November 23, 2009

Southwest Climate Outlook

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Source: Zack Guido, CLIMAS. October 18, 2009.

Photo Description: Clouds shade part of the craggy cliffs on the eastern side of the Dragoon Mountains in southern Arizona.

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In this issue...

CLIMAS Climate Assessment for the Southwest

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

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November Climate Summary

Drought– In Arizona, the entire state is classified as experiencing abnormally dry conditions or worse while in New Mexico only 29 percent of the state is abnormally dry or worse.

Temperature– For most of Arizona, temperatures have been 0–4 degrees F above average the past 30 days. In New Mexico temperatures ranged from two degrees above to two degrees below average.

Precipitation– In the past 30 days, only two storms brought significant precipitation to the Southwest, predominantly benefitting central and eastern New Mexico. All of Arizona has received below-average precipitation, and most of the state has experienced less than 25 percent of average precipitation.

ENSO– El Niño conditions strengthened to moderate levels this past month with sea surface temperatures exceeding 1.5 degrees C in the central and eastern equatorial Pacific Ocean. Weak-to-moderate El Niño conditions are expected to persist throughout the winter and early spring seasons.

Climate Forecasts– Seasonal temperature forecasts call for a slightly enhanced chance that temperatures will be above average. For precipitation, the El Niño event heavily influences the seasonal forecasts all of which call for increased chances for precipitation to be above average.

The Bottom Line– All of Arizona continues to be classified with abnormally dry conditions or worse as winter precipitation has not yet helped minimize the effect of a very dry summer monsoon season and temperatures in much of the region have been above-average. However, rain and snow may be on the way as El Niño often brings wetter-than-average conditions to the southern portions of the Southwest. A wet winter, however, is not guaranteed. The last time the Southwest experienced a moderate-strength winter El Nino, dry conditions reigned.

Southwestern forests may be ineffective at storing CO_2

Reforestation often has been lauded as an effective strategy for sucking carbon dioxide from the atmosphere and minimizing the global warming effect of the heat-trapping gas. The idea is simple. Trees consume carbon dioxide from the atmosphere to grow. With lower amounts of CO_2 in the air, less energy is trapped and temperatures decrease. However, reforestation may not be a wise strategy in the Southwest, and many questions still remain.

Forest ecologists at the Northern Arizona University (NAU) say that allowing forests to grow unchecked in the arid Southwest can create enormous tinder boxes. If a forest ignites, most of the carbon stored in the wood and roots is released back into the atmosphere and forms CO_2, negating any temperature-reducing benefit of storing the CO_2 in the trees. The amount of CO_2 released by a fire, however, may be different for small and large conflagrations. Researchers from NAU hope to answer this question, which will aid in forest management decisions.

Table of Contents:

SWCO Staff:

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

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

The 2009 southwest monsoon: El Niño's heavy hand

By Zack Guido

Anvil-shaped cumulous clouds dotted the sky in early June, occasionally bursting with heavy rains in many parts of New Mexico and southeastern Arizona. The much-needed moisture turned the stalks of blue and black gramma grasses a light green, filled stock ponds, and flushed torrents of water down sandy washes. The monsoon rains had arrived. This year they moistened the landscape earlier than usual and in quantities that exceeded average years.

But soon after the rains arrived, the clouds evaporated. The wet June turned into a dry July then a parched August and then a dehydrated September. Not even tropical storm Jimena, which blew into the Southwest in early September, could dampen the effects of drought. Impacts of the dry conditions were reported all over Arizona. Ranchers in southern portions of the state sold livestock in droves, sections of streams with perennial flow dried to a trickle, and Blue Oak trees aborted their buds. In the Four Corners region springs dried and corn stalks withered.

About half of the yearly precipitation in Arizona and New Mexico pelts the ground between the beginning of June and the end of September—but not this year. A close examination at rainfall amounts from this summer reveals that most of Arizona experienced the driest summer in the last 60 years, causing the entire state to be plagued with drought conditions. Although New Mexico fared better, it also was not spared. Climatologists point to El Niño as the principal cause of scant rains. But while El Niño stonewalled summer rains and brought short-term drought conditions to most of the Southwest, El Niño often enhances winter precipitation. A wet winter, however, is not guaranteed.

Monsoon Recap

Prior to the monsoon season, climate scientists noted low snowpack in the Rocky Mountains, dry conditions on the southern plains, and Pacific Ocean sea surface temperatures with a pattern in space that was similar to last year. These clues contributed to the prediction that the monsoon storms would arrive early and unload above-average rainfall during the first part of the season. This forecast came true for many parts of southeastern Arizona and New Mexico. Some areas received more than 300 percent of their average rain between June 15—the official start date of the monsoon season in Arizona—and July 15 (Figure 1a).

"The beginning of the monsoon season looked good," said Erik Pytlak, Science and Operations Officer at the National Weather Service in Tucson.

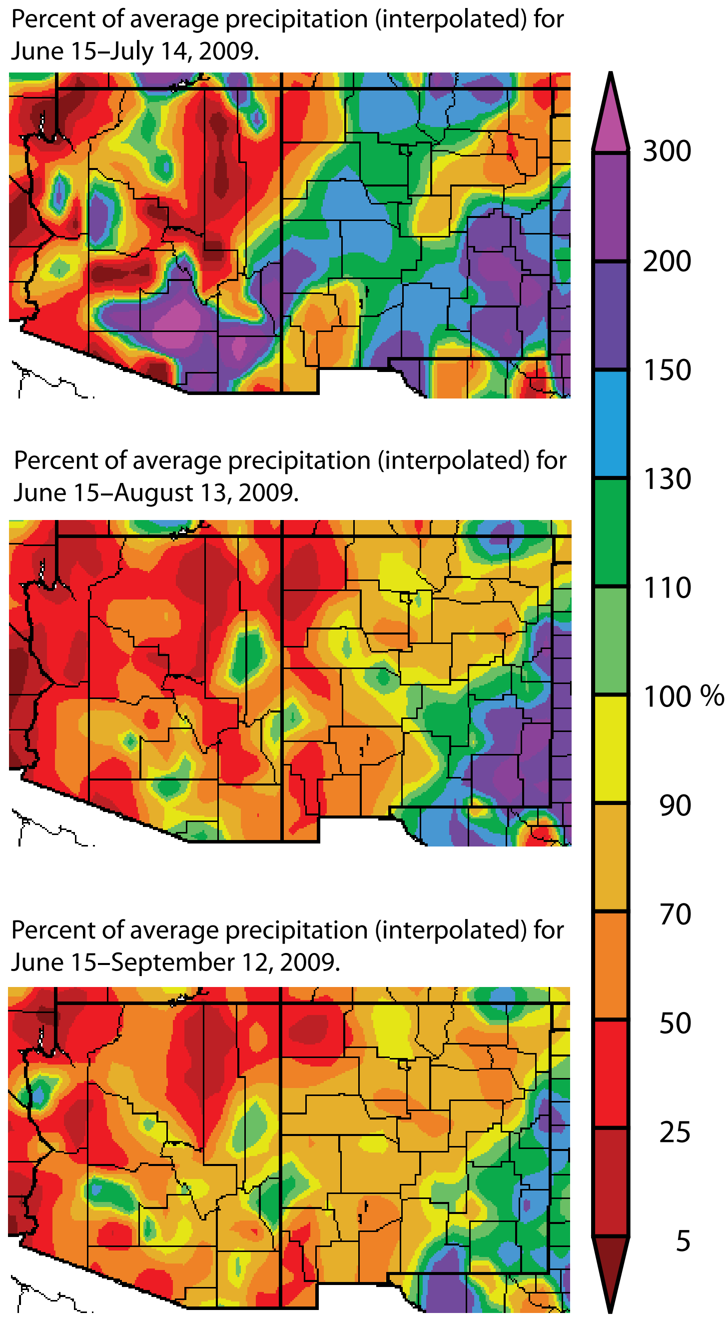


Figure 1. Monsoon rainfall in the Southwest was characterized by an early and wet beginning in some parts of the region with dry conditions that began soon thereafter. The maps display the evolution of summer rains during the 30-day period beginning on June 15—the official start of the monsoon in Arizona—and September 12. Rainfall is expressed as the percent of the 1971–2000 average.

In the first month of the monsoon season, southern Arizona, southeastern New Mexico, and parts of central and northern New Mexico received above-average precipitation. The Four Corners region, however, was dry, a normal occurrence at this time of year because rain usually begins in earnest in late July. While the dryness in the northern region was not out of the ordinary, it was unusual for

continued on page 4

Monsoon, continued

Arizona's Mogollon Rim country to have received less than 50 percent of average precipitation. According to the National Weather Service in Tucson, this likely occurred because hot and dry weather in south Texas stalled the high pressure system south of its typical location over the Four Corners region which prevented moisture aloft in the atmosphere from passing over the Mogollon Rim.

At the beginning of July, however, climate scientists were skeptical that the rains would continue. The official seasonal forecasts issued by the National Oceanic and Atmospheric Administration (NOAA) stated that there was an equal chance that August–October precipitation would be above average, below average, or average for all of Arizona and the southwestern half of New Mexico. This uncertainty resided in the rapidly forming El Niño event which often causes two phenomena that have opposite effects on precipitation in the Southwest. On one hand, El Niño events can stifle summer rains because they weaken and/or reposition the subtropical high that guides moisture into the Southwest. On the other hand, El Niño events also can foment a higher number of tropical storms, some of which blow into the Southwest and deliver torrential rains.

