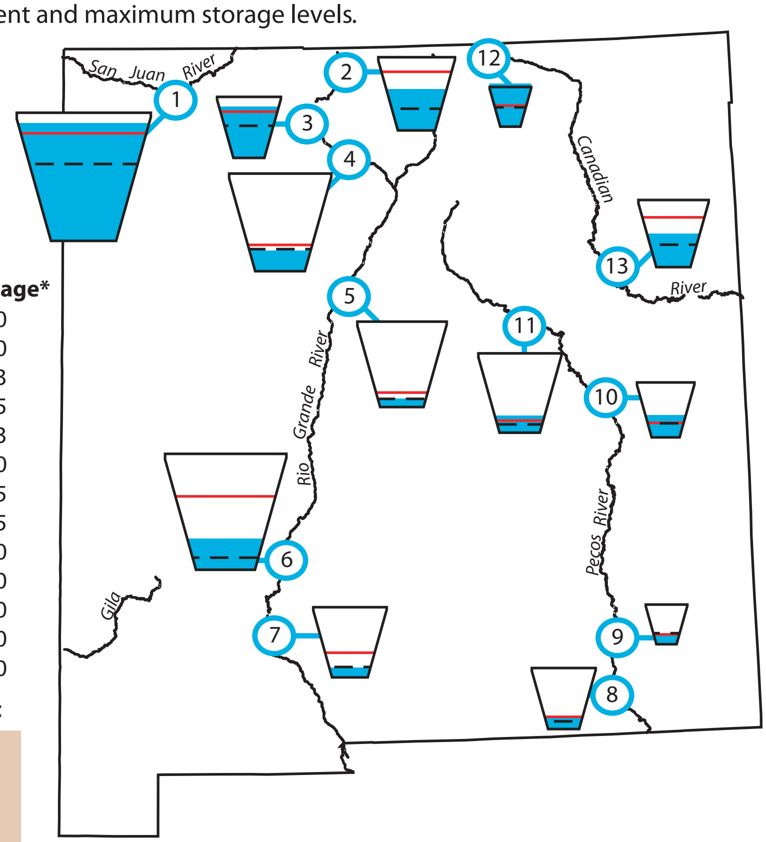
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service. For additional information, contact Tom Pagano at the National Water Climate Center (tpagano@wcc.nrcs.usda.gov; 503-414-3010) 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 June 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	92%	1,564.7	1,696.0
2. Heron	57%	227.3	400.0
3. El Vado	84%	156.4	186.3
4. Abiquiu	21%	116.5	554.5
5. Cochiti	10%	49.5	502.3
6. Elephant Butte	27%	559.5	2,065.0
7. Caballo	14%	47.8	331.5
8. Brantley	20%	29.8	147.5
9. Lake Avalon	22%	1.3	6.0
10. Sumner	41%	41.6	102.0
11. Santa Rosa	21%	95.5	447.0
12. Costilla	108%	17.2	16.0
13. Conchas	50%	126.5	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 Fire Summary

(updated 7/19/05)

Source: Southwest Coordination Center

The number of fires and area burned in the Southwest increased dramatically since mid-June, with 3,391 fires charring 580,246 acres through July 19 (Figure 7a), excluding wildland fire use and prescribed burns. Human-caused fires account for more than 3 times the number of fires ignited by lightning, but lightning-caused fires have burned more than 163,000 more acres. Arizona continues to have more human-caused fires and acreage, more lightning-caused fires and acreage, and therefore more total fires and acreage. In fact, Arizona has had 79 percent of the total wildfires in 2005 in the Southwest, which accounts for 96 percent of the acres burned.

There have been 91 large wildfires in Arizona and New Mexico since January (Figure 7b). These fires account for nearly 530,000 acres burned. The region's largest fire to date is the Cave Creek Complex, north of Phoenix, which charred 248,310 acres from June 21–July 11. An additional 11 blazes (6 in Arizona and 5 in New Mexico) were treated as wildland fire use. The Black Range Complex in New Mexico, the largest wildland fire use blaze, burned nearly 71,000 acres. Four of these large fires have cost over $1 million each to fight, the most expensive of which has been the Florida fire near Green Valley, Arizona with a $7.2 million price tag as of July 19.

Notes:

The fires discussed here have been reported by federal, state, or tribal agencies during 2005. The figures include information both for current fires and for fires that have been suppressed. Figure 7a shows a table of year-to-date fire information for Arizona and New Mexico. Prescribed burns are not included in these numbers. Figure 7b indicates the approximate location of past and present "large" wildland fires and prescribed burns. A "large" fire is defined as a blaze covering 100 acres or more in timber and 300 acres or more in grass or brush. The red symbols indicate wildfires ignited by humans or lightning. The green symbols are prescribed fires started by fire management officials. The name of each fire is provided next to the symbol.

