Issued: May 24, 2005

CLIMAS
Southwest Climate Outlook

May Climate Summary

Hydrological Drought – Drought impacts continue to ease in much of the Southwest, as snowmelt runoff feeds reservoirs.

- Lake Powell storage is expected to increase through July 2005. However, combined storage at Lake Powell and Lake Mead is still well below capacity.
- Storage in most Arizona and New Mexico reservoirs continued to increase. Most New Mexico reservoirs, remain below 35 percent of capacity.

Temperature – During the past 30 days temperatures in the Southwest were generally cooler than average.

Precipitation – Water year precipitation is above average for most of the Southwest. During the past 30 days, southern Arizona and southwestern and eastern New Mexico have been drier than average. Northern Arizona and northwestern New Mexico received above-average precipitation, chiefly during late April.

Climate Forecasts – Seasonal temperature outlooks call for increased chances of above-average temperatures in the Southwest. Seasonal precipitation outlooks call for slightly increased chances of below-average precipitation in the Southwest this summer. Precipitation is rarely predicted in the summer.

El Niño – Neutral conditions have the highest probability of occurrence in the tropical Pacific Ocean, although the probability of continuing El Niño conditions remains above average.

The Bottom Line – Above-average streamflow, from runoff of above-average snowpack, especially in northern New Mexico, will continue to ameliorate hydrological drought conditions Southwest. Summer season forecasts indicate increased chances of above-average temperatures and below-average precipitation in the Southwest.

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

Reservoir Debate

Drought-depleted Lake Powell will release its usual allocation this year, following a May directive from the U.S. Interior Secretary. The decision favors Arizona and other Lower Basin states, which argued that reducing its downstream flow would reduce Glen Canyon Dam's and Hoover Dam's ability to supply electricity. New Mexico and other Upper Basin states had argued that abundant precipitation since fall meant Lake Mead should provide more of the Lower Basin's share of the Colorado River.

See Arizona Reservoir Levels (page 9) 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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Tree-ring records inform water management decisions

Workshop strives for better integration of past with present

BY DUSTIN GARRICK AND KATHY JACOBS

Water managers seeking new decision support tools and the scientists developing them congregated May 5 in Tucson to discuss how looking at the past may help inform future water planning efforts.

The workshop brought together key western water managers and paleoclimate researchers—those who use tree rings and other natural records to reconstruct what the climate was like hundreds or even thousands of years ago. Participants were specifically looking at how to incorporate dendrohydrology information into water planning. Dendrohydrology involves using tree ring qualities, typically the width of the annual growth rings, to estimate hydrological values, such as the annual streamflow of a specific river.

Among the outcomes of the meeting were a long list of research and collaborative opportunities, expanded interest in historic flow reconstructions on the part of water managers, and some lessons learned about how to structure meetings to encourage conversations across the perceived gulf between scientists and water managers.

Recent episodes of prolonged drought have functioned as a wake-up call for water supply managers seeking to satisfy demands in the context of water supply uncertainty and variability. Though most of the Southwest has had a wet winter, the severity of recent drought conditions is still fresh in residents' minds, and the low water levels in the Colorado reservoirs are a constant reminder that the drought is likely not over yet.

Meanwhile, conditions in the Pacific Northwest are very dry. The water managers in the room clearly understood the importance of having better climate information, especially in providing context for long-term infrastructure decisions and for drought planning.

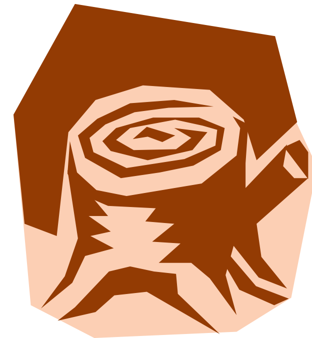
The conference reflected the increasing interest in paleoclimate information, such as tree-ring based streamflow reconstructions, for use in water management and reservoir storage operations. Paleoclimate research and hydrologic reconstructions can aid water managers by extending the historical record of streamflow and other key water planning parameters—such as temperature—beyond the instrumental record, which covers approximately the past 100 years.

The lead workshop organizers were Connie Woodhouse of the National Oceanic and Atmospheric Administration (NOAA) Paleoclimatology Program, and Robert S. Webb of NOAA. They were joined by co-organizers from two NOAA-funded projects: the Western Water Assessment and the Climate Assessment for the Southwest (CLIMAS), in conjunction with the University of Arizona's Laboratory of Tree-Ring Research and UA's Water Resources Research Center. CLIMAS hosted the conference with funding from NOAA. The meeting advanced two overarching goals: broadening the use of paleoclimatic data and expanding the application of these data in water management contexts.

Water Management

Water planning needs and priorities took center stage from the outset with presentations by water managers who have incorporated paleoclimatic reconstructions into their planning processes. They recounted experiences integrating paleoclimate research into water resource planning.

Denver Water is working to use tree-ring records in tandem with their water supply simulation model to estimate the occurrence, frequency, and intensity of drought in the Colorado and Platte River basins, according to Steve Schmitzer, the head of water resource analysis. Tree-ring reconstructions have provided the agency with an enhanced understanding of streamflow and water demands during drought periods.



In Arizona, the recent drought coupled with the findings of tree-ring reconstructions have prompted water managers at the Salt River Project to consider long-term drought in planning activities, noted Charlie Ester, manager of the Phoenix-based agency's water resource operations.

SRP has linked with UA researchers from the Laboratory of Tree-Ring Research to investigate simultaneous drought in the Salt River and Colorado River basins. The agency was surprised that preliminary findings show that synchronous drought in their two water supply sources are more common than was previously thought. This is not good news for SRP, and it has motivated development of new strategies to prepare for potential water supply shortfalls caused by broad regional drought events.

Ester concluded that the question, "Is the drought over?" may not be particularly relevant. Even if this drought is over, there will definitely be another one in the future, he pointed out.

"We always get alternating periods of wet and dry years, so we need to start planning for worst-case scenarios now." Ester said.

continued on page 3

Paleo meeting, continued

Ben Harding, principal engineer at Hydrosphere Resource Consultants presented on the potential benefits and lingering challenges of applying tree-ring and other paleoclimate research. He noted that water managers need to make decisions about the future, and paleohydrology information (for example, Figure 1) can help by providing a "surrogate for experience that tends to show you the large-scale structure of wet and dry periods."

However, like others, Harding warned that looking at such records does not allow predictions of specific future conditions, in part because conditions are changing in the context of global warming. Climate change scenarios predict average temperatures in the West will continue to rise in the foreseeable future because of the ongoing input of greenhouse gases from cars, industry, and land use changes. The warming has hydrological impacts, such as a tendency toward earlier melting of the mountain snow that sustains western rivers.

Harding also identified attributes of paleohydrologic data that have prevented wider adoption and application. For example, tree-ring reconstructions are often hard to connect to specific management decisions because the information is not available in locations where it is needed for water management. Often the measured data at key gauges do not have long-term, continuous records. In some cases the records are also less accurate than what is needed for high-quality calibration of the trends. Streamflow gauges may not be located appropriately to correlate to available tree-ring data, Harding noted.

The focus on water resource planning needs continued in a panel discussion involving high-level water managers from five states. The participants spanned the gamut of responsibilities, from reservoir operations at the Bureau of Reclamation to drought planning in New Mexico. The panel was asked how paleoclimate information has been and could be utilized by managers. Though several managers pointed out that they do not currently use tree ring information, all indicated that they were interested in doing so.

One theme that emerged from the panel discussion was the need to manage water resources in the context of uncertainty and to accommodate the role of politics and political pressure in the application of scientific findings.

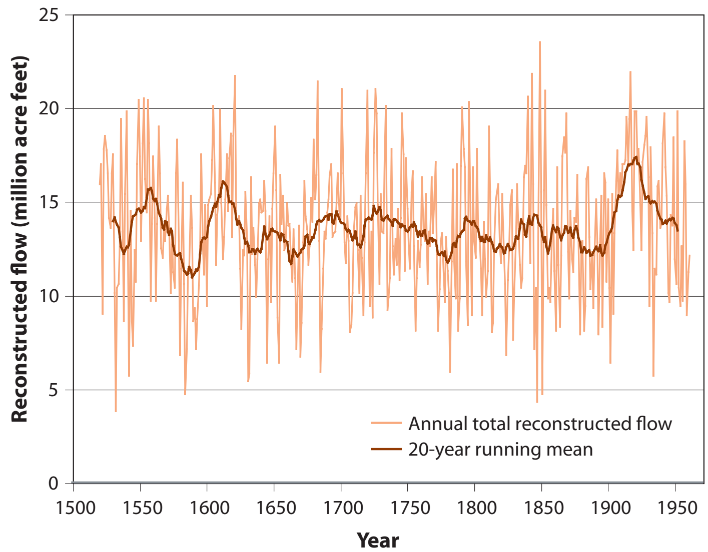


Figure 1. A 442-year record of Colorado River streamflow reconstructed from tree-ring evidence shows that variability is the norm, but high-flow or low-flow years often cluster together to span decades. The values are given in million of acre-feet from 1520 through 1961 and estimate streamflow throughout the Colorado River's 246,000-square-mile basin. Values are derived from tree-ring widths that were calibrated with U.S. Bureau of Reclamation records since 1906 based on gauged flow at Lee's Ferry, Arizona. Some of the scientists at the workshop are preparing an updated version of this record that extends into recent years. Source: Meko et al. 1995. *Water Resources Bulletin,* 31:789–801.

"Every decision is filtered through the political process, and this must be added to the science to come up with the correct method," noted Don Ostler, executive director of the Upper Colorado River Commission.

The notion of triggers—as indicators of drought conditions and water supply variability—also produced a lively discussion between scientists and managers. Water managers expressed the need for triggers that induce specific management procedures and operational measures. This provides a measure of insulation, separating them from the political pressures that are always looming in the water arena.

Paleoclimate Science

The morning concluded with a presentation session by paleoclimate scientists to identify how ongoing research in the Colorado and Platte River basins can support water management decisions.

