Issued: August 26, 2009

Southwest Climate Outlook

THE UNIVERSITY OF ARIZONA.
Arizona's First University.

Source: Randy Haas, The University of Arizona.

Photo Description: Prickly Pear cacti are baring fruit in the Sonoran Desert, a process that begins in the summer months.

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: macaulay@email.arizona.edu

In this issue...

CLIMAS Climate Assessment for the Southwest

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

NM STATE UNIVERSITY

August Climate Summary

Drought– The extent of drought has increased in Arizona but decreased in eastern New Mexico, where drought severity also has decreased.

Temperature– Seasonal temperatures have been above average in most of the Southwest, with some record-breaking temperatures in Arizona during July.

Precipitation– Despite an early and wet monsoon burst across the southern portion of the Southwest, seasonal and water year precipitation totals are below average, except in southeastern New Mexico.

ENSO– A weak El Niño event is in progress and is expected to strengthen as fall approaches. El Niño usually increases the chances of above-average winter half-year precipitation in the region.

Climate Forecasts– Forecasts for the fall indicate temperatures similar to the warmest 10 years of the 1971–2000 observed conditions. Forecasts for the winter season indicate slightly increased chances of above-average precipitation in the southern half of the region.

The Bottom Line– After a timely onset, the monsoon has fizzled in most of the Southwest. Summer precipitation deficits have decreased rangeland and vegetation health across much of the region, with the major exception of southeastern New Mexico. Forecasts hold the promise of somewhat increased chances of winter season precipitation as an El Niño episode continues to develop in the tropical Pacific Ocean.

Climate Change Driving Birds North

A recent study by the National Audubon Society (NAS) concluded that a dramatic northward movement nationally has occurred among many bird species during the past four decades due to climate change. This includes new species arriving to the Southwest from Mexico, such as the flame-colored tanager, and species moving northto more favorable habitats in Utah and Colorado.

Arizona is rated as one of the nation's top five bird-watching destinations. While the state will be a new stomping ground for some birds, including the tanager, the overall bird community will experience declines in diversity for species living in forests, riparian areas, and eventually deserts (*Arizona Daily Star*, June 10). During the past 40 years, bird species nesting in Arizona mountains declined between 74 to 95 percent,according to the NAS study. A possible explanation for this exodus is that drought has stressed forests, making them less habitable. If temperatures continue to increase, more migrations out of and emigrations into the Southwest are expected. A critical question then becomes: Will the birds thrive in the new habitats?

Report: http://birdsandclimate.audubon.org/

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.

Two or 12 degrees warmer? Greenhouse gas emission scenarios that drive future climate outlooks

By Zack Guido

It's 2100. Thousands of power plants incinerate coal to help feed a bustling world economy. People from Bangladesh to the United States generally are more affluent than they are today, and many of the planet's 8.7 billion inhabitants can afford cars, air conditioning, and other comforts that make life easier but more resource intensive.

This combination of population growth and a burgeoning energy appetite come at a climate cost. Carbon dioxide (CO_2) spews from tailpipes and smokestacks at nearly four times the present rate, congesting the atmosphere with CO_2 concentrations that approach 1,000 parts per million (ppm)—nearly 350 percent more than the amount before the Industrial Revolution began in earnest in the late 1800s. The build-up of greenhouse gases has sent the global average temperature soaring up to 12 degrees Fahrenheit warmer than it is now.

Scientists have called the 1,000 ppm point and its impact on temperature the worst-case scenario, citing increased chances that about half of the known endangered species will go extinct, most regions of the globe will feel economic shocks, ocean acidification will eat away at coral reefs, and millions of people will be displaced as sea levels rise from melting polar and mountain ice. Many scientists have stated CO_2 should not exceed 450 ppm for a long period, if at all, to avoid dangerous warming of the planet.

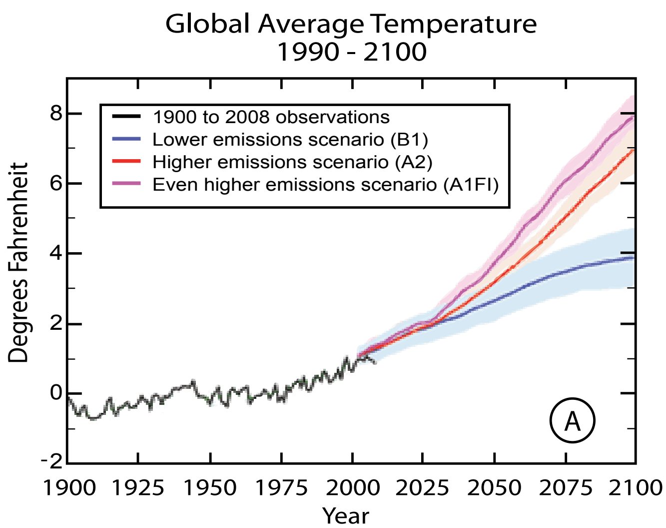
The good news is that this future world picture represents only one of 40 scenarios that each project different climate futures; some include increases in temperature as low as 2 degrees F. The bad news is that between 2000 and 2008, global greenhouse gas emissions outpaced scientists' worst-case scenario. So, what is the story with these scenarios, and how do scientists arrive at them?

Emission scenarios and temperatures projections

Future outlooks uniformly predict warmer temperatures but differ by up to 10 degrees. Whether temperatures in 2100 will be closer to 2 or 12 degrees hotter than present depends on two factors: realistically describing human actions that influence emissions of greenhouse gases, including economic development and population growth, and accurately modeling physical processes, such as air and water movement. While emission scenarios describe the atmospheric fallout of human actions, climate models use that information to simulate the response of physical processes that alter temperature and other climate variables.

Ultimately, greenhouse gases like CO_2 cause changes in temperature. However, scientists cannot estimate the extent of change without knowing the amount of

continued on page 4



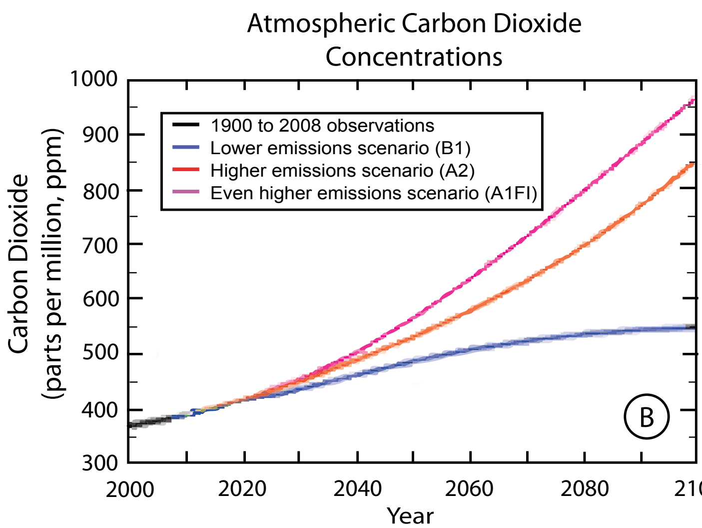


Figure 1a. Observed and projected changes in the global average temperature under three IPCC emissions scenarios. The shaded areas show the likely ranges, while the lines show the central projections from a set of climate models. A wider range of model types shows outcomes from 2 to 11.5 degrees F. Changes are relative to the 1960–1979 average.

Figure 1b. The graph displays atmospheric concentrations on the right under four emissions scenarios, including a "stabilization scenario" designed to stabilize atmospheric carbon dioxide concentration at 450 ppm. The figure was modified from the U.S. Global Climate Research Program (2008).

Two or 12 degrees, continued

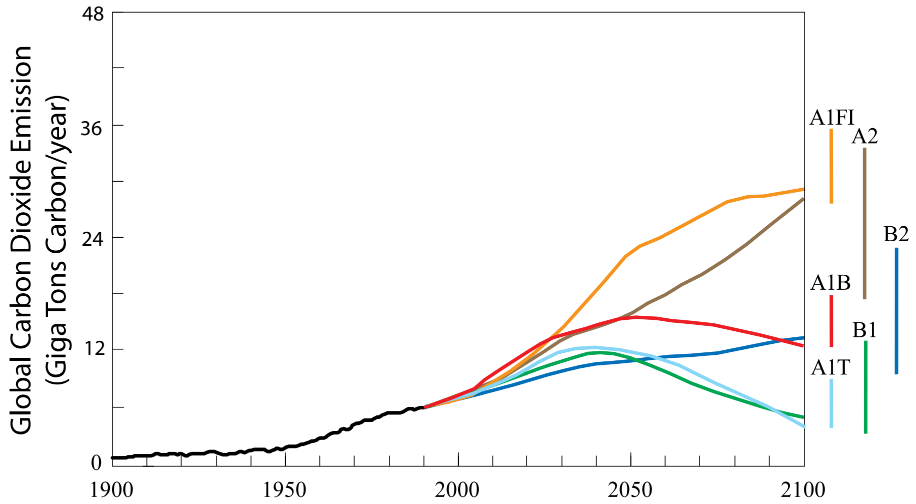


Figure 2. Global CO_2 emissions produced by energy generation and industry from 1900 to 2100. Each path depicts how future CO_2 emissions may change in response to different societal evolutions. The vertical bars indicate the range of emissions in 2100, which was generated by creating slightly different variations of each narrative. The figure was modified from the U.S. Global Climate Research Program (2008).

gases injected into the atmosphere. To do this, the Intergovernmental Panel on Climate Change (IPCC) created six emission narratives to explore the evolution of and relationship among economic, social, and environmental factors that influence greenhouse gas emissions, and hence climate.

These story lines, published in 2000 in the Special Report on Emissions Scenarios (SRES), are conceptual outlines that guide quantitative assessments of the key factors that influence greenhouse gas emissions, including gross domestic product, income disparity, energy intensity, fossil fuel and clean energy use, and CO_2 consumption by the land. Six modeling groups used these guidelines to create different evolutions for the key indictors and generated 40 unique greenhouse gas scenarios, about seven for each narrative.

The groups did not cobble together haphazard assessments of these indicators. They were informed by more than 800 emission scenarios published in academic journals as well as sophisticated studies from institutions like the International Institute for Applied Systems Analysis, which projects population trends and highlights the strains that a more crowded planet place on resources and society.

