February 23, 2011

Southwest Climate Outlook

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Source: Zack Guido, CLIMAS.

Photo Description: Many prickly pear cacti around Tucson were nipped by frost in early February, severing many pads or causing the succulents to slump.

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

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February Climate Summary

Drought– Exceptionally dry weather over the past 30 days has caused short-term drought conditions to expand and intensify across much of the Southwest. Drought conditions have intensified from moderate to severe levels across much of southeastern Arizona and southern New Mexico due to the continued dry spell.

Temperature– Several cold snaps have caused temperatures to be well below average in the past 30 days. Temperatures were 4–10 degrees F below average in eastern New Mexico and 0–4 degrees F below average in eastern and southern Arizona.

Precipitation– Scant precipitation fell in the Southwest between January 18 and February 16. The western half of Arizona and New Mexico generally saw less than 25 percent of average precipitation, with large swaths receiving less than 2 percent of average.

ENSO– The current La Niña event has shown some recent signs of weakening but still is at moderate strength. It is expected to continue impacting the winter weather pattern across the Southwest for the remainder of the winter season.

Climate Forecasts– Forecasts, largely influenced by recent warming trends and the expectation of a persisting La Niña event, call for warmer-than-average temperatures across the Southwest through the winter and spring and drier-than-average conditions into early spring.

The Bottom Line– The influence of the La Niña event is evident this month, as it has been since the winter began. January was a historically dry month for New Mexico, ranking as the driest January on record. As a result, drought conditions expanded across the region, with severe drought creeping into southern portions of both New Mexico and Arizona. Along with extremely dry conditions, a series of Arctic cold blasts sent temperatures plummeting below freezing, bursting water pipes, freezing vegetation, and wreaking havoc on other temperature-sensitive things. The La Niña event is expected to continue for the next few months, and as a result dry conditions are forecasted through the remainder of the winter. There are signs, however, that the La Niña event is weakening.

The Fifth IPCC Assessment Report off and Running

The Intergovernmental Panel on Climate Change (IPCC) is starting the preparation of the Fifth Assessment Report (AR5), which will be finalized in 2014. AR5, like its predecessors, is an international effort to synthesize peer-reviewed scientific studies. The current effort will draw on 831 climate experts who will summarize state-of-the-art climate science and climate change impacts, adaptation, and mitigation. New advances in science, including more realistic climate models, will introduce a whole new set of "what-if" scenarios of future climate projections, providing a more clear understanding of future climate in some cases while creating new uncertainties in others. Also new to the AR5 will be dedicated chapters on monsoons and El Niño–Southern Oscillation, as well as greater regional detail on climate change impacts, adaptation, and mitigation.

Previous reports have had important impacts in global and regional policy. AR1 in 1990 played a decisive role in leading to the United Nations Framework Convention on Climate Change. AR2 and AR3, issued in 1995 and 2001, respectively, helped lead to the Kyoto Protocol. AR4, published in 2007, was honored with the Nobel Peace Prize.

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SWCO Staff:

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

Deep Freezes: Will future warming paradoxically cause more extreme cold events?

By Zack Guido

Prickly pear cacti slump like wilted flowers in Tucson and all around the Sonoran Desert, a reminder of the deep freeze that wreaked havoc across the region in early February.

For several nights, temperatures plummeted in Arizona and New Mexico, freezing vegetation, bursting water pipes, and driving up energy consumption, all courtesy of the jet stream, the swift air current that flows thousands of feet above the Earth's surface.

Early this month, the jet stream looped farther to the south than normal, blasting Arizona and New Mexico with Arctic air. While the jet stream always meanders and sometimes brings winter air from the north into the Southwest, far off changes in sea level pressure over the Arctic also appear to be blasting parts of the U.S. and Europe with extreme cold.

Several nascent hypothesizes suggest global warming, paradoxically, may partially be to blame.

The Arctic Oscillation Matters Too

The most well known—and perhaps most influential—climate pattern is the El Niño–Southern Oscillation (ENSO). ENSO is a natural seesaw in oceanic sea surface temperatures and surface air pressure between the eastern and western tropical Pacific Ocean that causes changes in climate and weather thousands of miles away. During La Niña events, winters in the Southwest are often drier than average, while El Niño events usually bring wetter-than-average conditions to the region.

The Southwest is vividly experiencing the heavy hand of La Niña this winter. La Niña events can also influence temperatures by redirecting the path of the jet stream.

"During La Niña events the jet stream can loop more than normal," bringing Arctic air into the region, said Mike Crimmins, a climate science extension specialist at the University of Arizona.

However, ENSO is just one of the climate puzzle pieces.

"Changes in sea surface temperatures and atmospheric pressures in the north Pacific and Atlantic oceans combine with ENSO to influence the climate and weather," said Jeremy Weiss, senior research specialist for the Environmental Studies Laboratory in the Department of Geosciences at the University of Arizona.

Outside of the tropics, the Arctic Oscillation (AO) is the most influential natural climate fluctuation to affect climate in the Northern Hemisphere. The AO, also known as the Northern Annular Mode (NAM), is characterized by differences in the atmospheric pressures over the Arctic and surrounding regions (Figure 1).

The pressure difference, in turn, influences the strength of the winds aloft and either prevents or allows cold air to spill south. When surface air pressures are lower over the polar region and higher over surrounding regions (described as a positive phase of the AO), the jet stream blows harder and more consistently from west to east, pinning the cold Arctic air to the polar region and driving winter storms farther north.

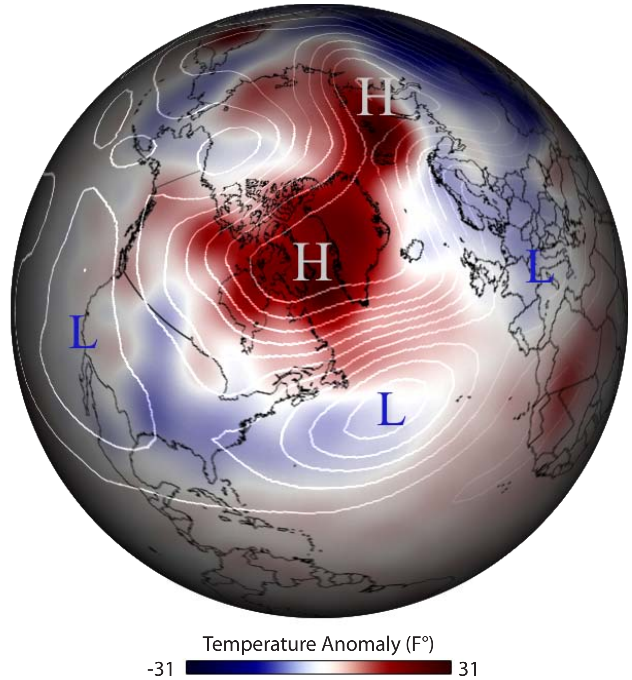


Figure 1. In February 2010, the Arctic Oscillation was strongly negative and Arctic air maintained higher pressure than lower latitude air masses. This allowed frigid air to spill south into mid-latitudes. This image shows surface temperatures for February 1-11, 2010, relative to the 1971–2000 average for the same dates. The Arctic was warmer than average (red colors), while most of the mid-latitude regions around the world were colder than average (blue colors). Image source: NOAA.

These changes in the atmospheric circulation contribute to drier conditions in the western U.S. Conversely, when pressures are high over the polar region (described as a negative phase of the AO), the winds slacken and the cold air can spill out into mid-latitudes. Positive and negative phases of the AO flip back and forth routinely, even over several weeks. However, one state of the AO usually predominates during a season.

During negative AO phases, temperatures in the U.S. during January–March and February–April tend to be below average (Figure 2). In many regions, the past two winters illustrated this; in both years the

continued on page 4

Deep Freezes, continued

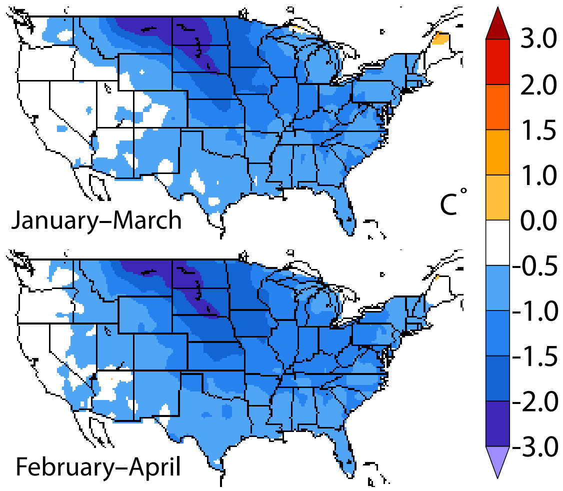


Figure 2. Average temperatures in degrees Celsius during the negative phase of the Arctic Oscillation between 1950 and 1999 and during the periods January–March (top) and February–April (bottom) have been below average in most of the U.S. 1 degree C is equal to about 1.6 degrees Fahrenheit. The maps and analysis were generated by the NOAA-Climate Prediction Center (CPC).

AO was very low. Between December 2009 and February 2010, when the AO hit its most negative reading since 1950, record-high snowfall blanketed Washington DC, Baltimore, and Philadelphia.

Will Global Warming Change the AO?

The average global temperature for 2010 tied 2005 for the warmest year on record since 1880, when widespread measurements began. The planet was 1.12 degrees Fahrenheit warmer than the 20th century average, according to the National Oceanic and Atmospheric Administration (NOAA).

The Arctic was even warmer, with temperatures soaring about 4 degrees F above average. In January, much of the Arctic experienced above-average temperatures of 4 to 11 degrees F, with some areas seeing even greater warming, according to the National Snow and Ice Data Center.

Temperatures have been much warmer in the Arctic in recent years, but it's not clear just yet what the impacts will be, Crimmins said.

Two different hypotheses both suggest that Arctic warming could alter the strength of the AO and alter the flow of air, which in turn could cause colder conditions in the U.S. and Europe.

