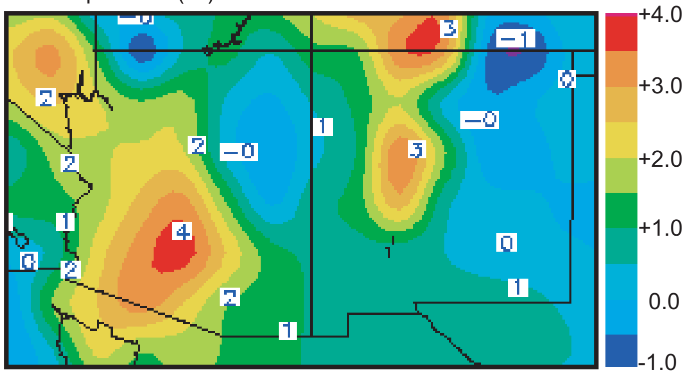
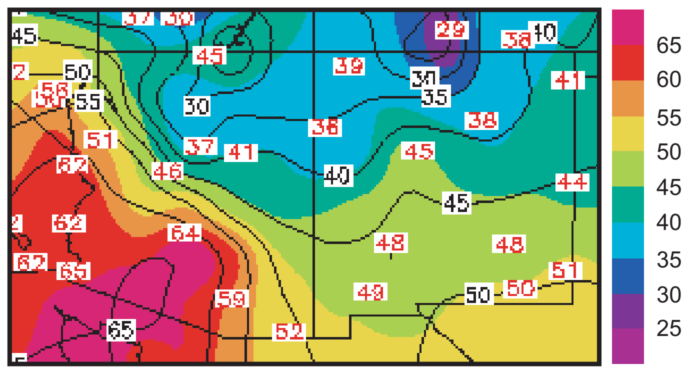
1. Recent Conditions: Temperature (up to 02/19/03) Source: Western Regional Climate Center

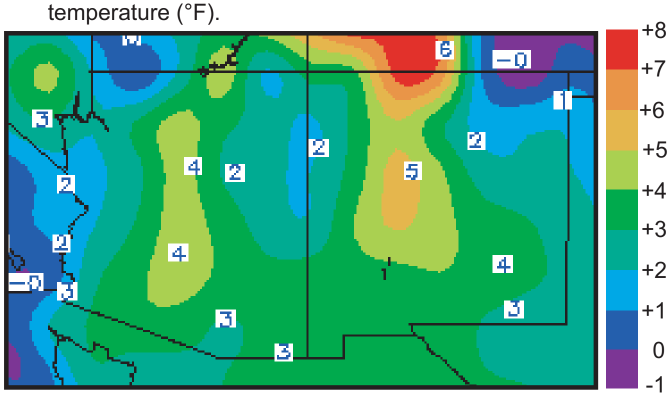
1a. Water year '02-'03 (through 02/19) departure from average temperature (°F).



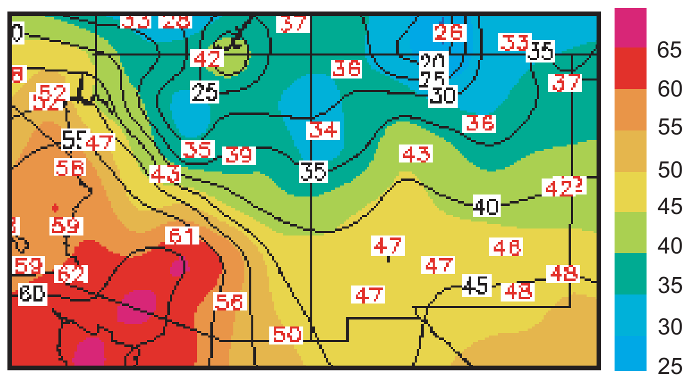
1b. Water year '02-'03 (through 02/19) average temperature (°F).



1c. Previous 28 days (01/23 - 02/19) departure from average temperature (°F).



1d. Previous 28 days (01/23 - 02/19) average temperature (°F).



Highlights: The previous 28 days have been warmer than average across virtually all of Arizona and New Mexico, with much of the region several degrees above normal (Figure 1c). Much of the warmth was due to a persistent ridge of high pressure over the western United States during January and early February. Departures from average temperatures (since October 1, 2002; Figure 1a) for most of Arizona and New Mexico have shifted a degree in the positive direction since last month. However, northeastern Arizona and east-central New Mexico still have below-average temperatures for the water year (October 1, 2002 – February 19, 2003) thus far.

For these and other temperature maps, visit: http://www.wrcc.dri.edu/recent_climate.html

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

Notes:

The Water Year begins on October 1 and ends on September 30 of the following year. As of October 1, we are in the 2003 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 arithmetic mean of annual data from 1971-2000.

The data are in degrees Fahrenheit (°F).

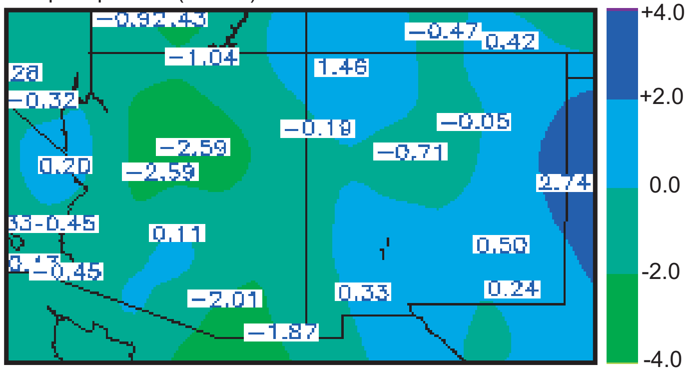
Departure from average temperature is calculated by subtracting current data from the average and can be positive or negative.

These maps are derived by taking measurements at meteorological stations (at airports) and estimating a continuous map surface based on the values of the measurements and a mathematical algorithm. This process of estimation is also called spatial interpolation.

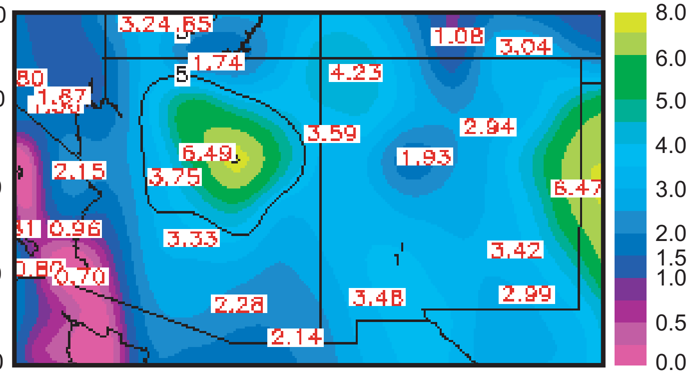
The red and blue numbers shown on the maps represent individual stations. The contour lines and black numbers show average temperatures.

2. Recent Conditions: Precipitation (up to 02/19/03) ♦ Source: Western Regional Climate Center

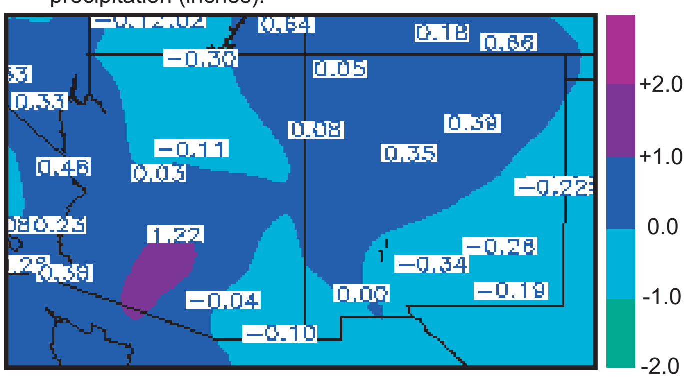
2a. Water year '02-'03 (through 02/19) departure from average precipitation (inches).



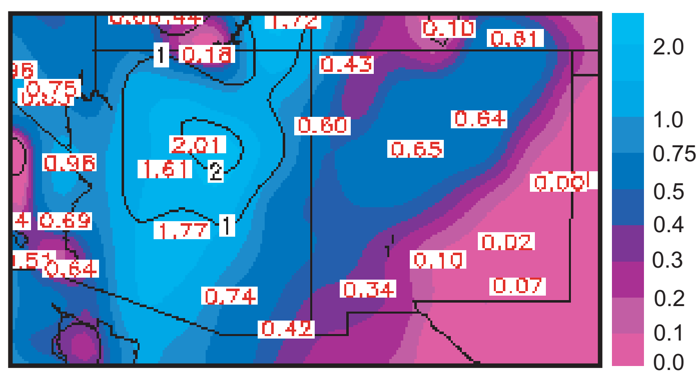
2b. Water year '02-'03 (through 02/19) total precipitation (inches).



2c. Previous 28 days (01/23 - 02/19) departure from average precipitation (inches).



2d. Previous 28 days (01/23 - 02/19) total precipitation (inches).



Highlights: Since the release of the January packet, the remainder of January produced little rain for Arizona and New Mexico. A storm in mid-February resulted in substantial precipitation for much of west-central Arizona; however, far lower precipitation totals were received in southern and eastern New Mexico. Figure 2c suggests that the mid-February storm has kept much of the region within 0.5 inches (above and below) of average precipitation for the late January to mid-February time period. A spatial pattern of above- and below-average precipitation for the water year has persisted since (at least) this time last month (Figure 2a), with the greatest below-average precipitation totals reported in north-central Arizona.

For these and other precipitation maps, visit: http://www.wrcc.dri.edu/recent_climate.html

For National Climatic Data Center monthly and weekly precipitation and drought reports for Arizona, New Mexico and the Southwest region, visit: http://lwf.ncdc.noaa.gov/oa/climate/research/2002/perspectives.html

Notes:

The Water Year begins on October 1 and ends on September 30 of the following year. As of October 1, we are in the 2003 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.