The narratives, described in more detail in the "IPCC Emission Scenarios" textbox, unfold something like this: The A1T and B1 scenarios dump the least amount of greenhouse gases into the atmosphere. A1B and B2 have moderate emissions, and A1F1 and A2 spew the highest amount of gases. An outline of B1, for example, would describe a world in which solar and wind farms dot the landscape in many countries, population growth is low, and CO_2 emissions are slightly less than they were in 1990. On the other hand, in an A1FI world—"FI" stands for Fossil Fuel Intensive—thousands of coal-fired power plants would belch CO_2 and other greenhouse gases into the atmosphere at four times the present rate to fuel the economy.

Emission scenarios by themselves say little more about future climate than higher concentrations of greenhouse gases will elevate temperatures. To quantify gas concentrations in ppm, which allows for more precise estimates of temperature changes,

continued on page 5

The IPCC Emission Scenarios

The Intergovernmental Panel on Climate Change (IPCC) developed six story lines to guide quantitative assessments of key indicators that influence greenhouse gas emissions, thus leading to a broad assessment of climate change (Figure 2). Although the IPCC states each scenario has the same probability of occurrence, current emissions are outpacing the highest emission scenario, A1FI. This suggests that if society continues burning fossil fuels at current levels, the global average temperature may be around 12 degrees F warmer by 2100.

A1 narratives: A1FI, A1B, A1T
Throughout this century, the global economy expands rapidly and becomes tightly integrated. As a result, wealth increases and regional differences in per capita income nearly vanish by 2100. Population growth is low, peaking in 2050 at 8.7 billion and declining thereafter.

This story line produces a wide range in carbon dioxide (CO_2) emissions due primarily to different strategies for supplying energy. To explore the effect of energy choices, this narrative is divided into three categories. A1FI encompasses the fossil fuel-intensive scenarios, which produce only modest increases in non-carbon energy such as wind and solar. The A1B story line has a more balanced energy portfolio, with a mixture of both clean and fossil-fuel energies. A1T is the green technology story line, which continually expands non-carbon energy production to 85 percent by 2100.

A2 narrative
This story line generates medium to high CO_2 emissions. Economic growth is slower than it is in A1 and geographically different. Although

continued on page 5

Two or 12 degrees, continued

scenarios are fed into state-of-the-art climate models. When the 40 emission scenarios are each filtered through climate models—which can capture thousands of dynamic natural processes that influence temperature, among other climate variables—the highest and lowest temperatures create bookends that provide a range in which global average temperature likely will fall.

The recently published Global Climate Change Impacts in the United States report conducted by the U.S. Global Change Research Program (GCRP) presents results from state-of-the-art climate models—the same ones used in the latest IPCC assessment report—driven by low (B1), high (A2), and higher (A1FI) emissions scenarios (Figure 1a).

For the B1 scenario, concentrations of CO_2 hover around 550 ppm by 2100, causing temperature increases of about 4 degrees F, according to the report. Concentrations of CO_2 and temperature in the A2 scenario climb even higher, reaching 850 ppm and about 7 degrees F. The A1FI scenario suggests CO_2 will approach 1,000 ppm, driving temperatures upwards of 8 degrees F (Figure 1b).

These results collectively suggest that if emissions are within the ranges specified by the narratives, a 66–90 percent chance exists that temperatures will be 3 to 8.5 degree F warmer than the 1960–1979 average. Lower probabilities, however, indicate a larger temperature range, between 2 and 12 degrees F. The results also show that temperatures for all of the story lines are similar until 2030, regardless of how society evolves.

Future Policy

The current scenarios should be viewed cautiously. They are not predictions, and the IPCC does not assign probabilities to their occurrences due to uncertainty. The genius of the scenarios is that they span a wide range of greenhouse gas emissions. With the help of climate models, this enables the exploration of the climate implications of each scenario for society and the planet.

The IPCC emissions scenarios also do not explicitly evaluate the effect of policy changes on emissions. For example, no scenario evaluates the impact of a worldwide adoption of the Kyoto Protocol, which puts enforceable limits on many greenhouse gases but was not ratified by some countries, including the United States. Also, the scenarios do not encompass the full range of possible emissions. The IPCC avoided "disaster" or "surprise" scenarios that describe economic collapse or crises that hurl society back to primitive times, or futures where emissions outpace the A1FI scenario.

New emission scenarios are in the works. They will include up-to-date data and a wider range of emissions. They also will likely include scenarios that analyze the impact of global climate treaties on greenhouse gas concentrations. Some will seek answers to the emission reductions needed to stabilize CO_2 concentrations at 450 ppm, 550 ppm, and other levels. The results will help test and devise new policy actions.

Many nations are debating legislation that curbs greenhouse gas emissions, and a world treaty which will update the Kyoto Protocol is set to be negotiated in December in Denmark. An important question is, to what degree will these new laws minimize temperature change? The U.S., for example, proposes reducing greenhouse gas emissions 17 percent below 2005 levels by 2020 and 83 percent by 2050. The European Union, which has the most aggressive targets, proposes a 30 percent cut below 1990 levels by 2020 and up to 80 percent by 2050.

Scenarios, continued

wealth increases and the income disparity narrows between rich and poor nations, inequality is still widespread. Fertility remains high in some regions, resulting in high population growth—15.1 billion people by 2100. Technological change is also regionally disparate, and adoption of clean energy production is lower than in all other story lines. Greenhouse gas emissions rise unabated and are nearly five times more than they were in 1990.

B1 narrative

This story line, along with A1T, produces the lowest CO_2 emissions. Widespread economic growth increases wealth and reduces the income disparity between rich and poor nations. Society rapidly transforms from a manufacturing-based economy to one that provides services and information, reducing material consumption and the burden on some natural resources. Energy is increasingly produced by clean and efficient technologies. By 2100, 53 percent of the energy produced emits zero greenhouse gases. Global population peaks in 2050 at 8.7 billion and then declines, similar to A1. The evolution of these characteristics cause greenhouse gas emissions to peak in mid-century and decline below 1990 levels by 2100.

B2 narrative

CO_2 emissions fall in the medium range. Economic development is moderate and clean technologies are slowly integrated into society. By 2100, clean energy supplies nearly 50 percent of the total energy consumed. Population growth continues to increase but slows in the second half of the 21st century. Greenhouse gas emissions also persistently rise, but their growth is progressively slower so that by 2100 emissions are double what there were in 1990.

Temperature (through 8/19/09)

Source: High Plains Regional Climate Center

Water year average temperatures (since Oct. 1) in the Southwest deserts of Arizona have been between 65 and 75 degrees Fahrenheit, while the highest average temperatures in southern New Mexico have been between 60 and 65 degrees F (Figure 1a). The rest of New Mexico and the Colorado Plateau of Arizona have had average temperatures between 50 and 60 degrees F, with 40–50 degree F average temperatures at the highest mountain elevations of both states. These temperatures remain 1–3 degrees F above average across both states (Figure 1b). Temperatures in the far northeast corner of New Mexico have been 3–4 degrees above average, and much of western New Mexico has been within 1 degree of the long-term average. Over the past 30 days, temperatures generally have been 1–3 degrees above average across central and southern Arizona and New Mexico (Figures 1c–d). The higher elevations in New Mexico and a small area of northwest Arizona have been 0–2 degrees F below average. July had record-setting heat in much of the Southwest; temperatures in southeastern and a small area of northwestern Arizona were 3–5 degrees F warmer than average. August, however, has been much cooler and closer to the long-term average even though rainfall has been suppressed due to dry air incursions from the west.

Figure 1a. Water year '08–'09 (through August 19, 2009) average temperature.

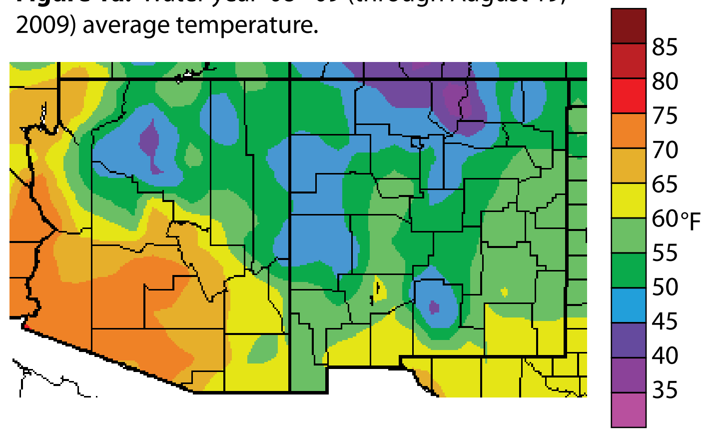


Figure 1b. Water year '08–'09 (through August 19, 2009) departure from average temperature.

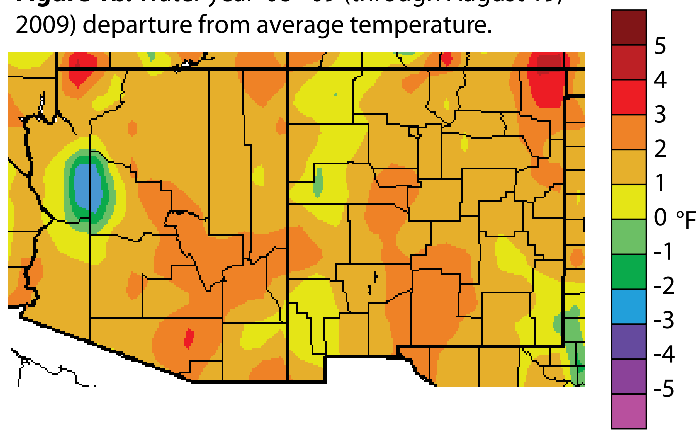


Figure 1c. Previous 30 days (July 21–August 19, 2009) departure from average temperature (interpolated).