One hypothesis states that as global temperatures have warmed and Arctic sea ice has melted during the past two and a half decades, more moisture has become available to fall as snow over the continents.

As a result, snow extent in Siberia, Russia—a region with a favorable geographic position to alter atmospheric circulation—has steadily increased over this period. Because the white landscape reflects solar rays back to space, the overlying atmosphere in this region has cooled, creating a barrier in the atmosphere that forces the jet stream to move north or south of Siberia. This then has sparked a chain-reaction, ultimately causing the AO to weaken and allowing Arctic air to move down into the U.S. and Europe. Analyses of observational data suggest that the increasing snow cover over Siberia during fall and early winter correlates to decreasing September Arctic sea ice over the Pacific sector.

The other hypothesis points to a causal chain that begins with melting ice and ends with slackening winds in polar regions and a lower AO. Around the North Pole, some of the world's coldest air currents normally bluster in a tight loop known as the polar vortex. Melting sea ice in recent years has left more of the Arctic Ocean free from ice in the winter. The relatively warm water has heated the atmosphere, increasing pressure in the polar region and causing the Polar Vortex to wane in strength. As a result of the weakened AO, cold air has been able to move south.

Both of these hypotheses suggest continued global, and therefore Arctic, warming would bring more cold winters. However, more research and time are needed to substantiate these theories.

"If there is a relationship with the Arctic and the recent cold winters, it is certainly not simple," said Klaus Wolter, research associate for the NOAA Earth System Research Laboratory in Boulder, Colorado. Sea ice has been low for the last four winters, but only two of those winters have been very cold.

In the Southwest, the current winter has been extremely chilly. Temperatures in Tucson dipped to 18 degrees F February 3—only one degree warmer than the coldest February temperature in the city's recorded history. The mercury in Albuquerque dipped to -7 degrees F, an all-time record for that date.

New Mexico declared a state of emergency after demand for gas and electric heat drained supplies and extreme temperatures forced suppliers to halt delivery citing safety precautions. A week later, another freeze clipped northeast New Mexico and areas to the east of the state.

During the first two weeks of February, temperatures averaged more than 6 degrees F below average in eastern Arizona and more than 12 degrees F below average in most of New Mexico.

Wolter thinks the recent freezing in the region has more to do with La Niña than the Arctic Oscillation. But the jury is still out on future cold events.

"The $64,000 question is will a warmer future bring more extreme cold temperatures," Wolter said.

Temperature (through 2/16/11)

Data Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 have averaged between 55 and 65 degrees Fahrenheit in the Southwest deserts and along the lower Colorado River, 45 to 55 degree F in southeastern Arizona and southern New Mexico, and 30 to 45 degrees F across most of central and northern New Mexico and the Colorado Plateau (Figure 1a). These temperatures have been 0–2 degrees F warmer than average across most of Arizona and 2–4 degrees warmer than average in Gila and western Maricopa counties (Figure 1b). In north-central New Mexico, temperatures were 1–3 degrees F warmer than average, while central and southern New Mexico were 0–3 degrees colder than average. Many areas have seen average water year temperatures decrease because of recent cold snaps.

Temperatures during the past 30 days were 2–6 degrees F colder than average over western New Mexico and 4–10 degrees F colder than average across the eastern half of the state (Figures 1c–d). Arizona temperatures ranged from 2 degrees warmer to 4 degrees colder than average, with the warmest conditions in the western half of the state. The unseasonably cold temperatures were due to the La Niña circulation that has brought cold polar air southward as upper level low pressure troughs have extended deep into the southern tier of states.

Notes:

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

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

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

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

On the Web:

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

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

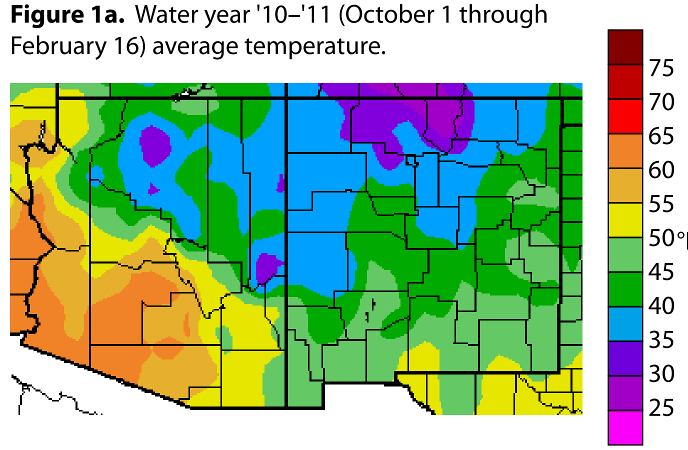


Figure 1a. Water year '10–'11 (October 1 through February 16) average temperature.

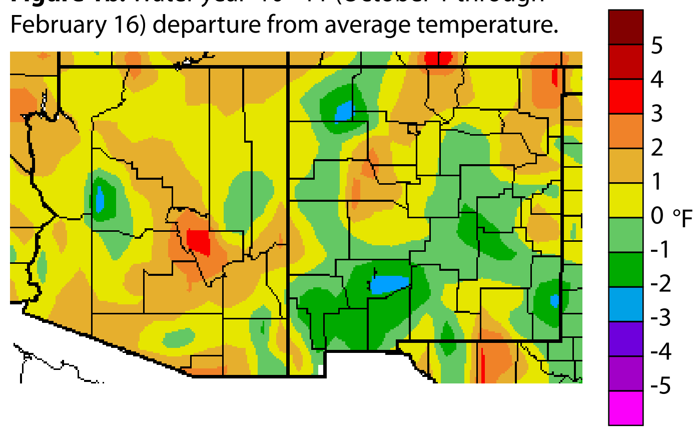


Figure 1b. Water year '10–'11 (October 1 through February 16) departure from average temperature.

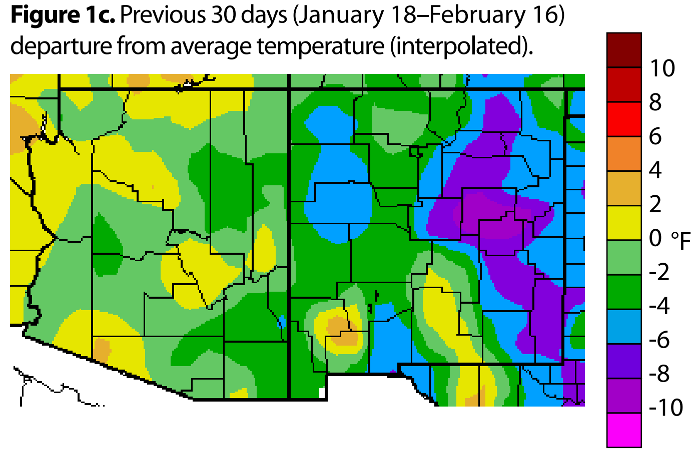


Figure 1c. Previous 30 days (January 18–February 16) departure from average temperature (interpolated).

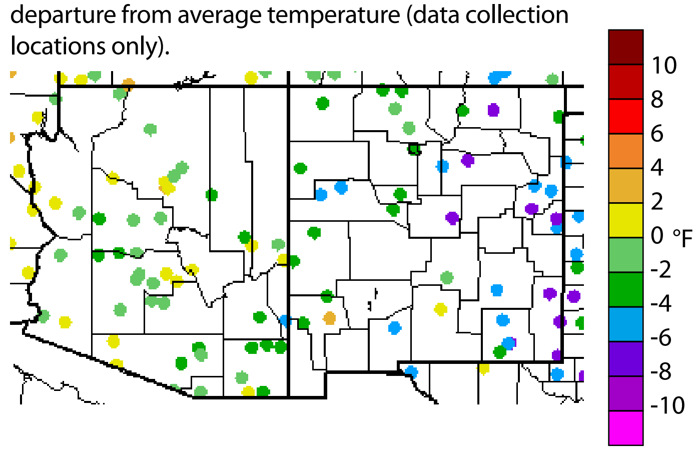


Figure 1d. Previous 30 days (January 18–February 16) departure from average temperature (data collection locations only).

Precipitation (through 2/16/11)

Data Source: High Plains Regional Climate Center

The 2011 water year, which began on October 1, continues to be extremely dry in the Southwest. Only a few winter storms have swept through the Southwest, and their trajectories have been northeast, moving across Southern California and only clipping the northwest corner of Arizona. Extremely dry conditions have dominated in southern Arizona and New Mexico, while northwest Arizona and parts of northern New Mexico have experienced above-average rain and snow (Figures 2a–b). Southeastern Arizona and southwestern New Mexico have received less than 25 percent of average precipitation since October 1.

In the last 30 days, the western half of Arizona and a large area of northern New Mexico received less than 2 percent of average precipitation (Figures 2c–d). Eastern Arizona and western New Mexico received 5–75 percent of average precipitation. Only the Four Corners region in Arizona experienced above-average precipitation, with one station measuring up to 1,000 percent of average (Figure 2d). Southeastern New Mexico received 25–75 percent of average precipitation, while the northeast corner of New Mexico has been much wetter with 75–400 percent of average precipitation in the last month.

Figure 2a. Water year '10–'11 (October 1 through February 16) percent of average precipitation (interpolated).