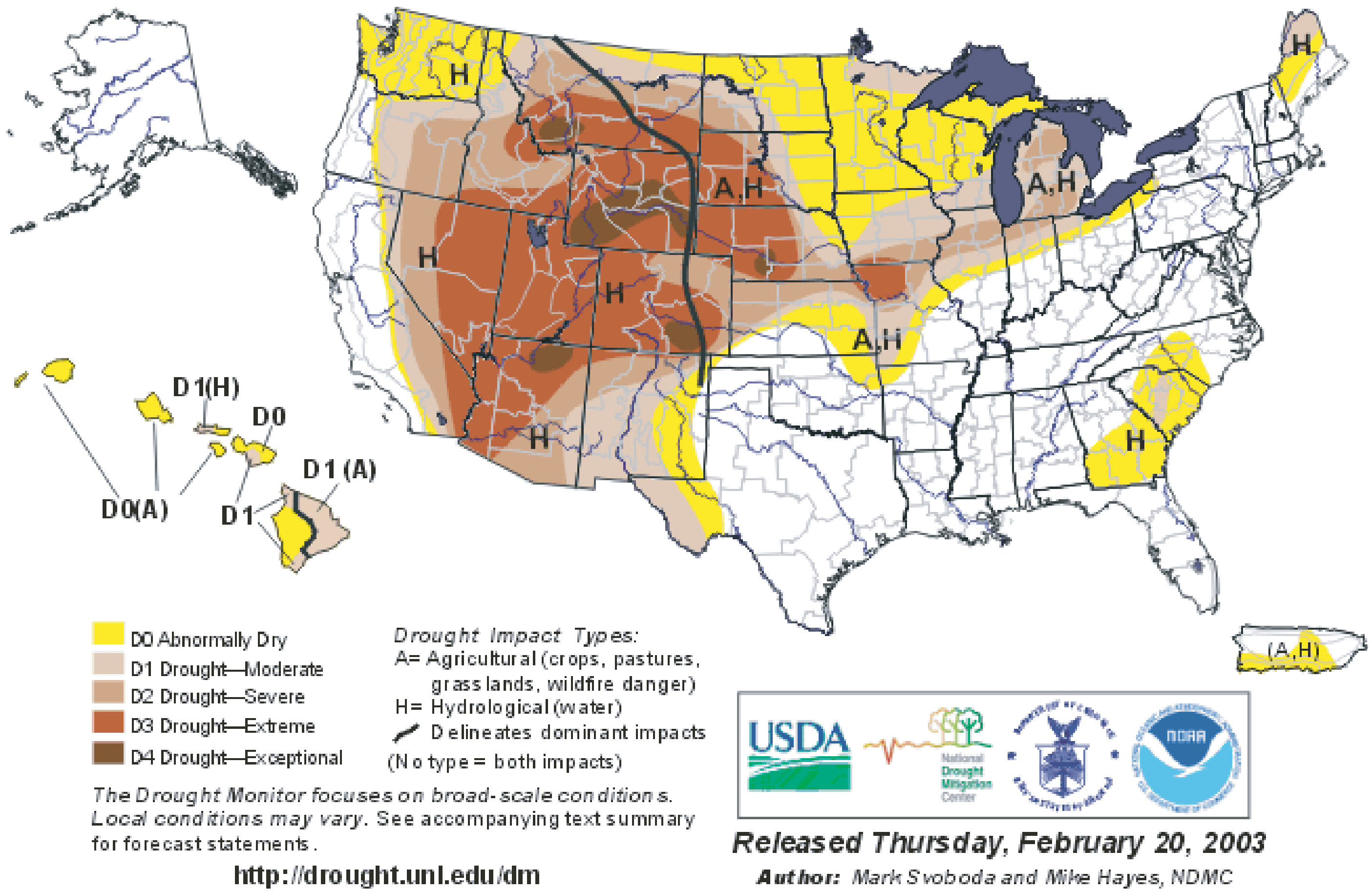
The data are in inches of precipitation. **Note: The scales for Figures 2b & 2d are non-linear.**

Departure from average precipitation is calculated by subtracting current data from the average and can be positive or negative.

These maps are derived by taking measurements at meteorological stations (at airports) and estimating a continuous map surface based on the values of the measurements and a mathematical algorithm. This process of estimation is also called spatial interpolation.

The red and blue numbers shown on the maps represent individual stations. The contour lines and black numbers show average precipitation.

3. U.S. Drought Monitor (updated 02/18/03) ♦ Source: USDA, NDMC, NOAA



Notes:

The U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. This monitor was released on 02/20 and is based on data collected through 02/18 (as indicated in the title).

The best way to monitor drought trends is to pay a weekly visit to the U.S. Drought Monitor website (see left and below).

The U.S. Drought Monitor maps are based on expert assessment of variables including (but not limited to) PDSI, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts.

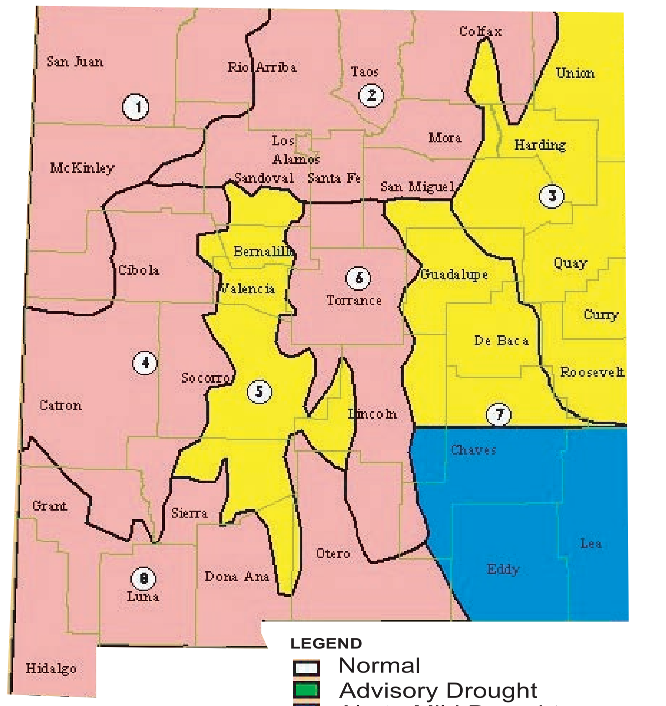
Highlights: Extreme drought conditions have expanded across Nevada and Utah since last month's Drought Monitor, and extreme to exceptional drought conditions remain in place over the northern Rockies and parts of the Great Plains. In Arizona and New Mexico, drought conditions remain almost unchanged since January, due to the persistence of long-term (hydrological) drought impacts. Generally speaking, drought conditions intensify from east to west across our region, with no drought to moderate drought conditions in New Mexico and severe to exceptional drought conditions in Arizona. Mid-February storms, which produced substantial amounts of rain in central-western Arizona, did not have a large effect on important water-producing parts of the state, and because the temperatures were at or above freezing, the storms actually reduced some of the snowpack in Arizona. Snowpack levels in Arizona are far below average for this time of year (see page 8) and reservoir levels are far below capacity as well (see page 6). Most of the Colorado River watershed is in similar severe conditions.

Animations of the current and past weekly drought monitor maps can be viewed at: http://www.drought.unl.edu/dm/monitor.html

4. Drought: Recent Drought Status for New Mexico (updated 02/20/03) Source: New Mexico NRCS

New Mexico Drought Map

Drought Status as of February 20, 2003



Note: NM map is delineated by climate zones.

Source: NM Natural Resources Conservation Service (2003)

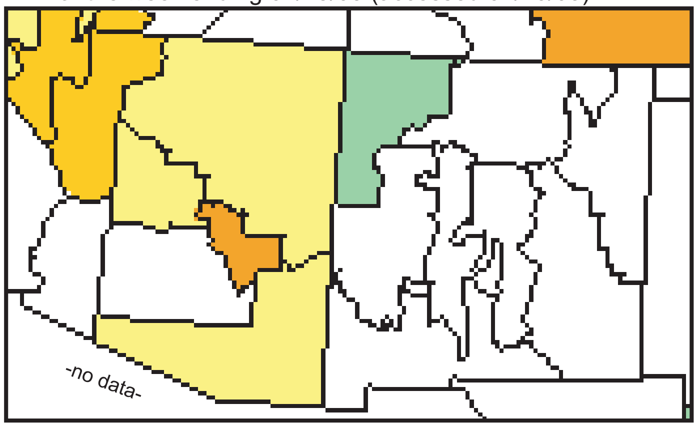
Notes: The New Mexico drought map above, provided by the New Mexico Natural Resource Conservation Service, indicates current drought status. Drought status has remained the same since September, 2002, due chiefly to concerns about water supply and streamflow. Short-term drought conditions have improved; however, streamflow forecasts and reservoir levels give cause for concern about long-term (hydrological) drought. River basin snowpack and precipitation are mostly below average across New Mexico and in southern Colorado basins that feed the Rio Grande; above-average levels are located chiefly in north-central New Mexico. No changes will be made in the New Mexico drought status map until winter precipitation and projected water supply for 2003 is assessed (New Mexico Drought Planning Team).

On January 13, 2003 the Arizona Department of Emergency Management (ADEM) released a drought situation report. Among the report highlights are the following: the overall drought situation in Arizona has only improved slightly since last year; some reservoir levels are at all-time lows; dry winter conditions mean that the possibility of a severe wildland fire season in 2003 is still a major concern. The report does not contain a detailed map for Arizona.

The New Mexico map (http://www.nm.nrcs.usda.gov/drought/drought.htm), currently is produced monthly, but when near-normal conditions exist, it is updated quarterly. Contact Matt Parks at ADEM at (602) 392-7510 for more information on Arizona regional drought declarations and situation reports.

5. PDSI Measures of Recent Conditions (up to 02/15/03) ♦ Source: NOAA Climate Prediction Center

5a. Current weekly Palmer Drought Severity Index (PDSI), for the week ending 02/15/03 (accessed 02/20/03).



-4.0 to -4.9 (extreme drought)

-3.0 to -3.9 (severe drought)

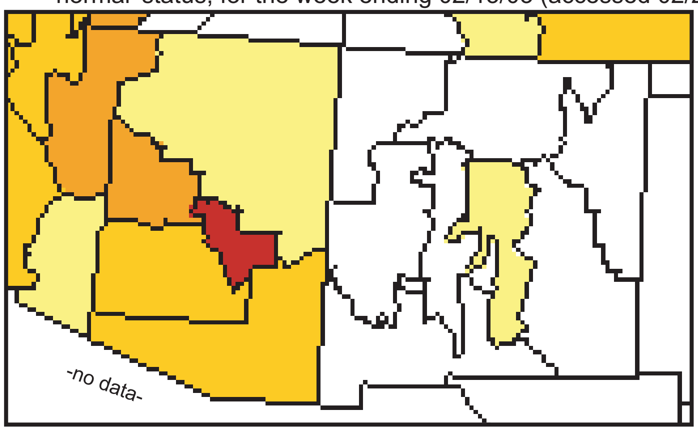
-2.0 to -2.9 (moderate drought)

-1.9 to +1.9 (near normal)

+2.0 to +2.9 (unusual moist spell)

+3.0 to +3.9 (very moist spell)

5b. Precipitation needed to bring current weekly PDSI assessment to 'normal' status, for the week ending 02/15/03 (accessed 02/20).



Zero inches

Trace to 3 inches

3 to 6 inches

6 to 9 inches

9 to 12 inches

12 to 15 inches

Over 15 inches

Notes:
The PDSI (Palmer Drought Severity Index) attempts to measure the duration and intensity of long-term conditions that underlie drought.

'Normal' on the PDSI scale is defined as amounts of moisture that reflect long-term climate expectations.

Arizona and New Mexico are divided into *climate divisions.* Climate data are aggregated and averaged for each division within each state. Note that climate division calculations stop at state boundaries.