Many different Colorado River streamflow reconstructions, using varied statistical approaches, show good agreement with regard to the major periods of high and low flow, according to findings presented by David Meko, an associate research professor at the UA Laboratory of Tree-Ring Research. However, a comparison of Colorado River streamflow reconstructions showed significant differences in the precise volume of reconstructed streamflow.

Meko also presented work in progress, which shows that the average volume of flow at Lee's Ferry may actually be higher than the 13.5 million acre-feet that is frequently cited as the long-term average flow based on tree-ring records. However, even this higher long-term average is less than the average used in appropriating Colorado River water. Thus, the most up-to-date science still shows that the Colorado is over-appropriated.

The morning session laid the groundwork for a series of breakout groups in

continued on page 4

Paleo meeting, continued

the afternoon. Scientists and managers convened to identify potential arenas for incorporating tree-ring and other paleoclimate research in water management settings. These breakout groups highlighted the need for enhanced outreach and communication with policymakers to assuage concerns about the level of uncertainty and variation among paleoclimate reconstructions. Water managers also urged further validation of the connections between tree-ring information and streamflow, despite strong concurrence among the scientists that their findings are statistically valid.

Water managers and scientists were eager to exchange ideas in the breakout session. These conversations pointed to relatively easy opportunities to enhance integration of paleoscience into water planning as well as more ambitious proposals for collaborative projects. Scientists and managers realized, for example, that there is a great need to publish findings in publications commonly read by water managers, instead of in scientific journals—the usual practice by paleoscientists. Another idea was to use a National Academy of Sciences panel to develop standardized research methods and criteria that could offer politicians and water managers a seal of approval to help justify the use of paleoclimate information.

The meeting culminated with an overview by co-organizer Kathy Jacobs that synthesized the conference into a set of core messages. Paleoclimate reconstructions have provided a critical long-term frame of possible water supply scenarios that significantly broadens the perspective of water managers, she noted.

Understanding the full range of historic climate conditions allows comparison with conditions experienced during the careers of current water managers, Jacobs surmised. Long-term instrumental records show the period from about the 1970s through the mid-1990s was relatively wet, so our idea of "normal" may be skewed. In spite of the variation among tree-ring reconstructions, the studies do tell consistent stories about the fluctuations from high- to low-flow years, as well as long-term drought.

Jacobs, who is the deputy director for the UA Center for Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA), also noted that the implications of drought are regionally specific, and paleoclimate information allows us to have a view of the synchroneity of droughts and implications for watersheds at various scales. There is a need to have such information tailored to individual water supply systems.

Managers at the workshop underscored the need for a better understanding of the nature and source of uncertainty, and the need to develop paleoclimate data that can be tailored to specific decisions, such as the Colorado River water supply shortage negotiations. Among specific data needs, water managers seek improved estimation of the "natural" flows—those adjusted for reservoir operations and other depletions—that feed water supply planning and modeling efforts, as well as increased focus on accurate gauging of flows.

Workshop participants also suggested further evaluation of the role of soil moisture in affecting tree ring data, since soil moisture processes may dampen or delay the effect of climate on tree growth. In addition, they noted a need to focus on communication of the findings of paleoclimate research so that it reaches decisionmakers at the right time and in an accessible format. It is particularly important to put the historic information in the context of the growing population in the Southwest and increasing demand for water supplies, since these factors may overwhelm the climate signal in making reservoir operation decisions.

The workshop generated substantial interest in future projects. Two suggestions that workshop organizers are eager to follow through on are the development of an interactive paleohydrology data and analysis web tool, and the development of workshops and training sessions that bring paleohydrology to an audience of water professionals and decision makers.

Working together, participants agreed, scientists and resource managers can use paleohydrological research and analyses to help water resources decisionmakers develop better worst-case scenarios, and to understand the geographic scales of multi-year periods of low-and-high flows. With adequate funding and time, tree-ring scientists should be busy responding to water managers' suggestions for developing reconstructions of flows from unregulated high-elevation stream gauges, Colorado River tributaries, such as the Green River, and examining spring temperature and snowpack—climatic keys to streamflow during the season of high water demand.

Dustin Garrick is a PhD student in Geography at the University of Arizona. Kathy Jacobs is an associate professor at the UA Water Resources Research Center and Soil, Water and Environmental Science Department.

Resources on the Web

- Conference webpage (hosted by CLIMAS)
  http://www.ispe.arizona.edu/climas/conferences/CRBpaleo/index.html
- NOAA Paleoclimatology Program
  http://www.ngdc.noaa.gov/paleo/paleo.html/
- Laboratory of Tree-Ring Research, University of Arizona
  http:// www.ltrr.arizona.edu/

Temperature (through 5/18/05)

Sources: High Plains Regional Climate Center

Average water year temperatures have ranged from around 30 degrees Fahrenheit in the higher elevations to mid-60s in southwestern Arizona (Figure 1b). Overall, temperatures in the Southwest have been slightly above average since October 1. The coolest departures from average were in west-central Arizona, with the warmest departures in northeastern Arizona and northwestern New Mexico and southeastern New Mexico (Figure 1a). Temperatures over the past 30 days were generally near to below average across the Southwest (Figures 1c-d). Portions of western Arizona and eastern New Mexico were up to four degrees Fahrenheit (F) below average.

The National Weather Service (NWS) reports that the average temperature through the end of April at Tucson was 59.3 degrees F, which is 1.3 degrees F above average. This departure is slightly less than the 2–3 degree F above-average temperatures experienced in January and February. According to the Albuquerque NWS, temperatures across New Mexico were near average, except in the southeastern corner of the state where temperatures were slightly below normal.

Figure 1a. Water year '04–'05 (through May 18, 2005) departure from average temperature.

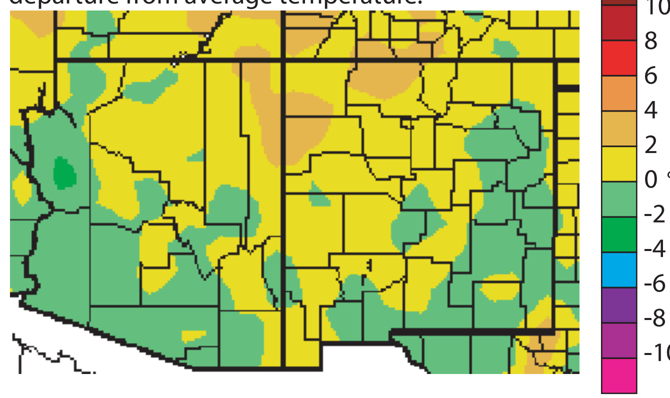


Figure 1b. Water year '04–'05 (through May 18, 2005) average temperature.

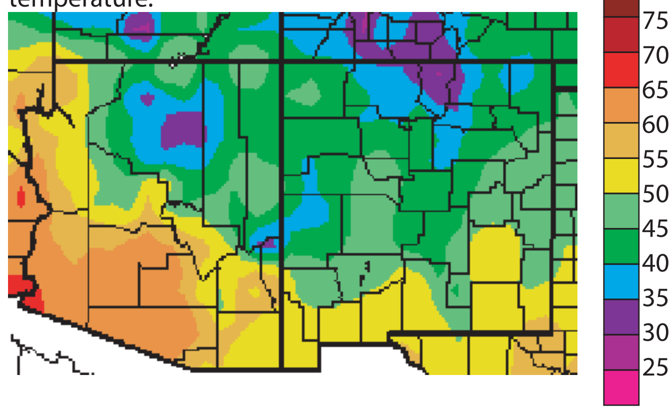


Figure 1c. Previous 30 days (April 19–May 18, 2005) departure from average temperature (interpolated).

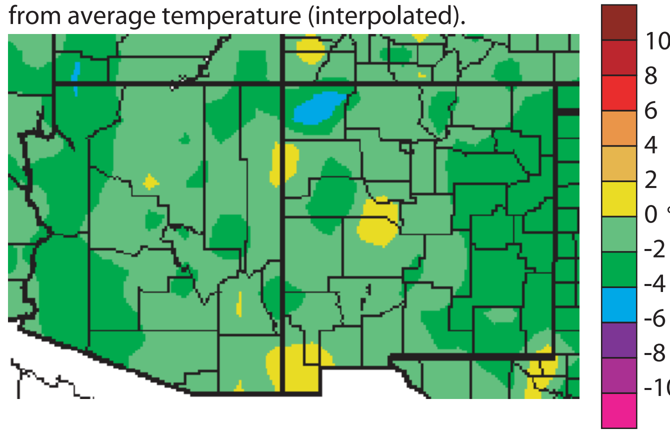
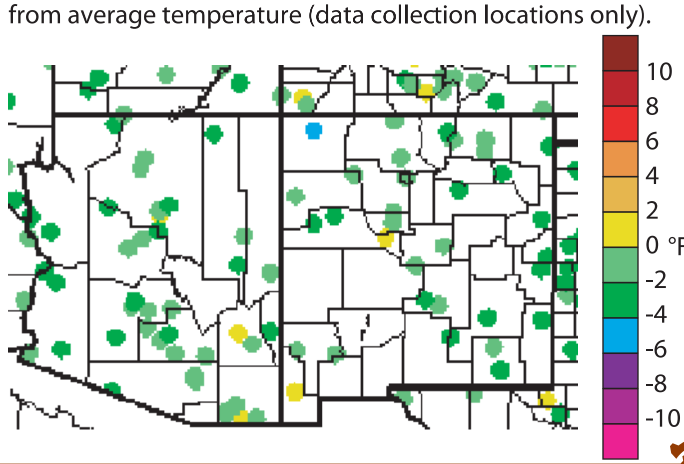


Figure 1d. Previous 30 days (April 19–May 18, 2005) departure from average temperature (data collection locations only).