On the Web:

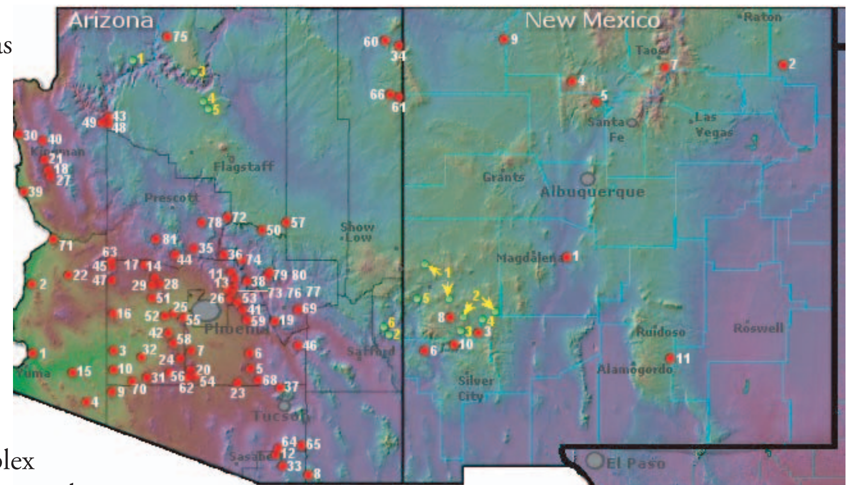
These data are obtained from the Southwest Area Wildland Fire Operations website:

http://www.fs.fed.us/r3/fire/swapredictive/swaintel/daily/ytd-daily-state.htm
http://www.fs.fed.us/r3/fire/swapredictive/swaintel/daily/ytd-large-map.jpg

Figure 7a. Year-to-date fire information for Arizona and New Mexico as of July 19, 2005.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	2,234	190,116	436	368,614	2,670	558,730
NM	333	18,388	388	3,128	721	21,516
Total	2,567	208,504	824	371,742	3,391	580,246

Figure 7b. Year-to-date wildland fire location. Map depicts large fires of greater than 100 acres burned as of July 21, 2005.



Wildland Fires

Arizona

1. Hidden
2. Bosque
3. Oatman Flat
4. Camino
5. Foster
6. Chapman
7. Haley Hills
8. Sunday
9. Growler Peak
10. 2000
11. St. Clair
12. Salero
13. Bart
14. Vulture
15. Getting
16. Eagle
17. Nuke
18. Sacramento
19. Skunk
20. Top
21. Shiner
22. Brenda
23. Green
24. Vekol
25. Goodyear
26. Memorial
27. Secret
28. Yoda
29. Bobby
30. Hulet
31. Goldwater
32. Theba
33. Aztec
34. Red Valley 1
35. Sunset Point
36. Cave Creek Complex
37. Cottonwood
38.Three Complex
39. Marsh
40.Perkins Complex
41. Boulder
42. Drain
43. Hindu
44. Humbug
45. Jane
46. Saddle
47. Bighorn
48. Matuck
49. Plain Tank
50. Zane
51. Bute
52. Buck
53. Ghost
54. Sand Tank Complex
55. West Estrella
56. Home
57. Line
58. Tracks
59. Liberty
60. Round Rock 3
61. Sawmill 2
62. Eagle Eye
63. Agro
64. Florida
65. Empire
66. Fluted Rock
67.
Missle
69. Dude
70. Crater
71. Enas
72. Bull Run
73. Mesquite
74. Oak
75. Ridge Complex
76. Edge
77. Valentine
78. Butte
79. Salome
80. Greenback
81. J. Canyon

New Mexico

1. Mitchell
2. Gladstone
3. East Fork
4. Mesa Camino
5. Valle
6. Bar Y Ranch
7. Osha Park
8. Cooper
9. Romine
10. Brush
11. Indian

Wildland Fire Use

Arizona

1. Tuweep,
2. Snake Ridge
3.Dragon Complex
4. Mudersbach
5. North-Skinner
6. Sunflower

New Mexico

1. North Fork
2. Black Range
3. Ring
4. Wahoo
5. Willow

Monsoon Summary (through 7/20/05)

Source: Western Regional Climate Center

Precipitation totals have been low during July, with less than 0.50 inches falling at most locations in the Southwest (Figure 8a). Some portions of south-central Arizona and eastern New Mexico received from 1.00–2.50 inches during the past three weeks. The precipitation totals are near to below average region-wide, except in small sections of eastern New Mexico (Figures 8a–b). The main reason for the low precipitation is the late onset of the monsoon in the southwestern United States. A ridge of high pressure centered over northwestern Mexico prevented the transport of moisture into Arizona and New Mexico. The high pressure is typically farther north, near the Four Corners area, which allows for the transport of monsoon moisture from the southeast. The dewpoint temperature criteria were met on July 18 at both Tucson and Phoenix to declare the official onset of the monsoon. This date marks the second latest onset for Tucson and one of the top three latest for Phoenix.

Long-lead outlooks for the NOAA-Climate Prediction Center (see Figure 10a) and the International Research Institute for Climate Prediction indicate increased chances of below-average precipitation in much of the Southwest over the next 3 months. This means that the region may experience a drier-than-average monsoon.

Notes:

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. Departure from average precipitation is calculated by subtracting the average from the current precipitation.

The continuous color maps (Figures 8a–c) 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 data used to create these maps is provisional and have not yet been subjected to rigorous quality control.