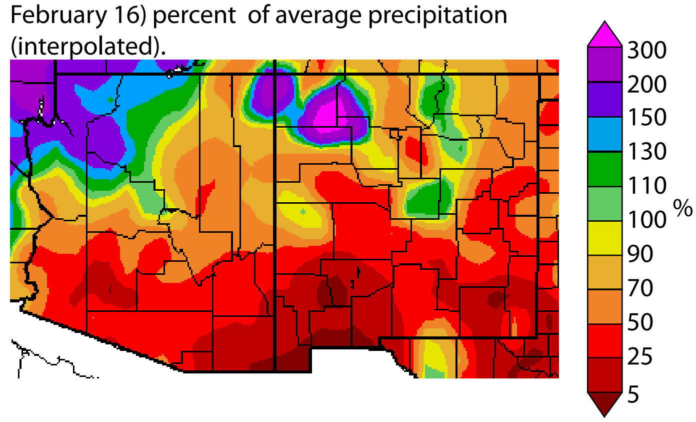
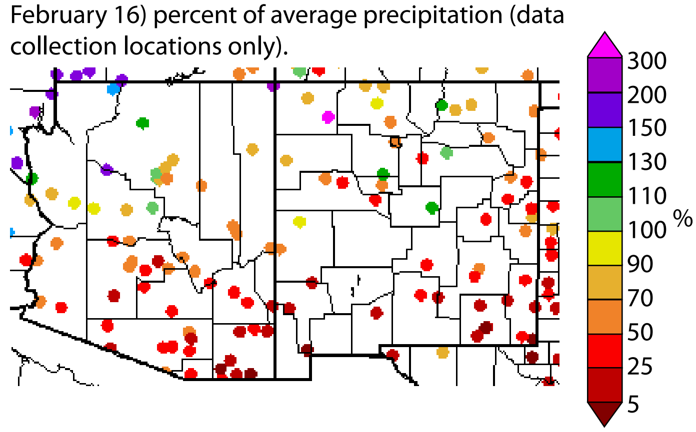


Figure 2b. Water year '10–'11 (October 1 through February 16) percent of average precipitation (data collection locations only).



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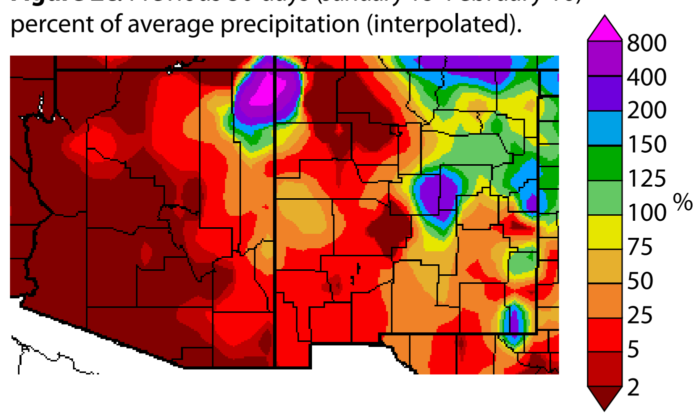
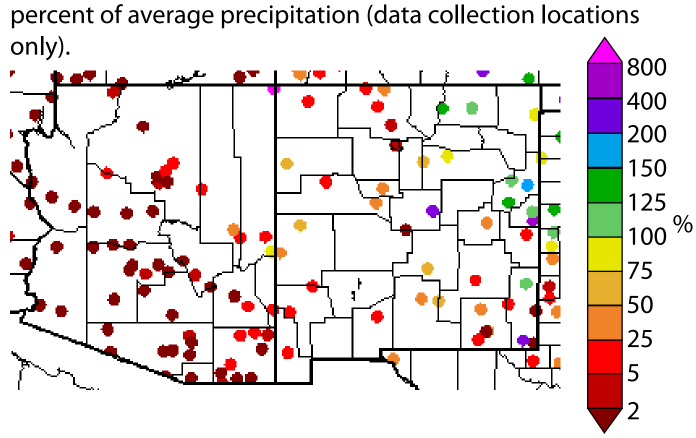


Figure 2d. Previous 30 days (January 18–February 16) percent of average precipitation (data collection locations only).



Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2010, we are in the 2011 water year. The water year is a more hydrologically sound measure of climate and hydrological activity than is the standard calendar year.

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

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

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

On the Web:

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

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

U.S. Drought Monitor

(data through 2/15/11)

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

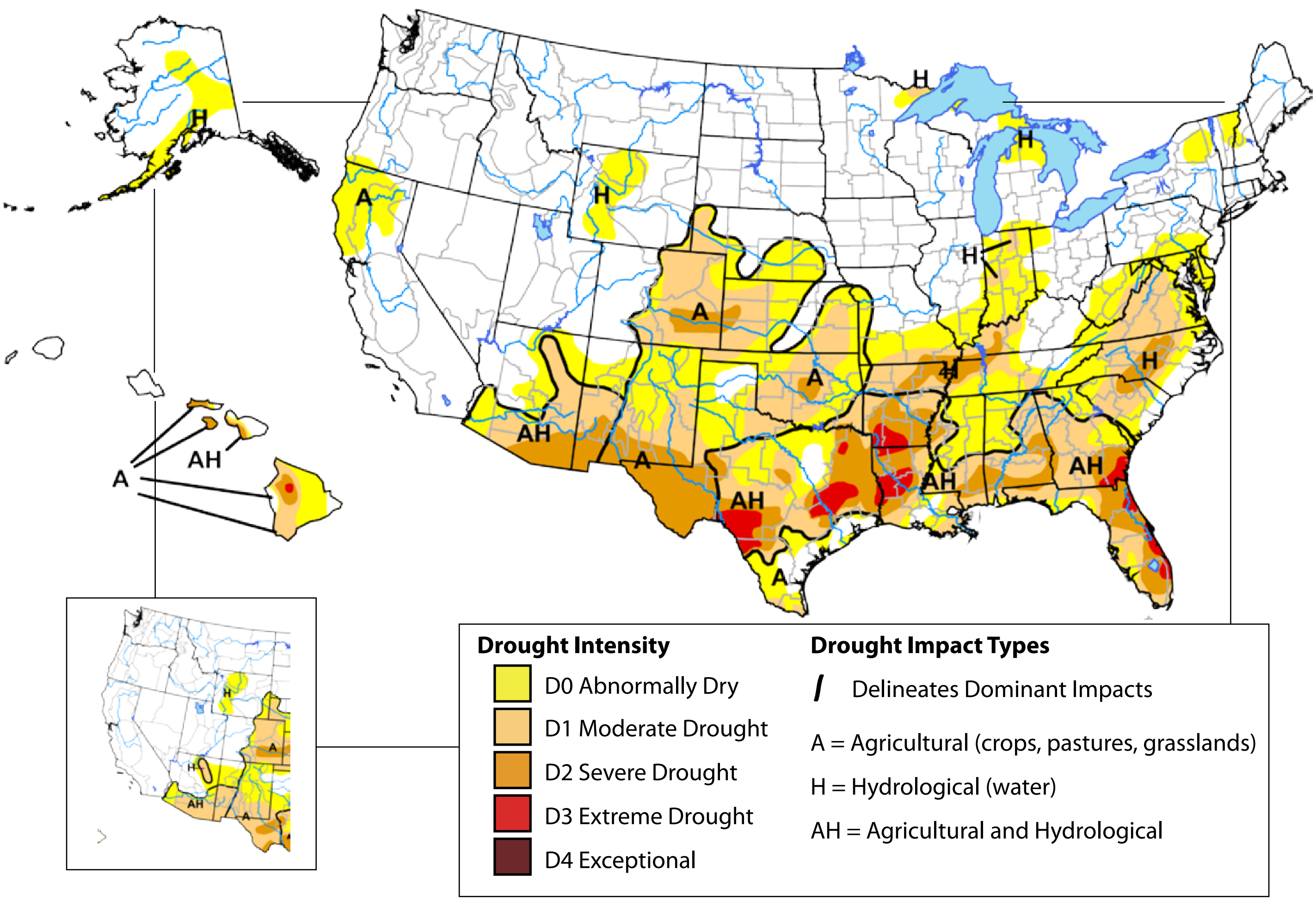
There has been little change in the extent of drought conditions across the western U.S. over the past 30 days. Overall, only 27 percent of the 11 western U.S. states, excluding Hawaii and Alaska, are observing abnormally dry conditions or worse; only about 9 and 4 percent is classified with moderate and severe drought, respectively. The majority of the area classified with abnormally dry conditions or worse is located in Arizona and New Mexico, where La Niña-induced dry conditions have reigned. A persistent northerly winter storm track has caused dry conditions in the Southwest, but also has contributed to above-average precipitation in the Pacific Northwest and much of the northern and central Rocky Mountains. A small area of abnormally dry conditions has developed over northern California, where below-average precipitation has fallen over the past month. Most of California and Utah and all of Nevada are drought free, in part because very intense storms walloped these regions in December. In parts of Southern California and Nevada, these storms alone delivered nearly a year's worth of precipitation.

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 several agencies; the author of this monitor is Matthew Rosencrans, NOAA/NWS/NCEP/CPC.

Figure 3. Drought Monitor data through February 15 (full size), and January 18 (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.gov/portal/server.pt/community/current_drought/208

Arizona Drought Status

(data through 2/15/11)

Data Source: U.S. Drought Monitor

Exceptionally dry weather over the past 30 days caused drought conditions to expand and intensify across much of Arizona, according to the February 15 update of the U.S. Drought Monitor. Overall, 70 percent of Arizona is observing some level of drought, up from 60 percent last month (Figures 4a–b). The biggest shift since last month was seen in the intensification of drought conditions from moderate to severe over southeast Arizona, an area that has experienced very little precipitation in the past 90 days. Severe drought now covers 12 percent of the state; severe drought was not present last month.

Drought impacts from Cochise County reported on Arizona DroughtWatch indicate that streams and ponds are unusually low for this time of year and that production on rangelands has been very limited, both supporting the presence of severe drought conditions. Impact reports from Mohave County also indicate drought conditions are creeping back into the area even after the exceptionally wet fall this area saw. More drought impact reports can be viewed onArizona Drought watch's webpage at http://www.azdroughtwatch.org.

Figure 4a. Arizona drought map based on data through February 15.