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 5/18/05)

Source: High Plains Regional Climate Center

Overall, precipitation since October 1 is much above average in the Southwest (Figures 2a–b). Most locations range from 130 to over 200 percent of average precipitation. The main exception is southeastern Arizona, where only 50–90 percent of average precipitation has been recorded, a trend that has been present since May 2004. The past 30 days were drier than average along much of the western and southern Arizona borders and in most of southern, central, and eastern New Mexico (Figures 2c–d). Some of these areas received less than 25 percent of average precipitation from mid-April to mid-May. Northern Arizona and northwestern New Mexico had some of the highest percent of average precipitation values, as several storm systems clipped these areas. The Albuquerque National Weather Service (NWS) reports that water year precipitation in New Mexico is 176 percent of average, which is the fourth wettest departure since records have been kept (starting in 1895). In addition, the first four months of 2005 were the wettest on record for the period and the fifth wettest for the entire state since 1895. The wet winter and early spring has brought mixed images for northern New Mexico residents. Weeds are causing headaches for homeowners and park supervisors (*Santa Fe New Mexican*, April 30), but butterfly enthusiasts are being treated to an abundance of Painted Lady and other species of butterflies (*Santa Fe New Mexican*, April 26).

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 May 18, 2005 percent o average precipitation (interpolated).

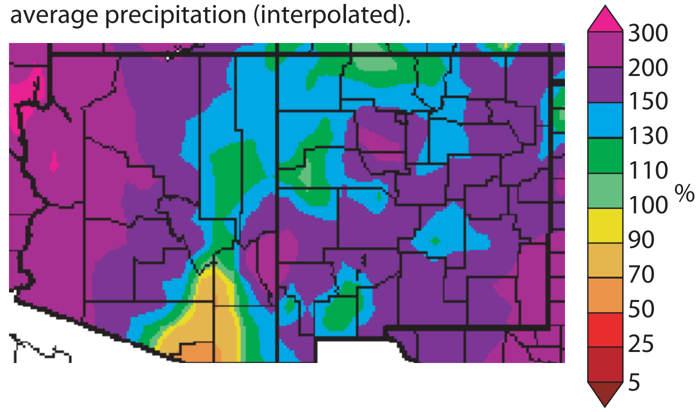


Figure 2b. Water year '04–'05 throughMay 18, 2005 percent of average precipitation (data collection locations only).

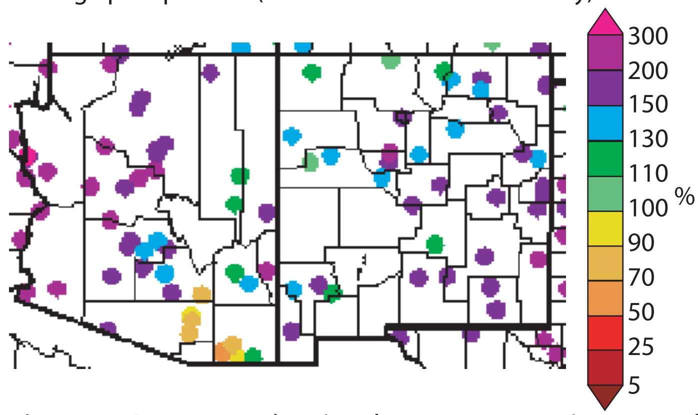


Figure 2c. Previous 30 days (April 19–May 18, 2005) percent of average precipitation (interpolated).

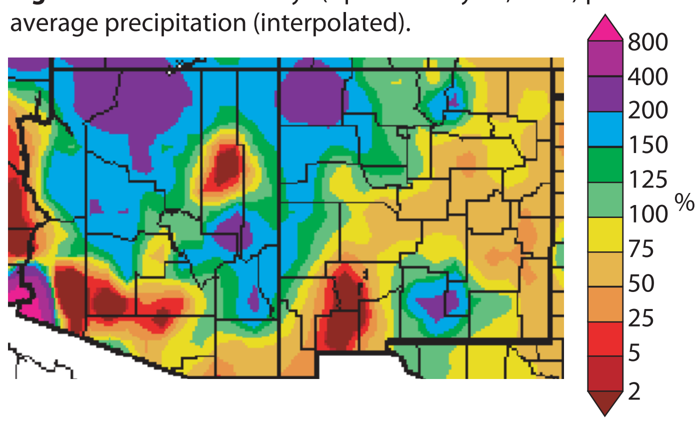
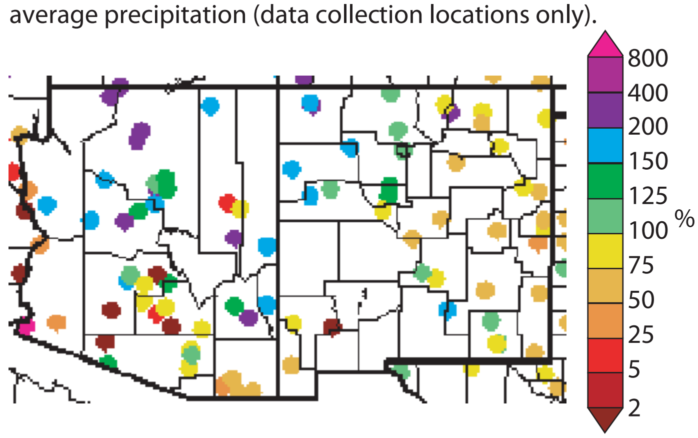


Figure 2d. Previous 30 days (April 19–May 18, 2005) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(released 5/19/05)

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

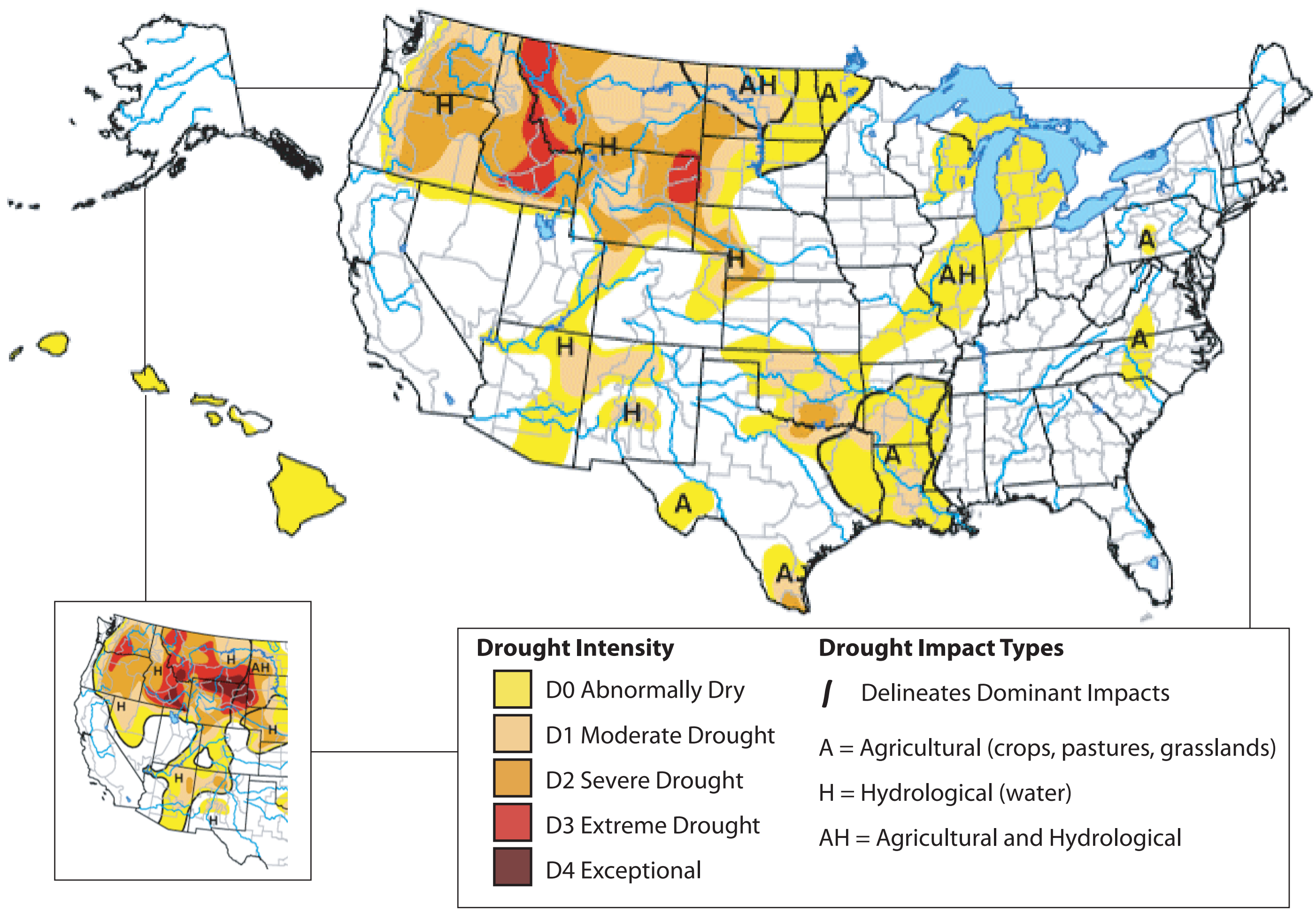
Drought conditions continue to improve in the Southwest (Figure 3). The Flagstaff, Arizona area and extreme northern New Mexico have been removed from all drought classifications since mid-April due to wetter-than-average conditions. Above-average precipitation and snowpack in northeastern Arizona and north-central New Mexico resulted in complete elimination of severe drought. The remainder of the West has seen improvement as well, but abnormally dry to severe drought conditions have begun to appear in the Northwest. Pasture and range land status (not shown) also indicates the positive effects of recent precipitation in the Southwest. Arizona has 41 percent of pasture and range land in good to excellent condition and only 22 percent in poor or very poor condition. The situation is better in New Mexico, where 60 percent of pasture and range land is in good to excellent condition, and only 7 percent is poor to very poor. In late April, the Bureau of Reclamation announced a new Water 2025 Challenge Grant Program (Bureau of Reclamation News Release, April 26). The program encourages governments in the West to propose cooperative projects between the states and the Bureau of Reclamation that will lead to more efficient water use.

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 author of this monitor is David Miskus, JAWF/CPC/NOAA.