Figure 8a. Total precipitation in inches July 1–July 20, 2005.

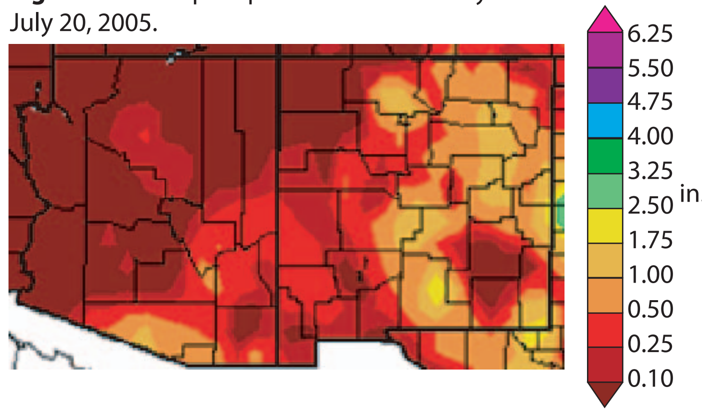


Figure 8b. Departure from average precipitation in inches July 1–July 20, 2005.

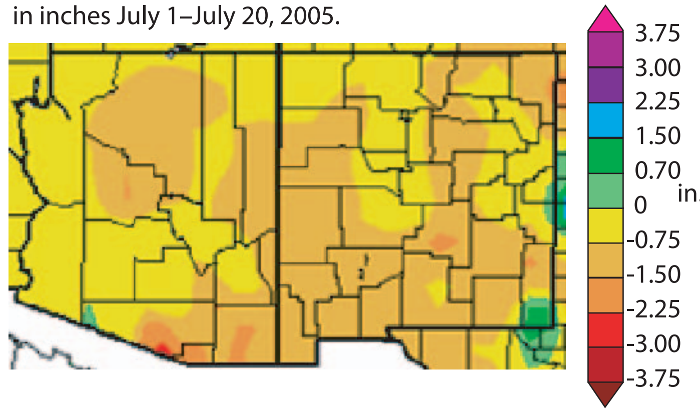
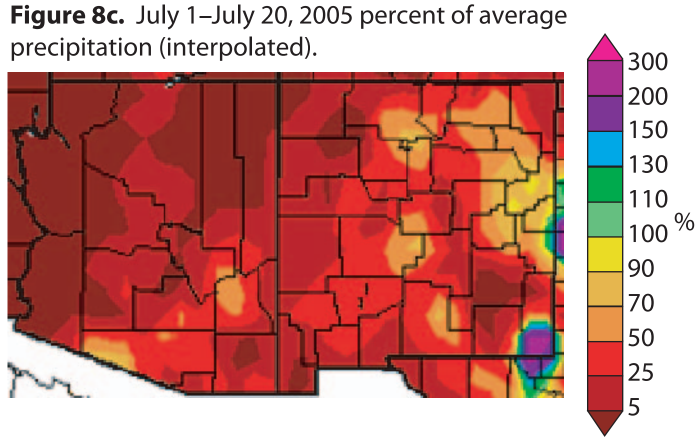


Figure 8c. July 1–July 20, 2005 percent of average precipitation (interpolated).



On the Web:

These data are obtained from the Western Regional Climate Center:

http://www.wrcc.dri.edu

Temperature Outlook
(August 2005–January 2006)
Source: NOAA Climate Prediction Center

According to the NOAA-CPC, the Southwest will not see a respite from the recent above-average temperatures. Long-lead temperature outlooks indicate increased chances of above-average temperatures in Arizona and most of New Mexico through January 2006 (Figures 9a–d). The highest probabilities are centered over southern and western Arizona, with the greatest values from August–October (Figure 9a). The forecasts are based on a strong consensus of various statistical and dynamical models, as well as recent trends. Outlooks issued by the International Research Institute for Climate Prediction (not shown) generally agree with the CPC outlooks, although some slight differences exist in the area covered and the magnitude of the probabilities in 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 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 temperature forecast for August–October 2005.

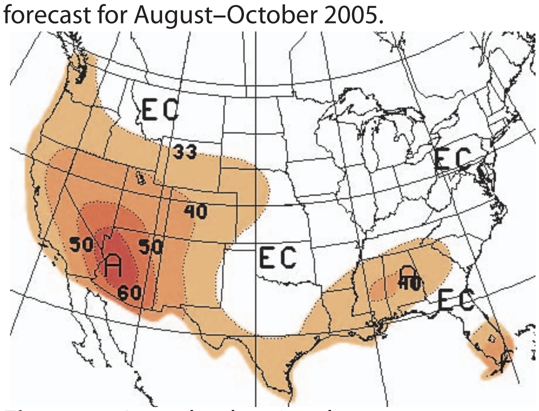


Figure 9b. Long-lead national temperature forecast for September–November 2005.