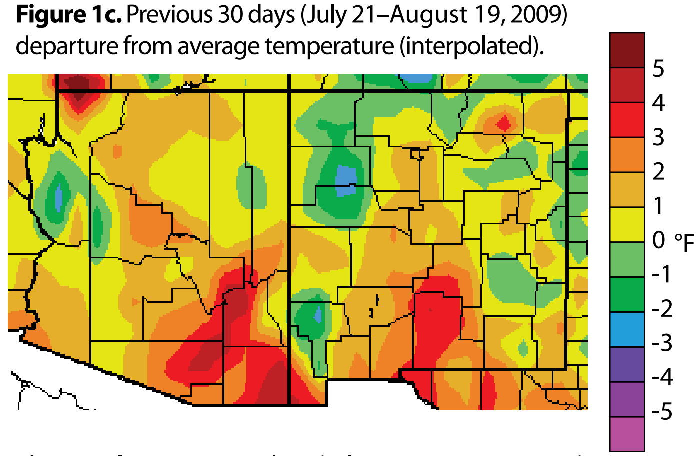
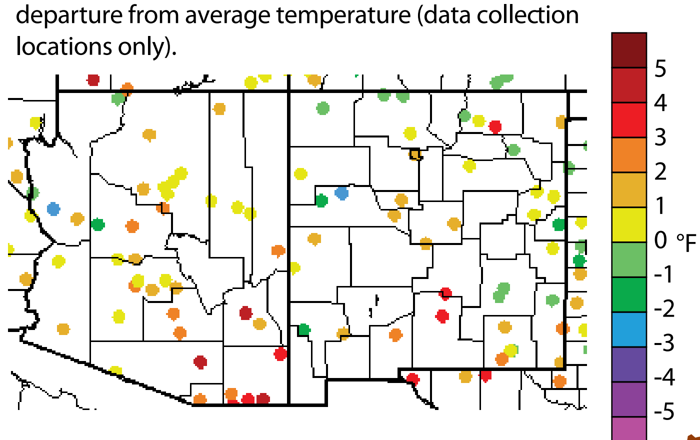


Figure 1d. Previous 30 days (July 21–August 19, 2009) departure from average temperature (data collection locations only).



Notes:

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

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

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

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

On the Web:

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

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

Precipitation (through 8/19/09)

Source: High Plains Regional Climate Center

The 2009 water year, which began Oct. 1,has been dry across the Southwest, with less than 80 percent of average precipitation in most areas of Arizona and New Mexico (Figures 2a–b). The exception is extreme eastern New Mexico, which has received 110–150 percent of average precipitation. Central and southern Arizona and southwestern New Mexico have received less than 70 percent of average precipitation. The dryness in the Southwest is due both to the La Niña winter, when storm tracks were well north of Arizona and New Mexico, and the relatively dry monsoon thus far this summer. The past 30 days have seen 125– 400 percent of average precipitation in the southeastern corner of New Mexico and along the New Mexico-Texas border (Figures 2c–d). Central New Mexico has received 75–100 percent of average precipitation during the monsoon. Western New Mexico and most of Arizona have received less than 75 percent of average July-August precipitation. Some areas of both northern and southern Arizona have received less than 25 percent of the average rainfall from the monsoon (see Figures 9a–c). The rainfall deficit is also significant in west-central Arizona along the Colorado River. The dry conditions put additional stress on vegetation and surface water supplies and contribute to the extreme wildfire conditions across both states.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2008, we are in the 2009 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 '08–'09 (through August 19, 2009) percent of average precipitation (interpolated).

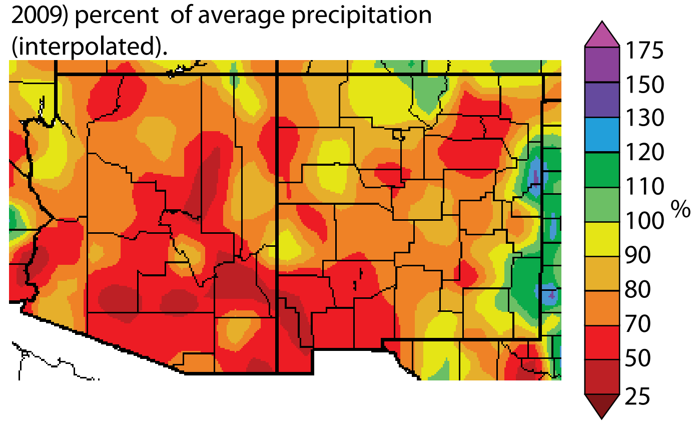


Figure 2b. Water year '08–'09 (through August 19, 2009) percent of average precipitation (data collection locations only).

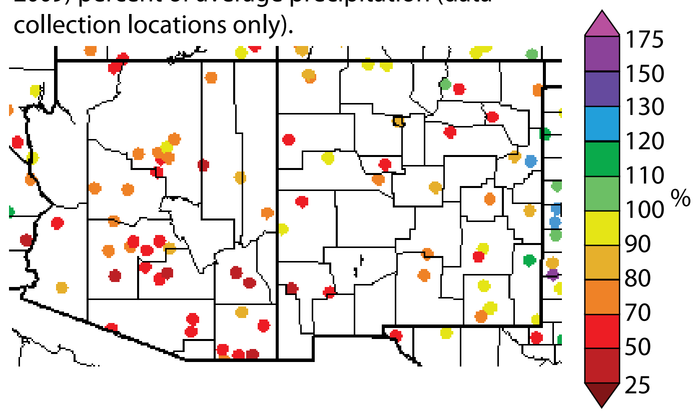


Figure 2c. Previous 30 days (July 21–August 19, 2009) percent of average precipitation (interpolated).

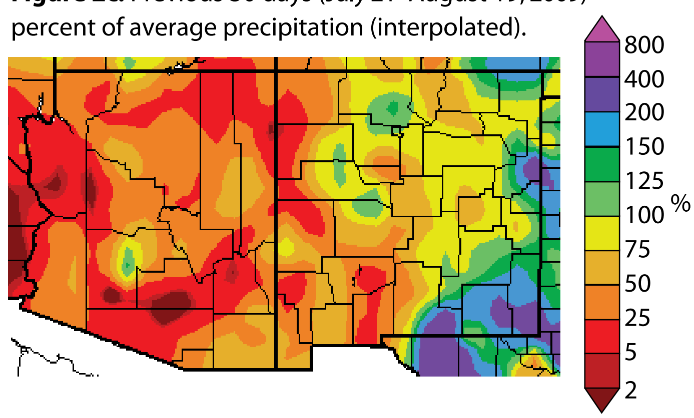
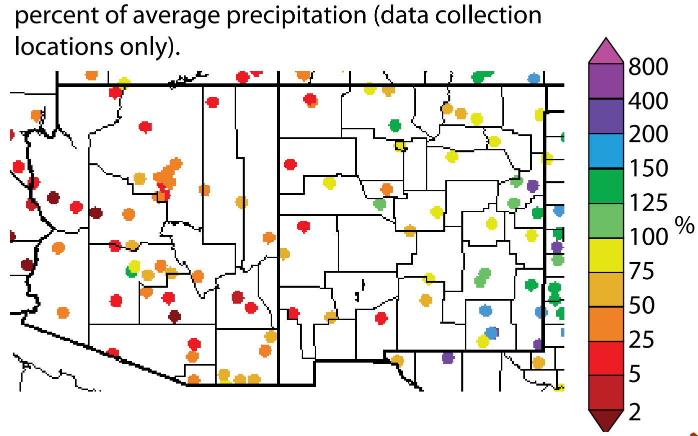


Figure 2d. Previous 30 days (July 21–August 19, 2009) percent of average precipitation (data collection locations only).



U.S. Drought Monitor
(released 8/20/09)

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

Monsoon season precipitation has helped pull New Mexico out of severe drought but left Arizona with expanding short-term drought conditions due to below-average precipitation over the past 30 days. The August 18 update of the U.S. Drought Monitor shows that abnormally dry conditions have expanded across Arizona and contracted across New Mexico since last month (Figure 3). Severe drought continues to persist throughout much of California and exceptional drought still plagues southern Texas, which has observed less than 25 percent of average precipitation over the past three months.

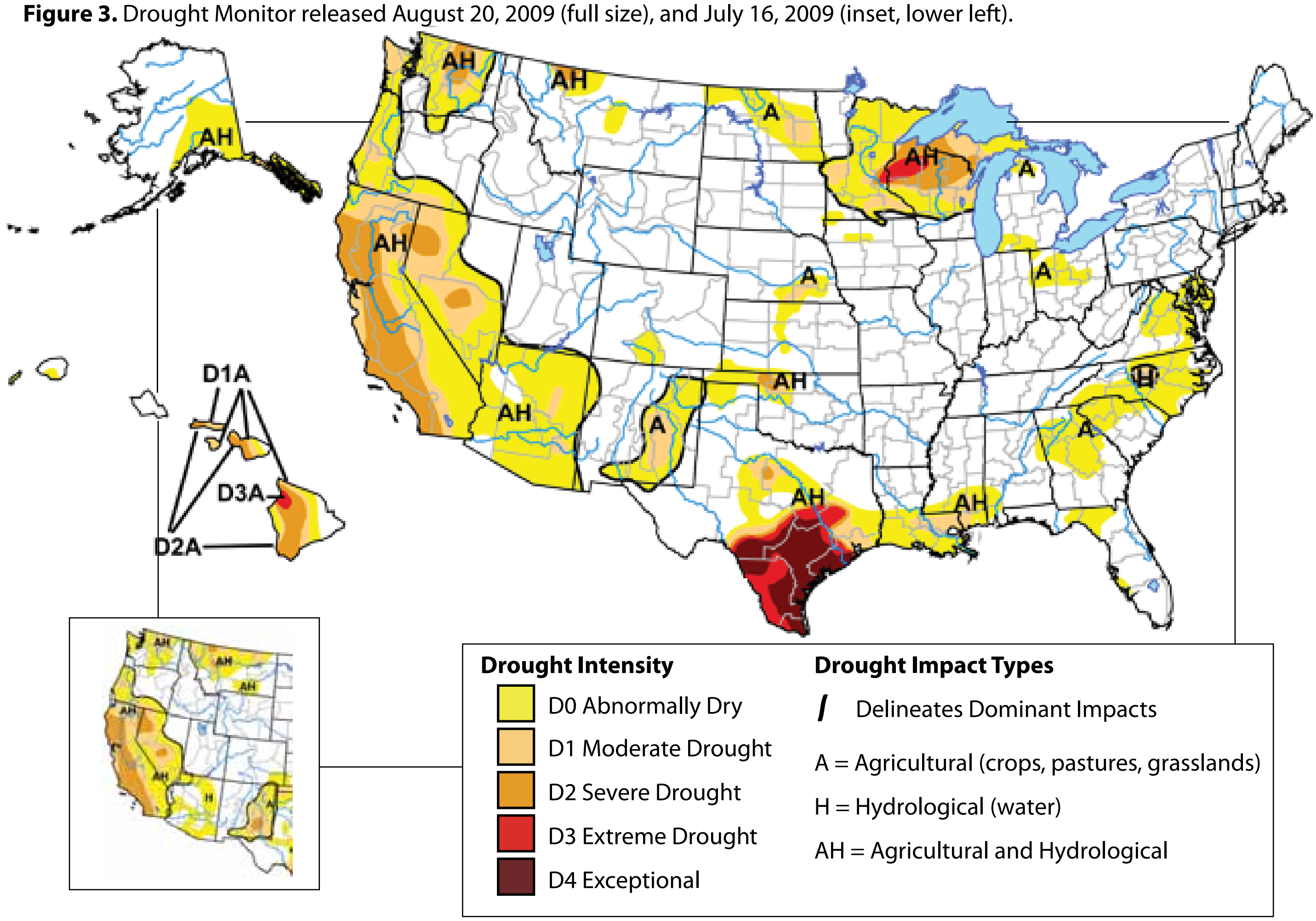
The reports of impacts from the extreme drought conditions in southern Texas continue to stream in. Cumulative agricultural losses top $3.6 billion since last November due to the drought that has been gripping the area since last fall (Reuters, August 20). These losses are expected to top the $4.1 billion observed with drought conditions in 2006. More than two million cattle are currently impacted by the drought and one county reported losing their entire cotton crop.

