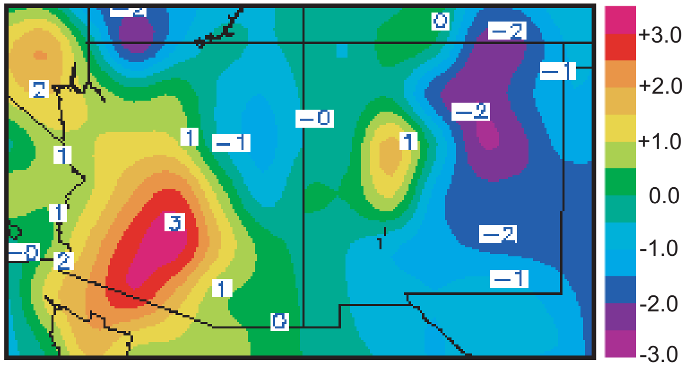
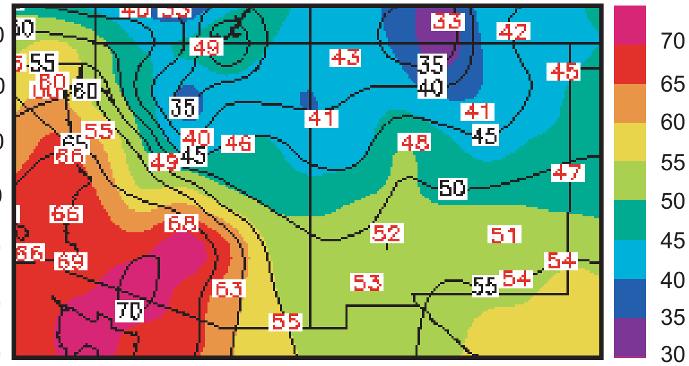
1. Recent Conditions: Temperature (up to 12/18/02) ♦ Source: Western Regional Climate Center

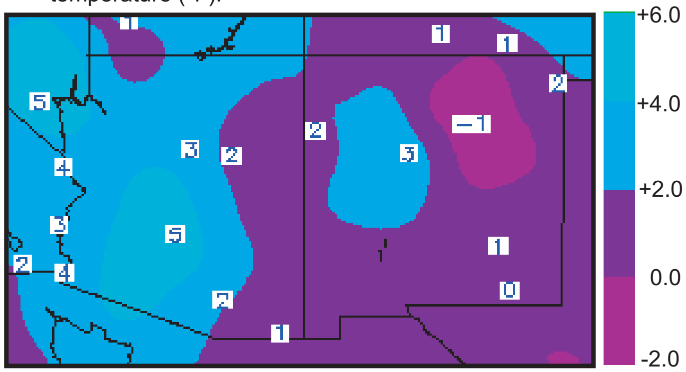
1a. Water year '02-'03 (through 12/18) departure from average temperature (°F).



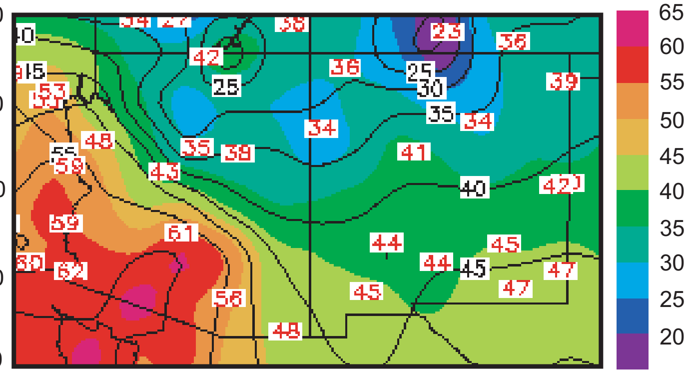
1b. Water year '02-'03 (through 12/18) average temperature (°F).



1c. Previous 28 days (11/21 - 12/18) departure from average temperature (°F).



1d. Previous 28 days (11/21 - 12/18) average temperature (°F).



Highlights: Temperatures since October 1, 2002 (Figures 1a and 1b) have been above the 1971-2000 average for western Arizona and central New Mexico, but below average elsewhere in our region. Eastern New Mexico temperatures have been below average, due chiefly to lower than average maximum temperatures. The previous 28 days (Figures 1c and 1d) have exhibited mostly above-average temperatures across the Southwest. During the previous 28 days, minimum temperatures have been well above average, especially in the Phoenix, Arizona area. However, the recent passage of a cold front across the western U.S. (as this report goes to press) will cause substantial decreases in minimum temperatures.

For these and other 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).

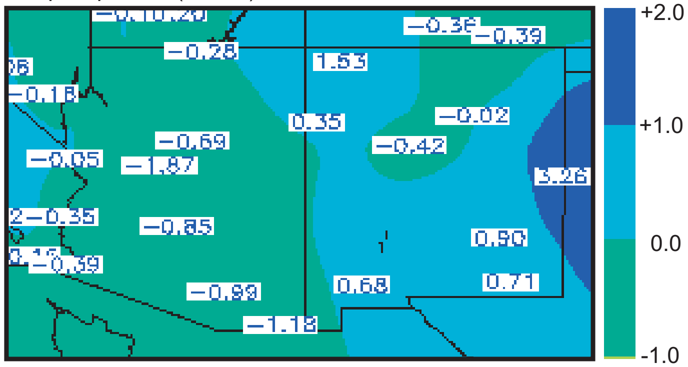
Departure from average temperature is calculated by subtracting current data from the average and can be positive or negative.

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.

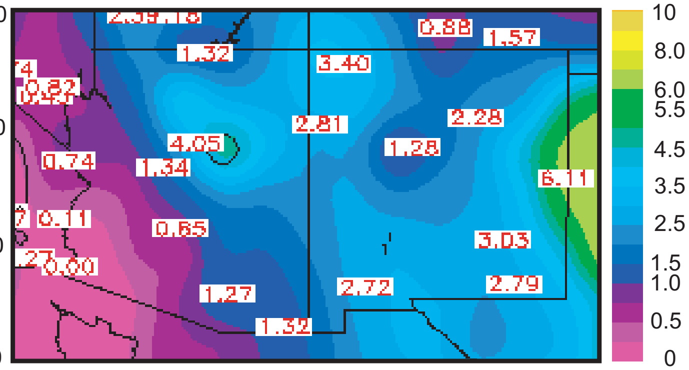
The red and blue numbers shown on the maps represent individual stations. The contour lines and black numbers show average temperatures.