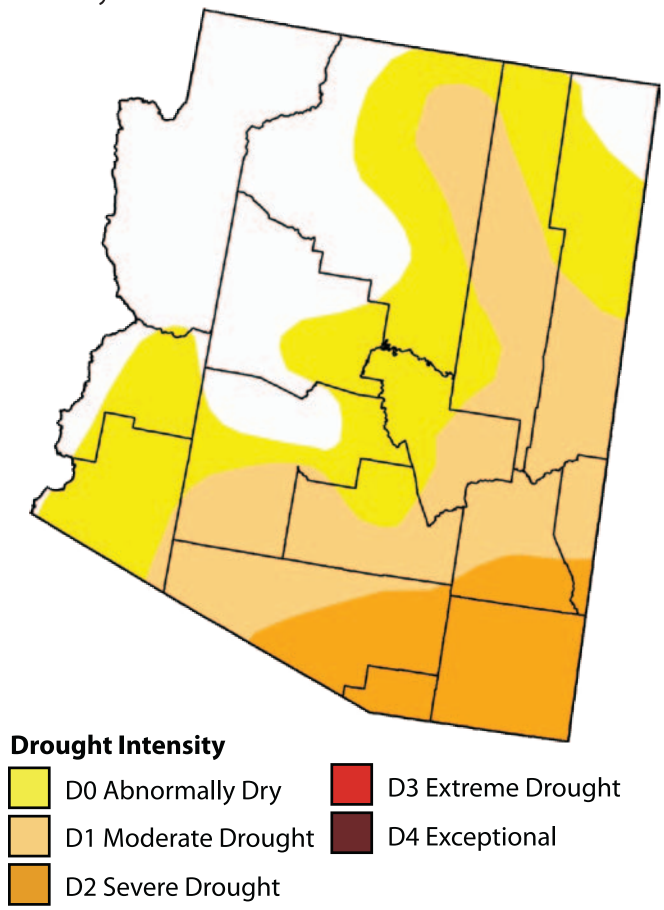


Figure 4b. Percent of Arizona designated with drought conditions based on data through February 15.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	29.07	70.93	40.88	12.59	0.00	0.00
Last Week (02/08/2011 map)	29.04	70.96	40.88	12.59	0.00	0.00
3 Months Ago (11/16/2010 map)	51.18	48.82	6.76	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	31.40	68.60	32.45	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	40.00	60.00	18.58	3.23	0.00	0.00
One Year Ago (02/09/2010 map)	15.16	84.84	53.37	14.48	0.00	0.00

Notes:

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

On the Web:

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

For monthly short-term and quarterly long-term Arizona drought status maps, visit:
http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/DroughtStatus.htm

New Mexico Drought Status

(data through 2/15/11)

Data Source: New Mexico State Drought Monitoring Committee , U.S. Drought Monitor

Drought conditions continued to expand and intensify across the Southwest over the past 30 days. January was a historically dry month of New Mexico, ranking as the driest January on record, and scant rain and snow fell in the first half of February. The low precipitation in southern New Mexico during January, which is usually a wet month, caused the region to slip from moderate to severe drought, according to the February 15 update of the U.S. Drought Monitor (Figures 5a–b). The expansion of severe drought across the southern third of the state is the biggest change since last month. Moderate drought expanded into east-central parts of the state, while abnormally dry conditions covered almost all of the remainder of New Mexico. Overall, 92 percent of the state is observing abnormally dry conditions or worse, with almost 23 percent experiencing severe drought conditions.

The La Niña event that has been in place since summer 2010 appears to be the main culprit behind dry conditions. The winter storm track has largely been north and east of New Mexico, leaving many parts of New Mexico and especially the southern part of the state with no chance for precipitation. Current La Niña conditions suggest that this pattern could last for the remainder of the winter, leading to further expansion and intensification of drought conditions across the Southwest.

Figure 5a. New Mexico drought map based on data through February 15.

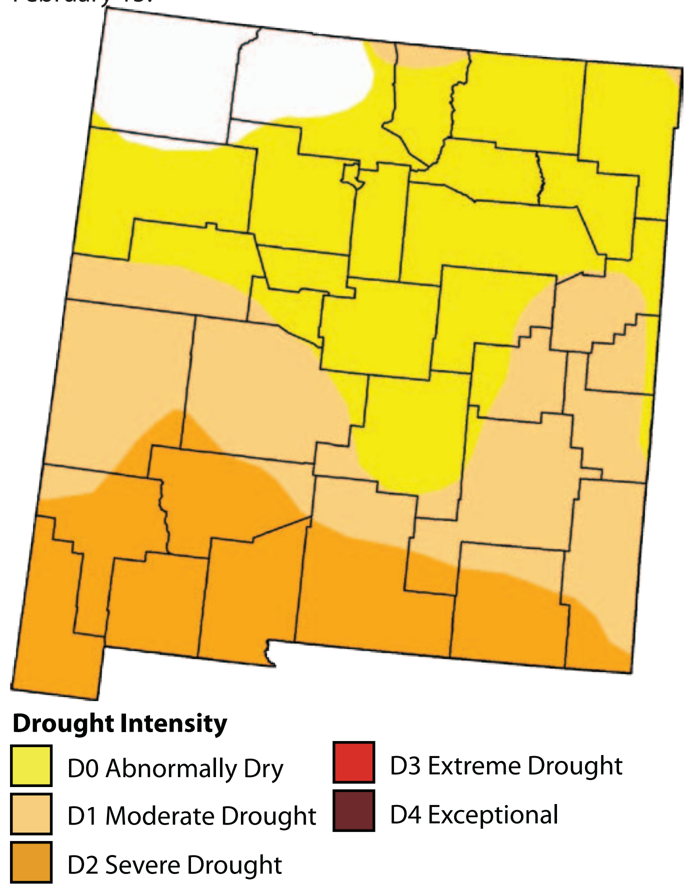


Figure 5b. Percent of New Mexico designated with drought conditions based on data through February 15.

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	7.79	92.21	52.89	22.86	0.00	0.00
Last Week (02/08/2011 map)	8.22	91.78	52.89	22.86	0.00	0.00
3 Months Ago (11/16/2010 map)	69.49	30.51	0.00	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	6.16	93.84	40.40	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	76.66	23.34	0.00	0.00	0.00	0.00
One Year Ago (02/09/2010 map)	57.30	42.71	0.00	0.00	0.00	0.00

Notes:

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

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

On the Web:

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

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

Arizona Reservoir Levels

(through 1/31/10)

Data Source: USDA-NRCS, National Water and Climate Ctr.

Combined storage in Lakes Mead and Powell decreased slightly in January. While Lake Mead increased by 463,000 acre-feet, Lake Powell decreased by 628,000 acre-feet. As of February 1, combined storage was at 49.1 percent of capacity, which is 1.8 percent less than a year ago (Figure 6). Storage in Salt and Verde River basins and the San Carlos Reservoir slightly increased by about 33,000 acre-feet. Total reservoir storage in Arizona is lower than it was one year ago.

In water-related news, the Flagstaff City Council approved the decision to drill six groundwater wells that will help meet future demand (Arizona Daily Sun, February 17). The decision is controversial and likely will lead to a lawsuit filed by the Navajo Nation, which contends it owns the water rights.

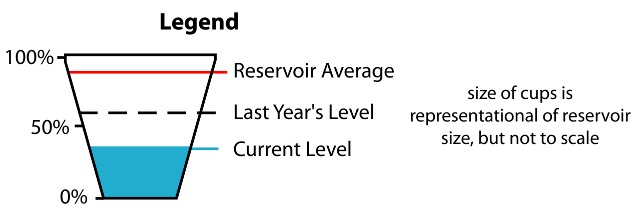
Notes:

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

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

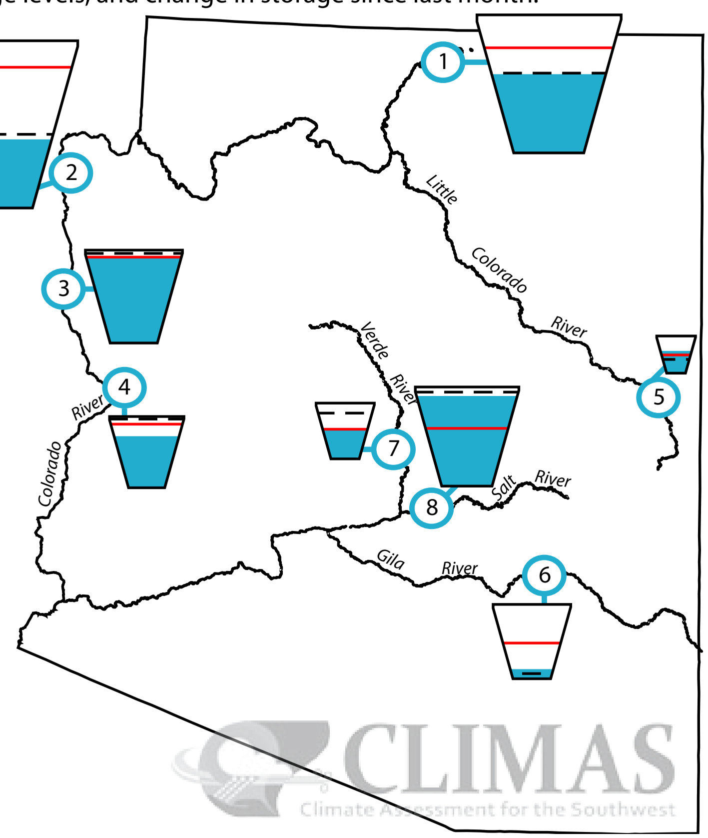
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Dino DeSimone, Dino.DeSimone@az.usda.gov.

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



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Lake Powell	57%	13,829.0	24,322.0	-628.0
2. Lake Mead	41%	10,765.0	26,159.0	463.0
3. Lake Mohave	92%	1,670.1	1,810.0	4.6
4. Lake Havasu	72%	446.4	619.0	-131.9
5. Lyman Reservoir	60%	17.9	30.0	0.0
6. San Carlos	13%	117.4	875.0	9.3
7. Verde River System	55%	158.1	287.4	7.7
8. Salt River System	91%	1,851.9	2,025.8	16.2

*** 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 1/31/10)

Data Source: USDA-NRCS, National Water and Climate Ctr.