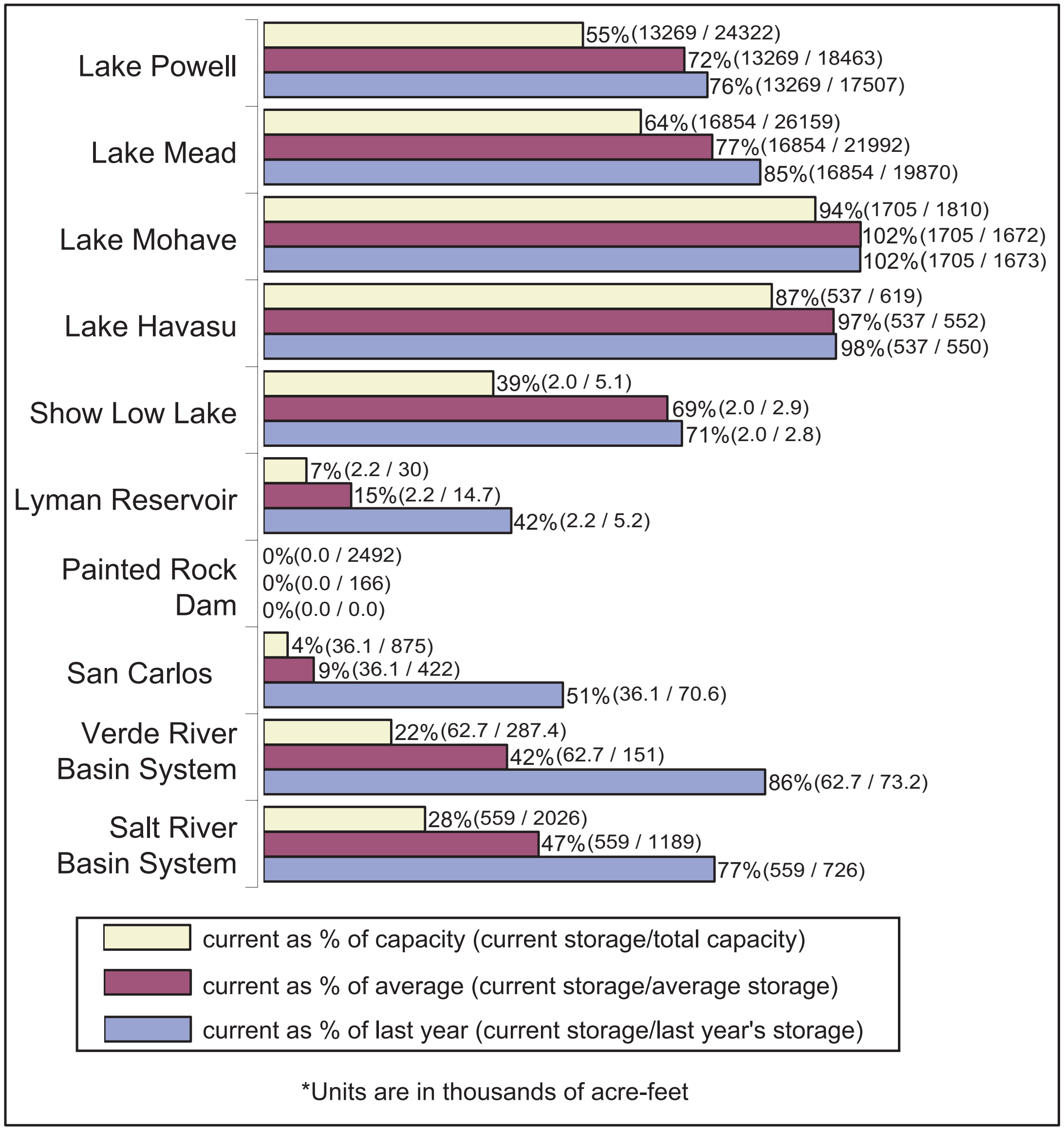
These maps are issued weekly by the NOAA CPC.

Highlights: Mid-February precipitation influenced the PDSI values for western Arizona, due to a storm system that moved through the region over Valentine's Day weekend. This precipitation, which according to Tom Pagano, Water Supply Forecaster for the USDA's National Water and Climate Center, was probably a 2-5 year rainfall event, helped downgrade short-term drought conditions in western Arizona (Figure 5a). The storm system did not produce much precipitation in New Mexico, where PDSI values remain near average. Figure 5b shows that precipitation needed to bring the PDSI to "normal" status has remained almost unchanged since January. Arizona still needs substantial amounts of precipitation (up to 12 inches in central Arizona); most of New Mexico requires little precipitation for PDSI values to be within "normal" status.

For a more technical description of PDSI, visit: http://www.cpc.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/ppdanote.html

For information on drought termination and amelioration, visit: http://lwf.ncdc.noaa.gov/oa/climate/research/drought/background.html

6. Arizona Reservoir Levels (through the end of January 2002) ♦ Source: USDA NRCS



Notes: Reservoir reports are updated monthly and are provided by the National Water and Climate Center (NWCC) of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). Portions of the information provided in this figure can be accessed at the NRCS website: (http://www.wcc.nrcs.usda.gov/water/reservoir/resv_rpt.html).

As of 02/18/03, Arizona's report had been updated through the end of January.

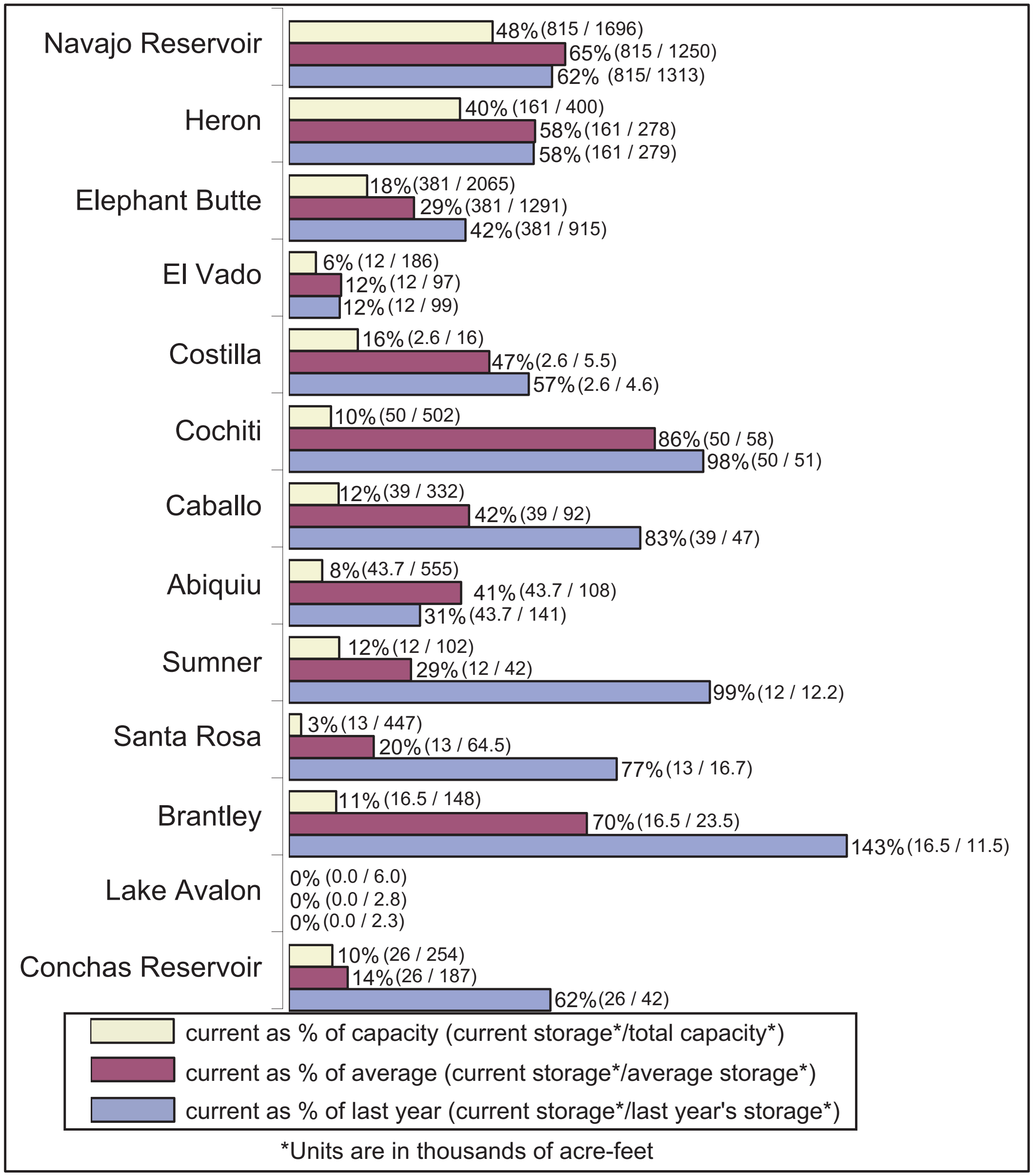
For additional information, contact Tom Pagano of the NWCC-NRCS-USDA (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Larry Martinez, NRCS, USDA, 3003 N. Central Ave, Suite 800, Phoenix, Arizona 85012-2945; 602-280-8841; Larry.Martinez@az.usda.gov)

Highlights: Levels in most Arizona reservoirs have decreased slightly since between the end of December and the end of January. Compared to last month and this time last year, levels are farther below average. Reservoirs on the Verde River Basin are at approximately the same level as last year at this time. Reservoir storage on the lower Colorado River (e.g., Lake Mohave and Lake Havasu reservoirs) increased during the month of January, while Lake Powell and Lake Mead storage declined slightly (2% and 1%, respectively).

Lake Powell is now at its lowest level since 1973, when the lake was still filling behind Glen Canyon Dam. The decline in the level of Lake Powell is of concern to regional water resource managers.

According to a U.S. Bureau of Reclamation spokesperson quoted in a report in the Arizona Daily Sun (February 13, 2003), "Water levels are expected to dip five more feet before late March, when mountain snow runoff is expected to start filling the lake again. The lake's water supply has been hard hit by record-low flows from the Colorado River and drought-driven demand from Arizona, Nevada and California."

7. New Mexico Reservoir Levels (through the end of January 2002) Source: USDA NRCS



Notes: Reservoir reports are updated monthly and are provided by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service. Reports can be accessed at their website (http://www.wcc.nrcs.usda.gov/water/reservoir/resv_rpt.html).

As of 02/18/03, New Mexico's report has been updated through the end of January.

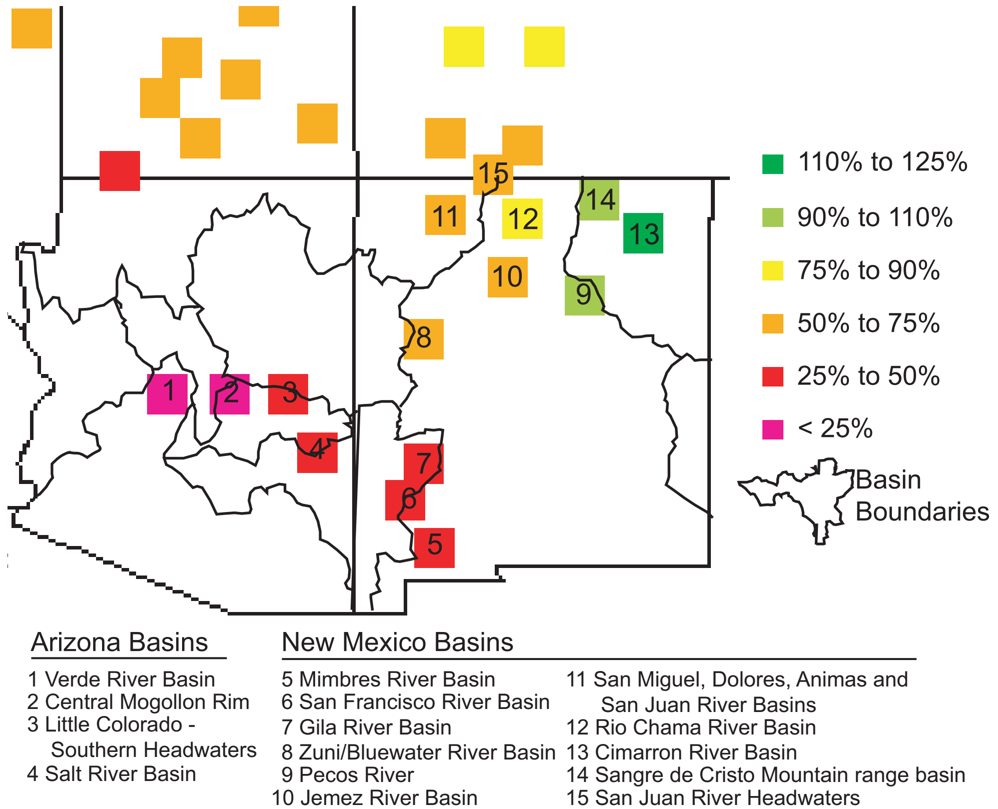
For additional information, contact Tom Pagano of the NWCC-NRCS-USDA (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Dan Murray, NRCS, USDA, 6200 Jefferson NE, Albuquerque, NM 87109; 505-761-4436; Dan.Murray@nm.usda.gov)

Highlights: During the past month, most New Mexico reservoir levels have held steady or dropped in storage amounts only slightly. For the Rio Grande basin, very little change from last month has occurred. For the Pecos River basin, Sumner reservoir doubled its storage from last month (from 6% to 12% of capacity), while in the southeastern part of the state, Lake Avalon was reduced to 0% of capacity, a loss of 3000 acre-feet during the month of January.