2. Recent Conditions: Precipitation (up to 12/18/02) ♦ Source: Western Regional Climate Center

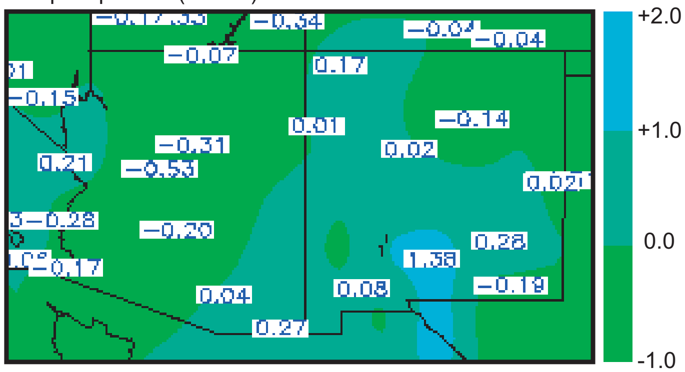
2a. Water year '02-'03 (through 12/18) departure from average precipitation (inches).



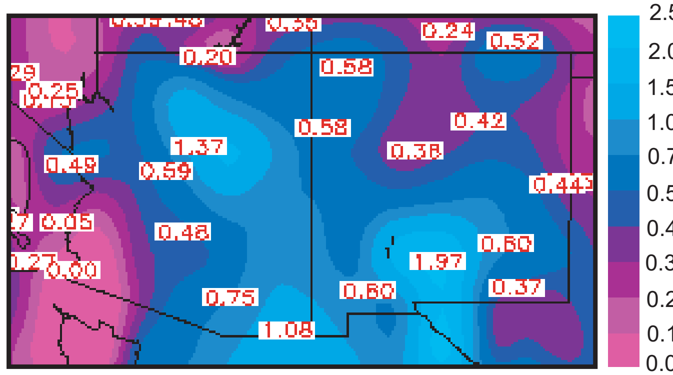
2b. Water year '02-'03 (through 12/18) total precipitation (inches).



2c. Previous 28 days (11/21 - 12/18) departure from average precipitation (inches).



2d. Previous 28 days (11/21 - 12/18) total precipitation (inches).



Highlights: Most of New Mexico has received above average precipitation since October 1, 2002. Eastern New Mexico has received substantial precipitation, which has resulted in a significant reduction of drought status for that region. However, accumulated precipitation across most of Arizona is still below average (Figure 2a). During the past 28 days (Figure 2d), almost all of the Southwest has received some precipitation, and the passage of a precipitation-bearing cold front across the western U.S. (as this report goes to press) should bring precipitation to much of Arizona. High-elevation locations in Arizona and New Mexico have received some snow, and northeastern New Mexico has received substantial snow for this time of year.

For these and other 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.

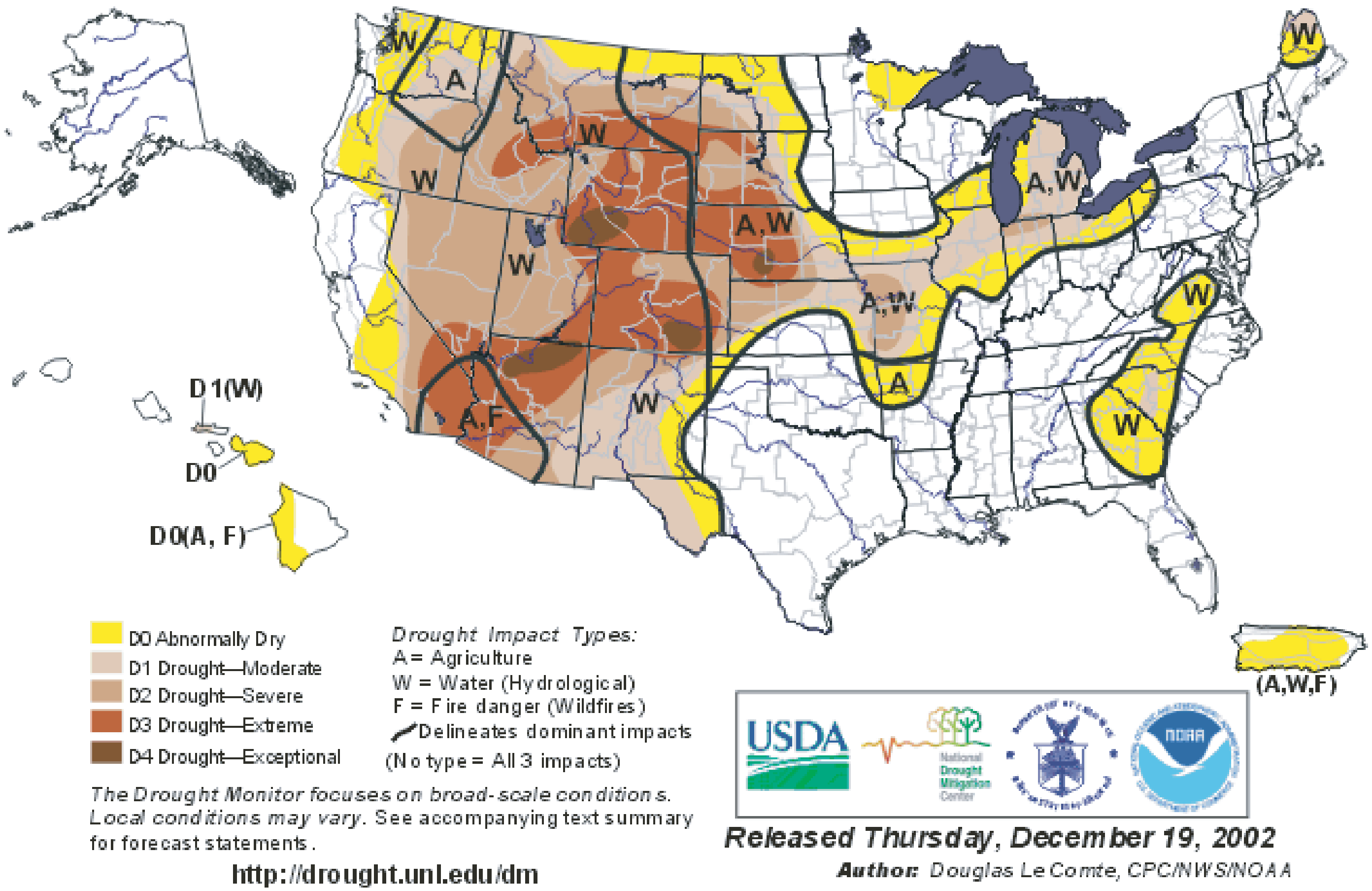
The data are in inches of precipitation. **Note: The scales for Figures 2b & 2d are non-linear.**