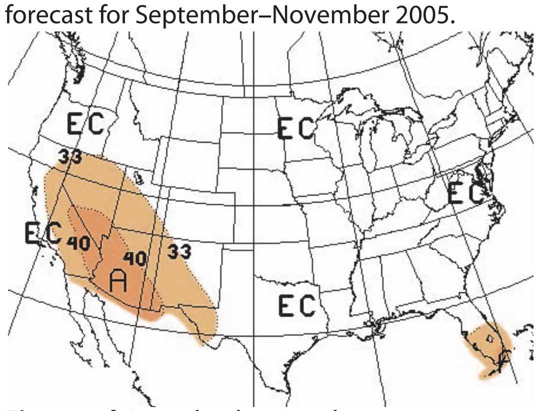


Figure 9c. Long-lead national temperature forecast for October–December 2005.

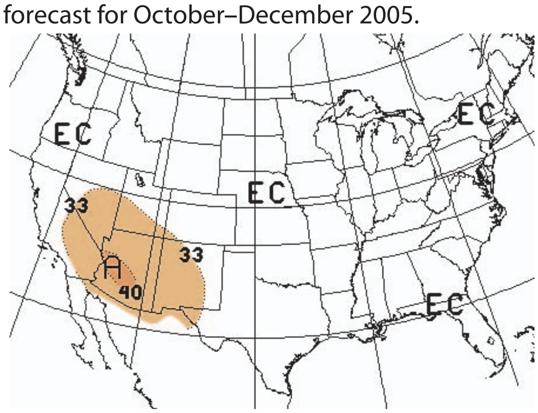
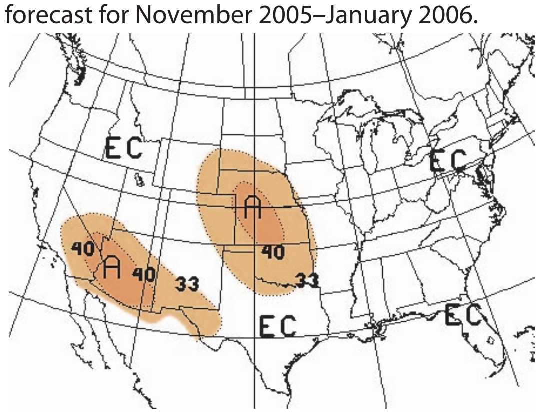


Figure 9d. Long-lead national temperature forecast for November 2005–January 2006.



A= Above
- 60.0–69.9%
- 50.0–59.9%
- 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

(August–January 2006)

Source: NOAA Climate Prediction Center

Long-lead forecasts from the NOAA-CPC show increased chances of below-average precipitation in Arizona and the western two-thirds of New Mexico from August–October (Figure 10a). This means that the monsoon would be dry and weak, which implies decreased fuel moisture and increased fire potential in the region. The seasonal wildland fire outlook covering July 15 through October (not shown) therefore blankets most of the Southwest with above-average wildland fire potential. Models indicate no forecasted anomalies in Arizona or New Mexico for the remainder of the forecast period (Figures 10b–d). The CPC states that there is moderate agreement between the statistical and dynamical models for precipitation probabilities in the Southwest through October, but very few reliable trends in subsequent months.

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 10a. Long-lead national precipitation forecast for August–October 2005.

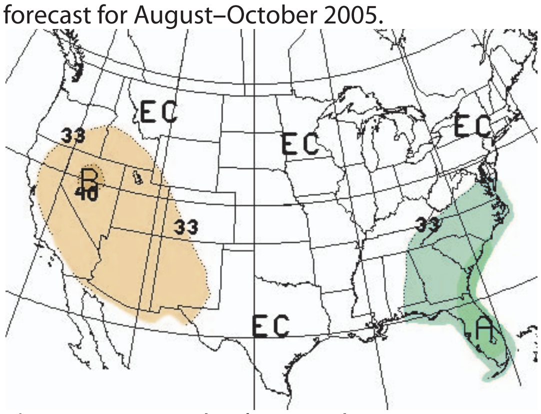


Figure 10b. Long-lead national precipitation forecast for September–November 2005.

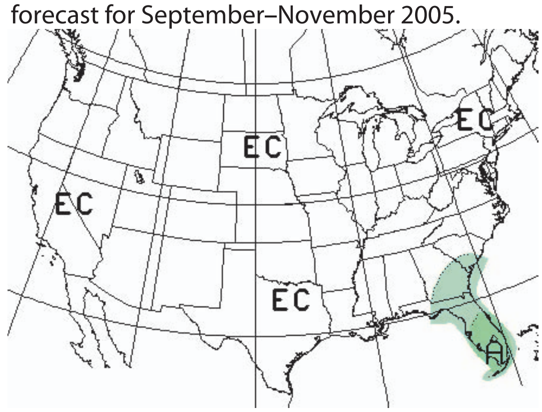


Figure 10c. Long-lead national precipitation forecast for October–December 2005.