Figure 3. Drought Monitor released May 19, 2005 (full size) and April 21, 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 4/15/05)

Source: New Mexico Natural Resources Conservation Service

Drought conditions in New Mexico have improved over the past several months due to above-average precipitation, including much snow in the high elevations. Most basins in northern New Mexico still had from 150–200 percent of average snow water content (SWC) as of May 19 (see Figure 7). Many typically dry rivers now have flowing water due to the winter precipitation. Spring runoff led to 150 percent of average flow on the Rio Grande in late April (*El Defensor Chieftain*, April 27). Officials reported that it was the highest volume seen in some areas since 1995. With snowpack still in the mountains, flow may become even greater. The Natural Resources Conservation Service predicts 150–180 percent of average flow through the remainder of the spring and early summer (see Figure 12). This means that the state's reservoirs, most of which remain well-below capacity, will increase in storage in the coming months.

Abnormally dry to moderate drought conditions persist in central and northwestern New Mexico, however (see Figure 3). Earlier this month, the Los Alamos National Laboratory opened a new $4.5 million water treatment facility (*U.S. Water News*, May 2005). The Sanitary Effluent Reclamation Facility removes silica from waste water so the water can be used in the cooling towers of the lab's computing center (*Santa Fe New Mexican*, May 4). Lab officials expect the facility to save approximately 21 million gallons of water per 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.

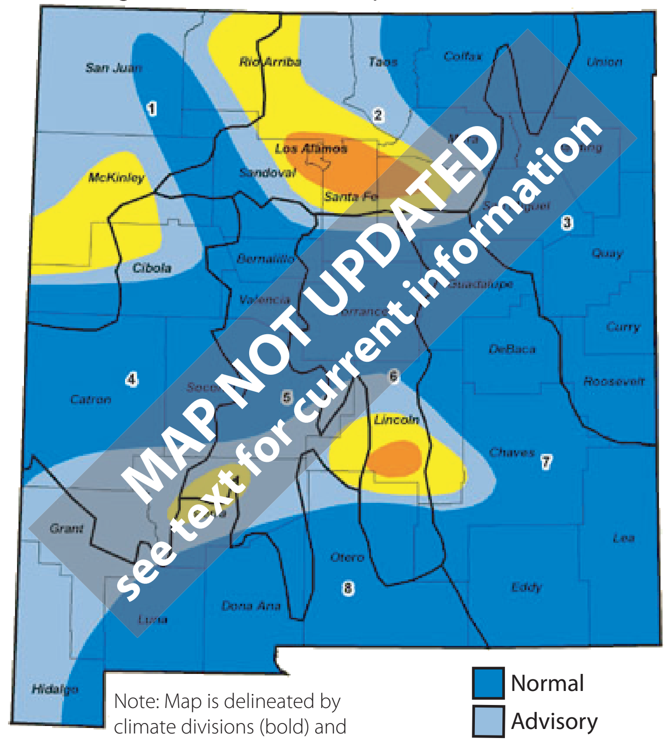
Figure 4a shows short-term or *meteorological* drought conditions. Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) over a relatively short duration (e.g., months). Figure 4b refers to long-term drought, sometimes known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

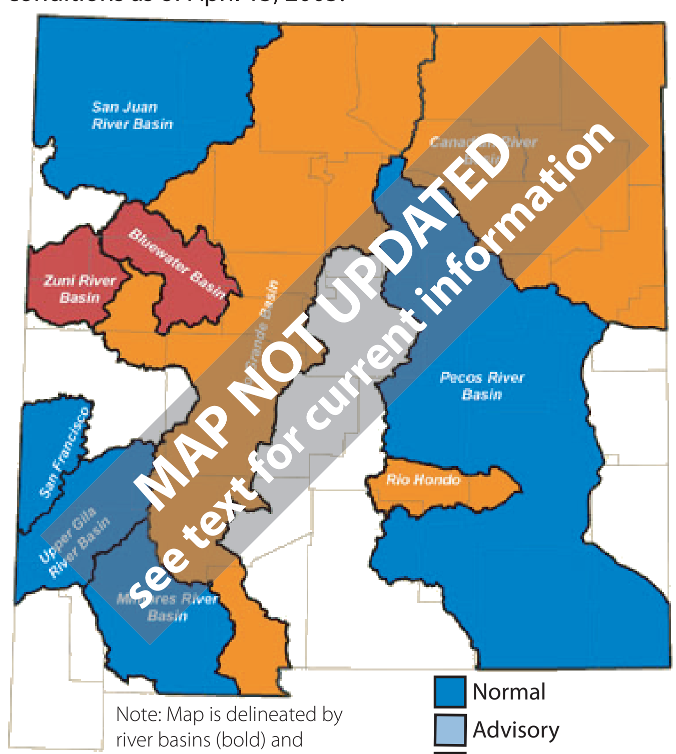
Figure 4a. Short-term drought map based on meteorological conditions as of April 15, 2005.



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 April 15, 2005.



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

- Normal
- Advisory
- Alert
- Warning
- Emergency

Arizona Reservoir Levels
(through 4/30/05)

Source: National Water and Climate Center

Arizona reservoirs continue to reap the benefits of the above-average winter precipitation. Much of the snowpack in Arizona has melted, and many state rivers and lakes are filling with the runoff. Five of the state's reservoirs are above 90 percent of capacity (Figure 5). All lakes, except Lake Powell, are above last year's levels. Only two lakes, Mead and San Carlos, had storage decreases since March. The largest increase occurred at Lyman Reservoir, which rose by 20 percent of capacity. Lake Powell, which is at its lowest level since the late 1960s, rose by 2 percent of capacity. Arizona is one of only four western states with above-average statewide reservoir storage. As of May 1, statewide reservoirs held approximately 83 percent of the usable water, 20 percent above the average. This is significantly higher than 2004 when statewide reservoirs held only 35–40 percent of usable water.

In early May, Secretary of the Interior Gale Norton announced that current water releases from Lake Powell would be sustained for the remainder of the 2005 water year (U.S. Department of the Interior News Release, May 2). The decision was based on input from the Colorado River Management Work Group. The news release also reports that Norton will meet again with the group at the end of May to discuss other Colorado River Basin issues, such as future drought plans. The Clean Water Coalition, following a study of water movement in Lake Mead, wants to continue plans to install a $585 million pipeline to transport and release treated wastewater from southern Nevada cities to the bottom of the lake (*Las Vegas Review-Journal*, May 17). A final assessment and strategy will be released in July 2006.

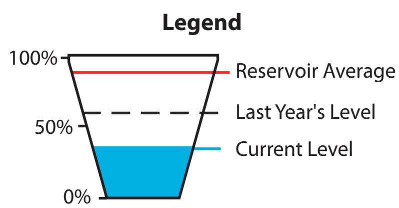
Notes:

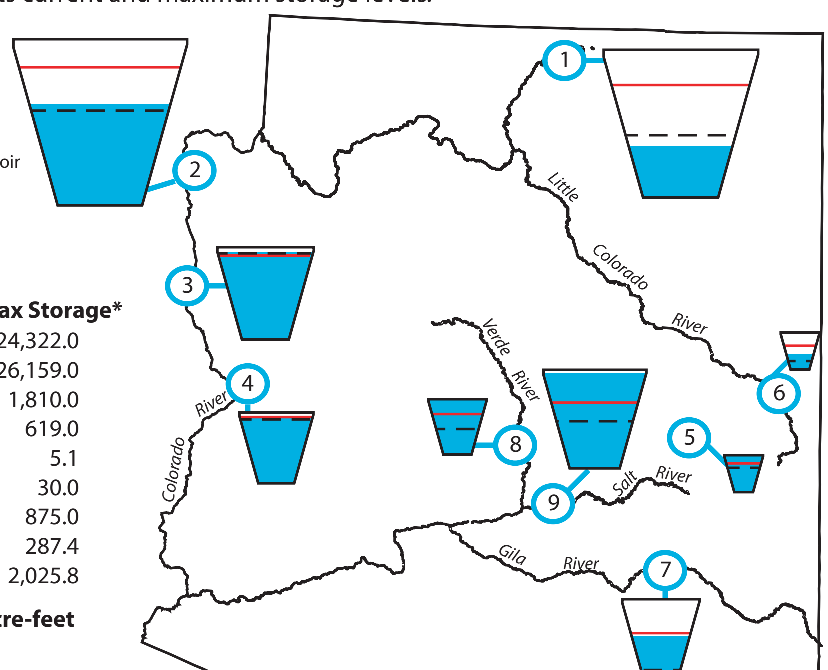
The map gives a representation of current storage levels for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total 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 April 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	35%	8,538.0	24,322.0
2. Lake Mead	61%	15,869.0	26,159.0
3. Lake Mohave	94%	1,708.6	1,810.0
4. Lake Havasu	95%	585.8	619.0
5. Show Low Lake	100%	5.1	5.1
6. Lyman Reservoir	41%	12.2	30.0
7. San Carlos	49%	425.0	875.0
8. Verde River System	99%	285.8	287.4
9. Salt River System	96%	1,936.8	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 4/30/05)

Source: National Water and Climate Center

Storage increased in many reservoirs in New Mexico in the past month. The largest rises occurred at Conchas and Navajo reservoirs, 13 and 12 percent of capacity respectively. While the increases pushed a few lakes to or above 33 percent full, all of them remain much below capacity, except for Navajo (Figure 6). Most lakes are also above last year's storage. Statewide storage increased and was approximately 35 percent of usable contents as of May 1. This is below the average of 50 percent, but it is better than 2004. Total New Mexico reservoir storage is nearly 700,000 acre-feet more than last year (New Mexico State Basin Outlook Report, May 1). Low reservoir levels are part of the reason why abnormally dry to moderate hydrological drought persists in portions of New Mexico (see Figure 3).

Elephant Butte Irrigation District directors recently allotted two acre-feet of water to each area farmer during the irrigation season (KOBTV, May 12). This is more than in 2004, but it is one acre-foot less than the allotment in previous years. *The Santa Fe New Mexican* (May 13) reports that flow in the Chama River between El Vado and Abiquiú reservoirs could be cut during the week of May 16, depending on storage at Elephant Butte. The Rio Grande Compact prohibits storing water in many reservoirs upstream of Elephant Butte when it holds less than 400,000 acre-feet. Once it reaches that volume storage may commence at other reservoirs. According to the article, the state estimates that Elephant Butte would reach that volume around May 20, due to high flow from above-average snowpack and streamflow.