Although tropical storms formed in the eastern Pacific Ocean this year more often than in average years, most storms wafted westward away from land, and the Southwest saw little benefit from the enhanced storm activity.

"To make a long story short, the primary driver in shutting down the monsoon was El Niño," said Pytlak.

By July the sea surface temperatures in the tropical Pacific Ocean were about 1 degree fahrenheit warmer than average, the temperature threshold for an El Niño event. The warm ocean water then influenced atmospheric circulation. The high pressure system that usually sets up over the Four Corners region was pulled southward, blocking the flow of moist air into southern Arizona and New Mexico. The Jet Stream wind current, ripping through the atmosphere at an altitude of about 30,000 feet, also was accelerated and flowed in a more southerly path across the U.S. This caused surface winds to originate out of the southwest instead of the southeast where the tap for much of monsoon moisture resides.

While scientific research has yet to pin down exactly why El Niño causes these changes to atmospheric circulation, it is a good bet that El Niño is to blame.

"Monsoon precipitation this year was so far below normal rainfall amounts that El Niño certainly played a role," said Mike Crimmins, Climate Science Extension Specialist at The University of Arizona.

Data gathered from weather stations throughout the Southwest place this summer's aridity in perspective. In each of the seven climate divisions in Arizona [climate divisions lump regions with similar agricultural productivity and are divided in part based on watersheds] July precipitation calculated by using the Parameter-elevation Regressions on Independent Slopes Model (PRISM) dataset was below the 1971–2000 average. July, however, seemed wet compared to August (Figures 1b–c). In the Northeast (Four Corners region) and East Central climate divisions in Arizona, August experienced the least amount of rainfall in the last 60 years (Figure 2). The five other climate divisions experienced conditions that ranked in the top eight driest Augusts on record. New Mexico had a similar story. Five of the eight climate divisions experienced the second, third, or fourth driest August, while the other three divisions were in the top thirteen. On August 20, the severe dry conditions lead the U.S. Drought Monitoring Committee to classify 96 percent of Arizona with abnormally dry conditions or worse, an increase of 36 percent from the previous month. The area in New Mexico classified as abnormally dry or worse was around 45 percent and had increased about nine percent from mid-July.

In September dry conditions continued to prevail. Rainfall in each of Arizona's climate divisions was again below average—five of the seven divisions received half the 1971–2000 September average (Figure 2). New Mexico, however, received near-average rainfall during the month in six of its eight climate divisions; the exceptions were in the Northeastern Plains and the Southeastern Plains regions where rainfall was about 60 percent of the 1971–2000 average. Had it not been for hurricane Jimena, which struck Baja, California and Mexico on September 2 and soaked parts of Arizona and New Mexico soon thereafter, rainfall in the Southwest would have been even less.

By the end of the summer, the verdict was in. The monsoon was a dud. In many parts of the Southwest, particularly in Arizona, El Niño had become this monsoon season's Grinch.

According to the PRISM dataset, Arizona experienced the driest June–September between 1950–2009—all seven climate divisions ranked in the top five driest summers; four of them ranked as the driest. Although New Mexico fared considerably better, the summer of 2009 still experienced below-average precipitation.

"Our worst fears that we had in May came true. El Niño took over," said Pytlak.

A look ahead

Climatologists cite El Niño as a leading cause for the scant rainfall in the Southwest this summer. But El Niño also has a tendency to bring wetter-than-average conditions to the Southwest in the winter. Although this bodes well for the prospect

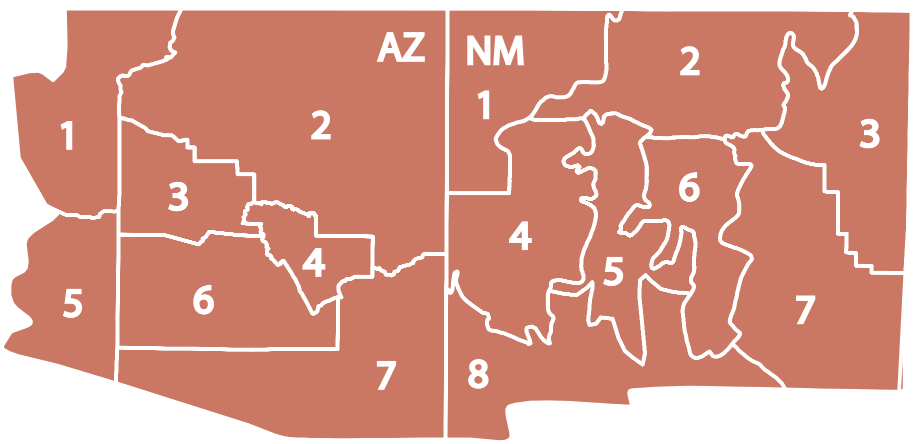
continued on page 5

Monsoon, continued

of much needed rain and snow, it is not a sure thing.

A cursory look at winter precipitation during El Niño events reveals that all climate divisions in Arizona and New Mexico tend to receive above-average precipitation. However, the amount of precipitation during the winter changes by location, and the possibility exists for a dry winter. In Arizona between 1896 and 2002, about 50 percent of the winters experiencing an El Niño event received more than 115 percent of the average precipitation and about 25 percent of the winters received less than 85 percent of the average precipitation.

Critical winter precipitation for the Southwest also falls as snow in the headwaters of the Colorado River in Utah, Wyoming, and Colorado. In fact, about 70 percent of the water that flows in the region's most important river originates in the mountains to the north. However, El Niño is more likely to bring drier conditions to those regions because storm tracks carrying vital moisture are deflected southward. Typically, when the southern regions of the Southwest are wet, the Upper Colorado River Basin is dry. For example, during El Niño events between 1896 and 2002, the Colorado portion of the Upper Colorado River Basin received less than 85 percent of average precipitation nearly one-third of the time. El Niño events during the same period delivered more than 115 percent of average precipitation only 27 percent of the time. If history plays out this year, the Upper Colorado River Basin has roughly the same odds for a wet or dry winter.



Climate Division	Jun (%)	Jul (%)	Aug (%)	Sep (%)	Summer Total (%)	Summer Rank (1950-2009)
AZ1–Northwest	65	60	23	51	46	3
AZ2–Northeast	106	56	27	55	49	1
AZ3–North Central	46	62	20	49	42	1
AZ4–East Central	97	76	21	77	55	1
AZ5–Southwest	50	58	22	55	41	5
AZ6–South Central	33	65	33	48	46	1
AZ7–Southeast	136	76	47	70	68	5
NM1–NW Plateau	236	50	30	99	73	13
NM2–Northern Mtns	142	84	36	124	86	21
NM3–NE Plains	77	135	48	60	84	20
NM4–SW Mtns	193	71	71	115	92	31
NM5–Central Valley	122	101	50	104	86	27
NM6–Central Highlands	101	98	45	104	121	15
NM7–SE Plains	105	174	30	58	88	30
NM8–Southern Desert	116	89	53	101	82	18

Figure 2. The percentage of average monthly precipitation in Arizona and New Mexico varied by climate division during the monsoon season. The summer rank indicates the relative dryness of each climate division compared to other summers during the 60-year period between1950–2009.

Even in Arizona, where the likelihood of a wet winter during an El Niño event is higher, there are regional differences in the amount of precipitation. The Four Corners region, for example, experiences high rain and snow amounts only 44 percent of the time compared to southeast and southwest Arizona, which receive higher precipitation 56 and 59 percent of the time.

"The important lesson is that El Niño does not mean a slam dunk for a wet winter," Pytlak said. "In 2002–2003," he continued, "the last time we had an El Niño event with similar strength as the current El Niño, the winter was dry."

In that year, however, El Niño peaked in October and fizzled out early in the winter. This year may be different.

"We are seeing a build-up of warm water just below the surface [in the Pacific Ocean]," said Pytlak. "We are seeing more and more evidence that water temperatures will warm and the El Niño event will increase in strength."

A longer lasting event may bring much needed rains. Fortunately, all indications point to El Niño continuing through the winter months.

"Right now, the National Weather Service is cautiously optimistic," said Pytlak.

Temperature (through 11/18/09)

Source: High Plains Regional Climate Center

Since the water year began on October 1, average temperatures have been between 65 and 75 degrees Fahrenheit in the southwest deserts of Arizona and 55 to 65 degrees F in southeast Arizona and along the Mogollon Rim in Arizona's northwest mountains (Figure 1a). Temperatures in the Colorado Plateau region of Arizona and in the northern two-thirds of New Mexico have mostly averaged 45 to 55 degrees F, with the highest elevations averaging between 40 and 45 degrees F in the Flagstaff area of Arizona and 35 to 40 degrees in the Sangre de Cristo Mountains in northern New Mexico. Since the water year began, temperatures are near average in northern and southwestern Arizona and northeastern and central New Mexico, but are one to two degrees F above average in southeastern New Mexico, and more than three degrees warmer in the southern half of the New Mexico-Arizona border and in southeastern Arizona (Figure 1b). The coolest part of the region has been in east central Arizona and west central New Mexico near Grants where temperatures have been 2 to 4 degrees below average.

In the past 30 days, temperatures in southern Arizona have been 2 to 4 degrees F above average while northern Arizona has been 0 to 4 degrees F above average (Figure 1c–d). New Mexico has had temperatures ranging from 2 degrees above to 2 degrees below average. Daytime temperatures have also been variable. Record high and record low temperatures in Arizona have occurred in the past six weeks.