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 (12/17/02)



Notes:

The U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. This monitor was released on 12/19 and is based on data collected through 12/17 (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.

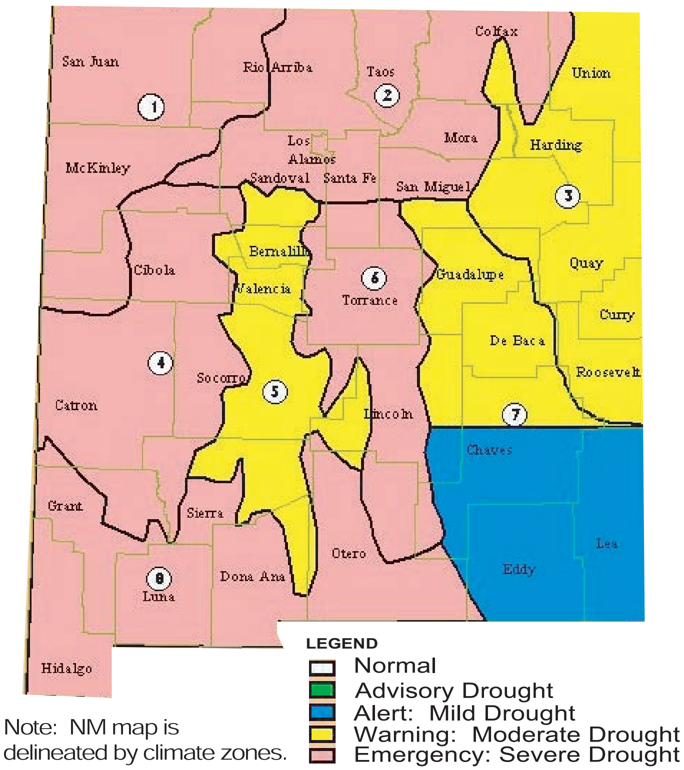
Highlights: The drought designation for much of Arizona and New Mexico has not changed much from last month. With the exception of eastern New Mexico, moderate to exceptional drought conditions persist over the entire region. Recent precipitation from the passage of vigorous winter storm fronts across the western U.S. during late December helped improve short-term conditions. Snowpack has increased, though not to the 1971-2000 average, at many recording sites along the Mogollon Rim and White Mountains in Arizona. In north-central New Mexico many basins are now recording above average snow water equivalent. However, long-term drought indicators, such as the Palmer Hydrological Drought Index, show that conditions related to water supply, though improved, are still indicative of drought. The impact of precipitation this winter on spring 2003 streamflow is likely to be tempered, due to deficits in soil moisture accumulated over the past several years of drought.

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 Designation for New Mexico

New Mexico Drought Map

Drought Status as of December 12, 2002



Note: NM map is delineated by climate zones.

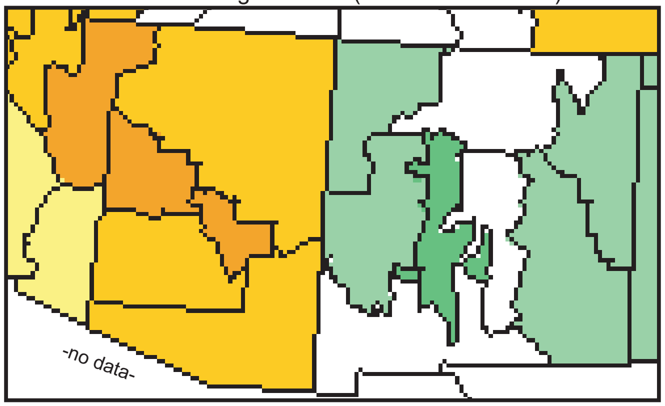
Source: NM Natural Resources Conservation Service (2002)

Notes: The New Mexico drought map above, provided by the New Mexico Natural Resource Conservation Service (NMNRCS), 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 over the past two months; however, long-term indicators (e.g., streamflow, reservoir levels) show that extreme hydrological (long-term) drought remains. New Mexico snowpack is near average, with some locations reporting below average snow and others reporting above average snow levels. Estimates indicate that New Mexico will need around 175-200% of (chiefly snow dependent) average spring runoff to bring reservoir conditions along the Rio Grande back to reasonable levels (Charlie Liles, NWS, Albuquerque). 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).

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. The Arizona drought declaration map is not yet produced on a regular basis. Contact Matt Parks at ADEM at (602) 392-7510 for more information on Arizona regional drought declarations.