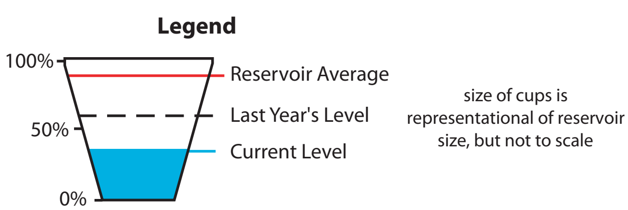
Notes:

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.

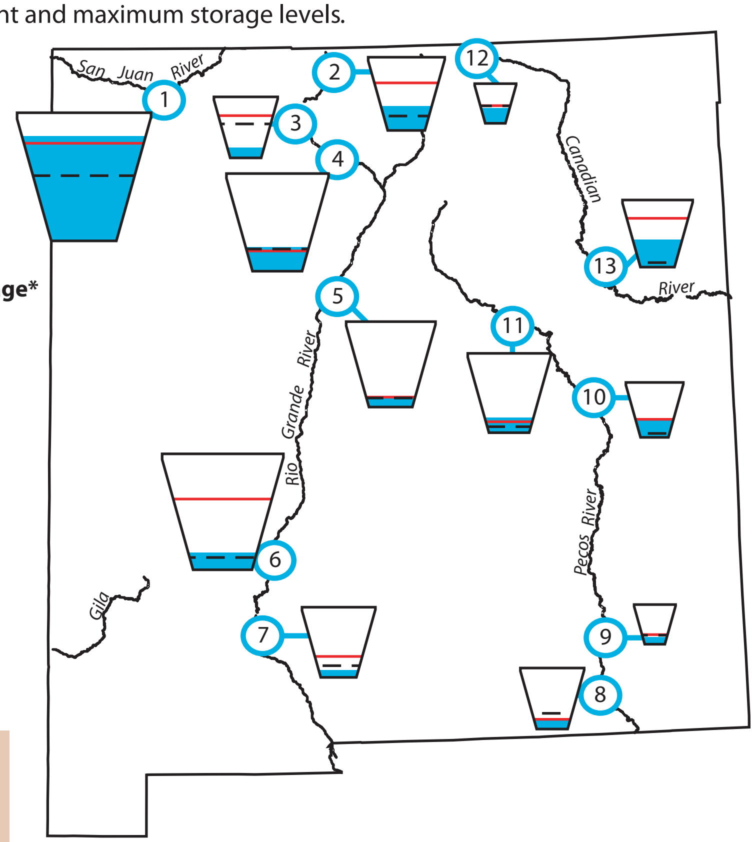
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service. For additional information, contact Tom Pagano at the National Water Climate Center (tpagano@wcc.nrcs.usda.gov; 503-414-3010) 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 April 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	82%	1,389.4	1,696.0
2. Heron	33%	133.2	400.0
3. El Vado	17%	31.8	186.3
4. Abiquiu	25%	139.0	554.5
5. Cochiti	12%	59.0	502.3
6. Elephant Butte	15%	309.3	2,065.0
7. Caballo	10%	32.9	331.5
8. Brantley	18%	25.9	147.5
9. Lake Avalon	18%	1.1	6.0
10. Sumner	31%	31.4	102.0
11. Santa Rosa	19%	85.0	447.0
12. Costilla	38%	6.0	16.0
13. Conchas	41%	103.5	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

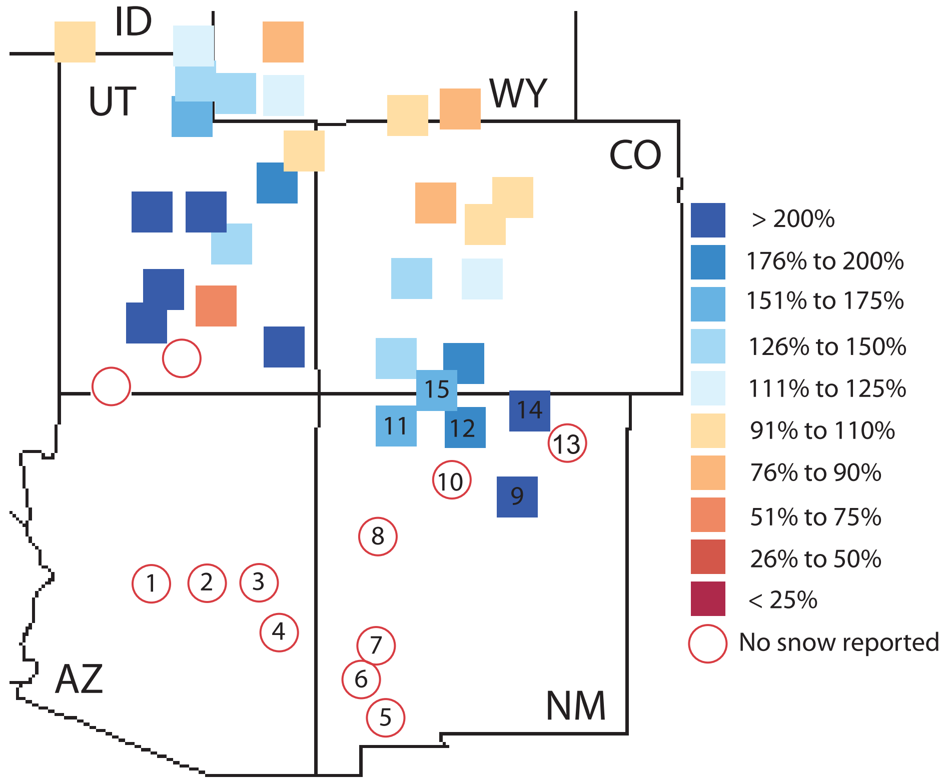
(updated 5/19/05)

Source: National Water and Climate Center

Above-average snow water content (SWC) persists in many basins with SNOTEL sites in the Southwest (Figure 7). However, the only location in Arizona still reporting snowpack is the San Francisco Peaks (not shown). This area and the locations around the North Rim of the Grand Canyon received from 2–14 inches of snow with a late April storm according to the Flagstaff National Weather Service (NWS). This same storm also contributed to already high snowpack in New Mexico. Basins in northern New Mexico range from 150 to nearly 300 percent of average SWC.

Snow in lower elevations and southern basins across the Southwest has already melted, and led to some flooding. The Taos Soil and Water Conservation District, the Taos County road department, and volunteers worked to protect homes near the Rio Costilla in late April (*Santa Fe New Mexican*, April 28). As temperatures warm in May and June, high streamflow and flooding will continue to be a threat in the region. The Grand Junction NWS issued flood watches for the weekend of May 21–22 for several counties in southwestern Colorado. According to data from the U.S. Bureau of Reclamation (USBR), Lake Powell has risen more than 15 feet since early April with over six feet of the increase occurring in the first three weeks of May. Hydrologists with the USBR expect a 45 foot increase at Powell though July (*Deseret Morning News*, April 26).

Figure 7. Average snow water content (SWC) in percent of average for available monitoring sites as of May 19, 2005.



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

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

Notes:

Snowpack telemetry (SNOTEL) sites are automated stations that measure snowpack depth, temperature, precipitation, soil moisture content, and soil saturation. A parameter called snow water content (SWC) 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 in Arizona and New Mexico, based on SNOTEL sites in or near the basins, compared to the 1971–2000 average values. Data for Utah, Colorado, and parts of Wyoming and Utah are also shown, since these states contribute to runoff and streamflow in the Colorado River basin. 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.

On the Web:

For a table of snowpack data, visit:
http://www.wcc.nrcs.usda.gov/snow/update.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

Southwest Fire Summary

(updated 5/15/05)

Source: Southwest Coordination Center

According to the Southwest Coordination Center (SWCC), the total number of fires, number of large fires, and acreage burned in the Southwest through the end of April 2005 was below average. Total fire count during the month of April alone was approximately half the average. The number of large fires was near average, which pushed the acreage burned for the month to near average.

As of May 15, year-to-date fire information shows that 441 fires have burned nearly 41,000 acres in Arizona and New Mexico (Figure 8a). The majority of these fires (422) and the resultant acreage burned (40,224) were human-caused. Prescribed fires account for another 236 fires and 84,780 acres (National Interagency Coordination Center [NICC], May 15). No wildland fire use activities have been reported to date.

Another nine large fires, all in Arizona, were reported since our last issue. Among the fires in the past month are Chapman, Haley Hills, Sunday, Growler Peak, St. Clair, 2000, Vulture, Bart, and Salero. The first six fires listed are shown in Figure 8b, but the Vulture, Bart, and Salero fires ignited after the SWCC developed their most recent map (NICC, May 18). The latter three fires add another 16,534 acres to the count for the year. This means that 17 large fires have burned approximately 85 percent of the total 2005 acreage through mid-May, disregarding prescribed fires.

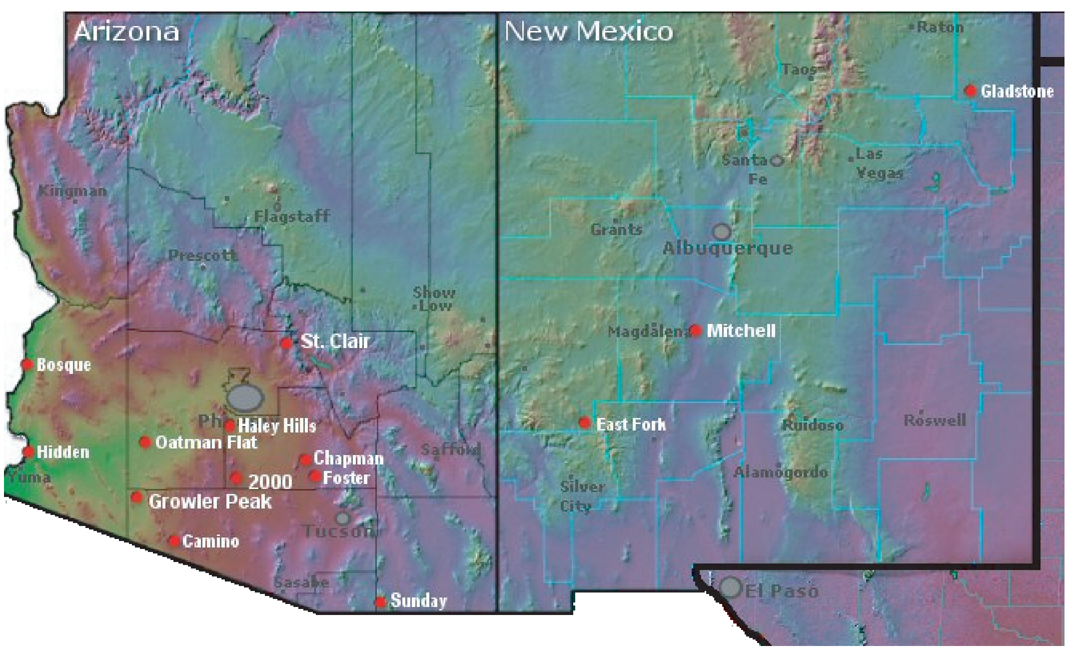
Notes:

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 8a shows a table of year-to-date fire information for Arizona and New Mexico. Prescribed burns are not included in these numbers. Figure 8b 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.