According to Wayne Treers of the U.S. Bureau of Reclamation, cited in the Albuquerque Journal (February 15, 2003), farmers in southern New Mexico and Texas have already been warned to expect 40- to 50-percent of the irrigation water they normally receive.

8. Snowpack in the Southwestern United States (updated 02/20/03) Source: USDA NRCS, WRCC

8. Basin average snow water content (SWC) for available monitoring sites as of 02/20/03 (% of average).



Highlights: As of February 20, 2003, snow water content (SWC) is largely below the 1971-2000 average for all regions except northeastern New Mexico, which is at close to average snowpack conditions (Figure 8). SWC in Arizona river basins and southwestern New Mexico river basins is *far below average* for this time of year and has decreased since January's snowpack report. Snowpack is so low in the Verde River Basins and Central Mogollon Rim region of Arizona that the SWC is at 9 and 19% of average, respectively. In southwestern New Mexico, SWC levels are at about 40% of average for this time of year. Storm systems traversing Arizona and New Mexico in mid-February have brought little snow at higher elevations and have not ameliorated the snowpack conditions, although this situation may improve if more storm systems move through the region. Warm El Niño storms probably will bring significant snow only to high elevations (>8500 ft).

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

For a numeric version of the SWC map, visit: http://www.wrcc.dri.edu/snotelanom/basinswen.html

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

Notes:

The data shown on this page are from snowpack telemetry (SNOTEL) stations grouped according to river basin. These remote stations sample snow, temperature, precipitation, and other parameters at individual sites.

Snow water content (SWC) and snow water equivalent (SWE) are different terms for the *same* parameter.

The SWC in Figure 8 refers to the snow water content found at selected SNOTEL sites in or near each basin compared to the *average* value for those sites on this day. *Average* refers to the arithmetic mean of annual data from 1971-2000. SWC is the amount of water currently in snow. It depends on the density and consistency of the snow. Wet, heavy snow will produce greater SWC than light, powdery snow.

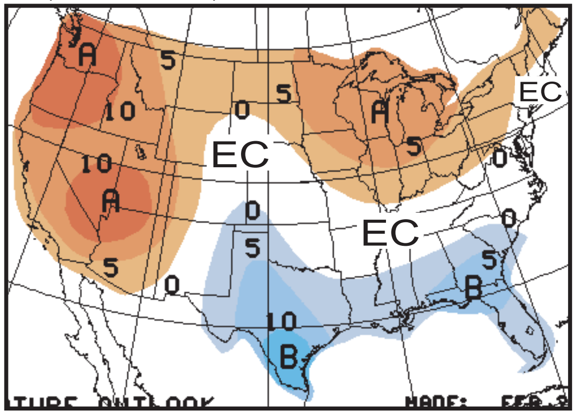
Each box on the map represents a river basin for which SWC data from individual SNOTEL sites have been averaged. Arizona and New Mexico river basins for which SNOTEL SWC estimates are available are numbered in Figure 8. The colors of the boxes correspond to the % of average SWC in the river basins.

The dark lines within state boundaries delineate large river basins in the Southwest.

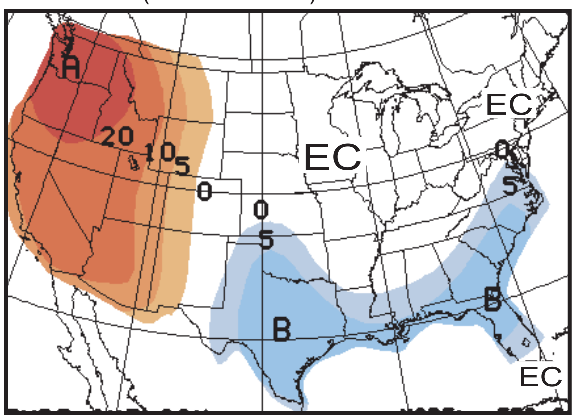
These data are provisional and subject to revision. They have not been processed for quality assurance. However, they provide the best available land-based estimates during the snow measurement season.

9. Temperature: Monthly and 3-Month Outlooks ♦ Source: NOAA Climate Prediction Center

9a. March 2003 U.S. temperature forecast (released 02/20).



9b. March - May 2003 U.S. temperature forecast (released 02/20).



Percent Likelihood of Above/ Below Average Temperatures*

20% - 30%
10% - 20%
5% - 10%
0% - 5%
A = Above

0% - 5%
5% - 10%
10% - 20%
B = Below

*EC indicates no forecasted anomalies due to lack of model skill.

Notes:
The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the "excess" 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average temperature.

Thus, using the NOAA CPC excess likelihood forecast, in areas with light brown shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average temperature.

The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no anomaly prediction is offered.

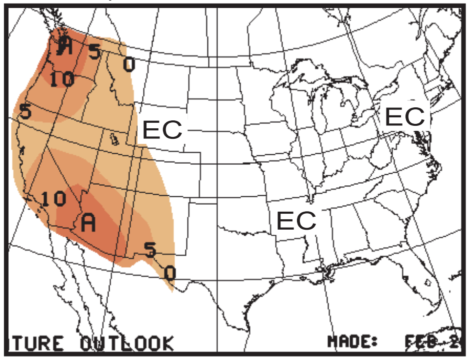
These forecasts are based on a combination of factors, including the results of statistical models, moderate El Niño conditions, and long-term trends.

Highlights: The CPC temperature outlooks for March (Figure 9a) and for the next three months (March-May; Figure 9b) indicate increased probabilities of above-average temperatures for most of the western United States. For March, the forecast is for increased probabilities of above-average temperatures (43% to 53% likelihood) in northwestern Arizona. There is low confidence to no confidence ("Equal Chances") in the temperature forecast for the rest of Arizona and all of New Mexico. The geographic extent of areas with high chances of above-average temperatures increases in the spring outlook (Figure 9b). The International Research Institute (IRI) for Climate Prediction also indicates a only slight shift in the chances of above-average temperatures in Arizona and western New Mexico for March-May (40% chance of above-average temperatures). The CPC predictions are based chiefly on historical El Niño temperature patterns reinforced by long-term temperature trends. NOAA CPC climate outlooks are released on the Thursday, between the 15th and 21st of each month. For more information, visit:
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html
Please note that this website has many graphics and may load slowly on your computer.

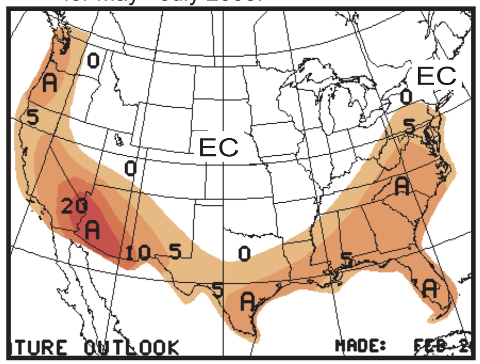
10. Temperature: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead temperature forecasts (released 02/20/03).

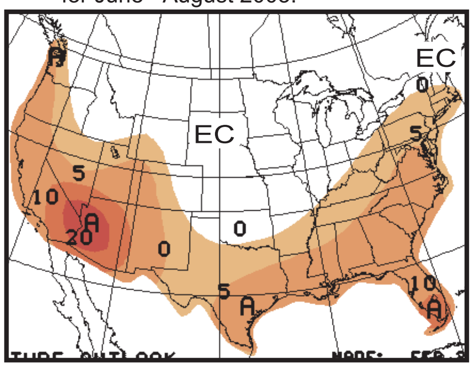
10a. Long-lead national temperature forecast for April - June 2003.



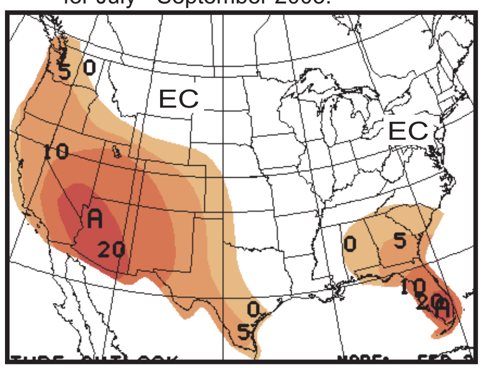
10b. Long-lead national temperature forecast for May - July 2003.



10c. Long-lead national temperature forecast for June - August 2003.



10d. Long-lead national temperature forecast for July - September 2003.



Percent Likelihood of Above/ Below Average Temperatures*

A = Above
- 20% - 30%
- 10% - 20%
- 5% - 10%
- 0% - 5%

B = Below
- 0% - 5%
- 5% - 10%
- 10% - 20%

*EC indicates no forecasted anomalies due to lack of model skill.

Highlights: The CPC temperature outlooks for April-September 2003 show increased probabilities of above-average temperatures for most of the western United States in the spring and summer (Figures 10a-d), with maximum forecast confidence shifted to the Southwest by summer. There is a fairly high probability of above-average temperatures across Arizona during the spring, with the greatest forecast confidence for the Southwest centered over southwestern Arizona. There is lower confidence in forecasts for above-average temperatures in New Mexico for the spring and summer; by late summer (Figure 10d), confidence increases for the probability of above-average temperatures across most of New Mexico. Forecasts from the International Research Institute (IRI) for Climate Prediction indicate similar or lower chances of above-average temperatures in the Southwest (around 40-45% chance of above-average temperatures in southwestern Arizona, for example) during the upcoming seasons. NOAA CPC climate outlooks are released on Thursday, between the 15th and 21st of each month.

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

Notes:
The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the “excess” 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average temperature.

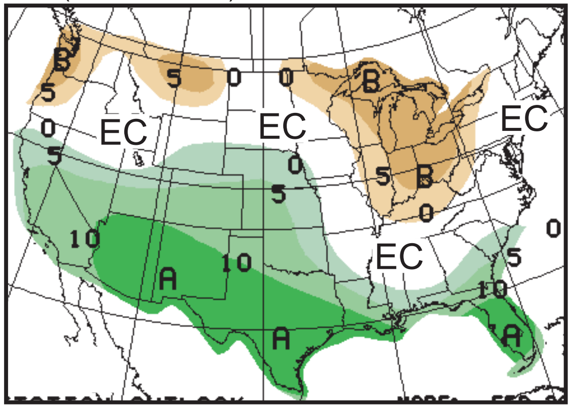
Thus, using the NOAA CPC excess likelihood forecast, in areas with light brown shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average temperature.

The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

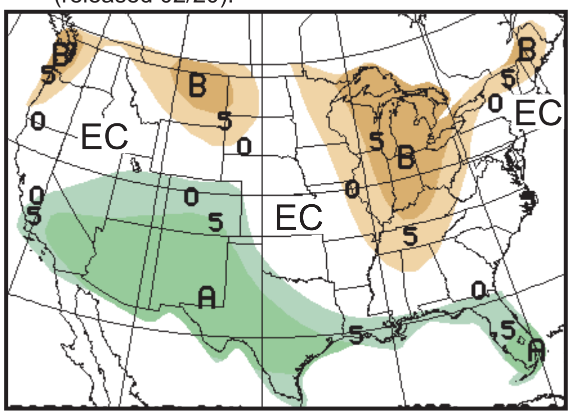
Equal Chances (EC) indicates areas where reliability (i.e., the ‘skill’) of the forecast is poor and no anomaly prediction is offered.

11. Precipitation: Monthly and 3-Month Outlooks Source: NOAA Climate Prediction Center

11a. March 2003 U.S. precipitation forecast (released 02/20).



11b. March - May 2003 U.S. precipitation forecast (released 02/20).