The total reservoir storage in New Mexico did not change substantially during January (Figure 7). Storage in Elephant Butte Reservoir increased by 37,000 acre-feet in the last month, but it is down from this time last year by about 85,000 acre-feet. Storage in the Navajo Reservoir decreased by 19,500 acre-feet but is up by about 7 percent compared with a year ago. Storage in the Pecos and Canadian river basin reservoirs increased slightly in January.

In water-related news, some farmers in Doña Ana County are worried about water supplies (Las Cruces Sun News, February 13). The Elephant Butte Irrigation District (EBID) has not declared the amount farmers can expect to receive throughout the year, and now is the time growers are making key decisions about whether to plant in given fields and which crops to grow. EBID is waiting for more certainty about the amount of precipitation and runoff it can expect before declaring an allocation.

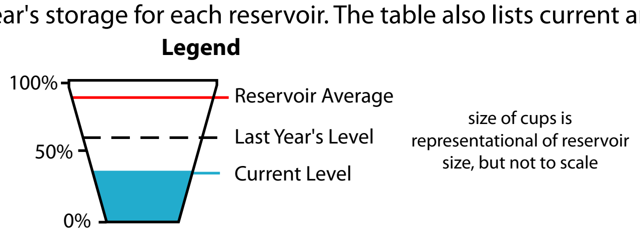
Notes:

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

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

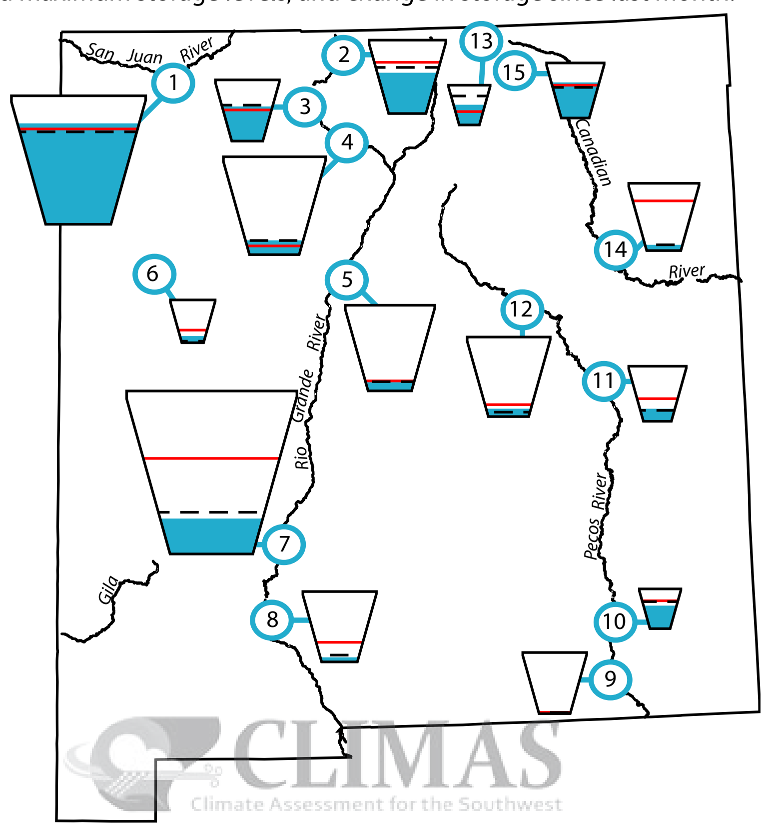
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Wayne Sleep, wayne.sleep@nm.usda.gov.

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



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Navajo	79%	1,342.5	1,696.0	-19.5
2. Heron	56%	223.0	400.0	-2.2
3. El Vado	57%	107.7	190.3	-0.4
4. Abiquiu	15%	182.1	1,192.8	-1.9
5. Cochiti	11%	52.8	491.0	-0.1
6. Bluewater	16%	6.1	38.5	0.0
7. Elephant Butte	22%	474.2	2,195.0	37.0
8. Caballo	7%	23.6	332.0	1.6
9. Brantley	1%	13.3	1,008.2	2.1
10. Lake Avalon	58%	2.3	4.0	0.5
11. Sumner	23%	23.7	102.0	2.9
12. Santa Rosa	10%	42.6	438.3	-0.2
13. Costilla	51%	8.1	16.0	0.4
14. Conchas	9%	21.9	254.2	0.2
15. Eagle Nest	65%	51.5	79.0	0.5

*** 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

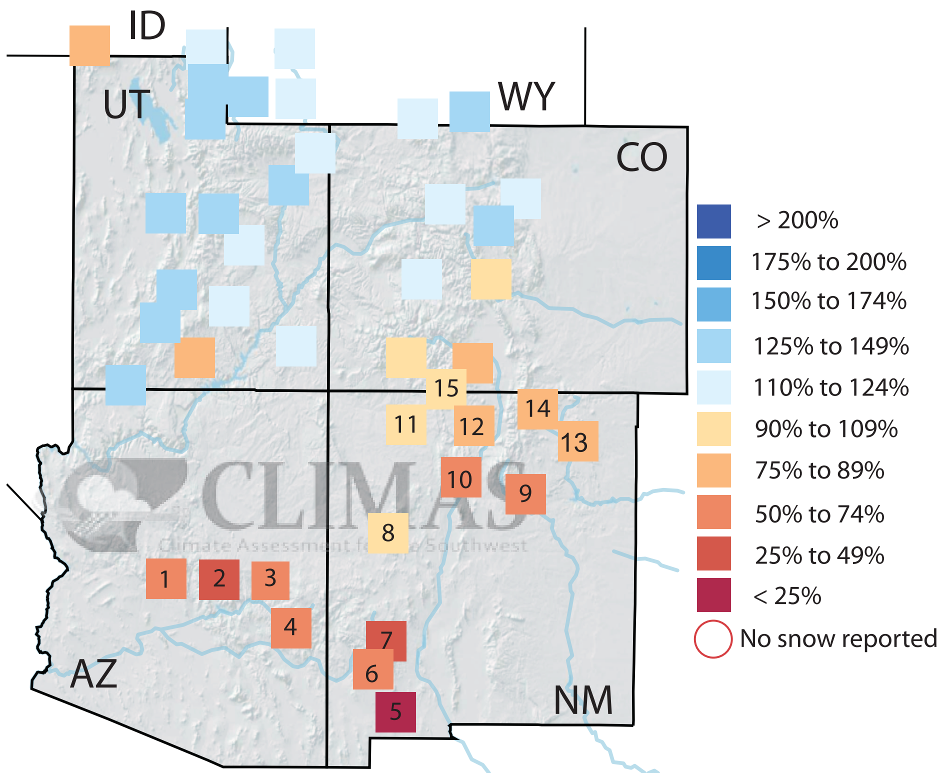
(updated 2/17/11)

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

The current La Niña event has continued to push winter storms to the north of the Southwest, leaving Arizona and New Mexico relatively dry. January was the driest January on record in New Mexico, and most areas in Arizona also experienced no rain or snow. Snowpack levels have significantly declined since last month, and most Snow Telemetry (SNOTEL) stations measure below-average snow water equivalent (SWE) in Arizona and New Mexico (Figure 8). As of February 17, SWE in the Upper Gila River Basin in Arizona was the lowest in the state, measuring only 26 percent of average. SWE in the central Mogollon Rim area and the Verde River Basin were only slightly better, tallying 40 and 61 percent of average, respectively. SWE was more variable in New Mexico. River basins in the northern part of the state had near-average levels, including the Zuni/Bluewater River Basin, where SWE is about 98 percent of average. On the other hand, river basins in southern regions have extremely low SWE, including the Mimbres, where SWE stood at 19 percent of average on February 17.

Forecasts call for the continued presence of the La Niña pattern and elevated chances for below-average precipitation for the next several months. As a result, streamflow forecasts anticipate below-average runoff from most basins in the Southwest, except those with headwaters in the Rocky Mountains to the north of Arizona and New Mexico where precipitation has been higher this winter.

Figure 8. Average snow water equivalent (SWE) in percent of average for available monitoring sites as of February 17.



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

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

Notes:

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

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

On the Web:

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

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

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

Temperature Outlook

(March 2011–August 2011)

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA–Climate Prediction Center (CPC) in February call for increased chances for temperatures to be similar to the warmest 10 years of the 1971–2000 period through the winter and summer. For the March–May period, CPC outlooks call for greater than a 50 percent chance that temperatures will resemble the warmest 10 years in the climatological record in most of New Mexico and eastern Arizona (Figure 9a). Temperatures in nearly all of Arizona and the southern half of New Mexico have greater than a 50 percent probability of being similar to the warmest 10 years in the climatological record for April–June, May–July, and June–August (Figures 9b–d). Recent decadal warming trends and the expectation that the La Niña event will persist during most of these periods contribute to the enhanced probability of above-average temperatures 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 no forecast skill has been demonstrated or there is no clear climate signal; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 9a. Long-lead national temperature forecast for March–May 2011.

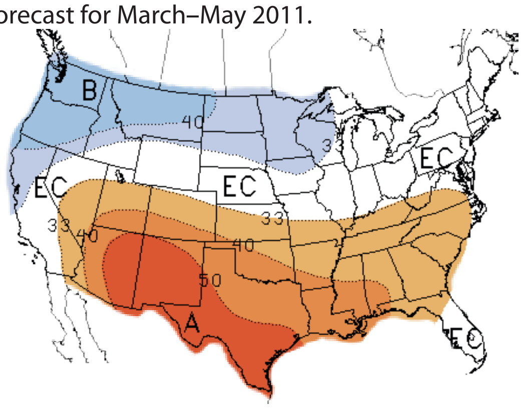


Figure 9b. Long-lead national temperature forecast for April–June 2011.