Figure 8a. Year-to-date fire information for Arizona and New Mexico as of May 15, 2005.

Location	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
Arizona	316	24,747	5	348	321	25,095
New Mexico	106	15,477	14	225	120	15,702
Total	422	40,224	19	573	441	40,797

Figure 8b. Year-to-date wildland fire location. Map depicts large fires of greater than 100 acres burned as of May 15, 2005.



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

Temperature Outlook
(June–November 2005)
Source: NOAA Climate Prediction Center

The NOAA-CPC long-lead temperature outlooks are consistent with last month's products. Models indicate increased chances of warmer-than-average conditions in the Southwest, southern Rocky Mountains, along the West Coast, and from the Southeast to southern Texas from July through October (Figures 9a–c). The highest probabilities are present in Arizona, southern Nevada, and southeastern California. The increased chances of below-average temperatures shown in the northern Great Plains from July–August (Figure 9a) disappear in later periods. Increased chances of above-average temperatures remain in much of the Southwest and some surrounding areas from September–November (Figure 9d). The statistical and dynamical forecast models show strong agreement in the first period (Figure 9a); thereafter, the outlooks are based on a combination of model output and trends.

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 June–August 2005.

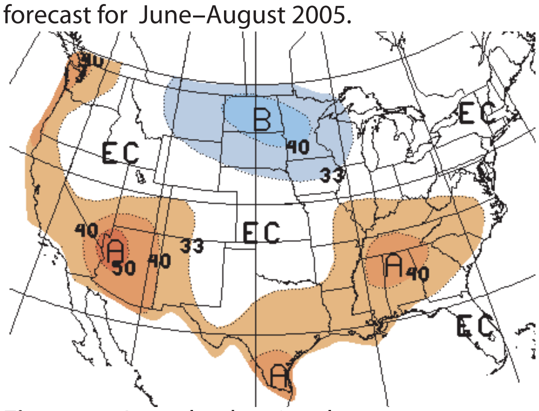


Figure 9b. Long-lead national temperature forecast for July–September 2005.

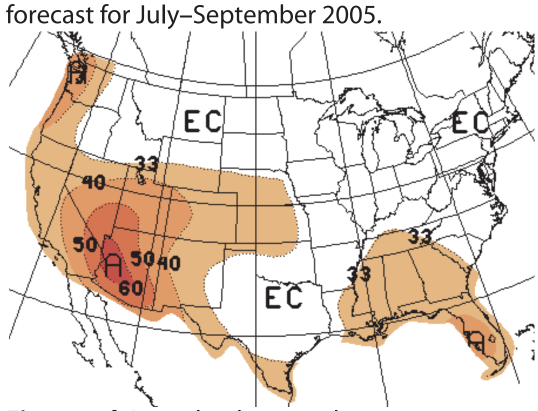


Figure 9c. Long-lead national temperature forecast for August–October 2005.

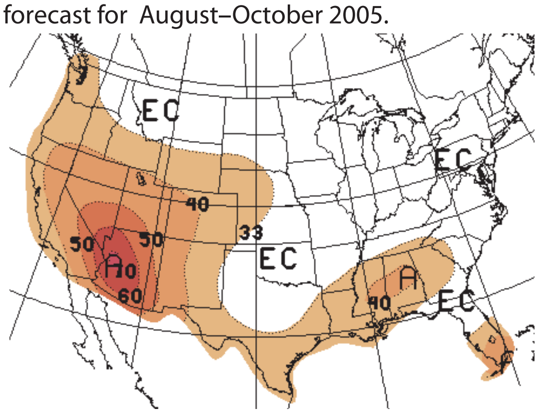
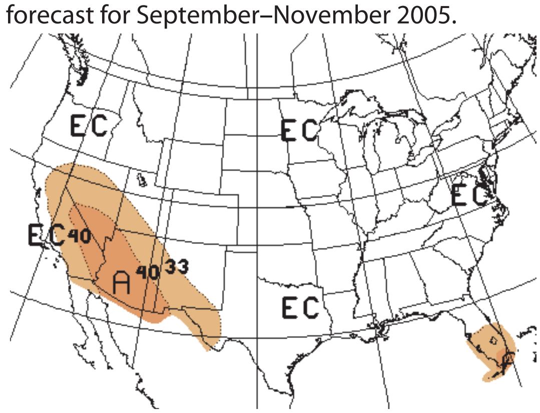


Figure 9d. Long-lead national temperature forecast for September–November 2005.



A= Above
- 60.0–69.9%
- 50.0–59.9%
- 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/

Precipitation Outlook

(June–November 2005)

Source: NOAA Climate Prediction Center

Long-lead precipitation outlooks from the NOAA-CPC indicate increased chances of drier-than-average conditions for much of the Southwest from June–September (Figures 10a and b). The highest probabilities are in southeastern Arizona and southwestern New Mexico. This agrees with output from models that forecast atmospheric circulation, which show a pattern that favors a weak monsoon. The same pattern results in increased chances of wetter-than-average conditions from the Northwest to the northwestern Great Plains (Figure 10a). By the later periods, there are no forecasted anomalies in the Southwest, except for increased chances of below-average precipitation in extreme northwestern Arizona (Figures 10c-d). The outlooks are based on trends and strong agreement in the output from statistical and dynamical models.

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 June–August 2005.

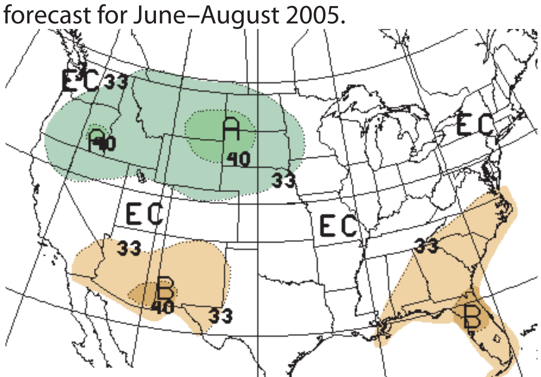


Figure 10b. Long-lead national precipitation forecast for July–September 2005.

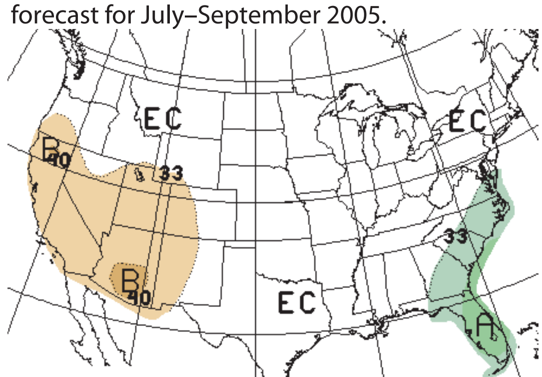


Figure 10c. Long-lead national precipitation forecast for August–October 2005.

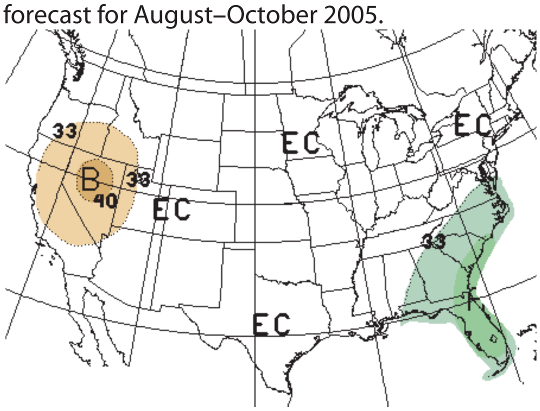
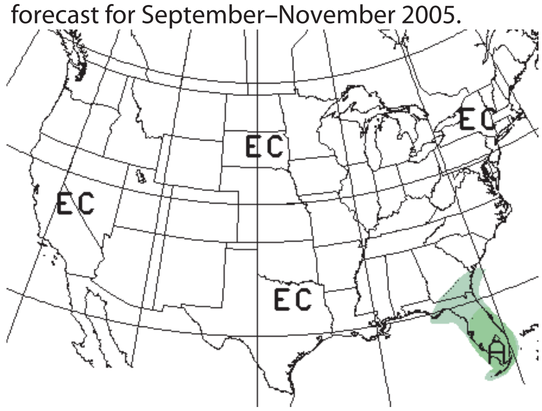


Figure 10d. Long-lead national precipitation forecast for September–November 2005.