Percent Likelihood of Above or Below Average Precipitation*

10% - 20%		
5% - 10%	A = Above	
0% - 5%		
0% - 5%	B = Below	
5% - 10%		

*EC indicates no forecasted anomalies due to lack of model skill.

Notes:

The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the “excess” 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average precipitation.

Thus, using the NOAA CPC excess likelihood forecast, in areas with light green shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average precipitation.

The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

Equal Chances (EC) indicates areas where reliability (i.e., the ‘skill’) of the forecast is poor and no anomaly prediction is offered.

These forecasts are based on a combination of factors, including the results of statistical models, moderate El Niño conditions, and long-term trends.

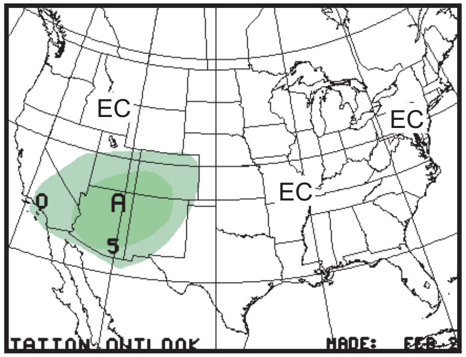
Highlights: The official NOAA-CPC precipitation outlook for March shows a fairly high probability of above-average precipitation across the Southwest, with likelihoods up to 43% to 54% (Figure 11a). The 3-month forecast shows reduced chances of above-average precipitation across the Southwest for March-May (Figure 11b), with the forecast confidence only 38% to 43% for above-average precipitation in Arizona and New Mexico. The March-May precipitation forecast from the International Research Institute (IRI) for Climate Prediction of a 40% chance of above-average precipitation is in agreement with the CPC forecast. The CPC bases its forecasts primarily on historical analyses that indicate enhanced precipitation under El Niño conditions. However, given observed weakening of the current El Niño, CPC now sees a reduced chance of our region receiving above-average precipitation. NOAA CPC climate outlooks are released on the Thursday, between the 15th and 21st of each month.

For more information about NOAA-CPC seasonal outlooks, visit:
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html
Please note that this website has many graphics and may load slowly on your computer.
For more information about IRI experimental seasonal forecasts, visit: http://iri.columbia.edu/climate/forecast/net_asmt/

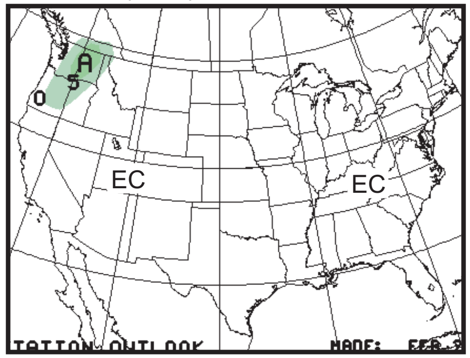
12. Precipitation: Multi-season Outlooks Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead precipitation forcasts (released 02/20/03).

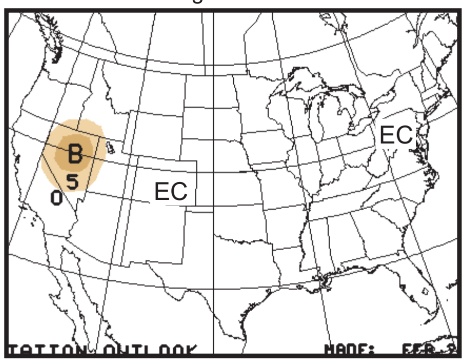
12a. Long-lead U.S. precipitation forecast for April - June 2003.



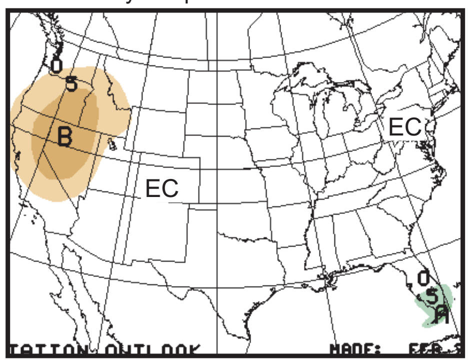
12b. Long-lead U.S. precipitation forecast for May - July 2003.



12c. Long-lead U.S. precipitation forecast for June - August 2003.



12d. Long-lead U.S. precipitation forecast for July - September 2003.



Percent Likelihood of Above or Below Average Precipitation*

5% - 10%
0% - 5%
A = Above

0% - 5%
5% - 10%
B = Below

*EC indicates no forecasted anomalies due to lack of model skill.

Highlights: The expected weakening (and perhaps elimination) of El Niño conditions and its impacts on the Southwest are reflected by the decreased probabilities of above-average precipitation for spring (Figures 12a). By late spring and through the summer, CPC forecasters have withheld judgment ("EC") for most of North America with the exception of increased confidence for below-average precipitation in the Pacific Northwest. The forecasted weakening of ENSO conditions contributes strongly to the EC status. Forecasts for April-August from the International Research Institute (IRI) for Climate Prediction corroborate CPC's forecast. NOAA CPC climate outlooks are released on Thursday, between the 15th and 21st of each month.

For more information, visit:
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html
Please note that this website has many graphics and may load slowly on your computer.
For more information about IRI experimental forecasts, visit: http://iri.columbia.edu/climate/forecast/net_asmt/

Notes:

The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the "excess" 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average precipitation.

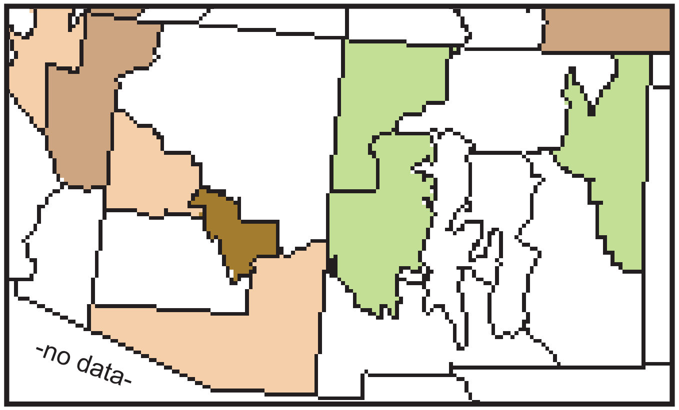
Thus, using the NOAA CPC excess likelihood forecast, in areas with light green shading (0-5% excess likelihood of above-average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average precipitation.

The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no anomaly prediction is offered.

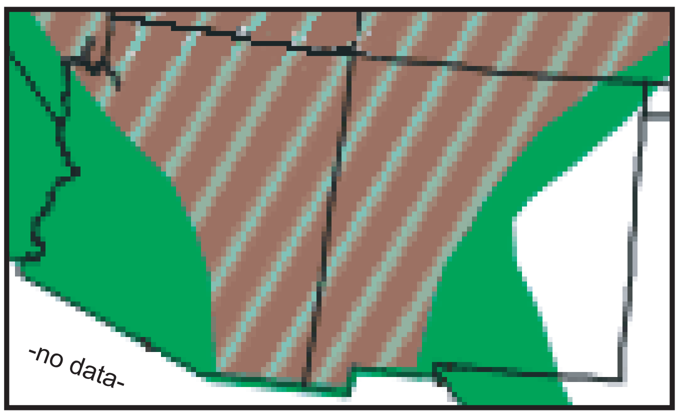
13. Drought: PDSI Forecast and U.S. Seasonal Outlook ♦ Source: NOAA Climate Prediction Center

13a. Short-term Palmer Drought Severity Index (PDSI) forecast through 02/22/03 (accessed 02/20).



- -4.0 or less (extreme drought)
- -3.0 to -3.9 (severe drought)
- -2.0 to -2.9 (moderate drought)
- -1.9 to +1.9 (near normal)
- +2.0 to +2.9 (unusual moist spell)
- +3.0 to +3.9 (very moist spell)

13b. Seasonal drought outlook through May 2003 (accessed 02/20).



- drought ongoing, some improvement
- Drought likely to improve, impacts ease

Notes:
The PDSI (Palmer Drought Severity Index) attempts to measure the duration and intensity of the climatological drought.

'Normal' on the PDSI scale is defined as amounts of moisture that reflect long-term climate expectations.

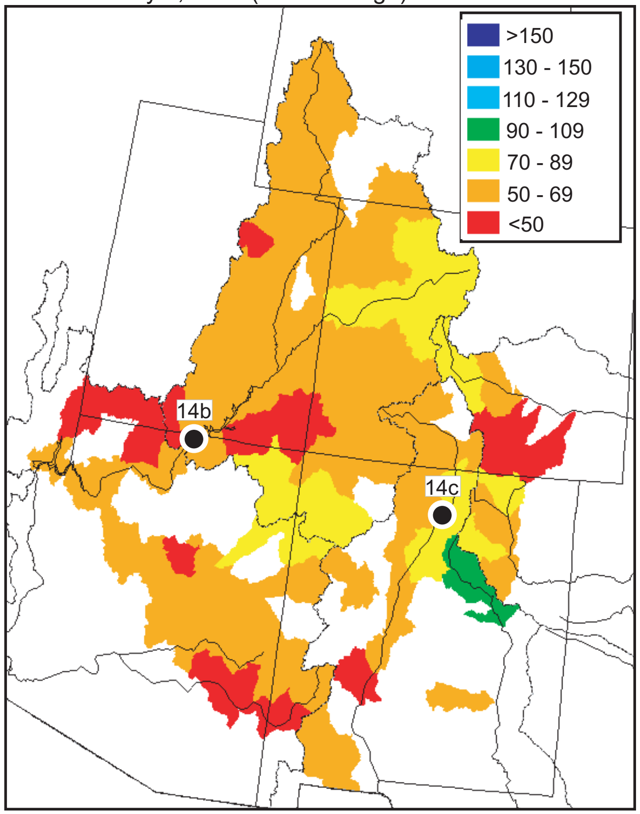
The delineated areas in the Seasonal Drought Outlook are defined subjectively and are based on expert assessment of numerous indicators including outputs of short- and long-term forecast models.

Highlights: The short-term Palmer Drought Severity Index (Figure 13a) remains unchanged for most of New Mexico from January's forecast, with near normal to somewhat moist conditions forecasted. In Arizona, although moderate to severe drought persists in some areas, short-term conditions overall have improved in the past month. The CPC has forecast El Niño conditions to weaken and perhaps disappear by April, thus the likelihood of El Niño-related above-average precipitation will decrease, and the seasonal drought outlook (Figure 13b) is for ongoing drought throughout much of eastern Arizona and western New Mexico. Hydrological drought conditions for Arizona and most of New Mexico are currently severe to exceptional (see Figure 3); exceptionally above-average precipitation (especially in the form of snow, which recharges reservoirs and streams during the spring when it melts) is necessary to relieve long-term drought conditions in the Southwest.

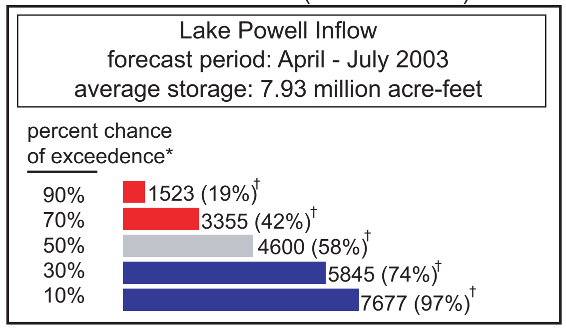
For more information, visit: http://www.drought.noaa.gov/

14. Streamflow Forecast for Spring and Summer ♦ Source: USDA NRCS National Water and Climate Center

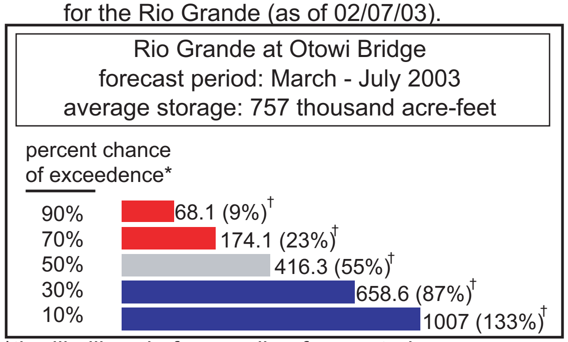
14a. NRCS spring and summer streamflow forecast as of February 1, 2003 (% of average).