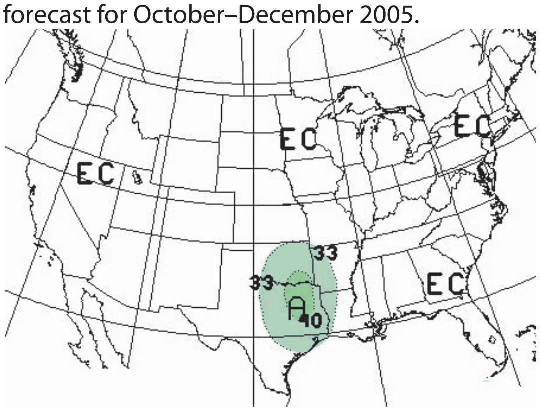
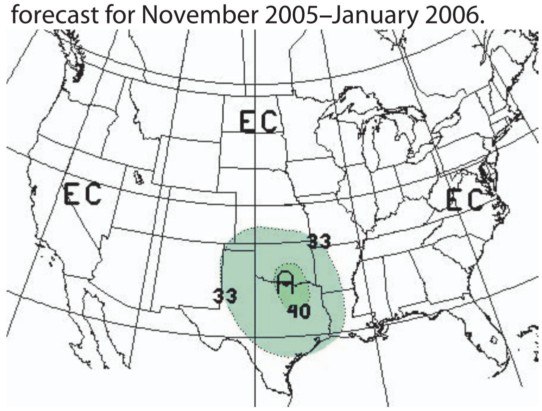


Figure 10d. Long-lead national precipitation forecast for November 2005–January 2006.



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 October 2005)

Sources: NOAA Climate Prediction Center

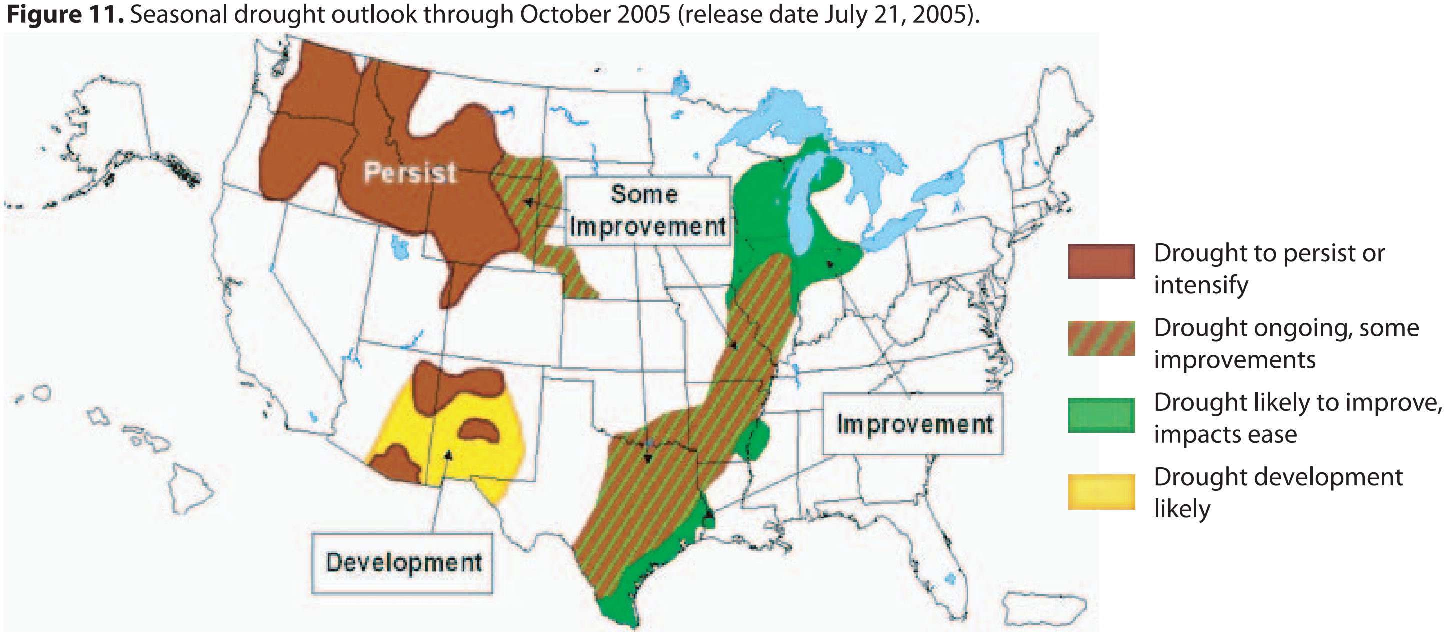
The seasonal drought outlook from the NOAA-Climate Prediction Center (CPC) indicates persistent drought conditions through October in the portions of the Southwest that are currently in moderate drought (Figure 11). The CPC predicts that drought will develop in eastern Arizona and most of New Mexico where abnormally dry conditions now exist. The CPC recognizes the importance of the much-above-average precipitation in the Southwest during the water year, but the late monsoon onset is the major reason for the forecast of the persistence or the development of drought in the region. Given the below-average precipitation in previous years when the monsoon was late (only 70–90 percent of average for June–September), the experts predict a drier-than-average June–September period. They also believe that these deficits will result in the development of moderate drought. Statistical and dynamical models used for the long-lead precipitation outlooks also point to a weak monsoon and dry conditions through October.