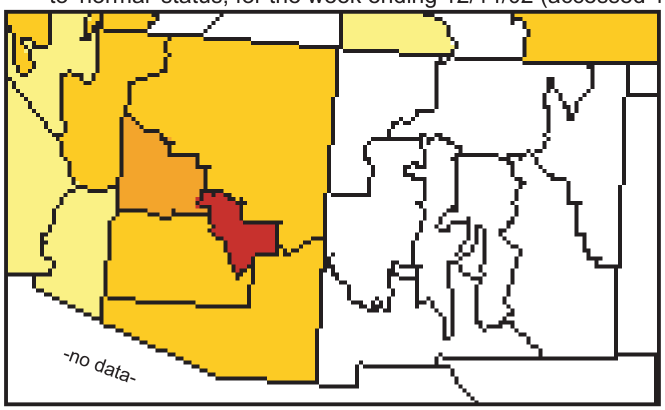
5. PDSI Measures of Recent Conditions (through 12/14/02) ♦ Source: NOAA Climate Prediction Center

5a. Current weekly Palmer Drought Severity Index (PDSI), for the week ending 12/14/02 (accessed 12/19/02).



- -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 12/14/02 (accessed 12/19).



- 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.

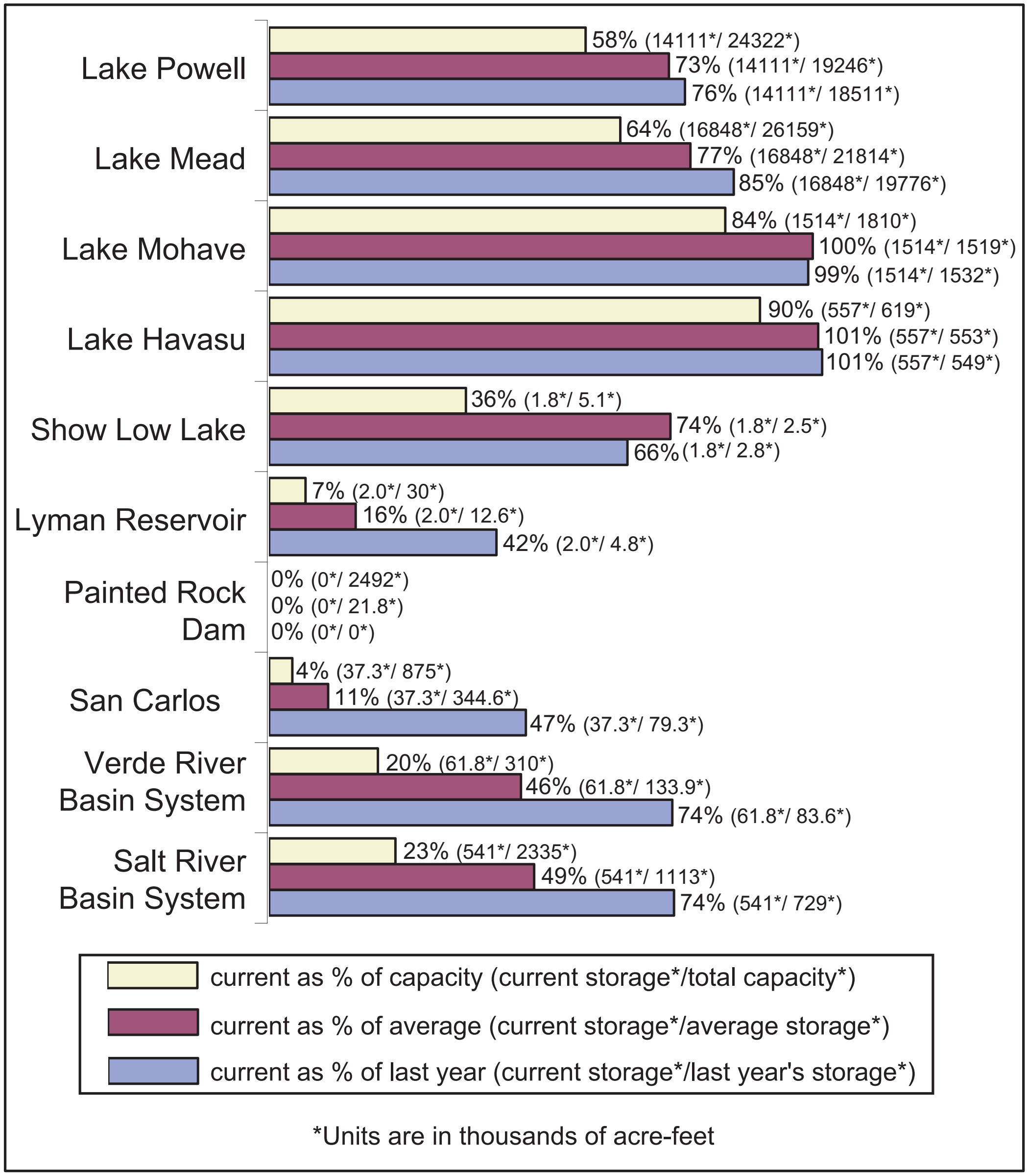
These maps are issued weekly by the NOAA CPC.

Highlights: PDSI values have improved or remain normal for most of New Mexico, compared to last month (Figure 5a). However, as of December 14, short-term drought status for most of Arizona remains unchanged since last month. The passage of precipitation-bearing cold fronts through the region in late-December brought some relief to much of eastern Arizona. The probability of significant drought amelioration during the next 6 months is still below 30% for all of Arizona. Historical evidence suggests that the moderate El Niño currently in progress should shift the odds enough that Arizona will receive average to above-average precipitation this winter and early spring. However, substantial precipitation and cool temperatures are necessary to relieve hydrologic drought. Figure 5b shows that, while in New Mexico drought has ameliorated, all of Arizona continues to require large amounts of precipitation within a one week time period to bring our drought status back to normal.

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 end of November 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).

Arizona's report was updated through the end of November, as of 12/19/02.