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, US. Department of Agriculture.

Figure 3. Drought Monitor released August 20, 2009 (full size), and July 16, 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 8/20/09)

Source: U.S. Drought Monitor

Exceptionally dry conditions over the past 30 days have led to the expansion of short-term drought across almost all of Arizona (Figure 4a). The August 18 update of the U.S. Drought Monitor indicates that abnormally dry conditions are present over most of the state, with moderate drought emerging in parts of Navajo and Graham counties. Abnormally dry conditions cover almost 90 percent of the state, up from 54 percent in mid-July (Figure 4b).

The current weak El Niño event in the Pacific Ocean is the most likely culprit in helping explain why the 2009 summer monsoon thunderstorm season in Arizona has been such a bust. The Tucson National Weather Service notes that the mid-latitude jet stream just north of Arizona has been stronger than average in response to the El Niño event in the Pacific. This has periodically pushed the monsoon high pressure system out of position, limiting the necessary flow of subtropical moisture up from Mexico into Arizona. The result has been exceptionally hot and dry conditions during the past 30 days, with most of Arizona observing less than 50 percent of average precipitation during this period (see Figures 2c–d). Rangelands that rely on summer precipitation have been especially hit hard during the quickly emerging short-term drought conditions. The US Department of Agriculture (USDA)-Natural Resources Conservation Service reports that more than 85 percent of rangelands in Arizona are classified in poor to very-poor condition.

Figure 4a. Arizona drought map based on data through August 18, 2009.

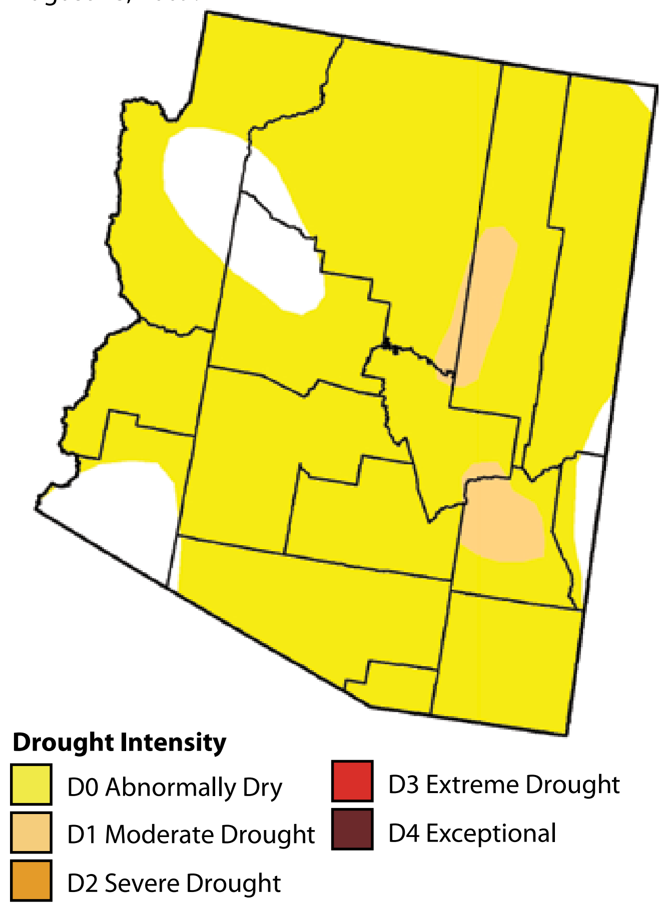


Figure 4b. Percent of Arizona designated with drought conditions based on data through August 18, 2009.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	10.4	89.6	4.3	0.0	0.0	0.0
Last Week (08/11/2009 map)	10.4	89.6	0.0	0.0	0.0	0.0
3 Months Ago (05/26/2009 map)	33.2	66.8	7.2	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 (10/07/2008 map)	83.1	16.9	0.8	0.0	0.0	0.0
One Year Ago (08/19/2008 map)	83.2	16.8	2.3	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 8/20/09)

Source: New Mexico State Drought Monitoring Committee

Monsoon rains have continued to help ease short-term drought conditions in parts of New Mexico. The August 18 update of the National Drought Monitor indicates that much of eastern New Mexico is still experiencing abnormally dry or moderate drought conditions (Figure 5a). Currently, 36 percent of New Mexico is experiencing some form of drought, down from 43 percent in mid-July (Figure 5b). The severe drought conditions observed in mid-July in Chaves County also have subsided slightly, shifting to moderate status. Summer monsoon thunderstorm activity has been spotty across the landscape, as is the usual case, but has delivered near to above-average precipitation to many of the drought-impacted areas in eastern New Mexico.

Even with improving drought conditions due to recent summer rains, the damage has been done to agricultural and livestock operations in eastern New Mexico. The U.S. Department of Agriculture has declared seven eastern New Mexico counties disaster areas due to severe drought (Associated Press, August 18). Farmers in Chaves, Eddy, Lincoln, Roosevelt, DeBaca, Lea, and Otero counties will be eligible for disaster assistance through the Farm Services Agency under the new declaration.

Figure 5a. New Mexico drought map based on data through August 18, 2009.

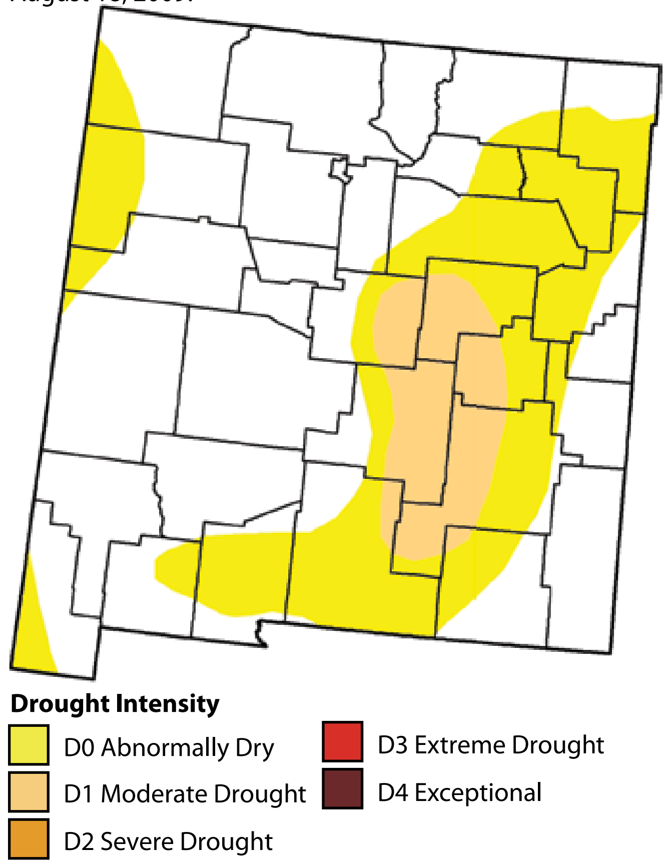


Figure 5b. Percent of New Mexico designated with drought conditions based on data through August 18, 2009.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	63.5	36.5	8.6	0.0	0.0	0.0
Last Week (08/11/2009 map)	63.5	36.5	8.6	0.0	0.0	0.0
3 Months Ago (05/26/2009 map)	38.5	61.5	37.1	10.3	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 (10/07/2008 map)	70.7	29.3	1.5	0.0	0.0	0.0
One Year Ago (08/19/2008 map)	68.4	31.6	2.5	0.3	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 7/31/09)

Source: NRCS, National Water and Climate Center

The water level in Lake Powell increased by 77,000 acre-feet during July. However, water storage in Lake Mead dropped by 93,000 acre-feet and storage declined in the Verde and Salt river reservoirs by a combined 97,000 acre-feet (Figure 6). Even with the rise in water level, Lake Powell is at 66 percent of capacity, well below the long-term average—85 percent—for the month. Lake Mead is at 42 percent of capacity, which reflects the effects of long-term drought conditions across the Upper Colorado River Basin.

In water-related news, the Arizona Department of Water Resources urged Prescott and Prescott Valley municipalities to devise a plan to ensure groundwater use will not impact the Verde River (*The Daily Courier,* August 1). Although roundwater modeling studies suggest pumping will not lower flows, people have questioned the modeling conclusions. A mitigation plan would include reducing pumping if monitoring wells show the water table is dropping to unacceptable levels.

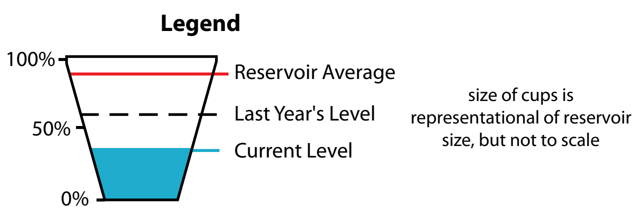
Notes:

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.