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

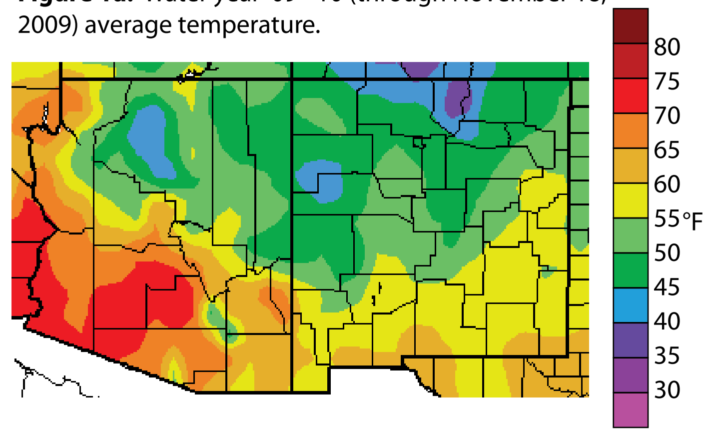


Figure 1a. Water year '09–'10 (through November 18, 2009) average temperature.

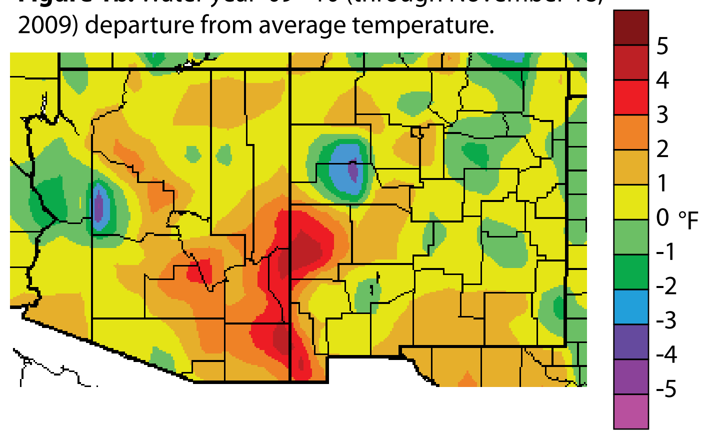


Figure 1b. Water year '09–'10 (through November 18, 2009) departure from average temperature.

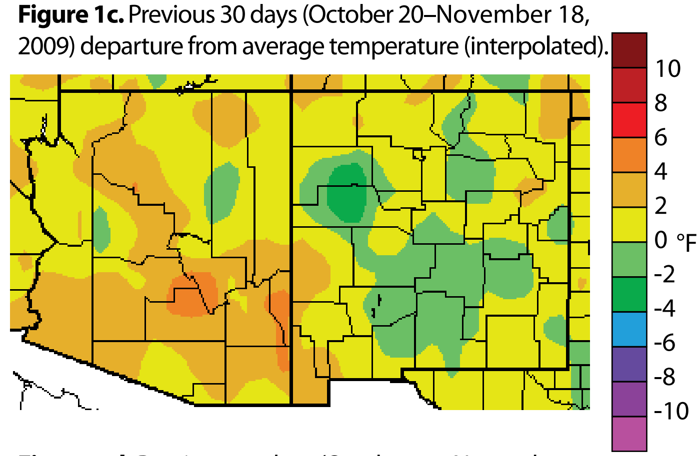


Figure 1c. Previous 30 days (October 20–November 18, 2009) departure from average temperature (interpolated).

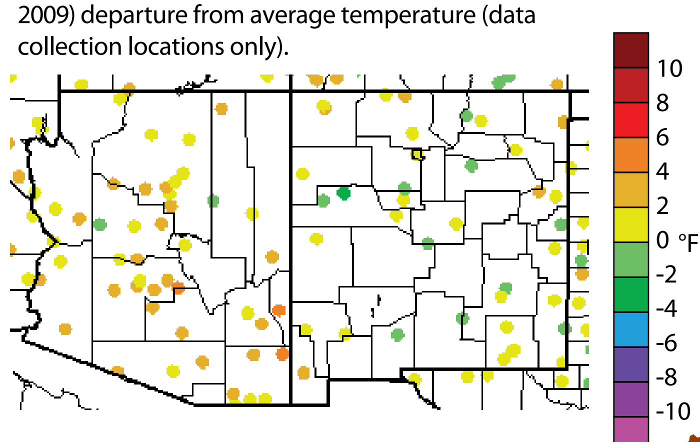


Figure 1d. Previous 30 days (October 20–November 18, 2009) departure from average temperature (data collection locations only).

Precipitation (through 11/18/09)

Source: High Plains Regional Climate Center

Dry conditions across Arizona and southwestern New Mexico characterize the 2009 water year, which began on October 1. Most of Arizona has received less than 25 percent of average precipitation since the start of the water year, and about half the state has received less than 5 percent of average precipitation (Figure 1a–b). The atmospheric circulation pattern since October 1 has directed upper level low pressure systems and cold fronts across Utah and Colorado, but well north of Arizona. New Mexico, on the other hand, benefited from heavy precipitation when several of those storms dipped into the state. Some isolated areas in New Mexico have received 110 to about 300 percent of average precipitation so far.

In the past 30 days, only two storms have brought significant precipitation to the region. While rain pelted the lower elevations and snow blanketed high areas in central and eastern New Mexico, these storms missed western and southwestern Arizona. Most of Arizona has received less than 25 percent of average precipitation, and many regions in both states have received less than 50 percent. Wetter conditions may return to the Southwest as El Niño events help direct storm systems down the west coast and across southern California into Arizona and New Mexico.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2009, we are in the 2010 water year. The water year is a more hydrologically sound measure of climate and hydrological activity than is the standard calendar year.

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

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

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

On the Web:

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

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

Figure 2a. Water year '09–'10 (through November 18, 2009) percent of average precipitation (interpolated).

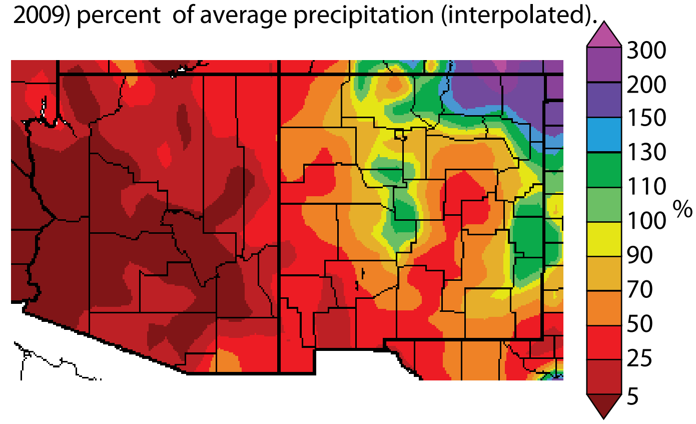


Figure 2b. Water year '09–'10 (through November 18, 2009) percent of average precipitation (data collection locations only).

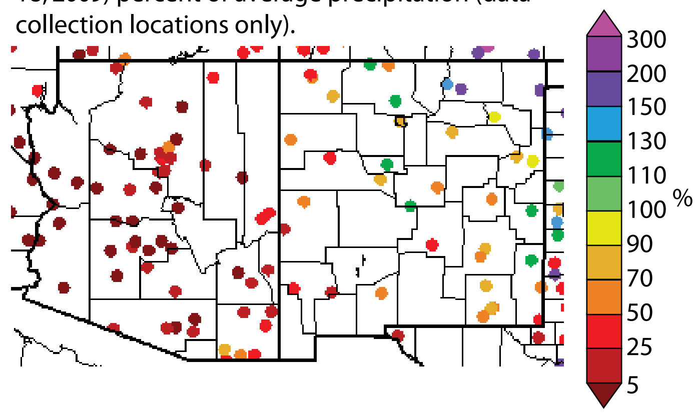


Figure 2c. Previous 30 days (October 20–November 18, 2009) percent of average precipitation (interpolated).

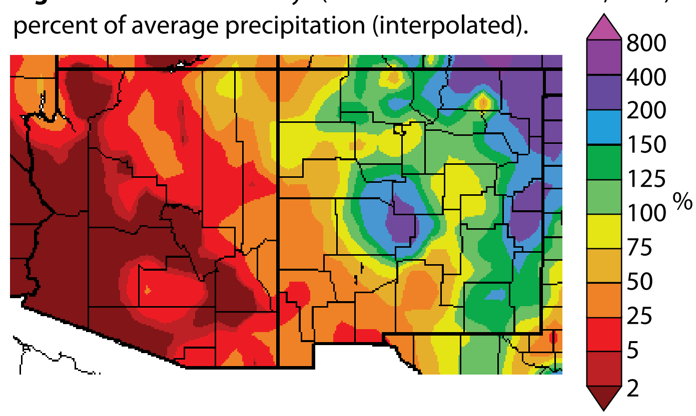
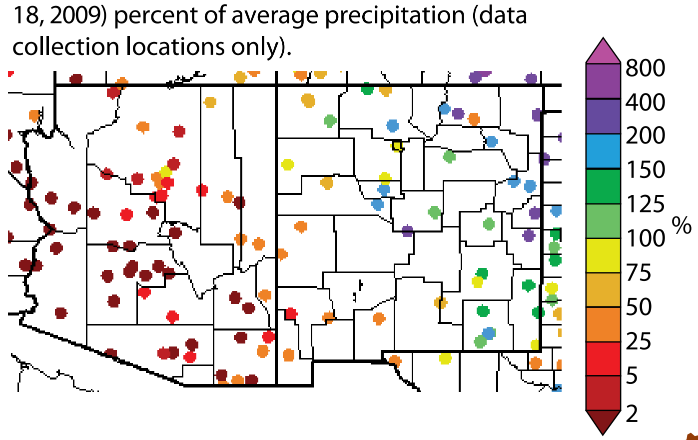


Figure 2d. Previous 30 days (October 20–November 18, 2009) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(released 11/19/09)

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

Dry conditions persisted during the last 30 days in Arizona, and the entire state continues to experience abnormally dry conditions or worse (Figure 3). The dry weather pattern across the Southwest in November led to an expansion of abnormally dry conditions in southern Utah. However, several early winter storms brought precipitation to the West Coast this past month, helping to improve short-term drought conditions in California. Drought conditions also improved along the Washington and Oregon coasts.