14b. NRCS percent exceedence forecast chart for Lake Powell inflow (as of 02/06/03).



14c. NRCS percent exceedence forecast chart for the Rio Grande (as of 02/07/03).



*the likelihood of exceeding forecasted streamflow volume.

†associated forecasted streamflow volume (thousands of acre-feet) and percent of average volume.

Highlights: February 1, 2003, streamflow forecasts for Arizona and New Mexico river basins indicate that below-average streamflow is most likely this spring and summer for many gauged basins in both states. Figure 14a shows that streamflow in large basins in the Upper Colorado River Basin states (WY, UT, CO) is forecasted to be below average, the same as the January forecast. The best estimate of streamflow volume given current conditions and based on past outcomes of similar situations is that inflow to Lake Powell will be 58% of average (Fig. 14b). However, there is a 50% likelihood that this forecasted flow will be exceeded. Inflow to the Rio Grande at Otowi Bridge in New Mexico is forecasted to be 55% of average, with a 30% chance that inflow will be as high as 87% of average. The forecast is based partly on the fact that only 3 of the past 16 El Niño events have produced less than 100% of average March 1st snowpack, whereas 9 of the last 16 El Niño events had more than 150% of average snowpack (USDA-NRCS news release #03-02).

For state river basin streamflow probability charts, visit: http://www.wcc.nrcs.usda.gov/water/strm_cht.pl
For information on interpreting streamflow forecasts, visit: http://www.wcc.nrcs.usda.gov/factpub/intrpret.html
For western U.S. water supply outlooks, visit http://www.wcc.nrcs.usda.gov/water/quantity/westwide.html

Notes:

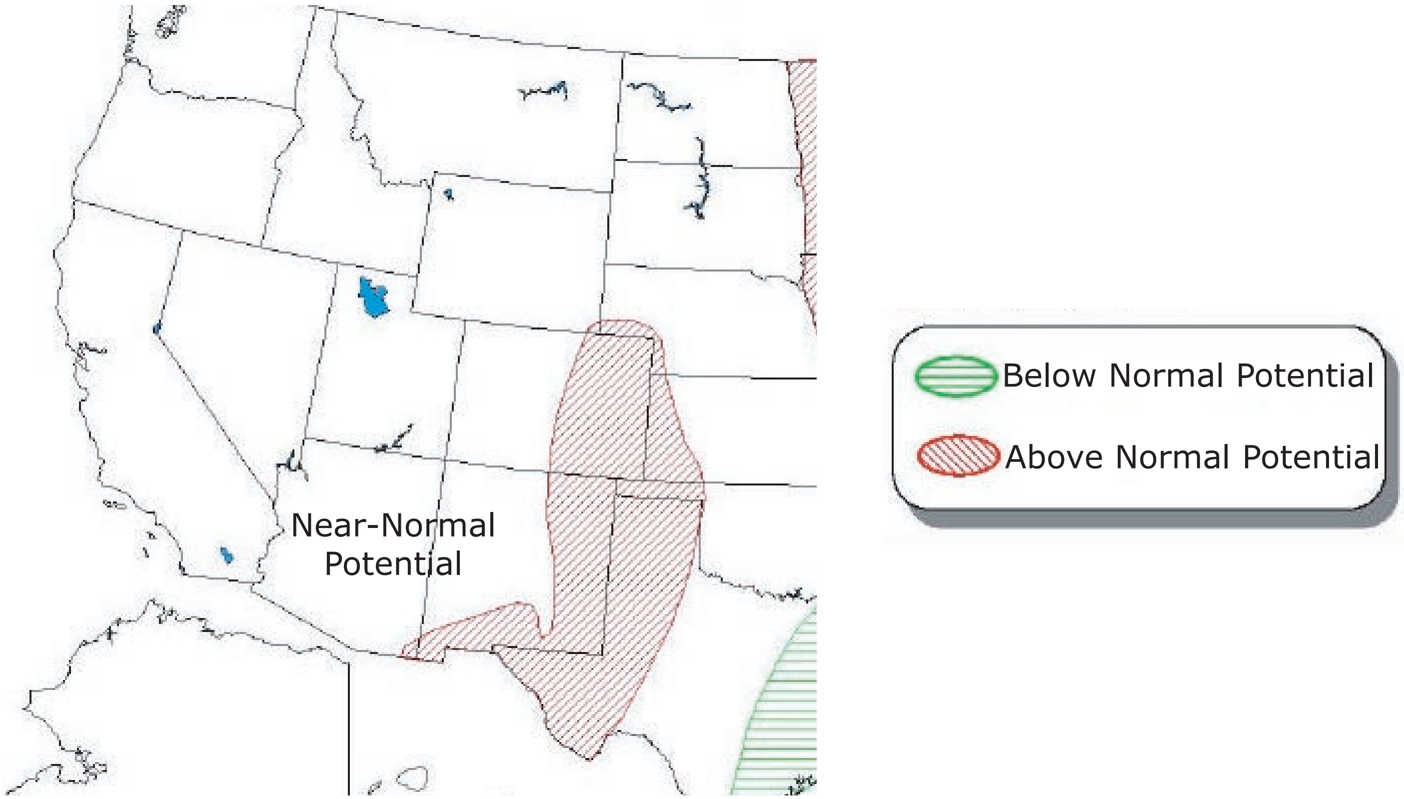
The forecast information provided in Figures 14a-c is updated monthly and is provided by the National Resources Conservation Service (NRCS). Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences, such as reservoirs and diversions.

Each month, five streamflow volume forecasts are made by the NRCS for several river basins in the United States. These five forecasts correspond to standard *exceedence* percentages, which can be used as approximations for varying 'risk' thresholds when planning for short-term future water availability.

90%, 70%, 50%, 30%, and 10% exceedence percentage streamflow volumes are provided by the NRCS. Each exceedence percentage level corresponds to the following statement: "There is an (X) percent chance that the streamflow volume will ***exceed*** the forecast volume value for that exceedence percentage." Conversely, the forecast also implies that there is a (100-X) percent chance the volume will be ***less than*** this forecasted volume. In Figure 14c for example, there is a 30% chance that Rio Grande at Otowi Bridge will exceed 5868 acre-feet of water (74% of average) between March and July and a 70% chance that it will not exceed that volume. Note that for an individual location, as the exceedance percentage declines, forecasted streamflow volume increases.

In addition to monthly graphical forecasts for individual points along rivers (Figures 14b and 14c), the NRCS provides a forecast map (Figure 14a) of basin-wide streamflow volume averages based on the forecasted 50% exceedence percentage threshold.

15. National Wildland Fire Outlook (valid Feb. 1–28, 2003) Source: National Interagency Fire Center

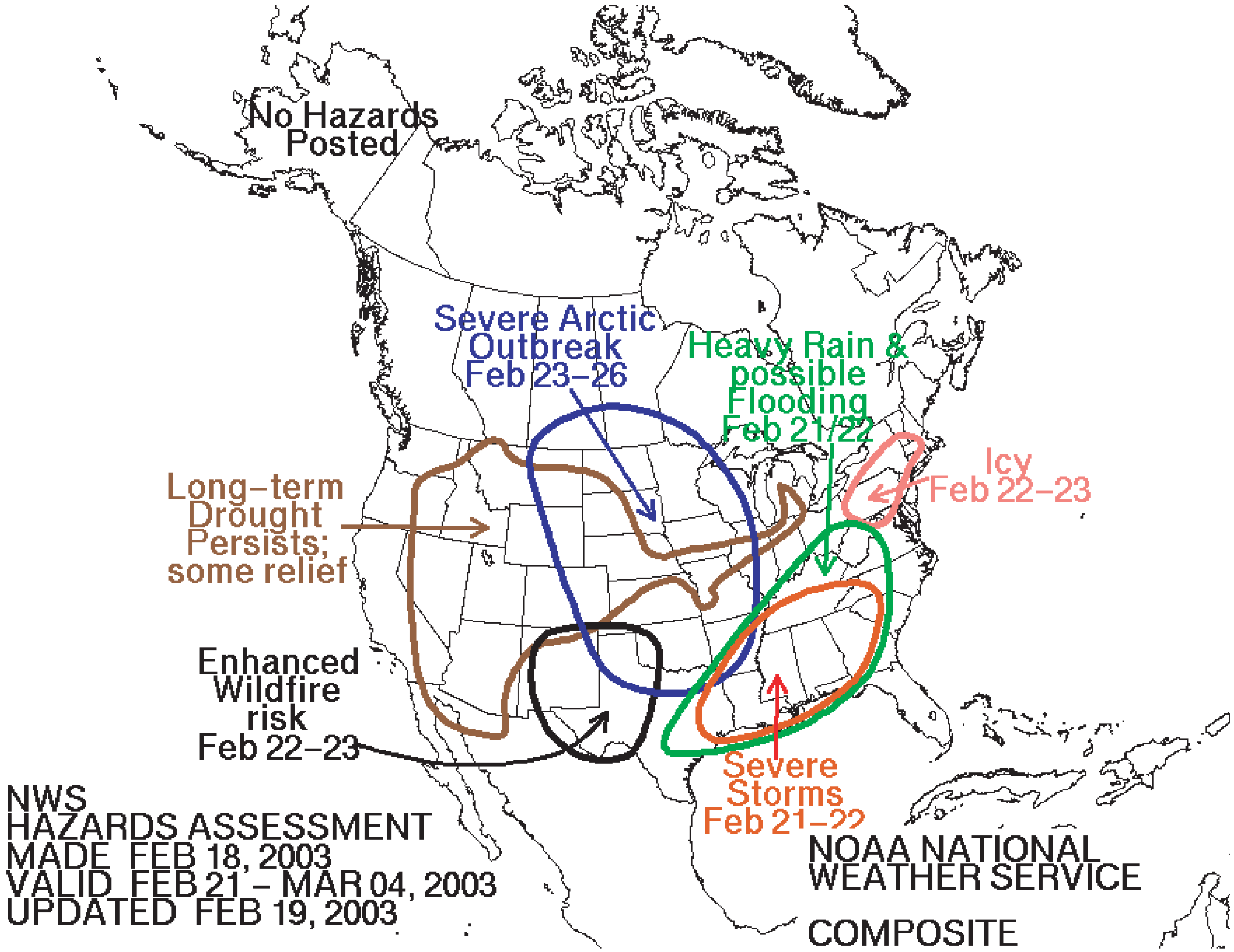


Notes: The National Wildland Fire Outlook (Figure 15) considers climate forecasts and surface-fuels conditions to assess fire potential. It is a subjective assessment, based on a synthesis of monthly regional fire danger outlooks. It is issued monthly by the National Interagency Coordination Center (NICC) at the National Interagency Fire Center (NIFC).

Highlights: The Wildland Fire Outlook for February 2003 indicates continued near-normal fire potential for all of the western United States except for southern and eastern New Mexico. According to the NICC fire potential forecast report, the warm and dry conditions that persisted through January decreased or diminished the existing snow pack at mid-level elevations across the southwestern United States. This contributed to an increase in the potential for large (>1000 acres) and short-duration fires on the rangelands in the region. Climate forecasts suggest that more normal temperatures and increased precipitation amounts will return to the region as February comes to a close.