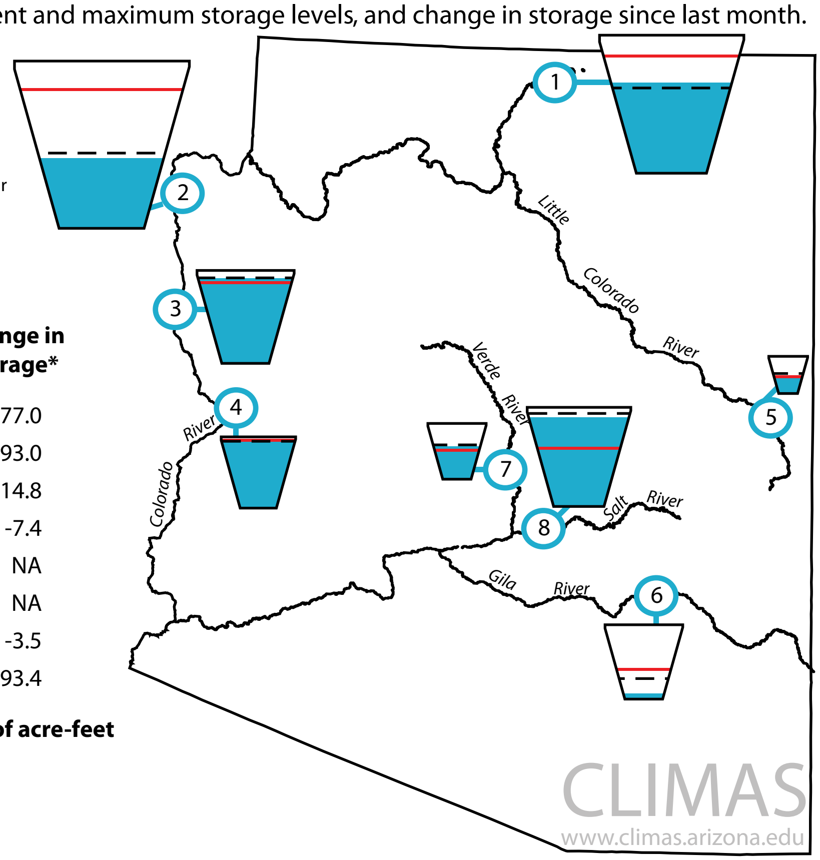
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Dino DeSimone, Dino.DeSimone@az.usda.gov.

Figure 6. Arizona reservoir levels for July 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	66%	16,138.0	24,322.0	77.0
2. Lake Mead	42%	10,978.0	26,159.0	-93.0
3. Lake Mohave	91%	1,654.4	1,810.0	-14.8
4. Lake Havasu	94%	582.1	619.0	-7.4
5. Lyman Reservoir	47%	14.1	30.0	NA
6. San Carlos	8%	68.1	875.0	NA
7. Verde River System	59%	169.8	287.4	-3.5
8. Salt River System	90%	1,823.0	2,025.8	-93.4

*** 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 7/31/09)

Source: NRCS, National Water and Climate Center

Total reservoir storage in New Mexico declined by approximately 188,000 acre- feet in July. Navajo Reservoir on the San Juan River and Elephant Butte Reservoir on the Rio Grande had the largest decreases—57,300 and 82,200 acre-feet, respectively (Figure 7). Navajo Reservoir currently is 84 percent full, which is right around its historical average for this month. Elephant Butte, however, is only 25 percent full and is below its historical average for July of 57 percent.

In water-related news, the New Mexico Senate has approved legislation that funds key water-related projects (qcsunonline.com, July 31). Among the funding recipients is Conchas Lake, which will receive about $1.8 million for continued management of the lake. Another $500,000 will be allocated for design and construction of an intake structure at Ute Reservoir for the Ute pipeline project.

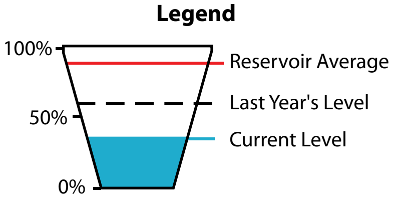
Notes:

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).

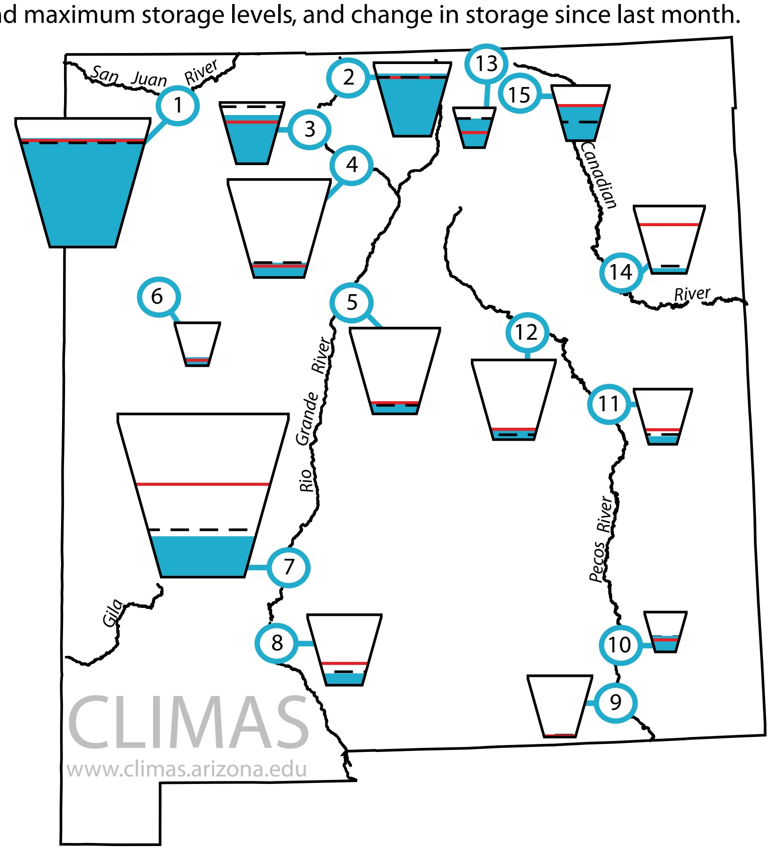
The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 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 July 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	84%	1422.1	1,696.0	-57.3
2. Heron	85%	339.5	400.0	0.1
3. El Vado	79%	150.2	190.3	-30.2
4. Abiquiu	15%	177.5	1192.8	0.4
5. Cochiti	11%	53.0	491.0	-0.9
6. Bluewater	19%	7.2	38.5	-0.2
7. Elephant Butte	25%	552.2	2,195.0	-82.2
8. Caballo	17%	56.0	332.0	-8.6
9. Brantley	2%	21.1	1008.2	9.9
10. Lake Avalon	40%	1.6	4.0	0.1
11. Sumner	14%	13.8	102.0	3.2
12. Santa Rosa	11%	48.3	438.3	-2.7
13. Costilla	72%	11.5	16.0	-3.2
14. Conchas	8%	20.0	254.2	0.1
15. Eagle Nest	61%	48.3	79.0	-2.7



On the Web:

Portions of the information provided in this figure can be accessed at the NRCS website:
http://www.wcc.nrcs.usda.gov/wsf/reservoir/resv_rpt.html

Southwest Fire Summary
(updated 8/20/09)

Source: Southwest Coordination Center

Wildfires have burned more than 191,000 acres in Arizona and more than 375,000 acres in New Mexico between January 1 and August 24 (Figures 8a–c). Due to hot, dry conditions and a monsoon that faded rapidly after initial onset, the region had several fire starts and large fires in late July through August. The majority of fires were caused by lightning strikes. Arizona and western New Mexico, where the majority of the recent wildfires occurred in the region, received 25–75 percent below-average precipitation in July. Temperatures for this part of the Southwest were also 2–6 degrees warmer than average. Both Phoenix and Yuma, Ariz., experienced their hottest July temperatures on record.

As of August 20, several wildfires in Arizona were burning in the Kaibab and Coconino national forests, including the Wild Horse Complex, which scorched more than 13,000 acres. A lightning strike ignited the blaze 16 miles northeast of Williams on August 2. Significant precipitation on August 12 helped wildland firefighters suppress the fire, according to the U.S. Forest Service.

Recently observed national fire danger ratings (not shown) indicate mostly high to very high fire danger across Arizona and New Mexico with isolated spots of moderate and extreme danger in both states. According to the U.S. Forest Service, the recently observed 1,000-hour fuel moisture index, which represents the moisture content of dead fuel from 3- to 8-inches in diameter, is between 6–15 percent for most of the Southwest, with two exceptions: the index is less than 5 percent along the Arizona borders with Nevada and California and between 16–20 percent in northeastern New Mexico.

Notes:

The fires discussed here have been reported by federal, state, or tribal agencies during 2009. The figures include information both for current fires and for fires that have been suppressed. The top figure shows a table of year-to-date fire information for Arizona and New Mexico. Prescribed burns are not included in these numbers. The bottom two figures indicate the approximate locations of past and present "large" wildland fires and prescribed burns in Arizona and in New Mexico. A "large" fire is defined as a blaze covering 100 acres or more in timber or 300 acres or more in grass or brush. The name of each fire is provided next to the symbol.

On the Web:

These data are obtained from the Southwest Coordination Center website:
http://gacc.nifc.gov/swcc/predictive/intelligence/daily/gacc_7_national_ytd_large_by_state.htm

http://gacc.nifc.gov/swcc/predictive/intelligence/maps/wf/swa_fire_combined.htm

Figure 8a. Year-to-date wildland fire information for Arizona and New Mexico as of August 14, 2009.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	1,035	82,250	533	87,190	1,586	169,440
NM	590	92,243	533	267,626	1,143	359,869
Total	1,625	174,497	1,086	354,824	2,711	529,309

Figure 8b. Arizona large fire incidents as of August 20, 2009.

Figure 8c. New Mexico large fire incidents as of August 20, 2009.

Monsoon Summary
(through 8/13/2009)

Source: Western Regional Climate Center

After an on-time arrival in the southern half of the region, the monsoon took a long break during late July and early August Thus far this season, monsoon precipitation has arrived primarily in three bursts, one in late June and early July that barely penetrated to northern Arizona, one around the third week of July, and a third burst during the second week of August. In general, monsoon season precipitation has been below average across most of Arizona and New Mexico, with average to above-average monsoon precipitation primarily throughout southeastern New Mexico (Figures 9a–c). According to products disseminated by the National Weather Service Tucson forecast office and the Western Regional Climate Center, the following regions have monsoon season precipitation deficits of 2 to more than 3 inches: north-central Arizona, most of the Arizona-New Mexico border region, and south-central and north-central New Mexico. As a result of dwindling summer precipitation, rangeland forage conditions have deteriorated in much of the region, and vegetation stress for this time of year (as shown in NOAA remote sensing products) is greater than it has been in the last six years.