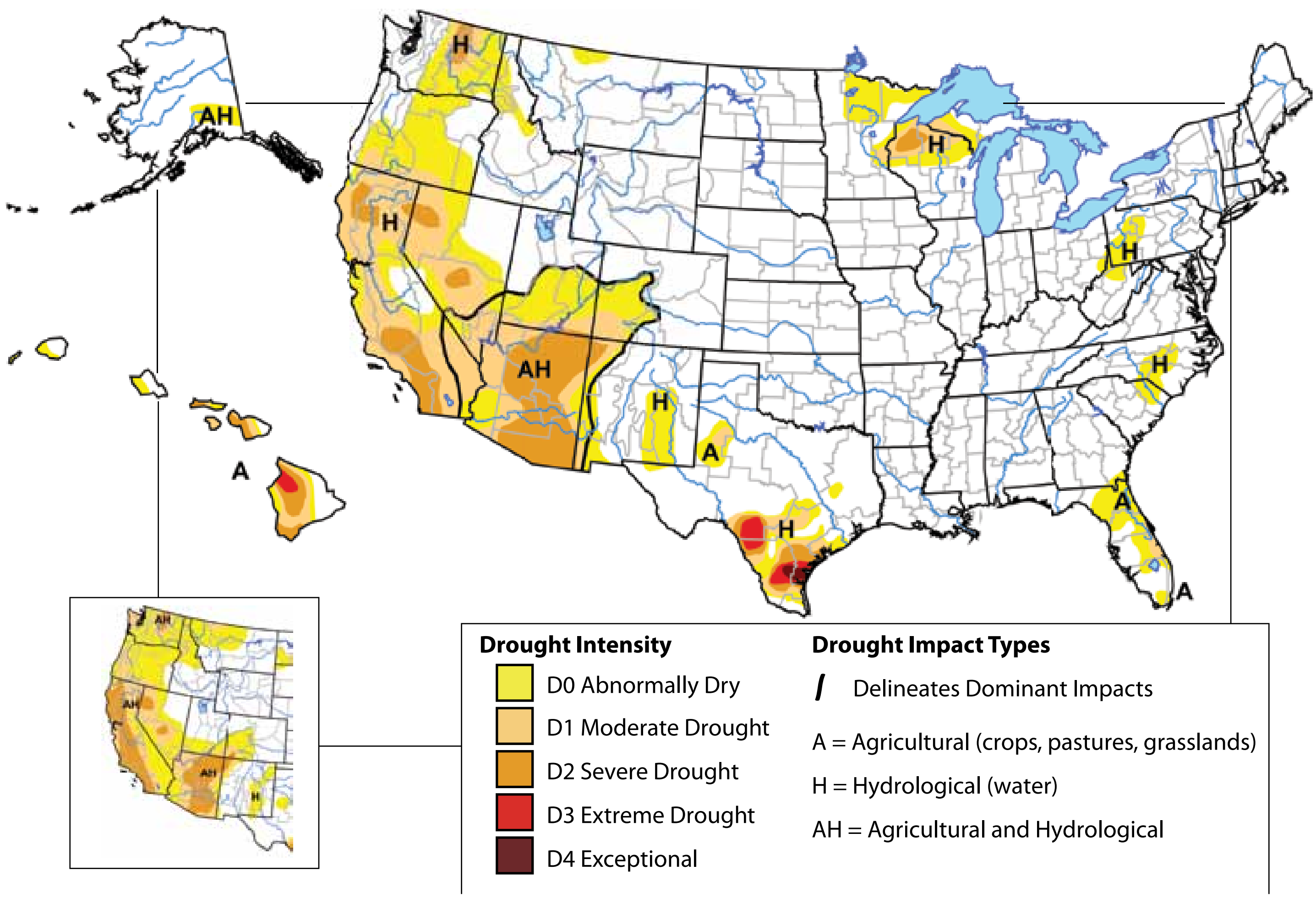
While dry conditions persisted in Arizona and other regions, the U.S as a whole experienced its wettest October on record. The National Oceanic and Atmospheric Administration (NOAA) reported that the average precipitation amount for the contiguous U.S. was 4.15 inches, nearly twice the normal amount based on long-term records. Iowa, Arkansas, and Louisiana observed their wettest October in 115 years. Only Florida, Utah, and Arizona recording below-average precipitation amounts during the month of October.

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 Eric Luebehusen, USDA.

Figure 3. Drought Monitor released November 19, 2009 (full size), and October 13, 2009 (inset, lower left).



On the Web:

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

Arizona Drought Status
(released 11/19/09)

Source: U.S. Drought Monitor

Dry conditions during the past thirty days have not helped improve drought conditions in Arizona. The entire state currently is experiencing some level of drought, and more than 50 percent of Arizona is classified with a severe drought status (Figure 4a). Despite the dry conditions in the past month, the National Drought Monitor's most recent update has the same drought condition pattern as was issued in mid-October and reported in the last issue of the Southwest Climate Outlook. For most of the state, drought conditions developed and quickly worsened during the second half of the monsoon season, since mid-July (Figure 4b). In many parts of the Southwest, including the Four Corners region, August rainfall measured close to the lowest value in the last 60 years.

Dry conditions in Arizona are causing numerous impacts to the landscape and people. The new on-line impact reporting system, Arizona DroughtWatch (http://azdroughtwatch.org), recorded more than 100 drought-related impacts in October. The majority occurred in the Santa Cruz River watershed where ranchers are observing dramatic reductions in forage quality and quantity, dry stock tanks, and exceptionally low water levels in ponds and streams. This is forcing many ranchers to sell herds. Similar impact reports have been logged on DroughtWatch for other areas in southeastern Arizona where exceptionally dry conditions have impacted local water resources and ecosystems, leading to secondary impacts on agricultural production and tourism.

Figure 4a. Arizona drought map based on data through November 17, 2009.

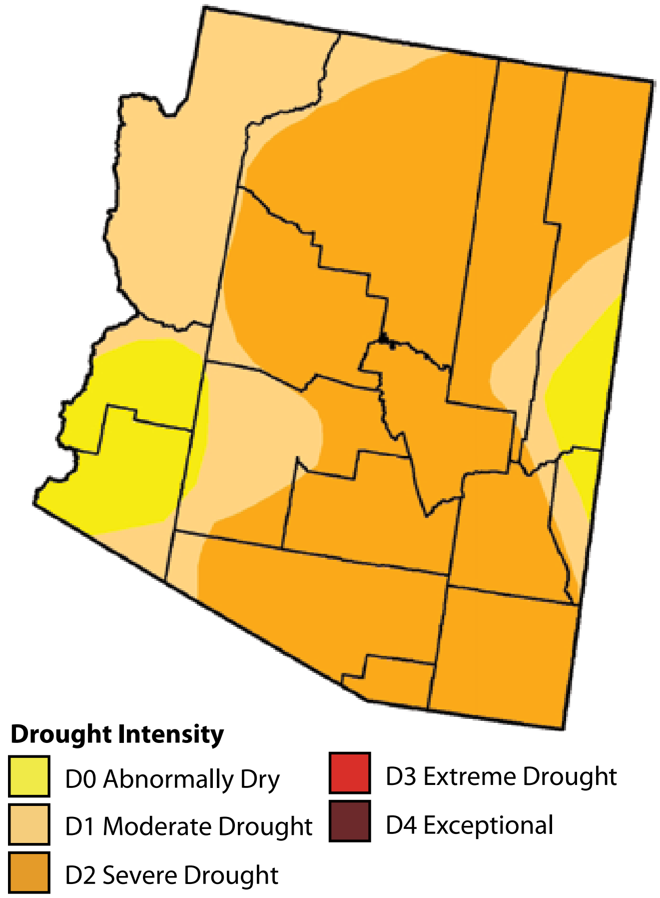


Figure 4b. Percent of Arizona designated with drought conditions based on data through November 17, 2009.