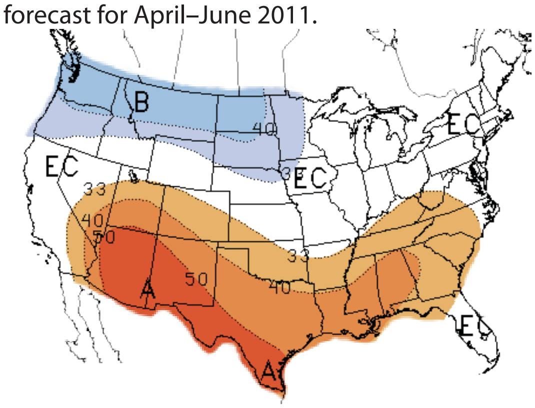


Figure 9c. Long-lead national temperature forecast for May–July 2011.

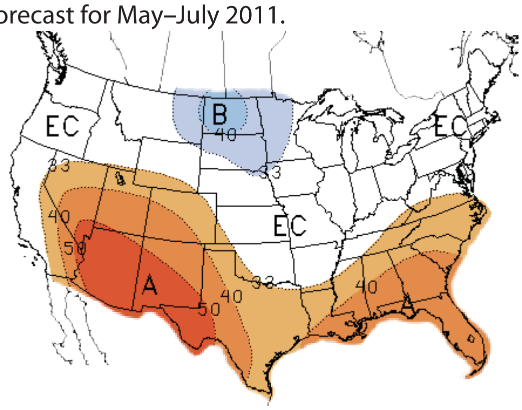
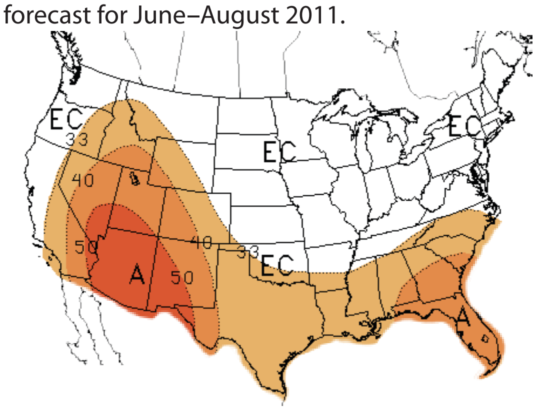


Figure 9d. Long-lead national temperature forecast for June–August 2011.



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

B = Below: 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.php

For seasonal temperature forecast downscaled to the local scale, visit: http://www.weather.gov/climate/l3mto.php

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

Precipitation Outlook

(March 2011–August 2011)

Data Source: NOAA-Climate Prediction Center (CPC)

The NOAA–Climate Prediction Center (CPC) precipitation outlooks suggest drier-than-average conditions for most of the winter and into the spring for all of Arizona and New Mexico (Figures 10a–b). The highest chances for decreased precipitation in Arizona are projected for the Mach–May period, while the highest chances in New Mexico correspond to April–June. Both of these outlooks in part reflect the expectation that the La Niña event will persist through these periods. As the summer progresses into the monsoon season, precipitation outlooks call for equal chances for above-, below-, or near-average conditions (Figures 10c–d). These outlooks largely reflect the lack of forecast skill for this period. As the monsoon season approaches, more accurate forecasts will be available.

Notes:

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

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

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

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

Figure 10a. Long-lead national precipitation forecast for March–May 2011.

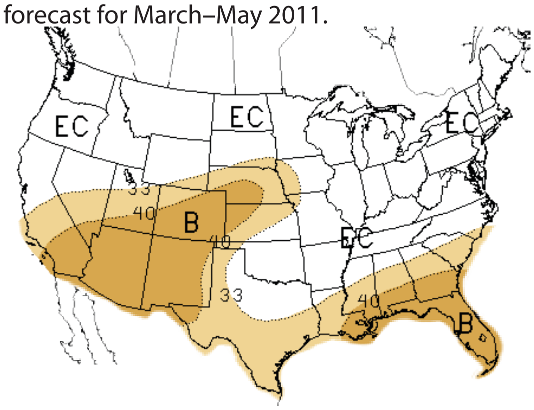
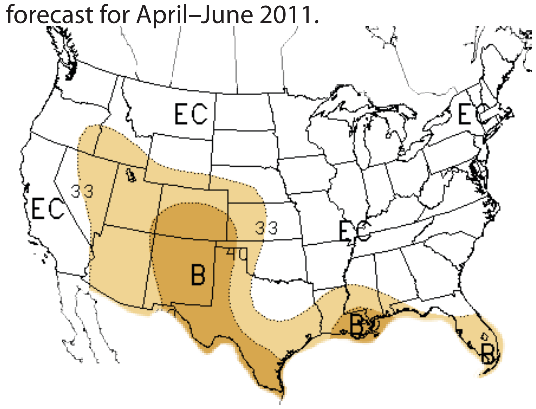


Figure 10b. Long-lead national precipitation forecast for April–June 2011.



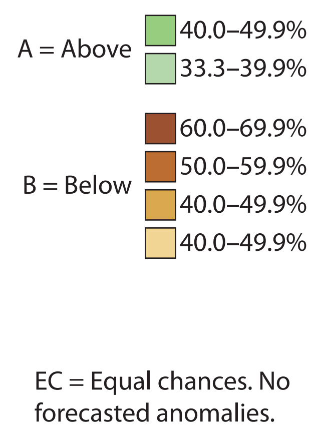


Figure 10c. Long-lead national precipitation forecast for May–July 2011.

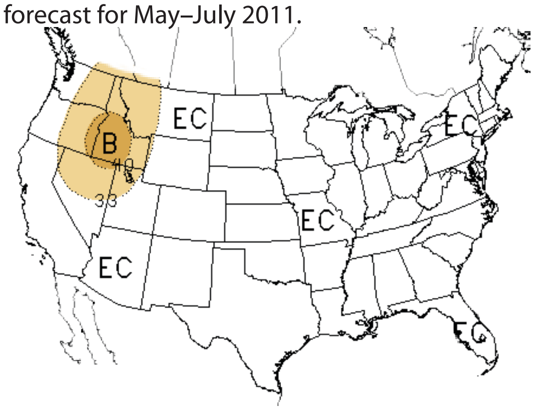
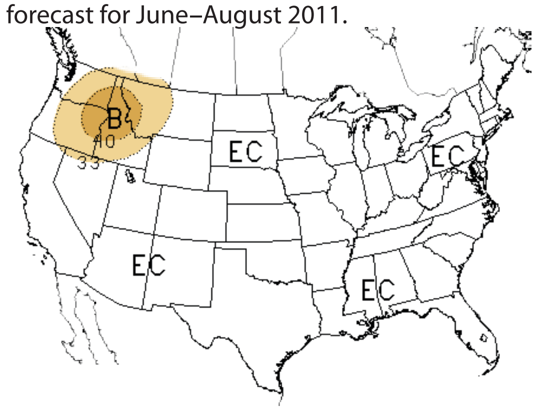


Figure 10d. Long-lead national precipitation forecast for June–August 2011.



On the Web:

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

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

Seasonal Drought Outlook

(through May)

Data Source: NOAA-Climate Prediction Center (CPC)

This summary is excerpted and edited from the February 17 Seasonal Drought Outlook technical discussion produced by the NOAA–Climate Prediction Center and written by forecaster D. Miskus.

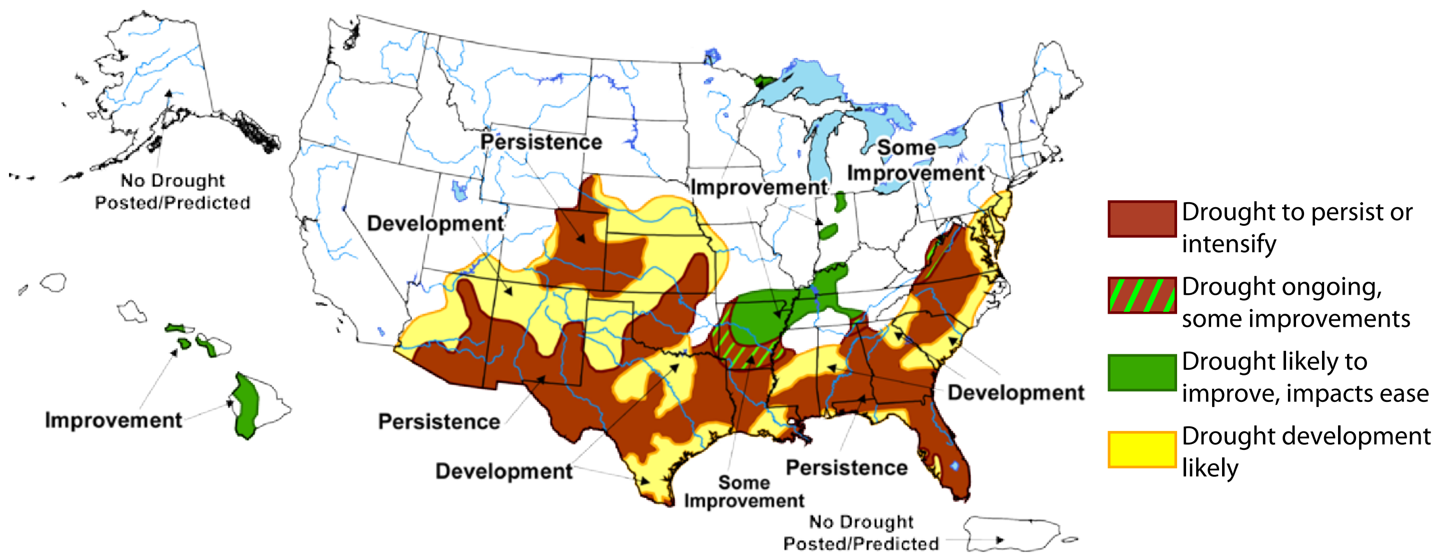
Drier-than-average conditions have affected much of Arizona and New Mexico since mid-December. No precipitation fell in January in many parts of both states, and New Mexico experienced its driest January on record, according the NOAA–Climate Prediction Center. By February 15, snow telemetry (SNOTEL) stations in southern and central Arizona and New Mexico were reporting 30 to 70 percent of average snow water content (SWC) in the snowpack. Looking forward, forecasts at all time ranges indicate increased chances for below-median precipitation and above-average temperatures. These forecasts are in part influenced by the La Niña event that is expected to continue and which typically brings drier and hotter weather to the region. As a result of scant precipitation so far this winter, a tendency for parched conditions during La Niña events, forecasts that call for below-median precipitation and above-average temperatures, and decreasing precipitation trends in recent decades, drought conditions are expected to persist and develop across much of Arizona and New Mexico and into southeastern Utah and southwestern Colorado (Figure 11). However, drought expansion is not forecast for Southern California, as many locations there already have exceeded their average winter precipitation as a result of intense storms in December. The CPC assigns a high confidence for this forecast.