The extended monsoon season break in southeastern Arizona and southwestern New Mexico is probably due, in part, to the strengthening El Niño episode. El Niño activity typically suppresses high pressure—an essential factor needed to draw moisture to the southwest—over the Four Corners region. Also associated with El Niño is an increase across the Midwest of summer precipitation, which has occurred this year.

Figure 9a. Total precipitation in inches (June 15–August 13, 2009).

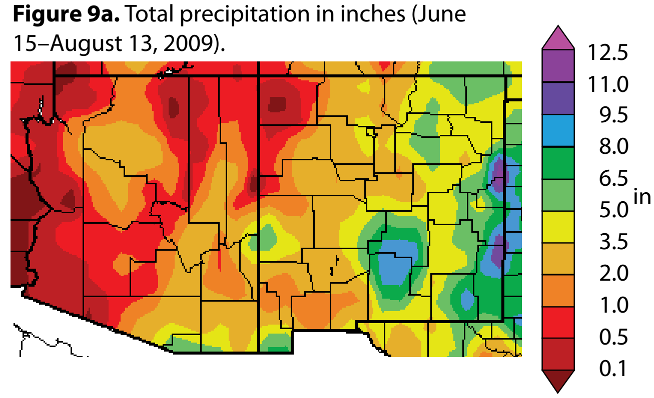


Figure 9b. Departure from average precipitation in inches (June 15–August 13, 2009).

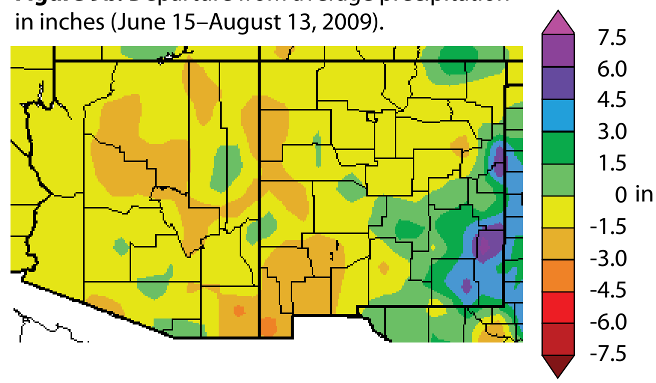
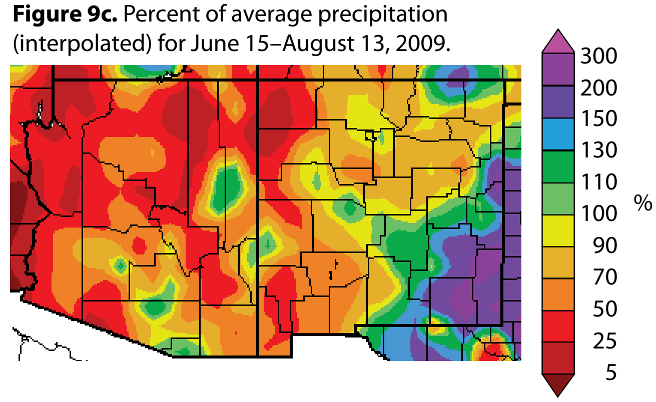


Figure 9c. Percent of average precipitation (interpolated) for June 15–August 13, 2009.



Notes:

The continuous color maps (figures above) 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.

On the Web:

These data are obtained from the National Climatic Data Center:
http://www.hprcc.unl.edu/maps/current/

Temperature Outlook

(September 2009–February 2010)

Source: NOAA-Climate Prediction Center (CPC)

The NOAA-Climate Prediction Center (NOAA–CPC) longlead temperature forecasts for the continental U.S. show increased chances of warmer-than-average fall and early winter temperatures throughout much of the country. The temperature outlook for September through November shows substantially increased chances for temperatures similar to those of the warmest 10 years of the 1971–2000 observed record for nearly all of Arizona and with merely increased chances of warmer-than-average temperatures for New Mexico (Figure 10a). Through the fall and into early winter, the forecast maintains increased chances that the Southwest will experience warmer-than-average temperatures (Figures 10b–d). These temperature forecasts are based on ongoing warming temperature trends, modified by El Niño-Southern Oscillation (ENSO) conditions. Equatorial Pacific sea surface temperatures indicate a mild El Niño has begun and will likely intensify somewhat into winter.

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 10a. Long-lead national temperature forecast for September–November 2009.

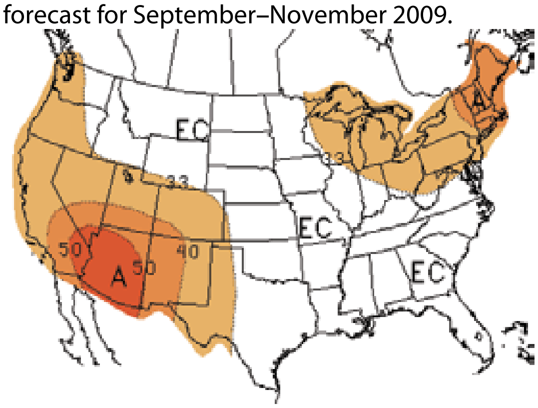
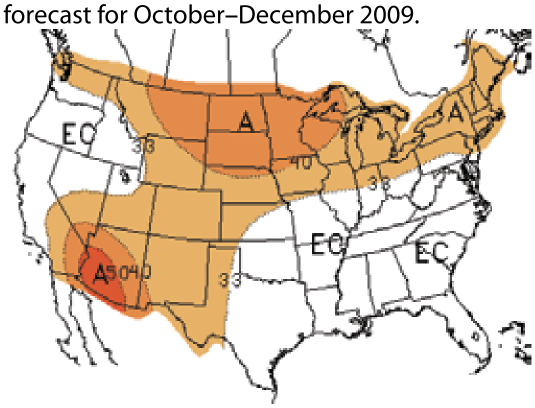


Figure 10b. Long-lead national temperature forecast for October–December 2009.



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 10c. Long-lead national temperature forecast for November 2009–January 2010.

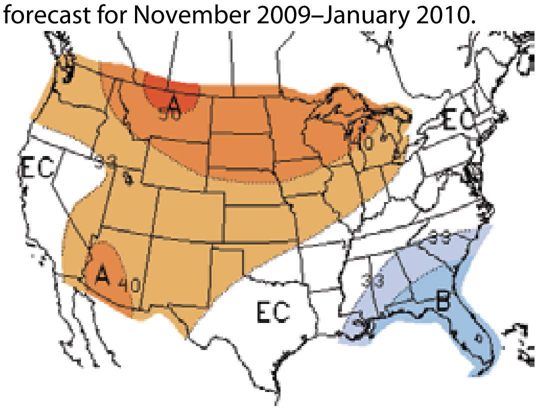
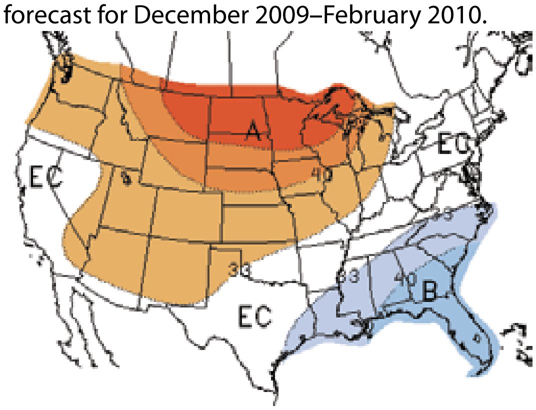


Figure 10d. Long-lead national temperature forecast for December 2009–February 2010.



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
(September 2009–February 2010)

Source: NOAA-Climate Prediction Center (CPC)

The NOAA-Climate Prediction Center (NOAA–CPC) long-lead precipitation forecast through November shows mostly equal chances of below-, above-, or near-average conditions throughout the Southwest (Figure 11a). An equal chances forecast indicates that for this period no forecast skill has been demonstrated or there is no clear climate signal influencing seasonal precipitation. As fall and early winter begin, the forecast shows a shift in the odds for much of the southern US toward precipitation conditions like those of wettest 10 years of the 1971–2000 observed record (Figures 11b–d). This is a particularly welcome forecast for much of Texas, which has been suffering through significant drought conditions. The increased chance is partly related to El Niño-Southern Oscillation conditions, which have shifted into a mild El Niño episode this summer. El Niño is likely to intensify over the next several months. This shift typically results in wetter fall and winter conditions through the Southwest.

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 11a. Long-lead national precipitation forecast for September–November 2009.

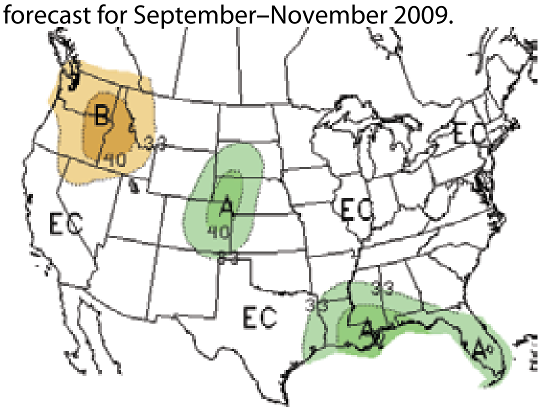


Figure 11b. Long-lead national precipitation forecast for October–December 2009.

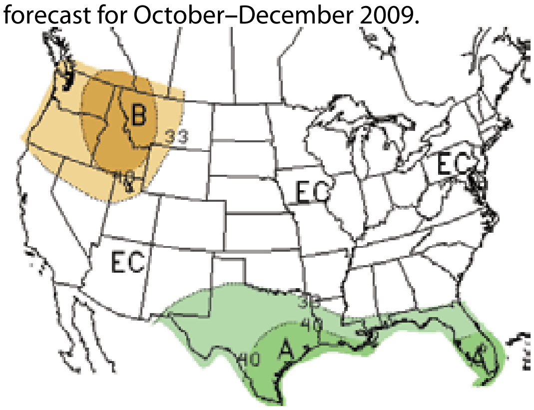


Figure 11c. Long-lead national precipitation forecast for November 2009–January 2010.