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.0	100.0	89.6	63.5	0.0	0.0
Last Week (11/10/2009 map)	0.0	100.0	86.9	55.2	0.0	0.0
3 Months Ago (08/25/2009 map)	10.3	89.7	47.3	0.0	0.0	0.0
Start of Calendar Year (01/06/2009 map)	62.3	37.7	1.0	0.0	0.0	0.0
Start of Water Year (10/06/2009 map)	1.4	98.6	80.3	10.7	0.0	0.0
One Year Ago (11/18/2008 map)	39.7	60.3	1.2	0.0	0.0	0.0

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

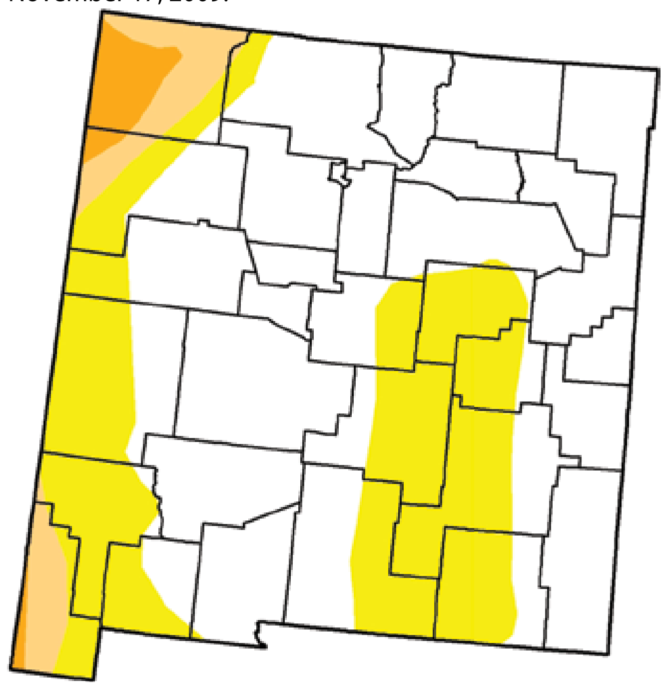
New Mexico Drought Status
(released 11/19/09)

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

Several early winter storms helped most of New Mexico reach average to above-average precipitation during the past thirty days. As a result, about 71 percent of the state remains drought-free, according to the November 17 update of the National Drought Monitor. There are, however, parts of the state where in the past thirty days short-term drought conditions have persisted or developed. Many parts of western New Mexico, for example, now have abnormally dry conditions, and areas in San Miguel, Harding, and Union counties in northeastern New Mexico also are now experiencing abnormally dry conditions. On the positive side, severe drought in San Juan County in the Four Corners region retreated slightly as a result of near-average precipitation during the past thirty days.

In drought-related news, Economic Injury Disaster Loans (EIDLs) are available to small non-farm businesses, small agricultural cooperatives, and most private, non-profit organizations in Curry, Lea, Quay, and Roosevelt counties (*The Cherokeean Herald*, November 18). Qualifying businesses may obtain economic assistance up to $2 million to help offset economic losses incurred due to drought, above-normal temperatures, or associated wildfires.

Figure 5a. New Mexico drought map based on data through November 17, 2009.



Drought Intensity

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional

Figure 5b. Percent of New Mexico designated with drought conditions based on data through November 17, 2009.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	64.5	35.5	7.0	2.4	0.0	0.0
Last Week (11/10/2009 map)	71.0	29.0	5.3	2.1	0.0	0.0
3 Months Ago (08/25/2009 map)	61.8	38.2	8.9	0.0	0.0	0.0
Start of Calendar Year (01/06/2009 map)	76.6	23.4	1.5	0.0	0.0	0.0
Start of Water Year (10/06/2009 map)	72.2	27.8	3.4	0.0	0.0	0.0
One Year Ago (11/18/2008 map)	60.6	39.4	1.5	0.0	0.0	0.0

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 10/31/09)

Source: NRCS, National Water and Climate Center

Water storage in Lake Powell dropped 213,000 acre-feet in October; the lake is now at 63 percent of capacity (Figure 6). Lake Mead is currently at 42 percent of capacity, with the water level elevation standing at 1093 feet above sea level. This is approximately 18 feet higher than the level that triggers the first tier of water shortage sharing requirements in the Colorado River basin. All of the Arizona reservoirs reported here declined during October by almost 350,000 acre-feet. San Carlos Reservoir is down to only one percent of capacity. Although storage in the Salt and Verde River basin systems declined in October, it is still well above average.

In water-related news, a pilot run of the Yuma Desalting Plant will be conducted in May, 2010 (*Yuma Daily Sun*, November 9). During the pilot, the plant will produce 21,700 acre-feet of desalted water which will be discharged into the Colorado River in combination with agricultural drainage water in order to meet Colorado River treaty obligations to Mexico.

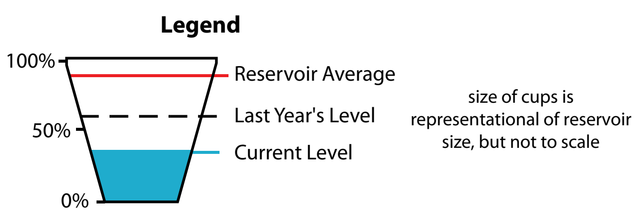
Notes:

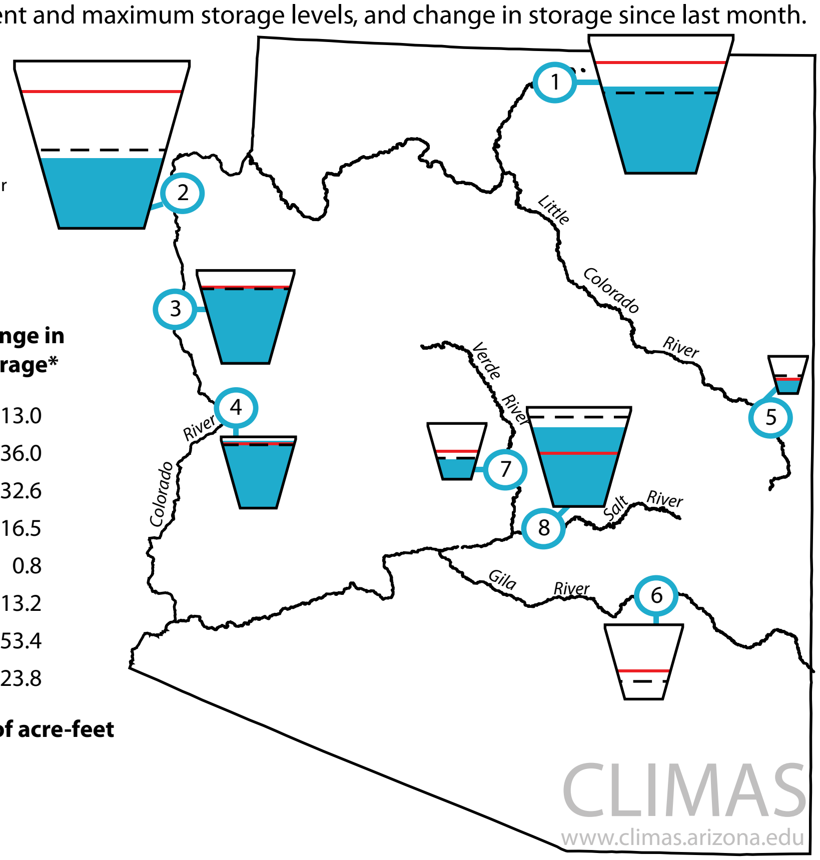
The map gives a representation of current storage levels for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total 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 October 2009 as a percent of capacity. The map depicts the average level and last year's storage for each reservoir. The table also lists current and maximum storage levels, and change in storage since last month.





Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Lake Powell	63%	15,251.0	24,322.0	-213.0
2. Lake Mead	42%	10,897.0	26,159.0	-36.0
3. Lake Mohave	81%	1,468.7	1,810.0	-32.6
4. Lake Havasu	94%	580.6	619.0	16.5
5. Lyman Reservoir	40%	11.9	30.0	0.8
6. San Carlos	1%	12.3	875.0	-13.2
7. Verde River System	36%	102.6	287.4	-53.4
8. Salt River System	80%	1,619.0	2,025.8	-23.8

*** 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 10/31/09)

Source: NRCS, National Water and Climate Center

The total reservoir storage in New Mexico declined by about 59,000 acre-feet in October. Navajo and El Vado Reservoirs had the largest storage declines last month (Figure 7). Reservoirs in southeastern New Mexico are at higher levels than the same time last year, although they account for a low percentage of the total reservoir storage capacity.

In water-related news, the city of Rio Rancho in north-central New Mexico is deliberating on developing a desalinization plant to provide potable water (*Rio Rancho Observer*, November 14). The plant will treat brackish groundwater from deep aquifers, which includes removing salts and other materials such as arsenic. The plant could provide as much as 43,200 acre-feet per year of drinking water. There are, however, concerns about waste disposal from the desalinization plant, including potentially hazardous materials such as arsenic.

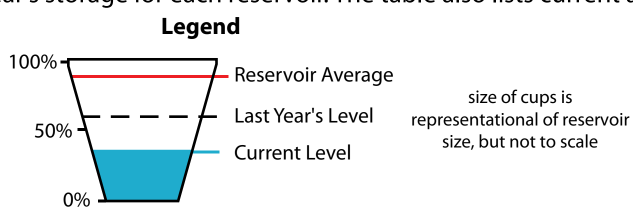
Notes:

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

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

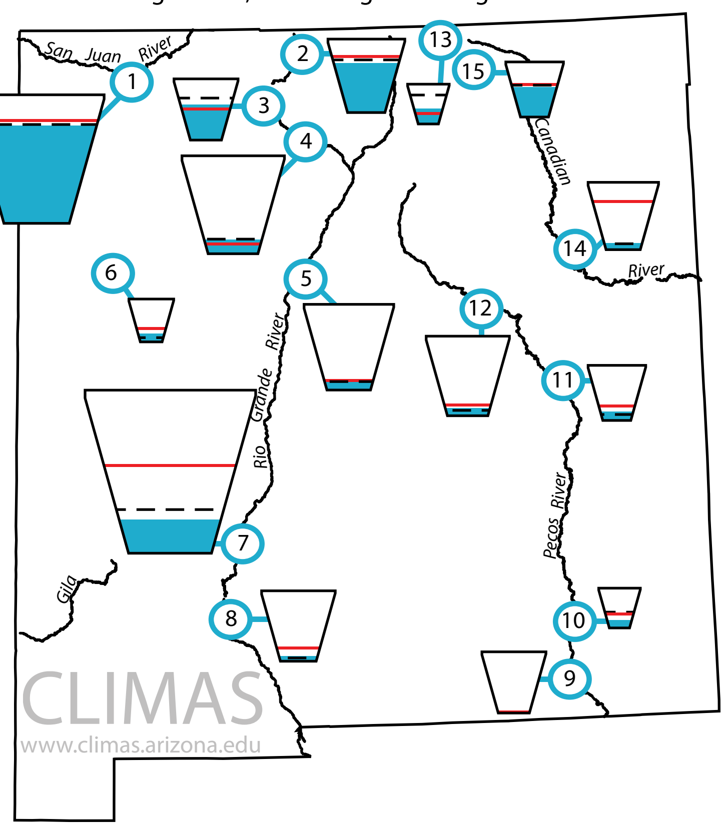
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Richard Armijo, Richard.Armijo@nm.usda.gov.