Elsewhere in the U.S., the La Niña event has and will continue to impact southern regions. The monthly and seasonal outlooks issued by the NOAA–Climate Prediction Center indicate the highest odds for below-median precipitation along the eastern two-thirds of the Gulf Coast. Drought is expected to persist or develop across most of the Southeast, except in northern sections of Mississippi and Alabama where initial conditions are wetter and the monthly precipitation outlook favors near- to above-median precipitation.

Notes:

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

Figure 11. Seasonal drought outlook through May (released February 17).



On the Web:

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

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

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

Streamflow Forecast

(for spring and summer)

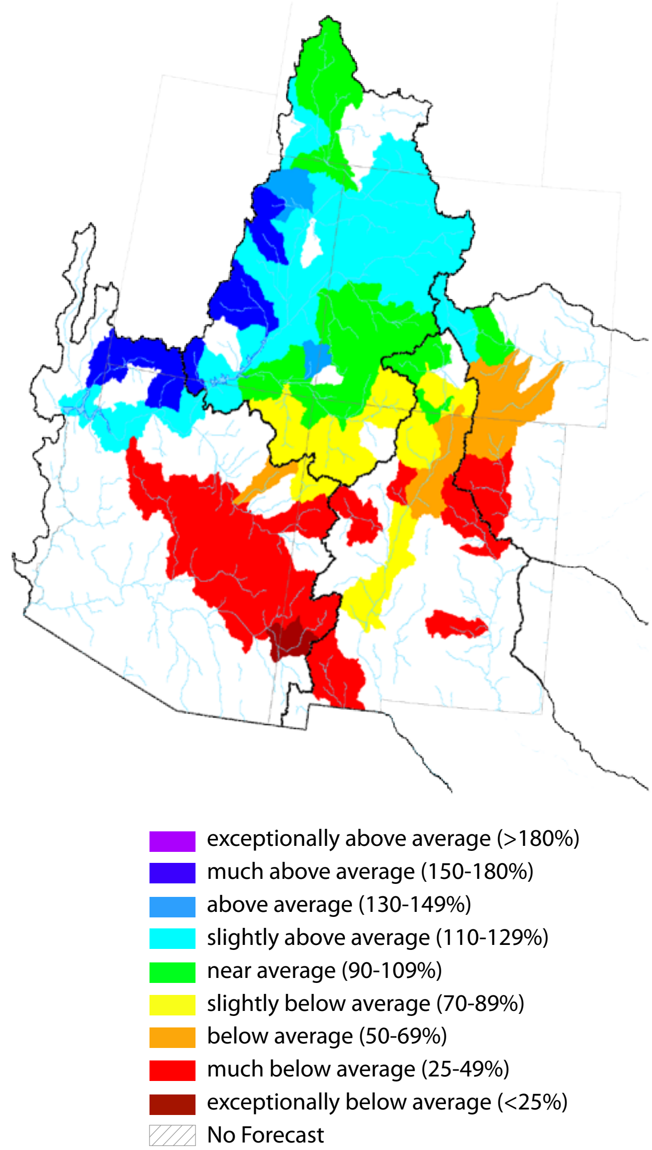
Source: National Water and Climate Center

The spring–summer streamflow forecast for the Southwest, issued on February 1, shows below-average flows for basins in the Mogollon Rim region of Arizona and New Mexico basins and near- to above-average flows for most of the Upper Colorado River Basin (Figure 12). Widespread and intense storms that drenched California, northwest Arizona, and Utah in mid-December have contributed to an optimistic spring streamflow forecast for the Colorado River Basin. The dry southern regions of Arizona and New Mexico reflect the influence of La Niña events, which often deflect the storms north. In January, most of New Mexico and Arizona received scant precipitation; it was the driest January on record for New Mexico, according to the NOAA-Climate Prediction Center.

The most current forecast for Arizona suggests a 50 percent chance that inflow to Lake Powell will be about 113 percent of the 1971–2000 average for April–July, or 9 million acre-feet, which is a slight decrease from the forecast issued on January 1. Forecasts for the Salt River and Upper Gila, on the other hand, call for very low probabilities that flows will be near average. Forecasts indicated only a 30 percent chance that streamflow in the Salt and Upper Gila rivers during the February–May period will be equal to or greater than about 50 and 37 percent of average, respectively.

In New Mexico, the February 1 forecast shows the majority of the state on pace for a below-average runoff season. The only average or above-average forecast is for the San Juan River Basin; this forecast reflects the above-average snowpack in northern New Mexico, southern Colorado, and the Upper Rio Grande. Streamflow forecasts decline south of these basins due to lower-than-average snowpack in these areas. However, it is still early in the snow season and conditions could change rapidly.

Figure 12. Spring and summer streamflow forecast as of February 1 (percent of average).



Notes:

Water supply forecasts for the Southwest are coordinated between the National Water and Climate Center, part of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), and the Colorado Basin River Forecast Center (CBRFC), part of NOAA. The forecast information provided in Figure 12 is updated monthly by the NWCC. Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences, such as reservoirs and diversions. The coordinated forecasts by NRCS and NOAA are only produces for Arizona between February and April, and for New Mexico between February and May.

The NRCS provides a range of forecasts expressed in terms of percent of average streamflow for various exceedance levels. The 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. The CBRFC provides a range of streamflow forecasts in the Colorado Basin ranging from short fused flood forecasts to longer range water supply forecasts. The water supply forecasts are coordinated monthly with NWCC.

On the Web:

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

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

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

El Niño Status and Forecast

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

The La Niña event continues to reign across the equatorial Pacific Ocean but recently has shown signs of weakening. Sea surface temperatures (SSTs) this past week were still quite cool across the eastern Pacific, measuring 1.2 degrees Celsius (about 2 degrees Fahrenheit) below average but have slightly warmed since the end of January. The NOAA-Climate Prediction Center (CPC) also noted that the far eastern Pacific SSTs had warmed to near-average levels, and subsurface water temperatures also had warmed slightly. The weakening event is also evident in the atmosphere. Easterly winds at the surface along the equator are currently with less strength than in previous months. However, the atmosphere is still fully engaged and responding to the current La Niña event, which is evident in the strongly positive Southern Oscillation Index (SOI, Figure 13a).

Forecasts produced by the International Research Institute for Climate and Society (IRI) continue to indicate a high probability (greater than 90 percent) that La Niña conditions will continue into the early spring (Figure 13b). The chance of La Niña conditions persisting into the April–June period falls to 49 percent, while the chance of neutral conditions returning rises to 42 percent. IRI notes that late winter is the typical time for La Niña events to weaken, and that is reflected in forecasts for the remainder of the spring. However, this is the time of year when the El Niño Southern Oscillation (ENSO) forecast confidence is lowest, according to the CPC, so it is unclear whether neutral conditions will rapidly return later this spring or La Niña conditions will continue to linger. Some models suggest a high chance that La Niña will persist for another year.

The continuation of La Niña conditions in the short-term will continue to have profound impacts on the Southwest, likely delivering below-average precipitation to Arizona and New Mexico.

Figure 13a. The standardized values of the Southern Oscillation Index from January 1980–December 2010. 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).

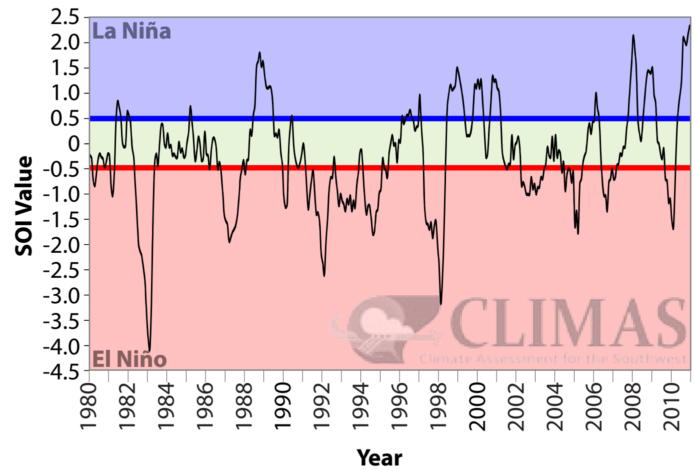
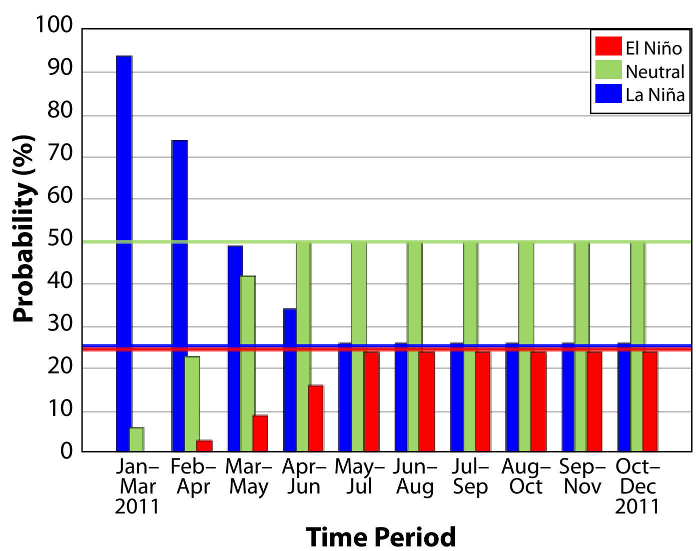


Figure 13b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released February 17). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through January 2011. 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.