The seven Colorado River Basin states recently met to work toward a drought plan for the river. According to the *Rocky Mountain News* (July 20), federal water officials, including Secretary of the Interior Gail Norton, are now involved with a two-year public process aimed at deciding the management of the river. The first set of public hearings will take place this week in Salt Lake City, Utah and Henderson, Nevada. A major issue is the ability of the Colorado River to support the region's increasing population. It is not only the large metropolitan areas where population growth is occurring. *The Arizona Republic* (June 24) reports that the state rural population doubled to over 1 million since 1980, and experts expect another 500,000 rural residents by 2030.

Notes:

The delineated areas in the Seasonal Drought Outlook (Figure 11) are defined subjectively and are based on expert assessment of numerous indicators, including outputs of short- and long-term forecasting models.

Figure 11. Seasonal drought outlook through October 2005 (release date July 21, 2005).



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

Wildland Fire Outlook

Sources: National Interagency Coordination Center, Southwest Coordination Center

According to the National Interagency Coordination Center (NICC), fire potential in the Southwest ranges from normal in eastern New Mexico to critical in western New Mexico and most of Arizona through the end of July (Figure 12a). The above-average to critical fire potential also extends through Nevada into southeastern Oregon and southern Idaho. Similar conditions also exist in southwestern Washington and from northern Louisiana to Michigan. Below-average fire potential exists in the northern Great Plains and from the central Gulf Coast to extreme southeastern Virginia. The high fire potential in the Southwest is due to the availability of dry fine fuels, such as grasses, particularly at the lower elevations. The prolonged dry conditions due to a late monsoon onset led to additional drying. Analysis of regional fuels indicates that grasses are cured and the amount of new growth is above average (Figure 12b). Live fuel moisture remains near to above average, but sagebrush moisture has decreased dramatically in the past month. The NICC also expects the late onset to increase fire potential in higher elevations in piñon-juniper and ponderosa stands. The Southwest has therefore been upgraded to "Preparedness Level 4," meaning that large fires are common and fire-fighting resources may be strained.

Figure 12a. National wildland fire potential for fires greater than 100 acres (valid July 1–30, 2005).

Figure 12b. Current fine fuel condition and live fuel moisture status in the Southwest.

Current Fine Fuels						
Grass Stage	Green		Cured			
New Growth	Sparse		Normal		Above Normal	x

Live Fuel Moisture	
	Percent of Average
Ponderosa Pine	90–100
Douglas Fir	85–95
Piñon	80–95
Juniper	85–100
Sagebrush	200–240
1000-hour dead fuel moisture	**8–13**
Average 1000-hour fuel moisture for this time of year	**8–14**

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces monthly wildland fire outlooks. The forecasts (Figure 12a) consider climate forecasts and surface-fuels conditions in order to assess fire potential for fires greater than 100 acres. They are subjective assessments, based on synthesis of regional fire danger outlooks.

The Southwest Area Wildland Fire Operations produces monthly fuel conditions and outlooks. Fuels are any live or dead vegetation that are capable of burning during a fire. Fuels are assigned rates for the length of time necessary to dry. Small, thin vegetation, such as grasses and weeds, are 1-hour and 10-hour fuels , while 1000-hour fuels are large-diameter trees. The top portion of Figure 12b indicates the current condition and amount of growth of fine (small) fuels. The lower section of the figure shows the moisture level of various live fuels as percent of average conditions.

On the Web:

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

Southwest Area Wildland Fire Operations (SWCC) web page:
http://www.fs.fed.us/r3/fire/

El Niño Status and Forecast

Sources: NOAA Climate Prediction Center, International Research Institute for Climate Prediction

The running average of the Southern Oscillation Index (SOI) continues to show a negative, though increasing, value (Figure 13a). It is still indicative of neutral conditions in the tropical Pacific Ocean. The International Research Institute for Climate Prediction (IRI) reports that sea surface temperatures are slightly warmer than average, but also point toward neutral ENSO conditions. Further evidence of neutral conditions includes a lack of wind direction shifts, no large-scale ocean-atmosphere coupling, and no anomalous changes in ocean structure.

Probabilistic ENSO forecasts from IRI indicate that the likelihood of neutral conditions in the tropical Pacific Ocean decrease slightly through June 2006, but it has the greatest likelihood of occurrence during the period (Figure 13b). It remains at least 15 percent above the historical average probability. Chances for El Niño stay at 25 percent through next year. La Niña conditions are very unlikely to develop, with probabilities of only 5–10 percent. These chances are based on the most recent observations and output from the majority of a large set of statistical and dynamical models. The NOAA-Climate Prediction Center reports similar conclusions. Some anomalous conditions exist in the tropical Pacific, according to the IRI. Experts expect any of their impacts to be localized.

Notes:

Figure 13a shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through May 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 13b 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/

Figure 13a. The standardized values of the Southern Oscillation Index from January 1980–June 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).