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



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Navajo	76%	1282.6	1,696.0	-31.5
2. Heron	68%	273.0	400.0	-0.6
3. El Vado	58%	109.6	190.3	-19.2
4. Abiquiu	15%	182.5	1192.8	0.9
5. Cochiti	11%	53.3	491.0	0.6
6. Bluewater	19%	7.4	38.5	0.0
7. Elephant Butte	21%	454.5	2,195.0	6.1
8. Caballo	8%	26.1	332.0	-7.3
9. Brantley	1%	11.9	1008.2	-4.6
10. Lake Avalon	20%	0.8	4.0	-0.4
11. Sumner	16%	16.5	102.0	0.1
12. Santa Rosa	10%	43.6	438.3	-1.0
13. Costilla	38%	6.0	16.0	0.5
14. Conchas	10%	26.2	254.2	-1.6
15. Eagle Nest	55%	43.6	79.0	-1.0

*** 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 11/19/09)

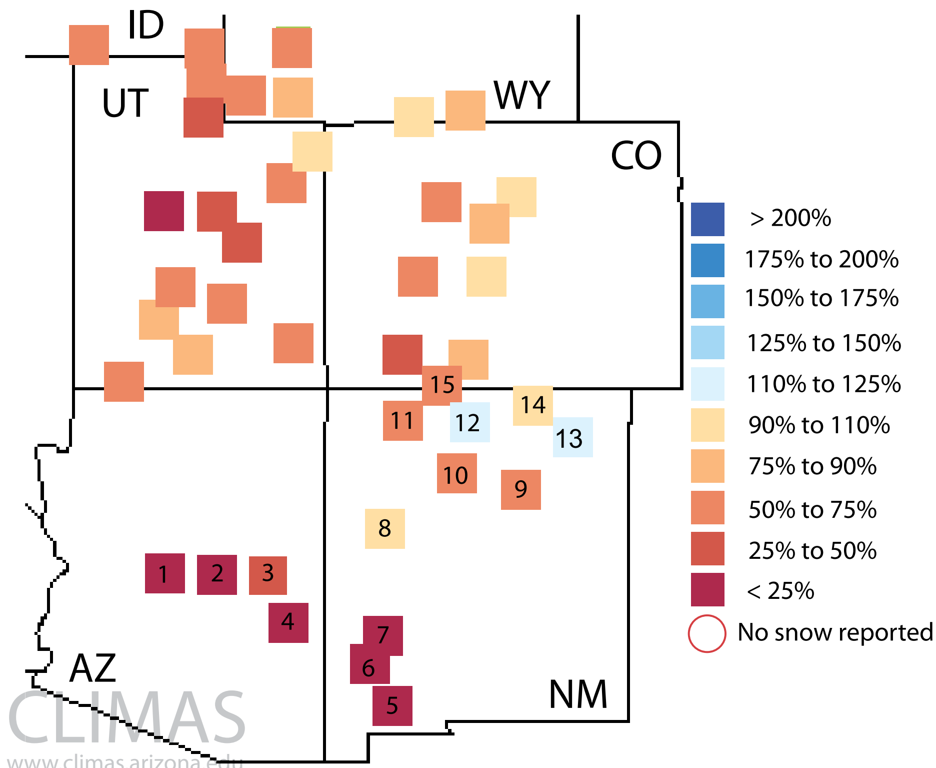
Sources: National Water and Climate Center, Western Regional Climate Center

The early season snowpack in Arizona and New Mexico as of November 18 predominantly contains less-than-average snow water equivalent (SWE), according to the National Resource Conservation Service's (NRCS) SNOTEL monitoring stations (Figure 8). In Arizona, the average SWE in all monitored basins is less than 36 percent of the 30-year, 1971–2000 average. The central Mogollon Rim region reports the lowest values. The average SWE in the three stations in this region is six percent of average. In the southern headwaters of the Little Colorado River basin, SWE is 36 percent of the historic average. In New Mexico, SWE values predominantly are less than 75 percent of average. The Gila and Mimbres basins report the lowest values of 14 and 0 percent of average, respectively. However, there is also above-average SWE. The Cimaron, Rio Chama, and Sangre de Cristo River basins report SWE values of 114, 112, and 100 percent of average, respectively.

The Rocky Mountain states to the north, which supply most of the water in the Colorado River and Rio Grande, have experienced low early-season snowfall. In the headwaters of the Rio Grande in Colorado, the average SWE of 10 SNOTEL measuring stations is 82 percent of average. Similarly, in the Upper Colorado River basin, the average SWE of the 28 reporting SNOTEL sites is 73 percent of average.

The National Oceanic and Atmospheric Administration's (NOAA) winter precipitation outlook for January–March calls for a slightly greater chance of above-average precipitation for most of New Mexico and Arizona and equal chances for above-, below-, and near-average precipitation for the Rocky Mountain region.

Figure 8. Average snow water content (SWC) in percent of average for available monitoring sites as of November 19, 2009.



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

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

Notes:

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

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
(December 2009–May 2010)
Source: NOAA-Climate Prediction Center (CPC)

The NOAA–Climate Prediction Center (NOAA–CPC) long-lead temperature forecasts for the continental US show an increased probability that most of the West will experience warmer-than-average temperatures throughout the winter and into early spring. For Arizona and New Mexico, the one-, two-, and three-month seasonal forecasts call for a slightly enhanced chance that temperatures will be similar to the warmest 10 years of the 1971–2000 observed record for the northern half of both states (Figures 9a–c). The four-month lead forecast shows that all of the Southwest has a greater chance of experiencing conditions similar to the warmest 10 years in the 1971-2000 observed record (Figure 9d).

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 December 2009–February 2010.

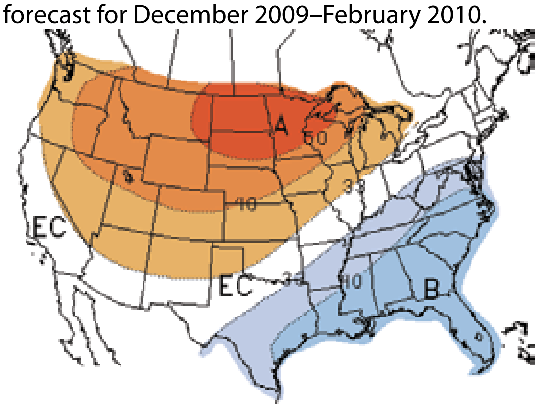
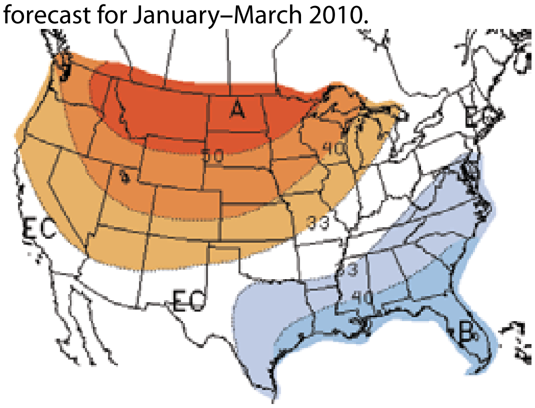


Figure 9b. Long-lead national temperature forecast for January–March 2010.



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

B=Below: 40.0–49.9%, 33.3–39.9%

Figure 9c. Long-lead national temperature forecast for February–April 2010.

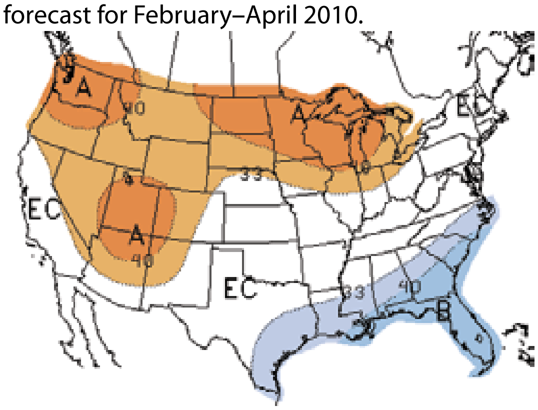
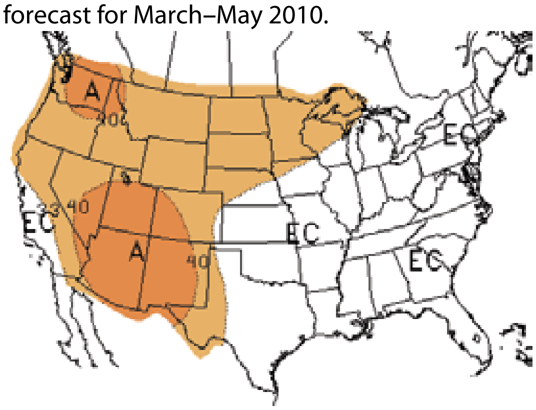


Figure 9d. Long-lead national temperature forecast for March–May 2010.