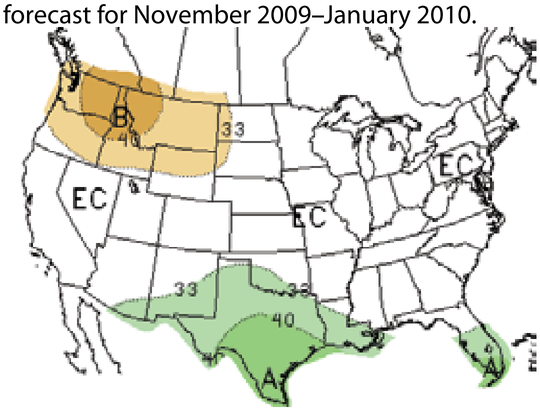
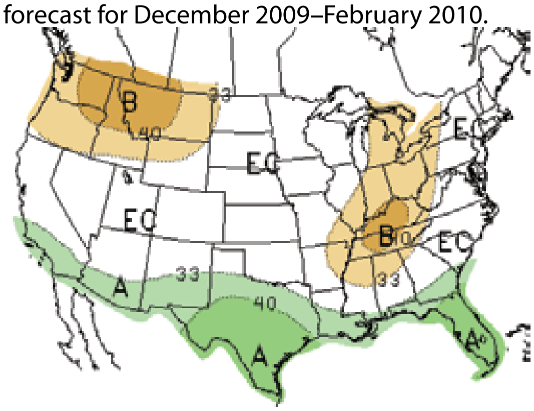


Figure 11d. Long-lead national precipitation forecast for December 2009–February 2010.



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 November 2009)

Source: NOAA-Climate Prediction Center (CPC)

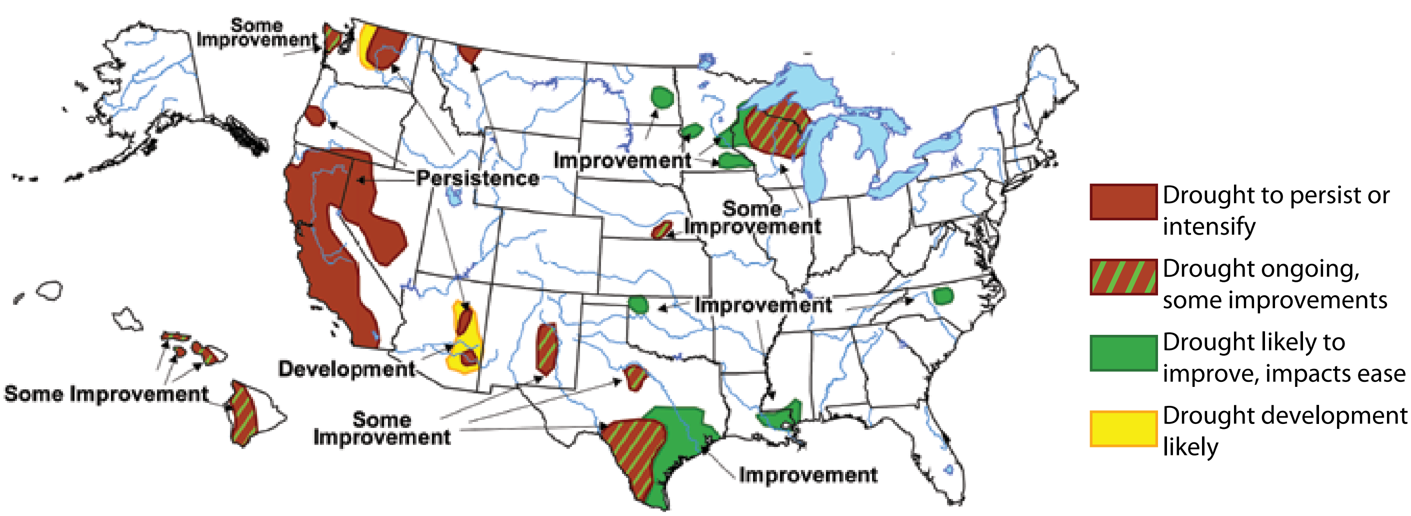
The latter part of the Southwest monsoon season has been weak, especially in Arizona, where several areas have dried out quickly over the last few weeks and small regions of moderate drought have recently developed over the eastern part of the state. Short and medium range indications are for continued dryness over eastern Arizona (Figure 12). Some climate indicators, such as historic average El Niño episode precipitation for the fall season and the NOAA climate forecast system model, indicate near to below-average precipitation for much of the region, despite the fact that the official CPC forecast shows equal chances for September through November (Figure 11a). For these reasons, CPC drought forecasts have indicated an area of persistent drought for the newly developed drought areas over eastern Arizona and an area of drought development for nearby parts of eastern and southern Arizona. In eastern New Mexico, forecasts indicate higher chances of near to above-normal precipitation as the fall season progresses, so a forecast of some improvement is specified Forecast confidence in Arizona and New Mexico is moderate.

As southern Texas continues to struggle with a historic drought, there are indications that the drought may begin to loosen its grip on some areas as fall begins. Historically, beneficial impacts from a developing El Niño episode are usually more pronounced in this region from November onward into winter, and longrange forecasts suggest decreasing odds for below-average rainfall by October. As a result, some improvement is forecast for the Texas drought areas over the next three months. (The above text is excerpted and edited from the August 20, 2009, Seasonal Drought Summary produced by the CPC).

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 12. Seasonal drought outlook through November 2009 (released August 20, 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

Wildland Fire Outlook
(September–November 2009)

Sources: National Interagency Coordination Center, Southwest Coordination Center

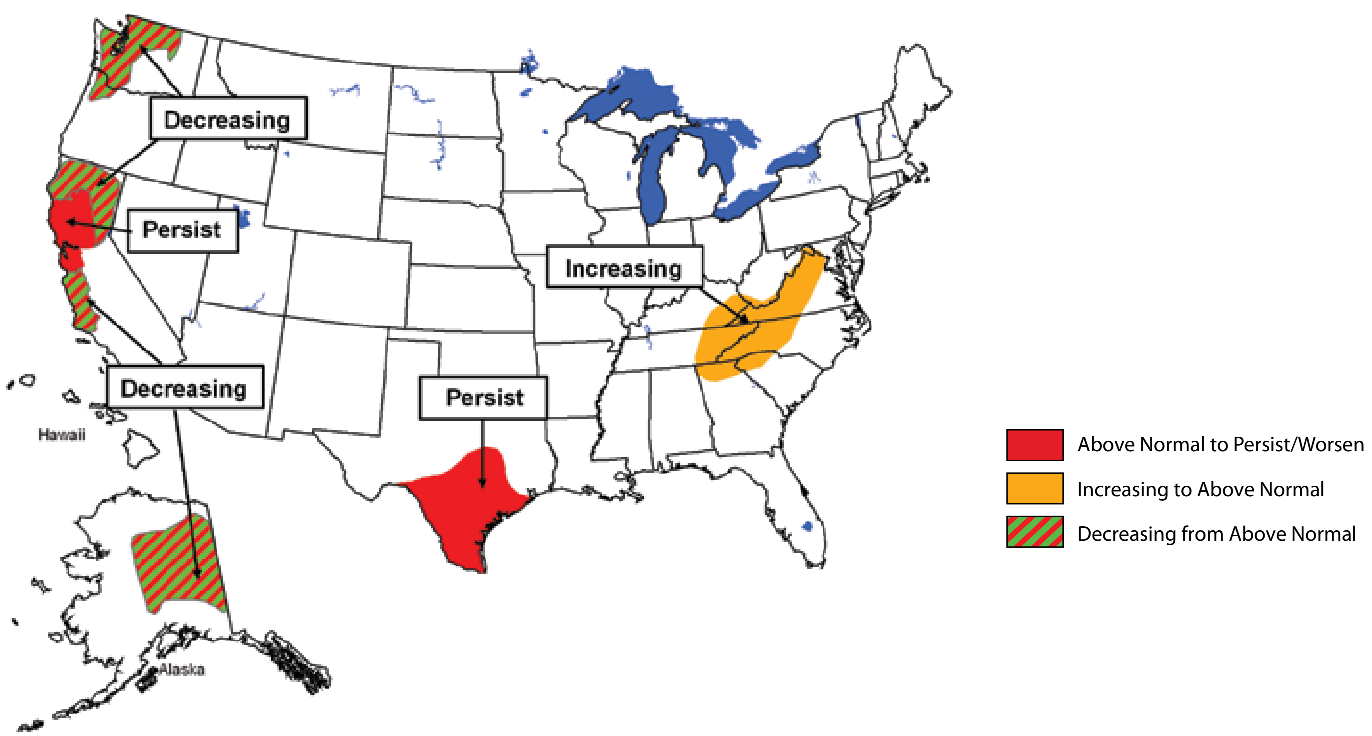
The National Interagency Fire Center Predictive Services forecasts normal significant fire potential for the Southwest through November (Figure 13). For the rest of August into September, the Southwest Coordination Center indicates normal significant fire potential for the majority of the region due to more usual monsoon conditions. Hot and dry conditions may cause several fire starts, especially in northwestern Arizona, where significant fire potential is above average. However, monsoon moisture will likely help to suppress fires before they become too widespread.

Forecasts that contribute to the fire outlook include the Climate Prediction Center (CPC) temperature and precipitation forecasts. The CPC's climate forecast for September through November indicates increased chances of above-average temperatures for the Southwest (see Figures 10a). CPC forecasters have withheld judgment regarding precipitation for this time period, assigning equal chances of above- or below-average precipitation for the region. The exception is a tiny portion of northeastern New Mexico, where slightly higher chances for above-average precipitation are predicted. El Niño conditions that have been developing in the Pacific are expected to influence fall and winter precipitation in the Southwest.

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces seasonal wildland fire outlooks each month. The forecasts (Figure 13) consider observed climate conditions, climate and weather forecasts, vegetation health, and surface-fuels conditions in order to assess fire potential for fires greater than 100 acres. They are subjective assessments, that synthesize information provided by fire and climate experts throughout the United States.

Figure 13. National wildland fire potential for fires greater than 100 acres (valid September–November 2009).



On the Web:

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

Southwest Coordination Center web page:
http://gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm

El Niño Status and Forecast

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

Text edited for clarity on August 28.

The "El Niño Advisory" status indicates El Niño conditions across the equatorial Pacific Ocean. Above-average Pacific Ocean sea surface temperatures (SSTs) have been present for the past several months along the equator out past the International Dateline. According to NOAA-CPC, SSTs were 0.5 to 1.5 degrees Celsius above-average in July, with the highest temperatures observed in the eastern Pacific. These conditions are consistent with a weak El Niño event. The Southern Oscillation Index (SOI, Figure 14a) turned negative in May and June, indicating an atmospheric response to the current El Niño event's warm SSTs, but has since bounced back to near zero and +0.1 in July. This, along with recent observations of cooling in water temperatures just below the surface, is further evidence that the current El Niño event is weak and having trouble getting firmly established.