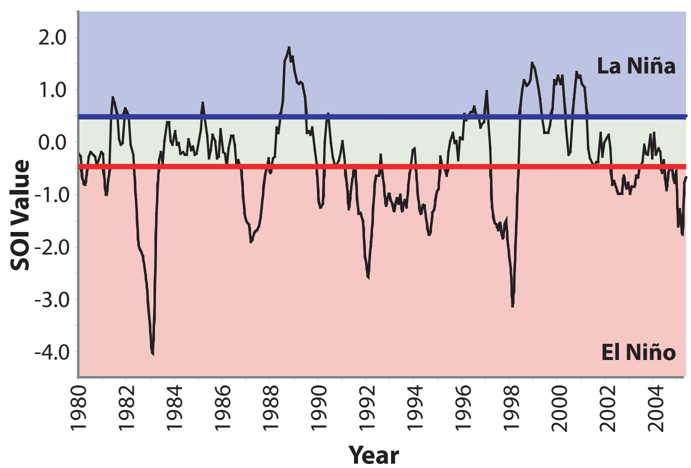
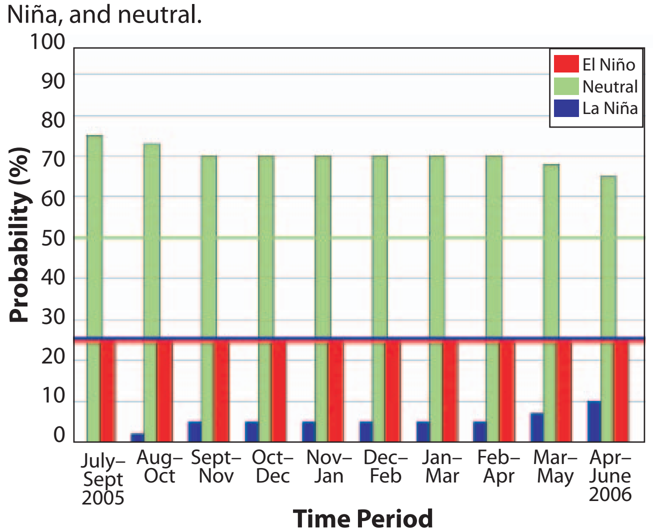


Figure 13b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released July 21, 2005). Colored lines represent average historical probability of El Niño, La Niña, and neutral.

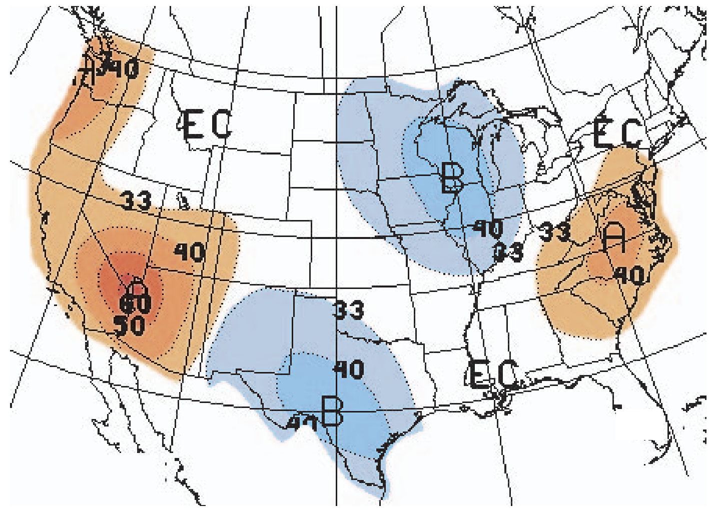


Temperature Verification
(April–June 2005)

Source: NOAA Climate Prediction Center

Long-range outlooks from the NOAA-Climate Prediction Center for April–June 2005 showed increased chances of above-average temperatures in Arizona and extreme northwestern New Mexico, as well as along the West Coast (Figure 14a). The highest probabilities were in western Arizona, southern Nevada, and southeastern California. Models predicted increased chances of cooler-than-average conditions for most of the remainder of New Mexico and into Texas. Elsewhere, forecasts indicated increased chances of warmer-than-average conditions from the Southeast to the Mid-Atlantic region and cooler-than-average conditions in the Midwest. Nationwide, temperatures during the period ranged from 5 degrees F below average to 5 degrees F above average (Figure 14b). The models performed best in eastern and central Arizona and in parts of the Northwest, where they predicted increased chances of warmer-than-average conditions, and in eastern New Mexico and Texas, where they showed increased chances of below-average temperatures. Model performance was worst in the Midwest and along the East Coast, although the small departures from average values were not significant.

Figure 14a. Long-lead U.S. temperature forecast for April–June 2005 (issued March 2005).



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%

EC= Equal chances. No forecasted anomalies.

Notes:

Figure 14a shows the NOAA Climate Prediction Center (CPC) temperature outlook for the months April–June 2005. This forecast was made in March 2005.