EC= Equal chances. No forecasted anomalies.

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

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

Precipitation Outlook
(December 2009–May 2010)
Source: NOAA-Climate Prediction Center (CPC)

The NOAA–Climate Prediction Center (NOAA–CPC) long-lead precipitation outlooks through May, 2010, indicate increasing chances for above-average precipitation along the southern tier of the US and increasing chances of below-average precipitation in the Pacific Northwest (Figures 10a–d). These outlooks rely heavily on the expected impacts of the current El Niño event, which typically brings wetter winter conditions to the southern US and drier conditions to the Northwest and Ohio and Mississippi valleys.

For Arizona and New Mexico, seasonal forecasts show increased chances for precipitation to be similar to the wettest 10 years in the 1971-2000 observed record (Figures 10a–d). In the Southwest, El Niño often brings wetter-than-average conditions, although the Southwest was drier than average during the last moderate-strength winter El Niño event in 2002–2003.

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 December 2009–February 2010.

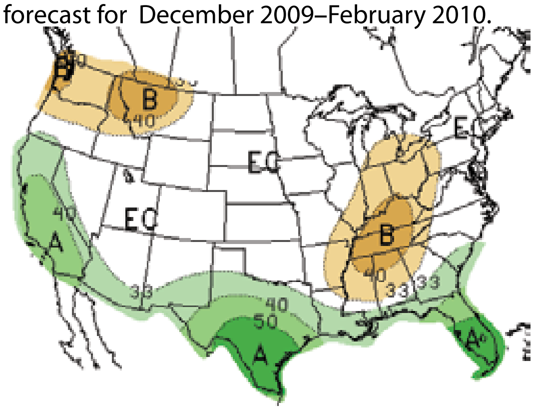


Figure 10b. Long-lead national precipitation forecast for January–March 2010.

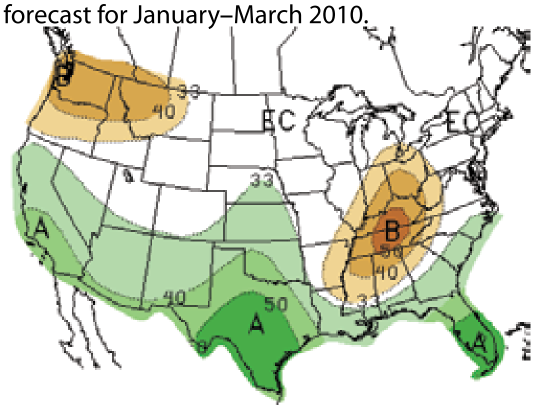


Figure 10c. Long-lead national precipitation forecast for February–April 2010.

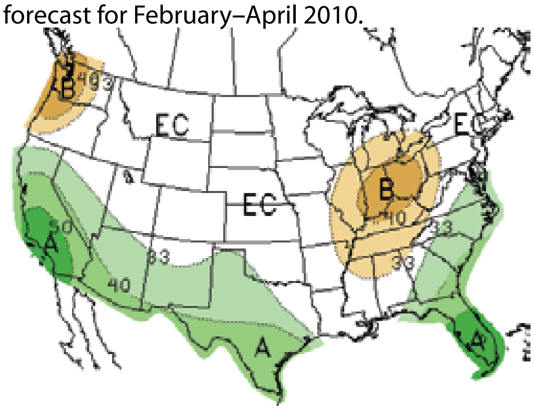
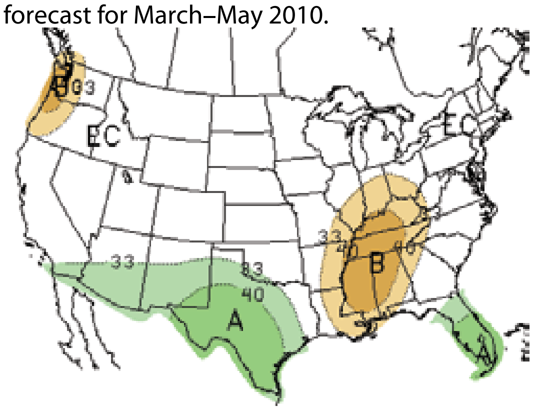


Figure 10d. Long-lead national precipitation forecast for March–May 2010.



B= Below
33.3–39.9%
40.0–49.9%

A=Above
40.0–49.9%
33.3–39.9%

EC= Equal chances. No forecasted anomalies.

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

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

Seasonal Drought Outlook

(through February 2010)

Source: NOAA-Climate Prediction Center (CPC)

This summary is excerpted and edited from the November 19 Seasonal Drought Outlook technical discussion produced by the NOAA–CPC and written by forecasters B. Pugh and D. Miskus.

Recent dry weather worsened drought conditions in the Southwest, especially in Arizona. However, a moderate strength El Niño event, which is expected to last through the winter, has increased the likelihood that winter rainfall will be above average. Since El Niño increases chances for a wet winter in southern portions of the Southwest, the NOAA–Climate Prediction Center (NOAA–CPC) seasonal precipitation forecast shows slightly increased odds for above-average precipitation for southern Arizona. With these considerations, drought improvement during the mid-November through February period is likely in southern Arizona (Figure 11).

Precipitation forecasts for northern regions of Arizona are less certain and call for equal chances for above-, below-, or near-normal precipitation. This uncertainty has contributed to the forecast for drought to continue with some improvement in central and northern Arizona and the Four Corners region.

In California, drought is forecasted to improve for most of the state. Forecasters call for moist onshore winds to bring several inches of precipitation to northern California around mid-November. By the end of November, enhanced rainfall associated with the Madden Julian Oscillation is expected to become established across the western Pacific, helping to deliver above-average precipitation to the state. Forecast confidence for California is high.

Elsewhere in the US, abundant moisture from the remnants of Hurricane Ida produced heavy rains in most of the Southeast, alleviating drought in the Carolinas. Drought coverage and intensity also decreased in the upper Mississippi Valley. However, severe drought continues in northwest Wisconsin and is forecasted to persist in part because of the relatively dry historical record for the outlook period.

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 February 2010 (released November 19, 2009).

On the Web:

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

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

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

El Niño Status and Forecast

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

El Niño conditions in the equatorial Pacific Ocean strengthened from weak to moderate levels this past month. Sea surface temperatures were 1.7 degrees Celsius, or about 3.0 degrees Fahrenheit, above average across much of the central equatorial Pacific Ocean, with localized areas showing temperatures as high as 2 degrees C. The Southern Oscillation Index (SOI) dropped from 0.3 in September to -1.7 in October (Figure 12a), possibly signaling that the atmosphere is responding to the above-average sea surface temperatures (SSTs). Monitoring stations in the Pacific Ocean also show a large body of warm water just below the surface in the central and eastern Pacific. NOAA–CPC expects that this warm water will help to extend El Niño conditions through next spring.

How long will El Niño persist? Forecast models indicate that at least a weak El Niño will continue through spring of 2010. According to the latest forecast produced by the International Research Institute for Climate and Society (IRI), the probability of El Niño conditions continuing through the period February–April exceeds 90 percent (Figure 12b). In the subsequent three month May–July period, the chance of El Niño persisting dips to 40 percent while the probability for the development of neutral conditions rises to 40 percent.

El Nino may help deliver much-needed winter precipitation to the Southwest. During past El Niño events, the sub-tropical jet stream has been enhanced. This has helped direct successive, wet winter storms to the region. The NOAA–CPC seasonal precipitation forecasts reflect this possibility, and forecasts express increased chances for Arizona and New Mexico to experience above-average precipitation, especially during the February–April period. However, above-average precipitation is not guaranteed.

Notes:

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

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/

Figure 12a. The standardized values of the Southern Oscillation Index from January 1980–October 2009. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red) respectively. Values between these thresholds are relatively neutral (green).