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 August 2005)

Sources: NOAA Climate Prediction Center

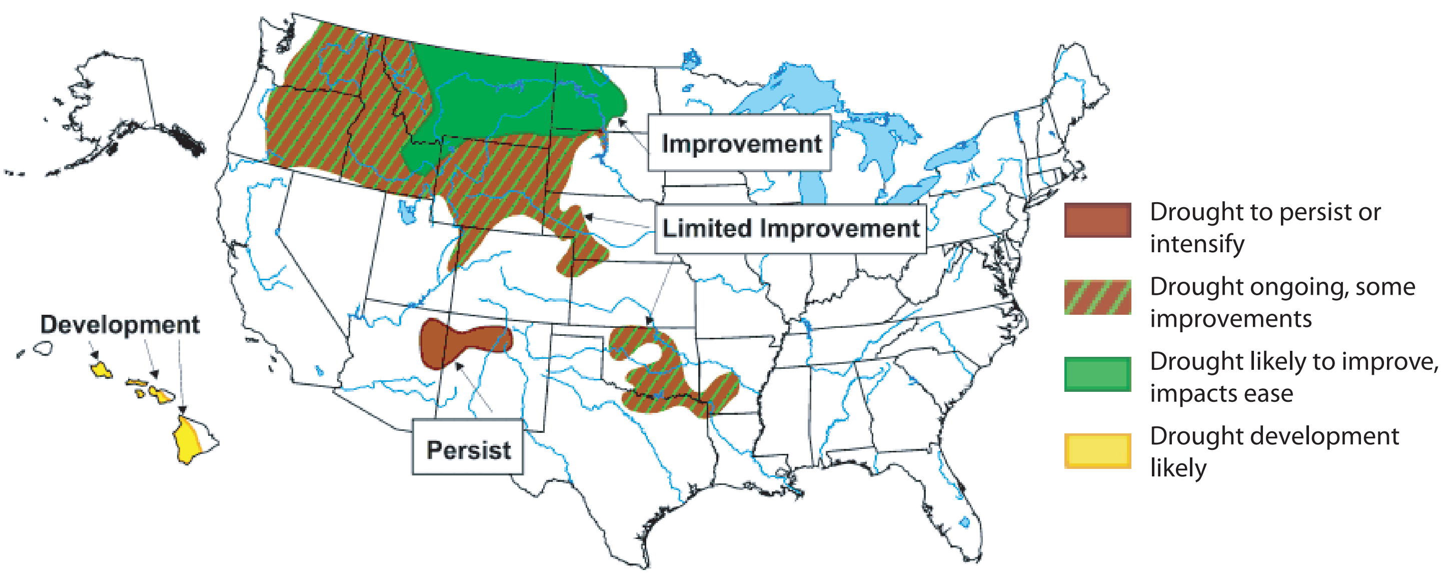
The seasonal drought outlook from the NOAA-CPC indicates a continuation of drought conditions from northeastern Arizona to north-central New Mexico (Figure 11). Officials recently reduced the severe drought classification that has been persistent in this area, but moderate drought remains (see Figure 3). As is typical of the late May through June period, the probability of precipitation will be low. Long-lead precipitation forecasts indicate increased chances of below-average precipitation over much of the Southwest through September (see Figure 10). Models also predict increased chances of above-average temperatures in Arizona and much of New Mexico at least until November (see Figure 9). This combination of warmer-than-average and drier-than-average conditions spells very little chance of relief for the region.

Even with the forecasted dry conditions, rivers and reservoirs will still see increased flow and storage for the next several months as remaining snowpack continues to melt. The above-average snowpack and future runoff played a role in the decision by Secretary of the Interior Gale Norton to maintain current releases from Lake Powell through September (*New York Times*; *Los Angeles Times*, May 3). John Keys, commissioner of the U.S. Bureau of Reclamation, is worried about water supply now and in the future. At a meeting in April, Keys warned that increasing population and regulations protecting endangered species must be considered even when the region receives average precipitation (*U.S. Water News*, April 2005). Elsewhere in the West, residents are concerned that a proposed pipeline to transport water from northeastern Nevada to southern Nevada would endanger their livelihoods and wildlife (*Las Vegas Review-Journal*, May 5). The Bureau of Land Management plans to conduct a study of groundwater and the potential impacts, as well as examine alternatives to the pipeline (*Reno Gazette-Journal*, May 6).

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 August 2005 (release date May 19, 2005).



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

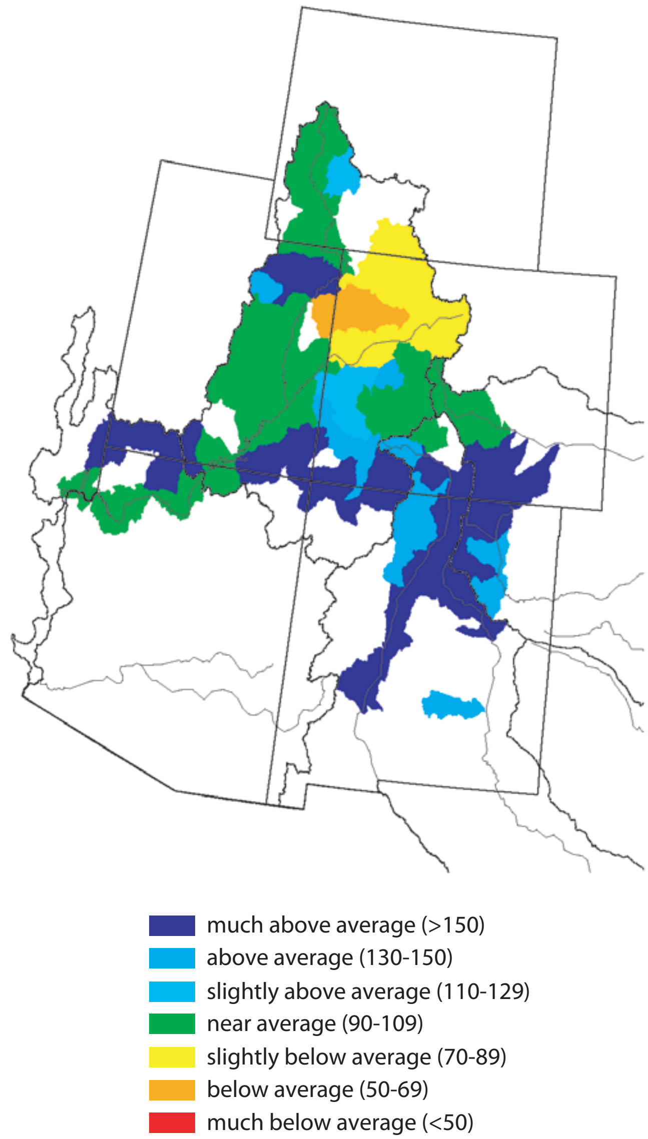
Streamflow Forecast
(for spring and summer)

Source: National Water and Climate Center

The forecast from the Natural Resources Conservation Service (NRCS) as of May 1 indicates near- to much above-average streamflow in the Southwest and most of the Colorado River Basin (Figure 12). The only exception is in northwestern Colorado state, where models predict only 50–89 percent of average flow. Portions of southwestern Wyoming have improved following early spring snowfall. Comparison of the snow water content (SWC) and predicted streamflow shows that areas with above-average SWC also tend to have above-average streamflow forecasts. Overall, the projections in the Southwest, Nevada, and California are significantly improved from one year ago (not shown) when predictions called for slightly-below to much-below-average flows. Despite some recent improvements in drought conditions in the northwestern United States, forecasts indicate below- to much-below-average streamflow, which is similar to last year.

While the continued for that region snowmelt and runoff is good news for streamflow and reservoir storage, experts warn of flooding potential (New Mexico State Basin Outlook Report, May 1). The Albuquerque National Weather Service office recently began issuing a special product called the "spring flood potential outlook" for northern New Mexico. Governor Bill Richardson declared an emergency, which provides $750,000 in state funding to prepare flood-susceptible areas and to monitor flow and flood-control structures (KRQE-TV, April 26). Taos County residents also began flood preparation, including gathering sandbags and building flood barriers (*Santa Fe New Mexican*; *Taos News*, April 28). According to the news articles, Taos Pueblo officials have posted road signs that warn of potential flooding and notes on community bulletin boards that ask all able-bodied tribal members to work on sandbag crews when needed.

Figure 12. Spring and summer streamflow forecast as of May 1, 2005 (percent of average).



Notes:

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

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

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

Wildland Fire Outlook

Sources: National Interagency Coordination Center, Southwest Coordination Center

The National Interagency Coordination Center (NICC) added three new categories to the national wildland fire outlook since last month. The current outlook shows average to below-average fire potential throughout the Southwest in May (Figure 13a). Large fire potential will remain below average, as will fire potential in the higher elevations and in the northern parts of the region. Although not indicated in Figure 13a, fire potential in southern and western Arizona and southern New Mexico will increase to slightly above average throughout the month as the abundance of new fine fuels dries. The NICC notes that these fine fuels, particularly in low elevations, are now drying in southern and western Arizona. Fine fuels in New Mexico are still "green" or just beginning to dry, but drying should increase throughout May (Figure 13b). Moisture in live fuels and large fuels (1000-hour) is near to above average in the Southwest (Figure 13b) due to above-average precipitation during the winter and early spring. Given these conditions, some prescribed burns have been and will be done throughout the month.

Figure 13a. National wildland fire potential for fires greater than 100 acres (valid May 1–31, 2005).

Figure 13b. Current fine fuel condition and live fuel moisture status in the Southwest.

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

Live Fuel Moisture	Percent of Average
Ponderosa Pine	95–103
Douglas Fir	103–107
Piñon	87–92
Juniper	76–92
Sagebrush	190–210
1000-hour dead fuel moisture	**8–17**
Average 1000-hour fuel moisture for this time of year	**10–15**

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces monthly wildland fire outlooks. The forecasts (Figure 13a) 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 13b 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

Although the Southern Oscillation Index (SOI) decreased slightly in the past month, its signal remains very weak. The graph of SOI (Figure 14a) appears to indicate a strong negative value, but it represents a 3-month average that is influenced by a very low SOI in February. The International Research Institute for Climate Prediction (IRI) reports that wind patterns are near their average strength for this time of year. Changes in wind speeds and reversal of wind direction are generally good indicators of changes in El Niño conditions. Sea surface temperatures in the east-central tropical Pacific Ocean indicate near-average or neutral conditions according to IRI. Since this area is most associated with global impacts, the IRI does not anticipate major remote influences on weather in distant locations (teleconnections).

Probabilistic forecasts from IRI indicate that neutral conditions have the highest likelihood of occurrence (60 percent) through April 2006 (Figure 14b). The probability decreases slightly during the summer, but it remains above historical averages. Although chances for El Niño are also above the historical average, these conditions are much less likely to occur. The probability of the development of La Niña is five percent or less for the next 12 months.