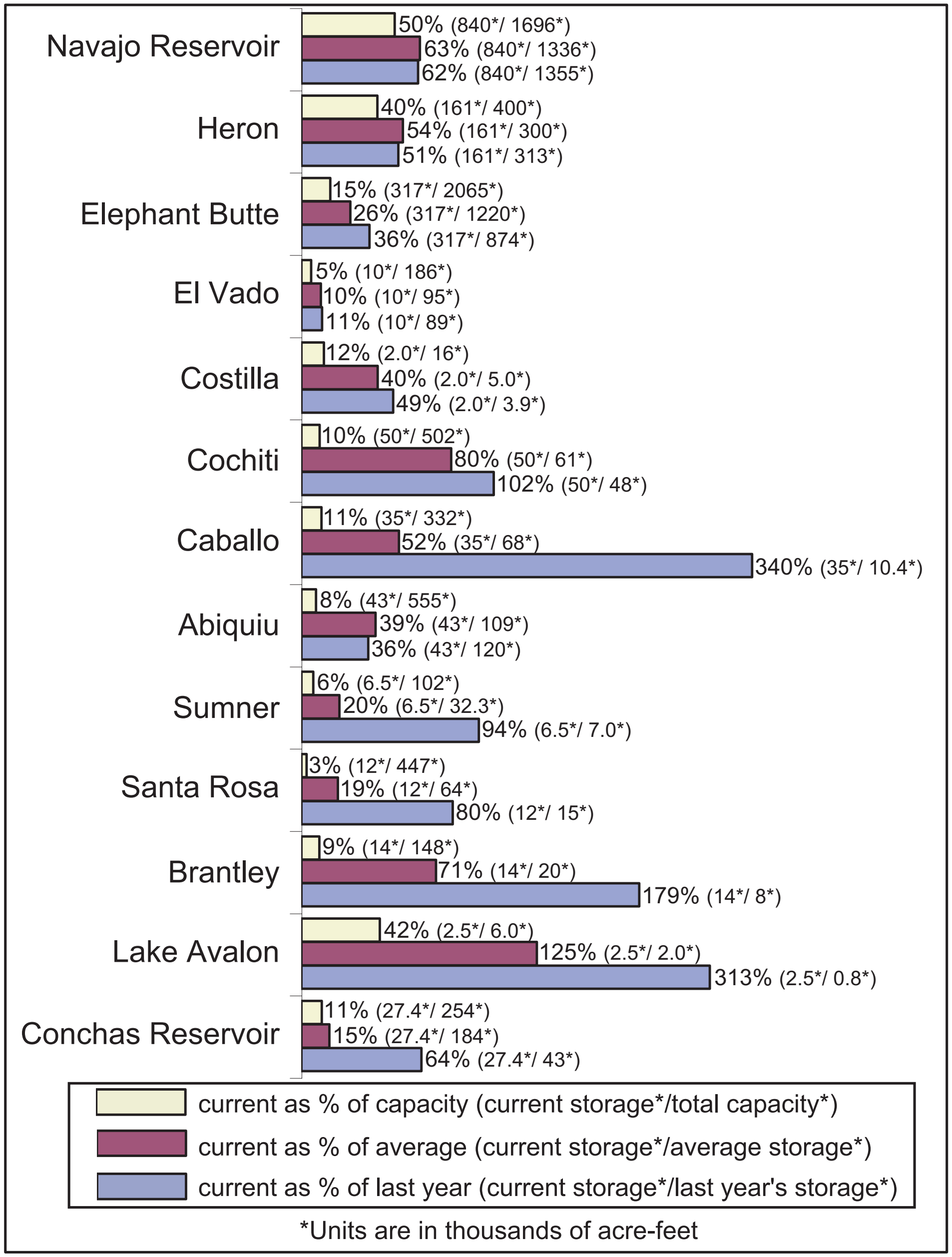
For additional information, contact Tom Pagano of the NWCC-NRCS-USDA (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Larry Martinez, NRCS, USDA, 3003 N. Central Ave, Suite 800, Phoenix, Arizona 85012-2945; 602-280-8841; Larry.Martinez@az.usda.gov)

Highlights: Levels in most Arizona reservoirs have mostly held steady or decreased slightly since last month, and continue to be below average and lower than last year at this time. Reservoirs on the lower Colorado River are near average, due to water transfers along the river.

In a recent report in the Arizona Republic (December 18, 2002), U.S. Secretary of the Interior Gale Norton was quoted with regard to conditions on the Colorado River as saying, "More drought planning is required. We no longer have abundant surpluses an full reservoirs. The future of the Colorado River will be shaped by drought and population growth. The era of limits is upon us."

According to an analysis of current and historical watershed conditions for Central Arizona (Tom Pagano, USDA-NRCS), the recent extended and extreme dryness may have a significant effect on the runoff that feeds Arizona reservoirs. Much above-average precipitation will be necessary to produce average runoff, given that a substantial amount of moisture *could* be absorbed by dry soils.

7. New Mexico Reservoir Levels (through end of November 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).

New Mexico's report was updated through the end of November, as of 12/19/02.

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)

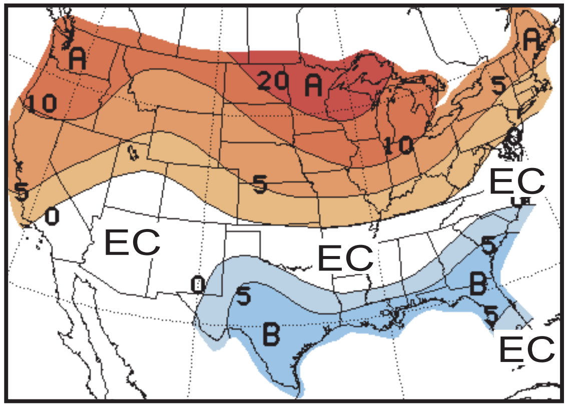
Highlights: New Mexico reservoir levels continue to be below average, although levels at a few reservoirs in the Rio Grande Basin are higher than last year at this time (i.e., Cochiti, Caballo, Brantley, Lake Avalon).

In northern New Mexico, snowpack is patchy, with some basins reporting below average snow water equivalent (SWE) and others reporting average to above-average SWE. Several of the southern Colorado basins that feed the Rio Grande River are back to below average SWE for this time of year (December 20, 2002), after reporting above average SWE last month.