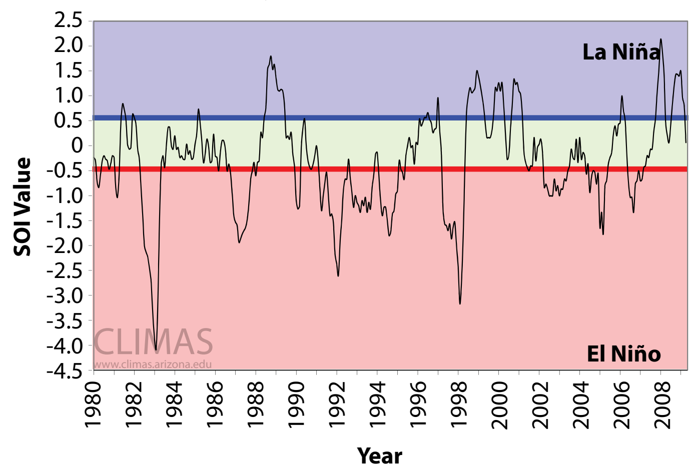
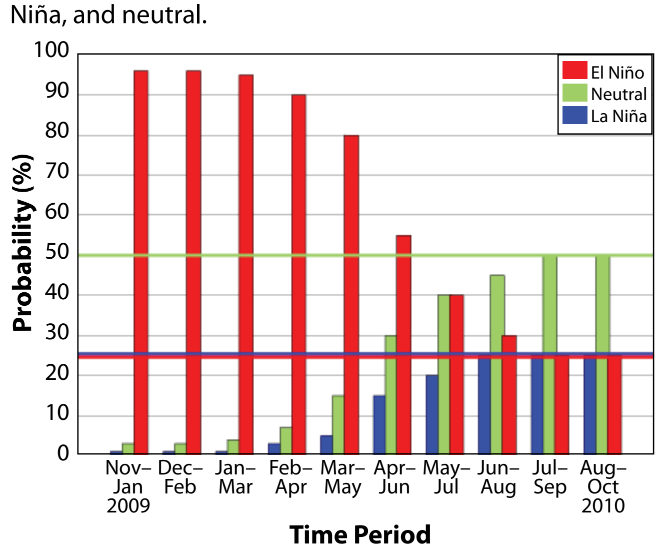


Figure 12b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released November 19, 2009). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Temperature Verification
(December 2009–May 2010)

Source: Forecast Evaluation Tool

CLIMAS seeks feedback on these new highlights.
Please email zguido@email.arizona.edu or call 520-622-8149.

Comparisons of observed temperatures for December–February to forecasts issued in November for the same period suggest that forecasts are most reliable in northwest Arizona and eastern New Mexico (Figure 13a). Forecast skill—a measure of the accuracy of the forecast—for southwestern Arizona and northwestern New Mexico has been only slightly better than simply using equal chances as a forecast. Forecast skill for the two-month and three-month lead times have been historically more accurate than equal chances in all of Arizona and New Mexico, with the most accurate forecasts in the southeast and northwest corners of Arizona and the southeast and central portions of New Mexico (Figures 13b–c). The four-month lead time forecast issued for the March–May season for Arizona displays some of the most accurate forecasts issued by NOAA–Climate Predictions Center (NOAA–CPC; Figure 13d). All regions in Arizona and New Mexico have been historically more accurate than equal chances. Bluish hues suggest that the NOAA–CPC forecasts have historically been more accurate than equal chances. However, caution is advised to users of the seasonal vaforecasts 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 13a. RPSS for December 2009–February 2010.

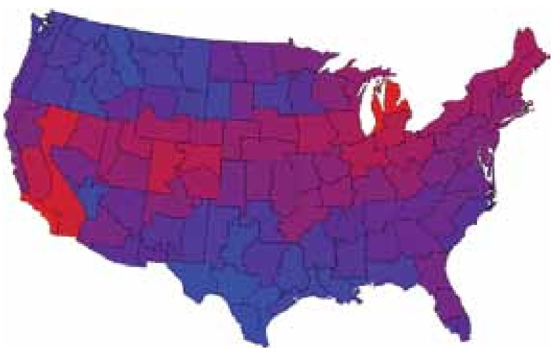


Figure 13b. RPSS for January–March 2010.

Figure 13c. RPSS for February–April 2010.

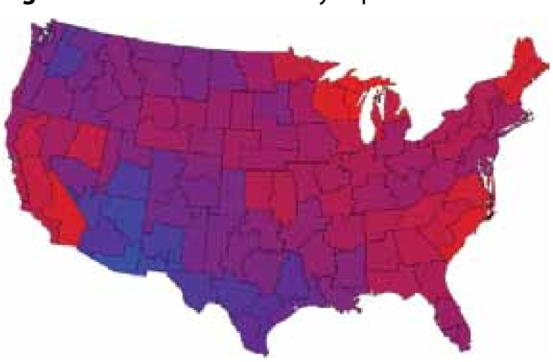
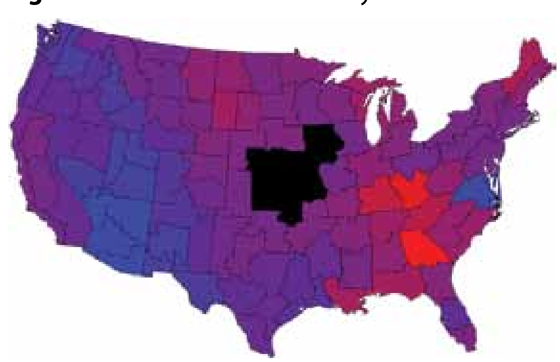
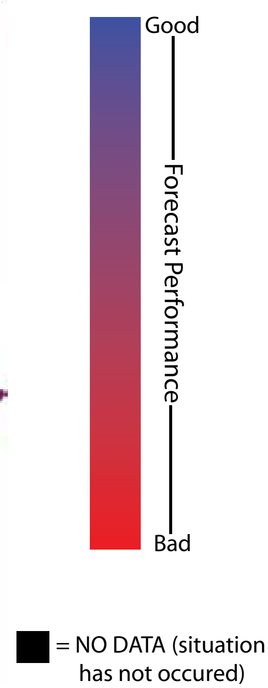


Figure 13d. RPSS for March–May 2010





On the Web:

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

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

Precipitation Verification
(December 2009–May 2010)

Source: Forecast Evaluation Tool

CLIMAS seeks feedback on these new highlights. Please email zguido@email.arizona.edu or call 520-622-8149.

Comparisons of observed precipitation for December–February to forecasts issued in November for the same period suggest that forecasts are most reliable in southern Arizona and New Mexico (Figure 14a). Forecast skill—a measure of the accuracy of the forecast—for northern Arizona and New Mexico has been only slightly better than simply using equal chances as a forecast. Forecast skill for the two-month lead times (forecasts issued in November for January–March) have been historically more accurate than equal chances in all of Arizona; forecast skill for the two-month lead time in New Mexico has been more accurate in the southeast and central portions of the state (Figure 14b). The three-month and four-month lead time forecasts have been more accurate than equal chances in all regions of Arizona and in the southeast and central regions of New Mexico (Figures 14c–d). Regions with bluish hues suggest that the NOAA–Climate Predictions Center (NOAA–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 14a. RPSS for December 2009–February 2010.

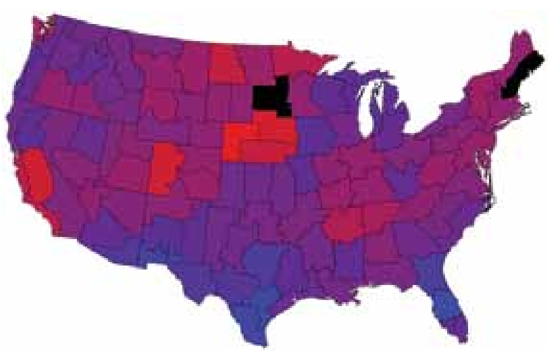


Figure 14b. RPSS for January–March 2010.

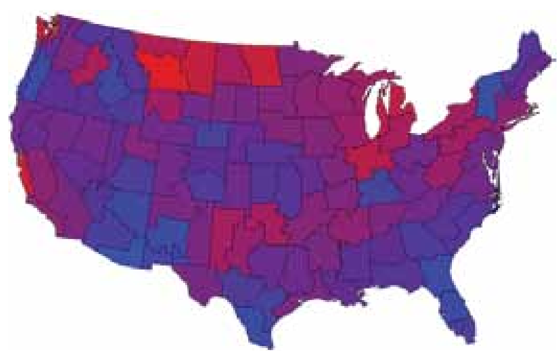


Figure 14c. RPSS for February–April 2010.

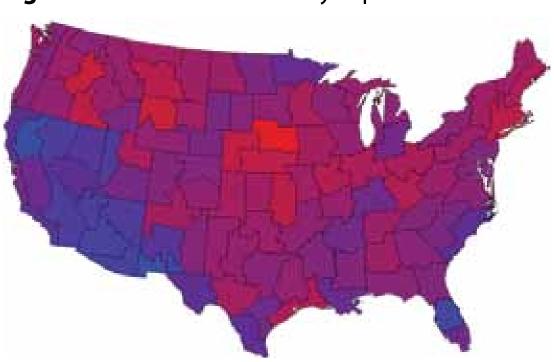
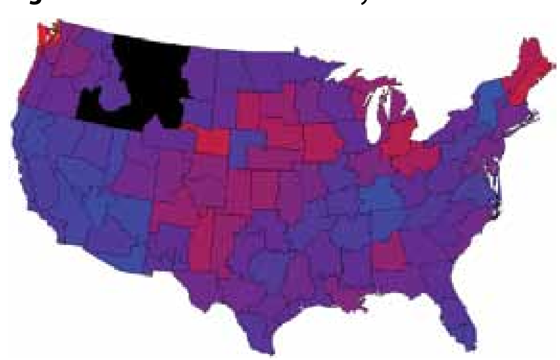
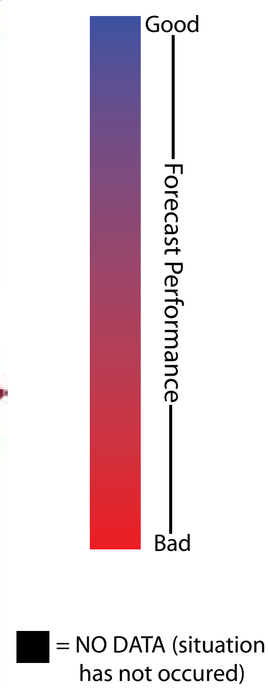


Figure 14d. RPSS for March–May 2010.





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