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

On the Web:

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

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

Temperature Verification

(March 2011–August 2011)

Data Source: Forecast Evaluation Tool

For a thorough description of the interpretation of these maps, see the feature article, "Evaluating forecasts with the RPSS," in the April 2009 issue of the Southwest Climate Outlook.

Comparisons of observed temperatures for March–May to forecasts issued in February for the same period suggest that forecasts have been more accurate than a forecast of equal chances (i.e., a 33 percent chance that temperatures will be above, below, or near average) in all of Arizona and New Mexico (Figure 14a). Forecast skill—a measure of the accuracy of the forecast—is substantially higher than equal chances in most of both states. For the April–June period, forecasts have been better than equal chances in all of Arizona and New Mexico, except for northern New Mexico (Figure 14b). For the three- and four-month lead times, forecasts issued in February generally have been substantially more accurate in Arizona (Figures 14c–d). While bluish hues suggest that NOAA–Climate Prediction Center (CPC) historical forecasts have been more accurate than equal chances, caution is advised to users of the seasonal forecasts for regions with reddish colors.

Notes:

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

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

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

Figure 14a. RPSS for March–May 2011.

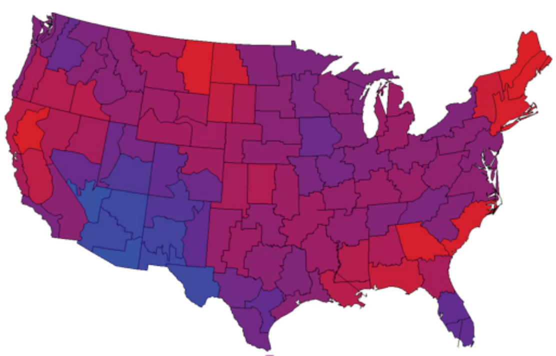


Figure 14b. RPSS for April–June 2011.

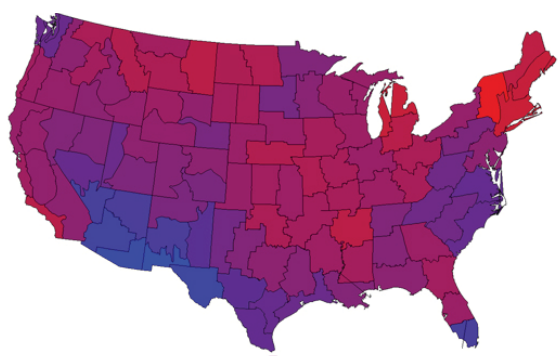


Figure 14c. RPSS for May–July 2011.

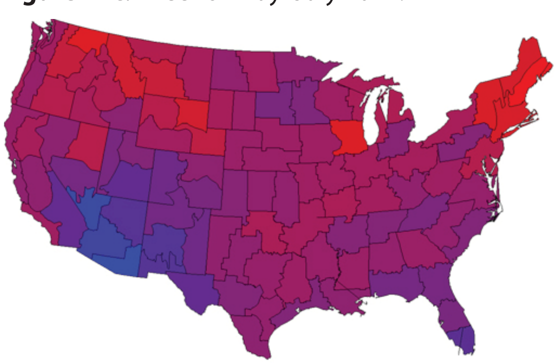
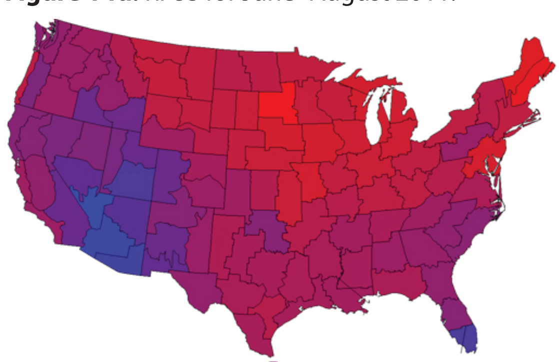
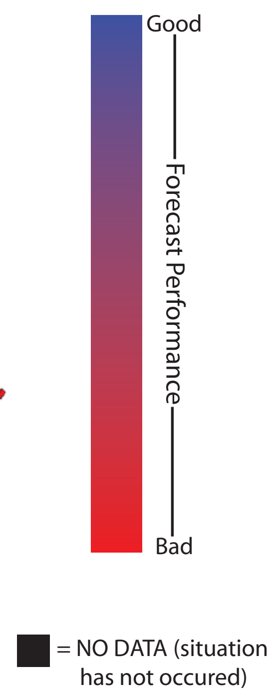


Figure 14d. RPSS for June–August 2011.





On the Web:

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

For a CLIMAS publication that explains how to use the Forecast Evaluation Tool, visit
http://www.climas.arizona.edu/feature-articles/november-2005

Precipitation Verification

(March 2011–August 2011)

Data Source: Forecast Evaluation Tool

For a thorough description of the interpretation of these maps, see the feature article, "Evaluating forecasts with the RPSS," in the April 2009 issue of the Southwest Climate Outlook.

Comparisons of observed precipitation for March–May to forecasts issued in February for the same period suggest that forecasts have only substantially been more accurate than equal chances in parts of Arizona (Figure 15a). Forecast skill—a measure of the accuracy of the forecast—has been highest in southern regions of both Arizona and New Mexico. For the April–June period, forecasts have been less accurate than equal chances in southern parts of both states and near equal chances in other regions (Figure 14b). For the three-month lead time, forecasts have been substantially more accurate than equal chances only in southeast Arizona (Figure 15c). For the four-month lead time, forecasts have been substantially more accurate than equal chances only in southern regions of both states (Figure 15d). Regions with bluish hues suggest that the NOAA–Climate Prediction Center (CPC) forecasts have historically been more accurate than equal chances. However, caution is advised to users of the NOAA–CPC seasonal outlooks for regions where the verification maps display reddish hues.

Notes:

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

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

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

Figure 15a. RPSS for March–May 2011.

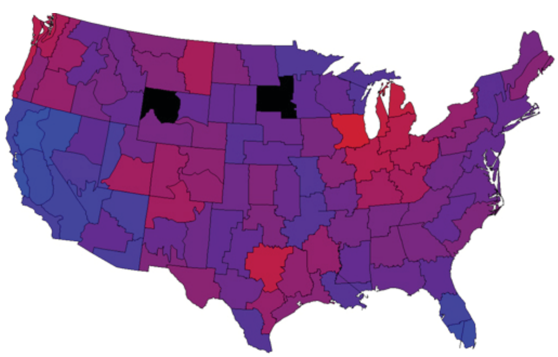


Figure 15b. RPSS for April–June 2011.

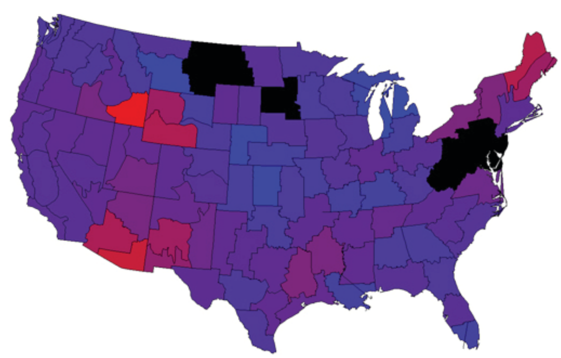


Figure 15c. RPSS for May–July 2011.

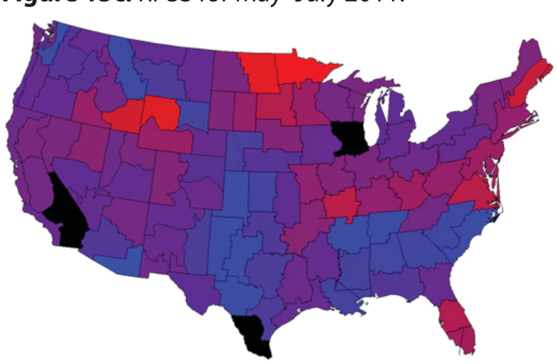
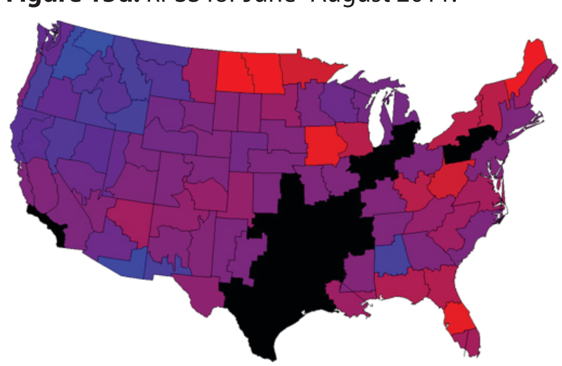
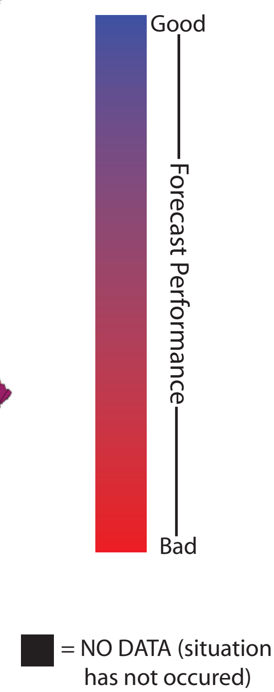


Figure 15d. RPSS for June–August 2011.





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