For more detailed discussions, visit the National Wildland Fire Outlook web page: http://www.nifc.gov/news/nicc.html
and the Southwest Area Wildland Fire Operations web page: http://www.fs.fed.us/r3/fire/ (click on Predictive Services > Outlooks Products)

16. U.S. Hazards Assessment Forecast (valid Feb. 21 – Mar. 4th, 2003) Source: NOAA CPC



Notes:
The hazards assessment incorporates outputs of National Weather Service medium- (3-5 day), extended- (6-10 day) and long-range (monthly and seasonal) forecasts and hydrological analyses and forecasts.

Influences such as complex topography may warrant modified local interpretations of hazards assessments.

Please consult local National Weather Service offices for short-range forecasts and region-specific information.

Individual maps of each type of hazard are available at the following websites:

Temperature and wind:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/t_threats.gif

Precipitation:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/p_threats.gif

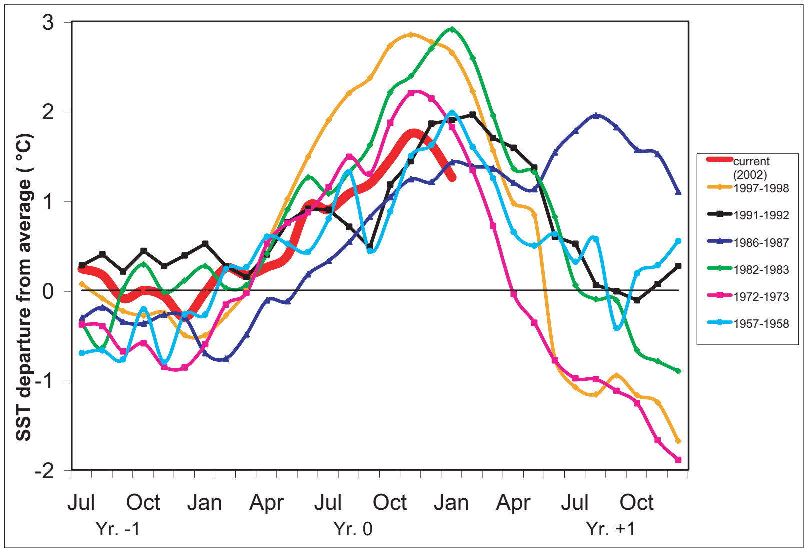
Soil and/or Fire:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/s_threats.gif

Highlights: The U.S. Hazards Assessment indicates the continuation of the long-term pattern of persistent drought for Arizona and the Four Corners area. Enhanced wildfire risk has been predicted for much of New Mexico and western Texas.

For more information, visit: http://www.cpc.ncep.noaa.gov/products/predictions/threats

17. Tropical Pacific SST and El Niño Forecasts ♦ Sources: NOAA CPC, IRI

17a. Past and current (red) El Niño episodes.

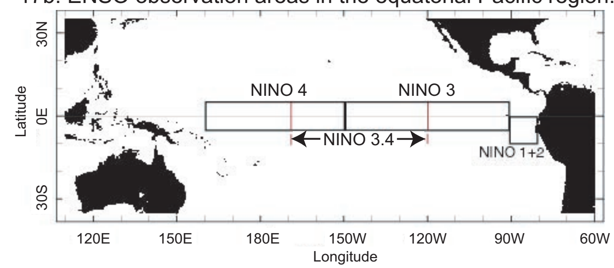


Notes: The graph (Figure 17a) shows sea-surface temperature (SST) departures from the long-term average for the Niño 3.4 region (Figure 17b). This is a sensitive indicator of ENSO conditions.

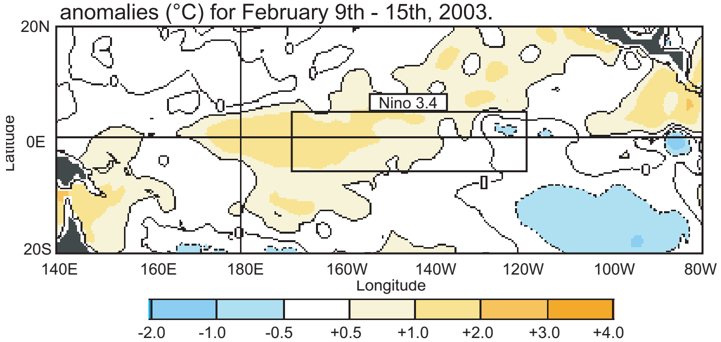
Each line on the graph represents SST departures for previous El Niño events, beginning with the year before the event began (Yr. –1), continuing through the event year (Yr. 0), and into the decay of the event during the subsequent year (Yr. +1).

This year's SST departures are plotted as a red line (Figure 17a). The magnitude of the SST departure, its timing during the seasonal cycle, and its exact location in the equatorial Pacific Ocean are some of the factors that determine the degree of impacts experienced in the Southwest.

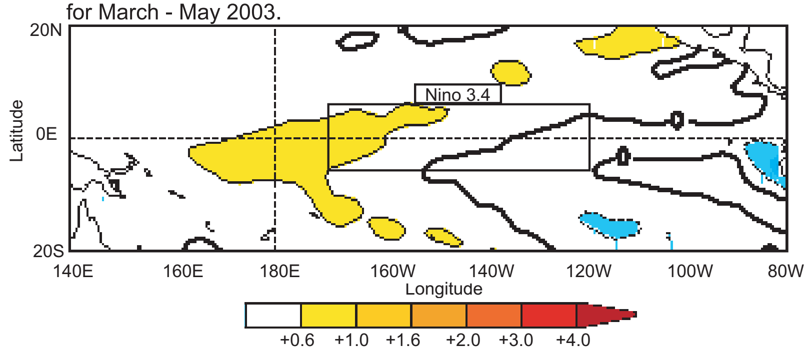
17b. ENSO observation areas in the equatorial Pacific region.



17c. 7-day averaged equatorial Pacific sea surface temperature anomalies (°C) for February 9th - 15th, 2003.



17d. Forecasted equatorial Pacific sea surface temperature anomalies (°C) for March - May 2003.

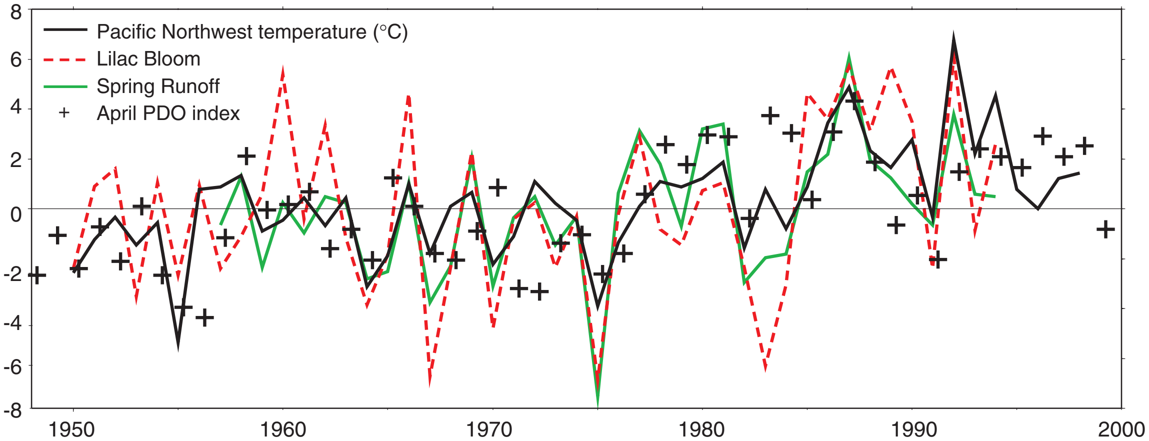


Highlights: El Niño conditions continued during January 2003, as equatorial SST anomalies remained greater than +1°C in the central equatorial Pacific but there were indications that the El Niño conditions were weakening, as SST anomalies decreased throughout the eastern equatorial Pacific by as much as 1.5°C. The NOAA Climate Prediction Center (CPC) notes that model forecasts indicate that El Niño conditions will continue to weaken through April 2003. The CPC forecasts a return to near-normal conditions during May-October 2003. The International Research Institute for Climate Prediction (IRI) forecast concurs with the CPC forecast and also notes that the chance for development of La Niña conditions during the second half of 2003 is greater than in an average year. Both the IRI and the CPC note that El Niño-related climate effects in most regions are likely to be weaker than during 1997-98, but that those areas of the world usually affected by El Niño may continue to experience related impacts during the next 2-3 months.

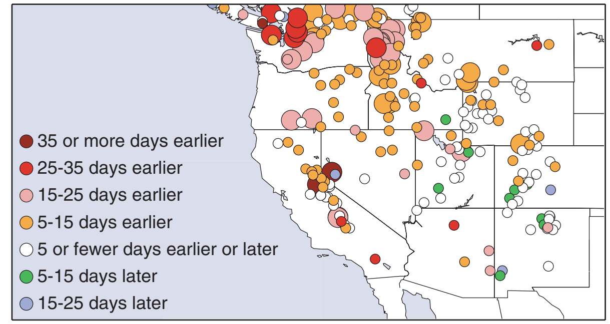
For a technical discussion of current El Niño conditions, visit: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/
For more information about El Niño and to access the graphics found on this page, visit: http://iri.columbia.edu/climate/ENSO/

18. Earlier Springs in the Western United States ♦ Multiple Sources

18a. Four early spring indicator datasets from 1948-1998 (After Cayan et al. 2001).



18b. Observed streamflow timing trends, 1948-2000 (After Stewart et al. in press).



Highlights: Research by Scripps Institution of Oceanography and USGS scientists, in conjunction with others, shows that several physical and biological indicators of spring have been occurring earlier in the year in recent decades (Fig. 18a). Their analyses of trends in *phenological* data in the western United States indicate that monitored species such as lilac and honeysuckle have been blooming 2 to 4 days earlier per decade during 1948-1998. (NB: The relationship between seasonal changes in vegetative development and the environment, known as *phenology*, has been studied for decades as an agricultural predictor.) Other lines of evidence, such as a trend toward earlier dates of the first major pulse in snowmelt streamflow, corroborate the phenological trends as do observations of long-term increases in northwestern North America spring air temperature, especially since the late 1950s (Fig. 18a). As Figure 18b shows, trends in the timing of the spring snowmelt-streamflow *pulse* in the upper (unregulated) sections of some rivers of the Southwest, particularly those in Arizona, are consistent with the early spring phenomenon in western North America. The *pulse* has occurred approximately 2 days earlier each decade during 1948-2000. Earlier honeysuckle bloom dates in eastern Arizona and throughout New Mexico also are consistent with the early spring phenomenon.

A major concern related to earlier spring trends is that, with more of the water running out of watersheds earlier in the year, summer conditions will be even drier if these trends continue. This trend presents a major challenge to water-resource managers. An important question is *Why are these trends occurring, especially since the late 1970s?* Whether these changes are symptoms of global change is uncertain. However, the biological and streamflow indicators are correlated with decadal variability in the Pacific Ocean (e.g., the PDO; Fig. 18a), as well as with the PNA atmospheric circulation pattern.

Notes: Figure 18a displays four early spring indicator datasets. *Pacific Northwest temperature* is an average of March-May temperature anomalies for Idaho, eastern Washington, western Montana, and western Wyoming. *Lilac bloom* is an index of the date of the first bloom of lilacs in the western United States. *Spring runoff* is an index of the date of the first major pulse of snowmelt runoff for western U.S. streams. *April PDO index* is the April value of the Pacific Decadal Oscillation (PDO), an index of decade-scale variability in Pacific Ocean surface temperatures and atmospheric circulation.

Figure 18b displays trends in the *timing of streamflow* in rivers of western North America, measured by the date of the centroid of annual streamflow hydrographs (a measure of peak streamflow discharge). Warm colors indicate trends toward streamflow peaks earlier in the year; cool colors indicate trends toward streamflow peaks later in the year. Larger circles indicate statistically significant trends.