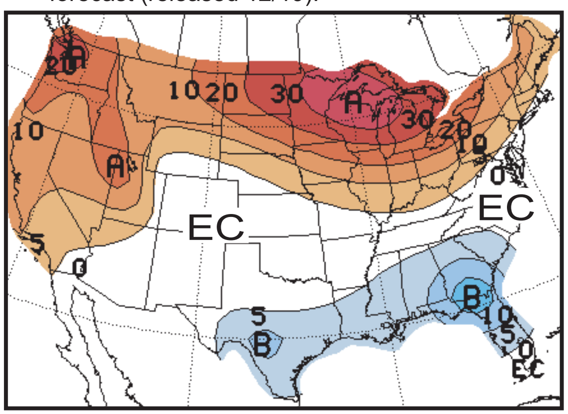
Water supply for irrigators who depend on water from Elephant Butte reservoir (currently at 25% of average) will depend on how winter and spring precipitation progresses. According to projections by the New Mexico Drought Planning Team, normal spring runoff will result in further lowering of Elephant Butte reservoir by July, 2003. It would take over 150% of normal runoff to return Elephant Butte reservoir to a *reasonable* level.

8. Temperature: Monthly (Jan.) and 3-Month (Jan. – Mar. ‘03) Outlooks ♦ Source: NOAA CPC

8a. January 2003 U.S. temperature forecast (released 12/19).



8b. January - March 2003 U.S. temperature forecast (released 12/19).



Percent Likelihood of Above/ Below Average Temperatures*

- 30% - 40%
- 20% - 30%
- 10% - 20%
- 5% - 10%
- 0% - 5%

- 0% - 5%
- 5% - 10%
- 10% - 20%

*EC indicates no forecast 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 prediction is offered.

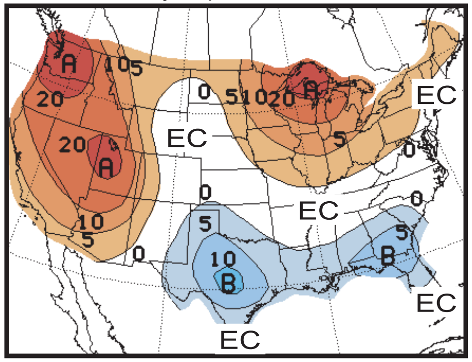
These forecasts are based on a combination of factors, including the results of statistical models, moderate El Niño conditions, and long-term trends.

Highlights: The CPC temperature outlook for January (Figure 8a) and for the next three months (January-March; Figure 8b) indicates increased probabilities of above-average temperatures for northern areas of the United States, consistent with historical mature El Niño conditions. No forecast (“EC”) has been made for the Southwest for January, and there is only a slight shift in the chances of above-average temperatures (shifted from 33% to 38%) in northwestern Arizona for January-March. The International Research Institute (IRI) for Climate Prediction also indicates a slight shift in the chances of above-average temperatures for January-March (40% chance of above-average temperatures); however, IRI shows this shift over the entire northern half of Arizona and New Mexico. 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.

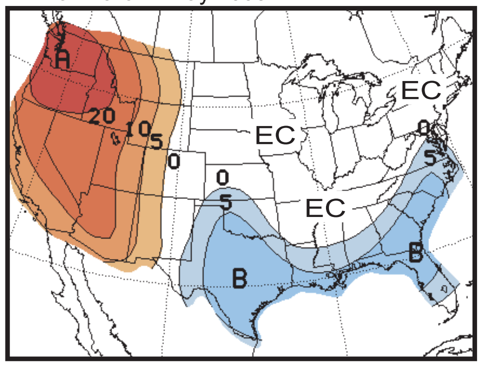
9. Temperature: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead temperature forecasts (released 12/19/02).

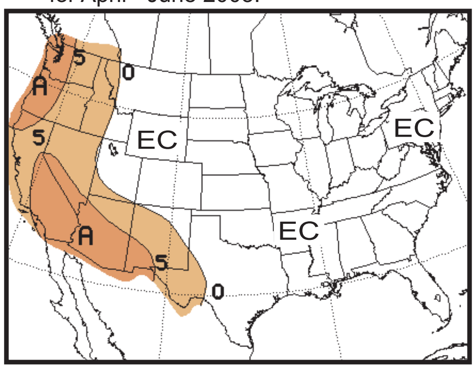
9a. Long-lead national temperature forecast for February - April 2003.



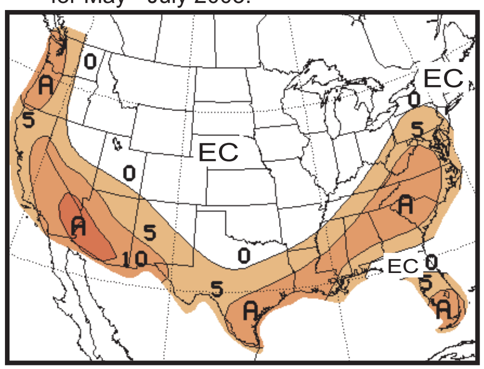
9b. Long-lead national temperature forecast for March - May 2003.



9c. Long-lead national temperature forecast for April - June 2003.



9d. Long-lead national temperature forecast for May - July 2003.



Percent Likelihood of Above/ Below Average Temperatures*

30% - 40%
20% - 30%
10% - 20%
5% - 10%
0% - 5%

0% - 5%
5% - 10%
10% - 20%

*EC indicates no forecast due to lack of model skill

Highlights: The CPC temperature outlooks for February-July 2003 show increased probabilities of above-average temperatures for most of the western United States in the winter and spring (Figures 9a-d). 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 northwest Arizona. There is only a small chance of above-average temperatures in New Mexico until April-June, when long-term temperature trends dominate the forecast, and forecast confidence increases for southwestern New Mexico (38-43% chance of above-average temperatures). Note that CPC forecasters indicate a 38% chance of *below-average* temperatures for eastern New Mexico for February-April, based chiefly on historical probabilities associated with mature El Niño conditions in the southern U.S. Forecasters at the International Research Institute (IRI) for Climate Prediction withhold judgment for most of the Southwest in their multi-season temperature forecasts until April-June, when they forecast a 40% chance of above-average temperatures in southwestern Arizona. 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.