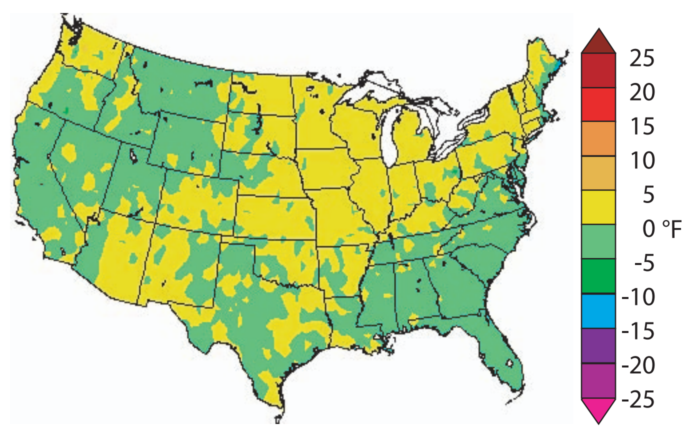
The April–June 2005 NOAA CPC outlook predicts the likelihood (chance) of above-average, average, and below-average temperature, but not the magnitude of such variation. The numbers on the maps do not refer to degrees of temperature. Care should be exercised when comparing the forecast (probability) map with the observed temperature maps described below.

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 14b shows the observed departure of temperature (°F) from the average for April–June 2005 period.

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 14b. Average temperature departure (in degrees F) for April–June 2005.



On the Web:

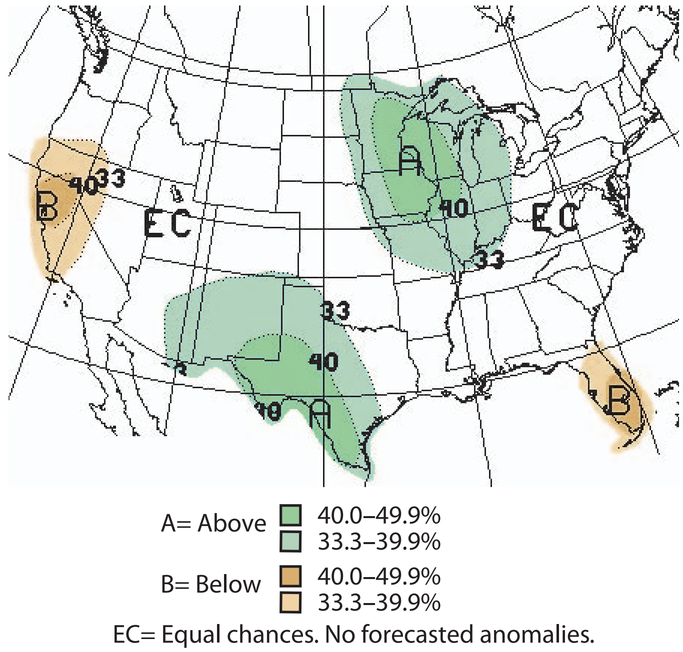
For more information on CPC forecasts, visit:
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Precipitation Verification
(April–June 2005)

Source: NOAA Climate Prediction Center

Forecasts from the NOAA-CPC indicated increased chances of above-average precipitation from eastern Arizona to central Texas and in the Midwest for April–June 2005 (Figure 14a). Models forecasted increased chances of drier-than-average conditions in northern California and most of Florida. Most of the area from the U.S.-Mexico border to the Great Lakes and southern New England were drier than average, although portions of the Southwest received above-average precipitation (Figure 14b). Elsewhere, conditions were wetter-than-average in northern New England, portions of the Southeast, and from the West Coast into the northern Great Plains. Models performed poorly in all regions where they indicated precipitation anomalies. Areas where they predicted increased chances of above-average precipitation were drier than average, and areas where the models forecasted increased chance of below-average precipitation were wetter than average. Other regions, which were shown to have no forecasted anomalies were generally well-above or well-below average precipitation.

Figure 15a. Long-lead U.S. precipitation forecast for April–June 2005 (issued March 2005).



Notes:

Figure 15a shows the NOAA Climate Prediction Center (CPC) precipitation outlook for the months April–June 2005. This forecast was made in March 2004.

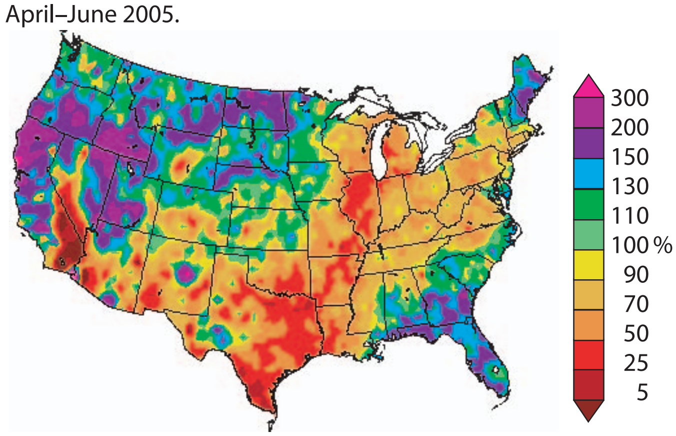
The April–June 2005 NOAA CPC outlook predicts the likelihood (chance) of above-average, average, and below-average precipitation, but not the magnitude of such variation. The numbers on the maps do not refer to inches of precipitation. Care should be exercised when comparing the forecast (probability) map with the observed precipitation maps described below.

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 15b shows the observed percent of average precipitation for April–June 2005.

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 15b. Percent of average precipitation observed from April–June 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