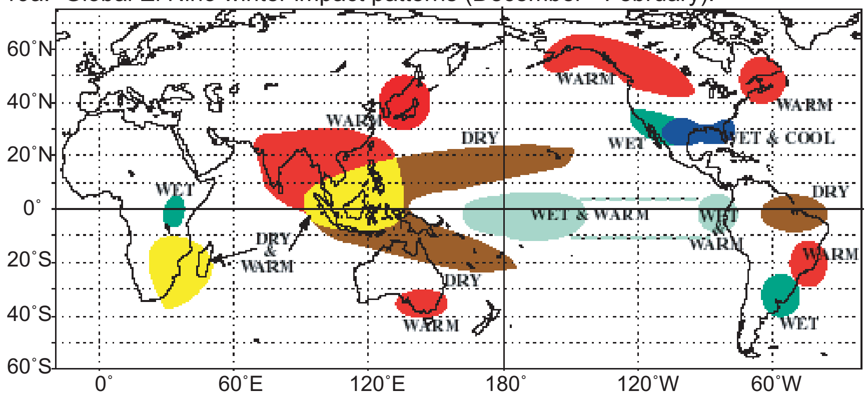
For information on earlier springs, visit:

Cayan, D.R., S.A. Kammerdiener, M.D. Dettinger, J.M. Caprio, and D.H. Peterson. 2001. Changes in the onset of spring in the western United States. *Bulletin of the American Meteorological Society*, 82(3):399-415. http://tenaya.ucsd.edu/~dettinge/western.html

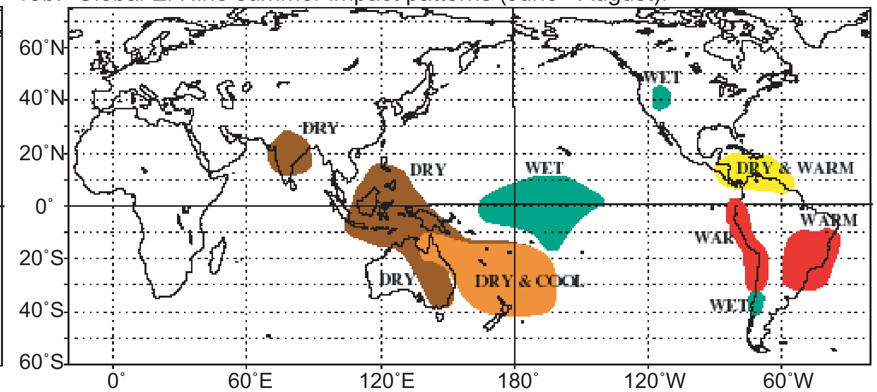
Iris Stewart, D.R. Cayan, and M.D. Dettinger. in press. Changes in snowmelt runoff timing in western North America under a business as usual climate-change scenario. *Climatic Change* special issue on Accelerated Climate Prediction Initiative (ACPI) studies. http://tenaya.ucsd.edu/~dettinge/iris.html

19. Global El Niño Southern Oscillation (ENSO) Impacts. Source:NOAA Climate Prediction Center

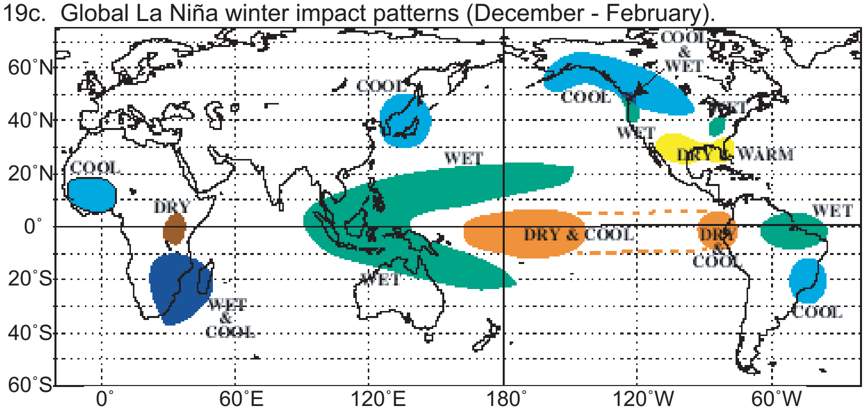
19a. Global El Niño winter impact patterns (December - February).



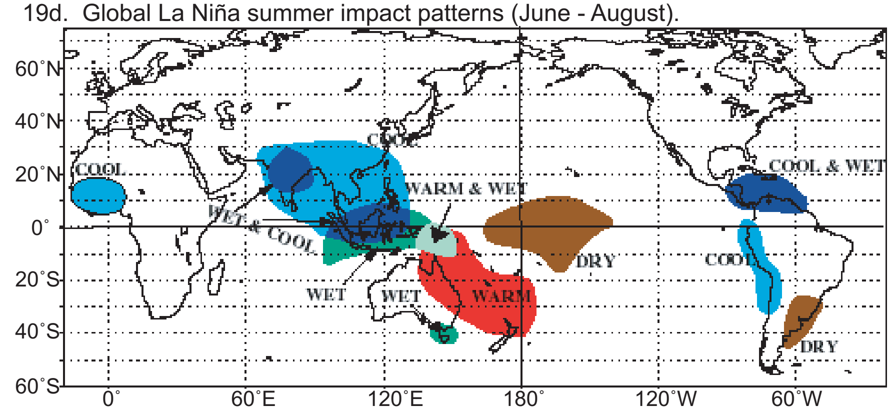
19b. Global El Niño summer impact patterns (June - August).



19c. Global La Niña winter impact patterns (December - February).



19d. Global La Niña summer impact patterns (June - August).



Highlights: We in the Southwest may associate El Niño with wetter than average conditions and La Niña with drier ones, but the maps above show that different El Niño-Southern Oscillation (ENSO) impacts occur in many parts of the world.

Both temperature and precipitation may be affected by ENSO espisodes. These effects shift between seasons. El Niño and La Niña episodes disrupt normal patterns of tropical precipitation and atmospheric circulation, leading to more cloudiness and precipitation in some areas and reduced precipitation in others. The figures above show these patterns. For example, El Niño can lead to the failure of the summer monsoon in India, while recent devastating floods in southeastern Africa occurred during a La Niña winter.

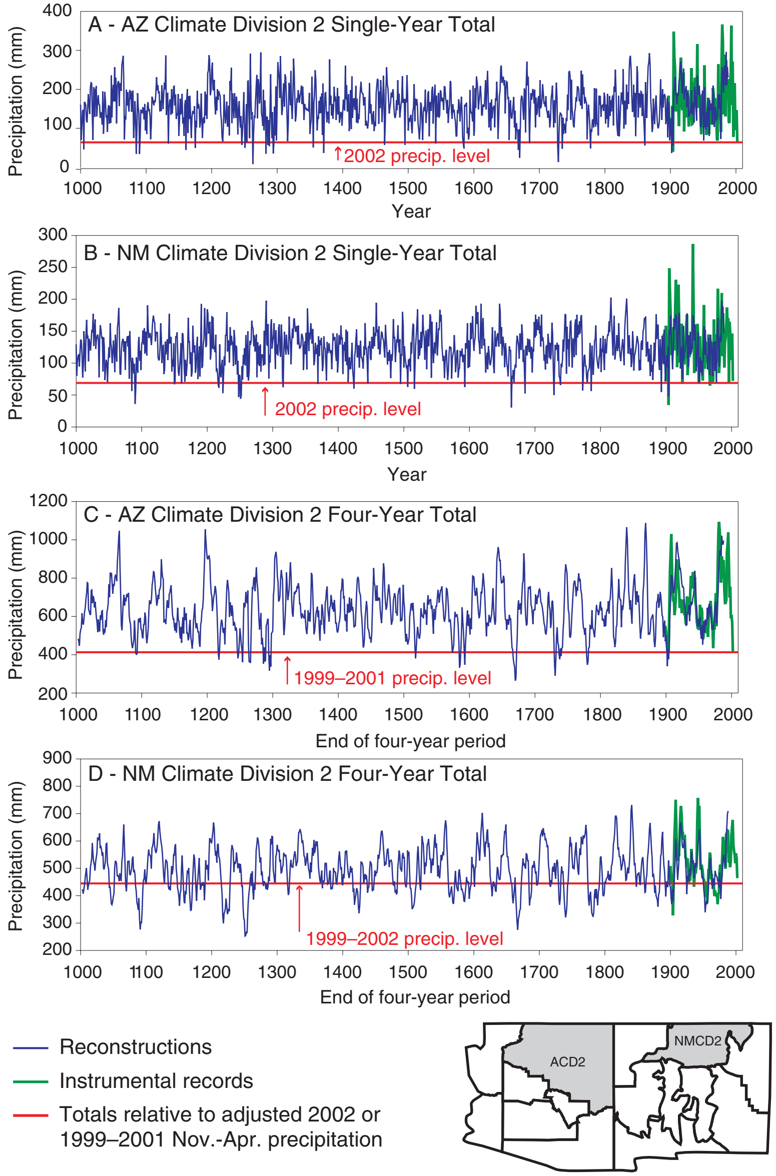
Notes: By studying past El Niño and La Niña episodes, scientists have discovered temperature and precipitation patterns that are consistent from one episode to another. Generally speaking, the strongest impacts occur in areas that have significant oceanic influences and border on the tropical Pacific.

Because the ocean temperature anomaly patterns that drive ENSO persist for several months to years, it is possible to make accurate long-range forecasts of the likely impacts of these events.

For more information about global ENSO impacts, see NOAA’s La Niña page, http://www.elnino.noaa.gov/lanina.html, or the El Niño page at http://www.elnino.noaa.gov/.

20. Recent Drought: A Paleo Perspective Source: UA Laboratory of Tree-Ring Research

20. Reconstructed single-year and four-year Nov.-Apr. precipitation for ACD2 and NMCD2.



Highlights:

The 1000-year record of cool-season precipitation (November-April), derived from the annual rings of hundreds of old trees in the Southwest and around it, provides a context in which to place the recent drought. Based on single-year precipitation, only 32 years since AD 1000 in Arizona Climate Division 2 (ACD2; Fig. 20a) and 27 years in New Mexico Climate Division 2 (NMCD2; Fig. 20b) had cool-season precipitation totals equal to or less than the 2002 cool-season precipitation. If droughts occur entirely by chance, a value as low as the 2002 case might be expected about three times in a century.

Only 15 four-year periods since AD 1000 were as dry in ACD2 as the last four years (1999-2002; Fig. 20c). However, some of these cumulative deficits lasted for more than four years. So, it could get worse! Four-year periods with similarly low cumulative totals to that of 1999-2002 were more common in NMCD2 (Fig. 20d).

It is important to note that warm-season precipitation totals also have been low over the last four years, exacerbating regional drought conditions. While not necessarily unprecedented in the last 1000 years, the most recent drought has certainly been relatively unusual.

Notes: Cool-season precipitation was reconstructed from AD 1000-1988 from tree-ring data collected throughout the Southwest. Tree rings are not perfect rain gauges, but they do respond clearly to extremes such as droughts. Reconstructions were made for all the climate divisions in Arizona and New Mexico, but we show only two examples here.

Because the reconstructions do not extend to the current drought period, the 2002 and four-year totals were determined as a percentage of average precipitation over period when both precipitation and tree ring data were available (1896-1988). This percentage was applied to the reconstructed average over the same time period to set the level of the red line. Years with cool-season precipitation that was less than that of 2002 or 1999-2002 plot below the red lines.

These reconstructions were reported by Ni et al. in 2002 in the *International Journal of Climatology.* To view this article, visit http://www3.interscience.wiley.com/cgi-bin/abstract/101020032/START.