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.

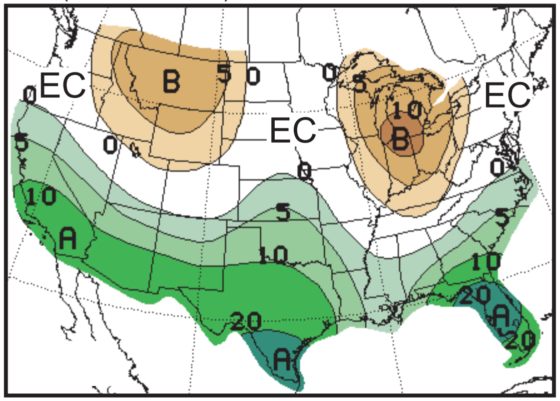
Thus, using the NOAA CPC excess likelihood forecast, in areas with light brown shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above average, a 33.3% chance of average, and a 28.3-33.3% chance of below average temperature.

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

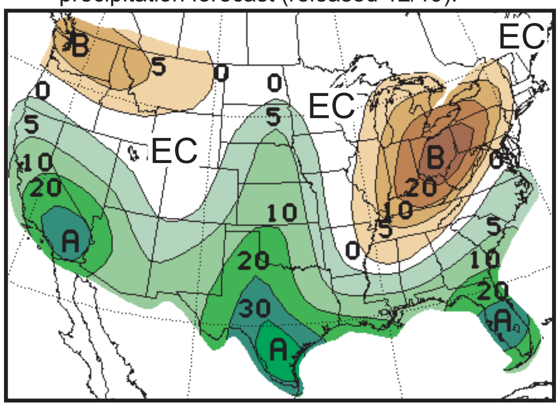
Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no prediction is offered.

10. Precipitation: Monthly (Jan.) and 3-Month (Jan. - Mar. '03) Outlooks Source: NOAA CPC

10a. January 2003 U.S. precipitation forecast (released 12/19).



10b. January - March 2003 U.S. precipitation forecast (released 12/19).



Percent Likelihood of Above or Below Average Precipitation*

20% - 30%	Above
10% - 20%	Above
5% - 10%	Above
0% - 5%	Above
0% - 5%	Below
5% - 10%	Below
10% - 20%	Below
10% - 20%	Below

*EC indicates no forecast 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 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.

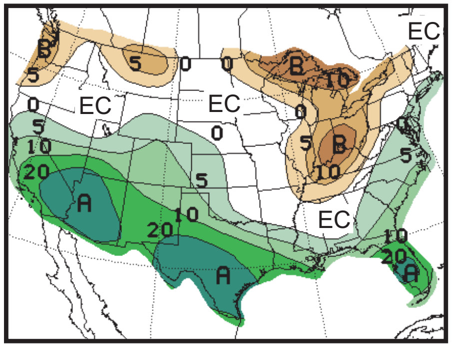
Highlights: The official NOAA-CPC precipitation outlook for January shows a fairly high probability of average to above-average precipitation across the Southwest, with the greatest forecast confidence centered over southern Arizona and New Mexico. Forecasters paint a similar picture for January-March, with the greatest forecast confidence centered over western Arizona. Forecasters at the International Research Institute (IRI) for Climate Prediction, which produces an experimental seasonal outlook, indicate smaller shifts in the chances of above-average precipitation in the Southwest during the winter. Both forecast agencies base most of their forecast on historical analyses of El Niño effects on Southwest 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/

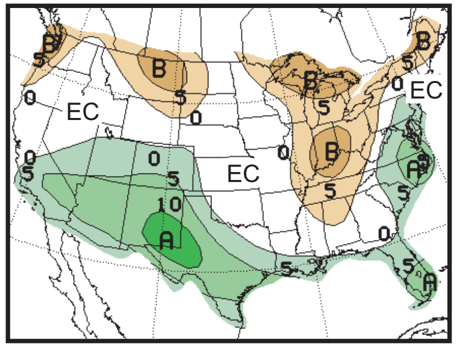
11. Precipitation: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead precipitation forcasts (released 12/19/02).

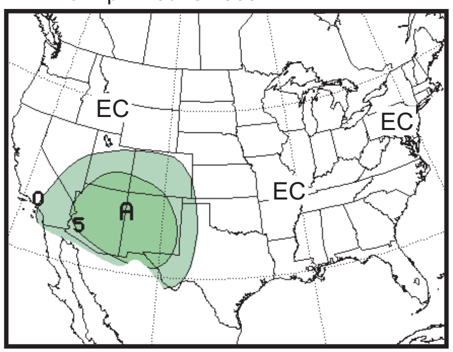
11a. Long-lead U.S. precipitation forecast for February - April 2003.



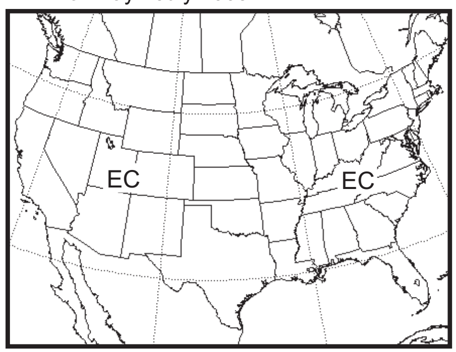
11b. Long-lead U.S. precipitation forecast for March - May 2003.



11c. Long-lead U.S. precipitation forecast for April - June 2003.



11d. Long-lead U.S. precipitation forecast for May - July 2003.