Statistical and dynamical forecast models once again showed substantial variation in their predictions over the next several months, but the majority of models indicate neutral conditions (Technical ENSO Update, May 19). Long-term forecasts are in better agreement, with most models predicting neutral or near-neutral conditions. The issued outlook incorporated both model output and current observations in the tropical Pacific Ocean.

Figure 14a. The standardized values of the Southern Oscillation Index from January 1980–April 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).

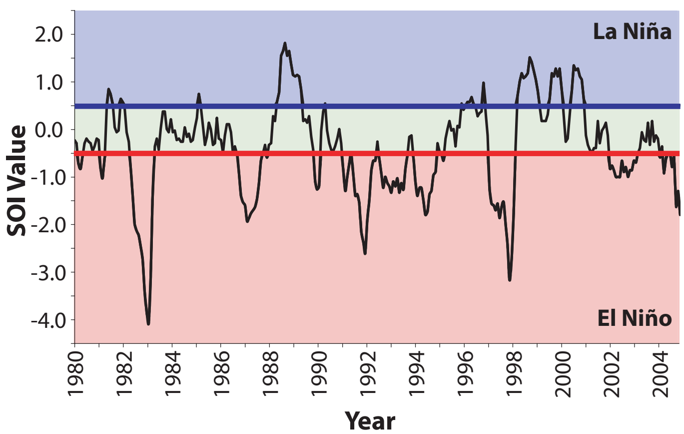
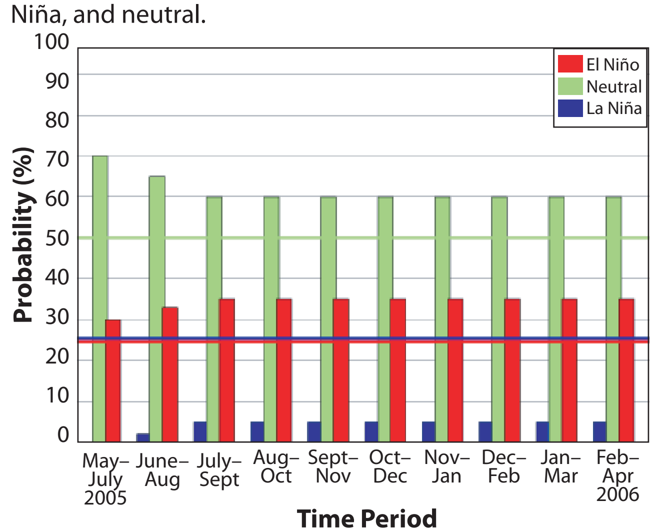


Figure 14b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released May 19, 2005). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Notes:

Figure 14a shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through March 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 14b 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/

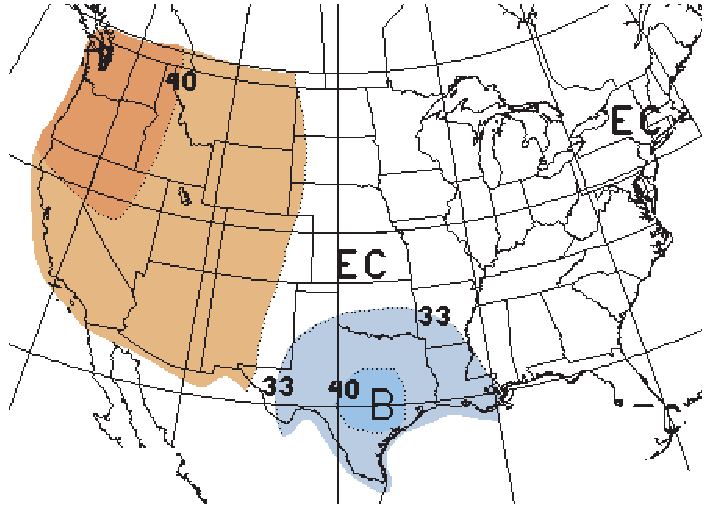
Temperature Verification
(February–April 2005)

Source: NOAA Climate Prediction Center

The long-lead forecast from the NOAA-Climate Prediction Center indicated increased chances of above-average temperatures in Arizona and western New Mexico, as well as most the of western United States, for February–April 2005 (Figure 15a). Models predicted increased chances of cooler-than-average conditions from far southeastern New Mexico to Louisiana and southern Arkansas.

Much of the Southwest was near average, except for western Arizona and eastern New Mexico where temperatures were 2–4 degrees Fahrenheit (F) below average. The remainder of the nation was generally within two degrees F of average, except in the northern Great Plains and parts of the Northwest. The outlooks performed well in the West overall, despite the cooler-than-average conditions in southern parts of the region, and in the south-central United States, where temperatures were near to below average. The models did not forecast anomalies in the northern Great Plains, which exhibited above-average temperatures during February–April.

Figure 15a. Long-lead U.S. temperature forecast for February–April 2005 (issued January 2005).

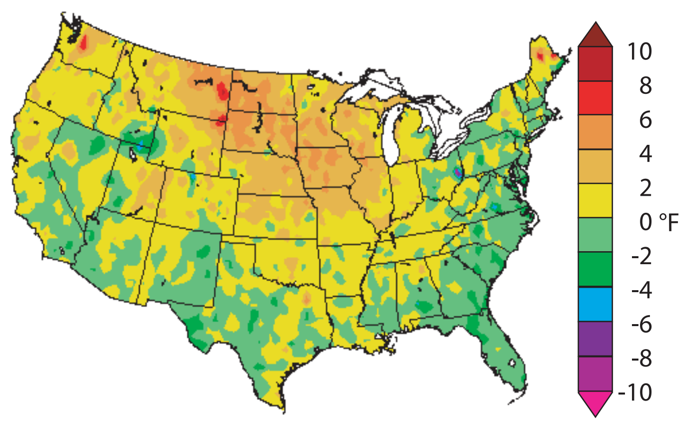


A= Above: 40.0–49.9%; 33.3–39.9%

B= Below: 40.0–49.9%; 33.3–39.9%

EC= Equal chances. No forecasted anomalies.

Figure 15b. Average temperature departure (in degrees F) for February–April 2005.



Notes:

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

The February–April 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 15b shows the observed departure of temperature (°F) from the average for February–April 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.

On the Web:

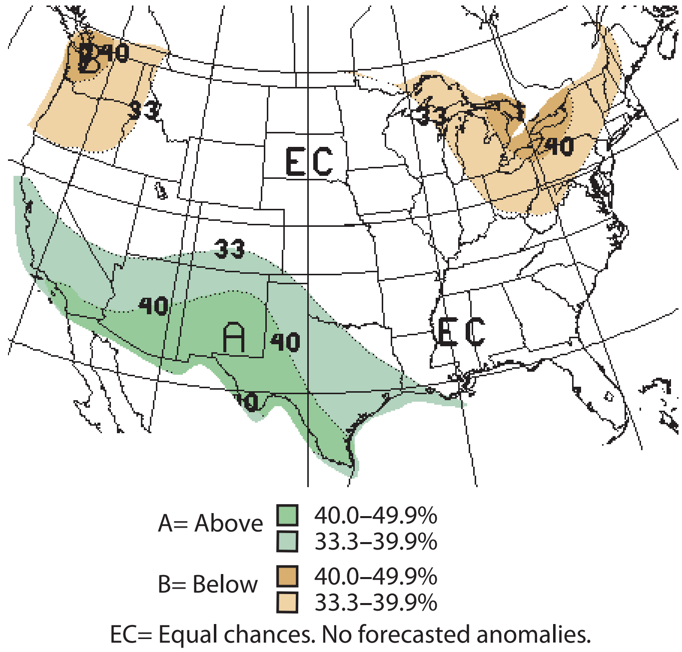
For more information on CPC forecasts, visit:
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Precipitation Verification
(February–April 2005)

Source: NOAA Climate Prediction Center

The NOAA-CPC long-lead precipitation outlook for February–April 2005 called for increased chances of wetter-than-average conditions from the western Gulf Coast to northern California (Figure 16a). Southern Arizona and much of New Mexico had some of the highest probabilities. Models predicted increased chances of below-average precipitation in the Pacific Northwest and in the Great Lakes region. Precipitation during the period was above average in the Southwest and portions of the northern Rocky Mountains, Southeast, and Northeast, while precipitation in other areas was generally near to below average (Figure 16b). Much of Arizona and New Mexico received more than 150 percent of average precipitation. A notable exception was the dryness in southeastern Arizona. The models performed well in all areas where anomalies were predicted. Some parts of the country were much drier than average, especially the extreme northern Great Plains and Oklahoma and north-central Texas. The outlook did not forecast these conditions.

Figure 16a. Long-lead U.S. precipitation forecast for February–April 2005 (issued January 2005).



Notes:

Figure 16a shows the NOAA Climate Prediction Center (CPC) precipitation outlook for the months January–March 2005. This forecast was made in December 2004.

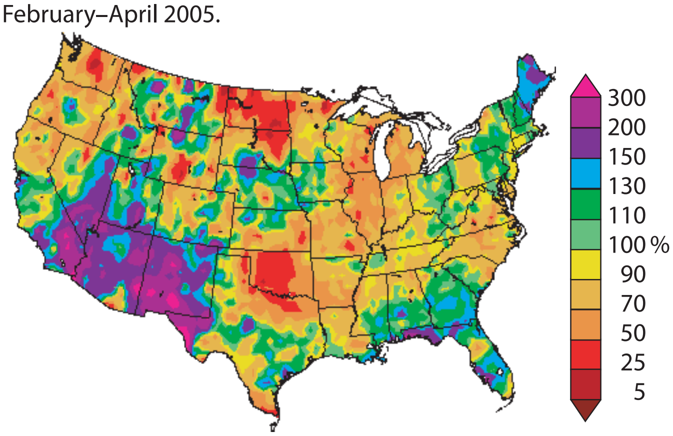
The February–April 2005 NOAA CPC outlook predicts the likelihood (chance) of above-average, average, and below-average precipitation, but not the magnitude of such variation. The numbers on the maps do not refer to inches of precipitation. Care should be exercised when comparing the forecast (probability) 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 16b shows the observed percent of average precipitation for February–April 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 16b. Percent of average precipitation observed from February–April 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