Nevertheless, both NOAA-CPC and the International Research Institute for Climate and Society (IRI) expect at least weak El Niño conditions to persist through the upcoming fall and early winter seasons. Most NOAA-CPC models suggest that El Niño will strengthen into the fall, while probabilistic forecasts produced by IRI indicate a greater than 80 percent chance that weak El Niño conditions will persist through the November-January period (Figure 14b). This chance falls to just above 50 percent by midwinter (February-April), when the chance of neutral conditions returning rises to 43 percent. The almost equal chance of either El Niño or neutral conditions during this period in the IRI forecast indicates that it is unclear whether or not the current El Niño will be able to hold through next spring. Regardless, weak El Niño conditions through the fall and early winter could help improve the odds of picking up some precipitation across Arizona and New Mexico. El Niño events can help foster a more active fall tropical storm season in the eastern Pacific and provide moisture for early winter storms in November and December.

Notes:

Figure 14a 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.

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

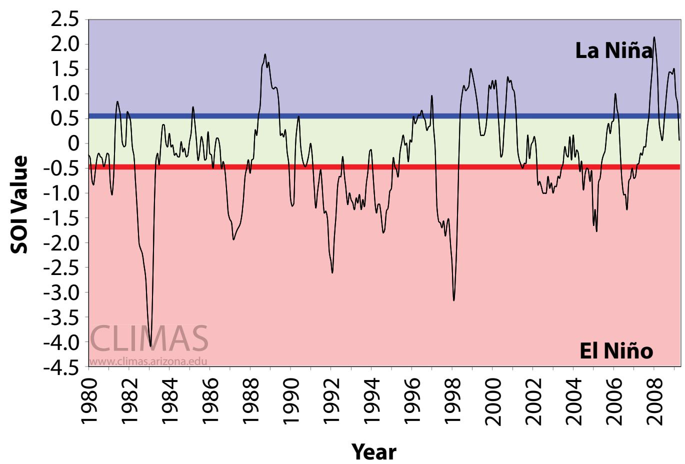
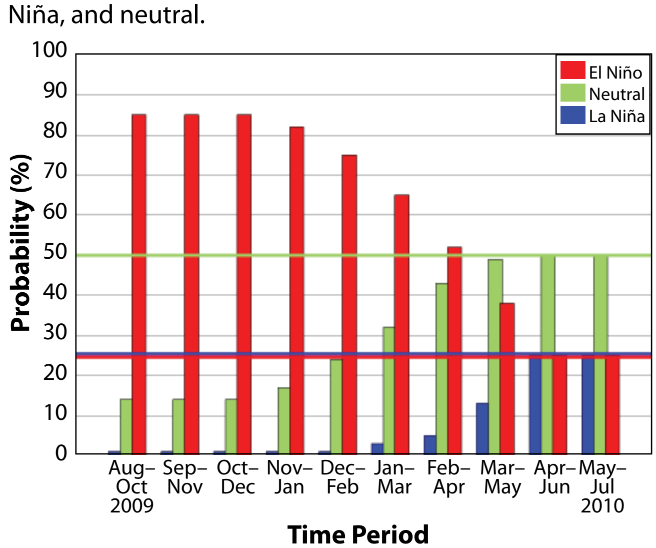


Figure 14b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released August 20, 2009). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Temperature Verification
(September 2009–February 2010)

Source: Forecast Evaluation Tool

CLIMAS seeks feedback on these new highlights. Please email zguido@email.arizona.edu or call 520-882-0870.

Comparisons of observed temperatures for September-November to forecasts issued in August for the one-month lead time covering the same period suggest that forecasts are most reliable in southern and northwestern Arizona and that skill for the northern parts of Arizona and New Mexico has not been much better than using equal chances as a forecast (Figure 15a). Forecast skill maps for the two- and three-month lead times display regional differences, with forecasts made for southern and northwestern Arizona and southwestern New Mexico generally exhibiting the greatest reliability (Figures 15b–c). For these forecasts, most regions have a blue tint, indicating that all the forecasts issued for these lead times have been more accurate than forecasts based on equal chances. Forecasts issued in August that cover the December-February season are considerably less reliable, with the exception of forecasts for northwestern Arizona (Figure 15d). 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 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 15a. RPSS for September–November 2009.

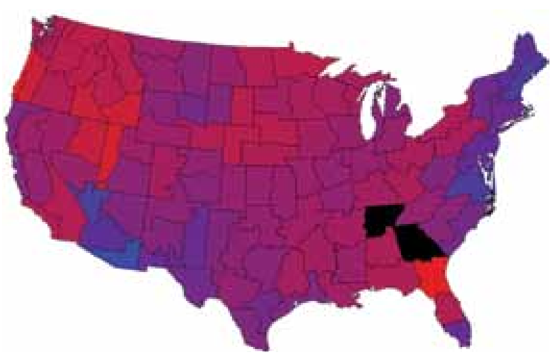


Figure 15b. RPSS for October–December 2009.

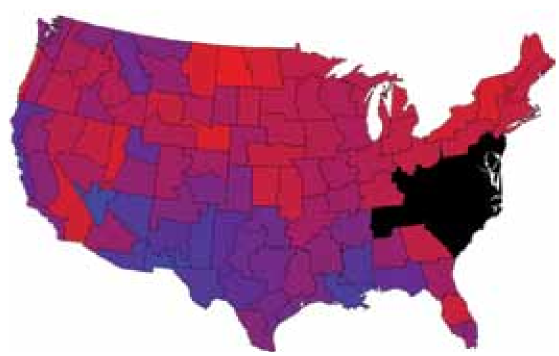
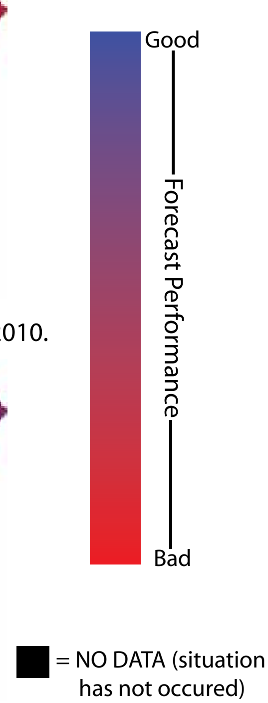


Figure 15c. RPSS for November 2009–January 2010.

Figure 15d. RPSS for December 2009–February 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
(September 2009–February 2010)

Source: Forecast Evaluation Tool

CLIMAS seeks feedback on these new highlights. Please email zguido@email.arizona.edu or call 520-882-0870.

Comparisons of observed precipitation for September-November to forecasts issued in August for the one-month lead time covering the same period suggest that forecast skill is good for southeastern Arizona, somewhat better than equal chances for most of Arizona and New Mexico, and poorer than equal chances in northern Arizona (Figure 16a). (Note: the NOAA Climate Predictions Center (NOAA-CPC) has not issued September-November forecasts in the past for map regions displayed in black). At all lead times, the part of the Southwest where seasonal forecasts issued in August have displayed the highest skill is in southeast Arizona. Forecast skill for the two-month lead time (forecasts issued in August for October-December) has been less accurate than equal chances in all of New Mexico and northeastern Arizona (Figure 16b). For this forecast, the southeast corner of Arizona again exhibits the highest skill. As the precipitation forecasts take on more of the winter season (Figures 16c–d), regional forecast skill increases, although some regions show slightly better skill than equal chances forecasts. Caution is advised to users of the NOAACPC 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 16a. RPSS for September–November 2009.

Figure 16b. RPSS for October–December 2009.

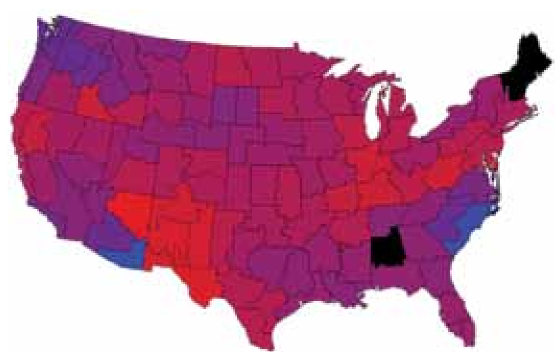


Figure 16c. RPSS for November 2009–January 2010.

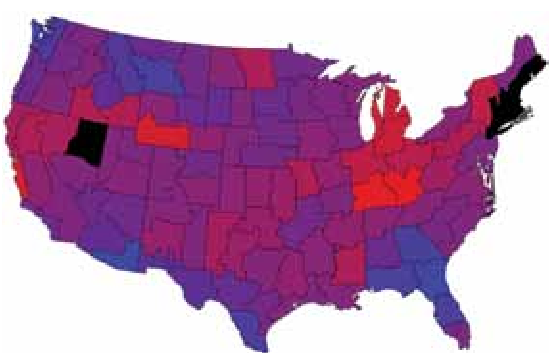
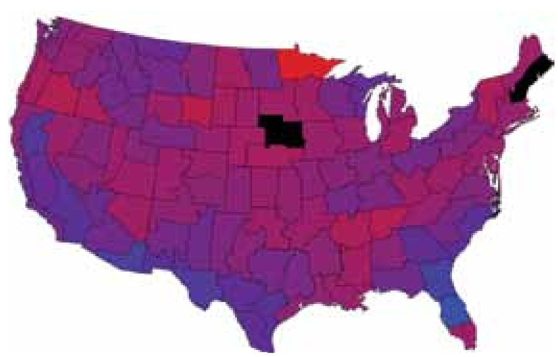
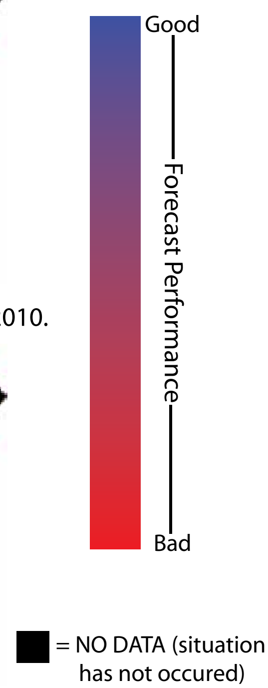


Figure 16d. RPSS for December 2009–February 2010.





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