Percent Likelihood of Above or Below Average Precipitation*

Above:
- 20% - 30%
- 10% - 20%
- 5% - 10%
- 0% - 5%

Below:
- 0% - 5%
- 5% - 10%
- 10% - 20%
- 20% - 30%

*EC indicates no forecast due to lack of model skill

Highlights: The effects of a moderate El Niño are indicated by the increased probability of above-average precipitation in the southern United States in the winter and spring (Figures 11a-c). For the Southwest, the greatest confidence in these predictions is centered over much of Arizona during February-April 2003, with probabilities reaching 53.3-63.3% for above-average precipitation (accompanied by only 3.3-13.3% probabilities of below-average precipitation). The probabilities for continued above-average precipitation in Arizona and New Mexico during the spring (Figure 11b) range between 38.3% (southern Arizona) and 43.3-53.3% (southeastern New Mexico). These predictions are based chiefly on the historical tendency for above-average precipitation in the Southwest during an El Niño event, supported by results of trend analysis. Forecasters expect moderate El Niño conditions to continue for at least the next 2-4 months. However, El Niño-related winter precipitation in the Southwest is highly variable. Peak El Niño strength is likely to occur either during December 2002 or January 2003. 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.

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.

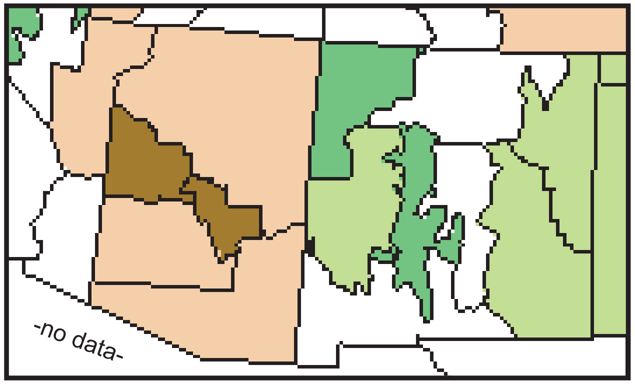
Thus, using the NOAA CPC excess likelihood forecast, in areas with light green shading (0-5% excess likelihood of above-average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average precipitation.

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 prediction is offered.

12. Drought: PDSI forecast and U.S. Seasonal Drought Outlook ♦ Source: NOAA CPC

12a. Short-term Palmer Drought Severity Index (PDSI) forecast through 12/21/02 (accessed 12/19).



- -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)
- +2.0 to +2.9 (very moist spell)

12b. Seasonal drought outlook through March 2003 (accessed 12/19).

- 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 long-term drought.

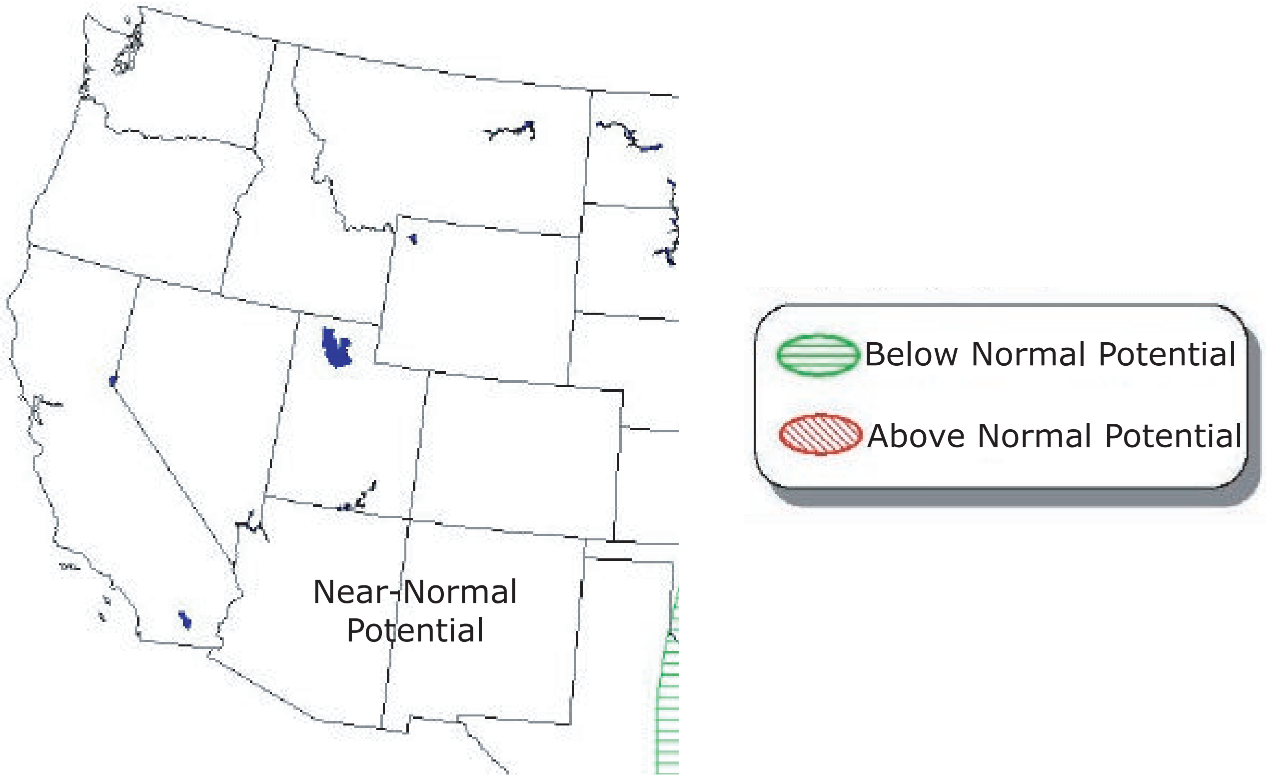
'Normal' on the PDSI scale is defined as amounts of moisture that reflect long-term climate expectations.

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 PDSI forecast (Figure 12a) indicates severe to extreme drought conditions for most of Arizona. In contrast, the forecast for New Mexico is for near-normal or moist conditions compared to the average for this time of year. As indicated in the CPC climate outlooks, the probability of El Niño-related above-average precipitation is fairly high for much of the Southwest; therefore, the seasonal drought outlook (Figure 12b) is for short-term drought to ease. However, hydrological drought conditions are likely to persist, unless the Southwest receives *substantially* above-average winter and spring precipitation, especially snow, which recharges reservoirs and streams.

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

13. National Wildland Fire Outlook (valid Dec. 1–31, 2002) Source: National Interagency Fire Center

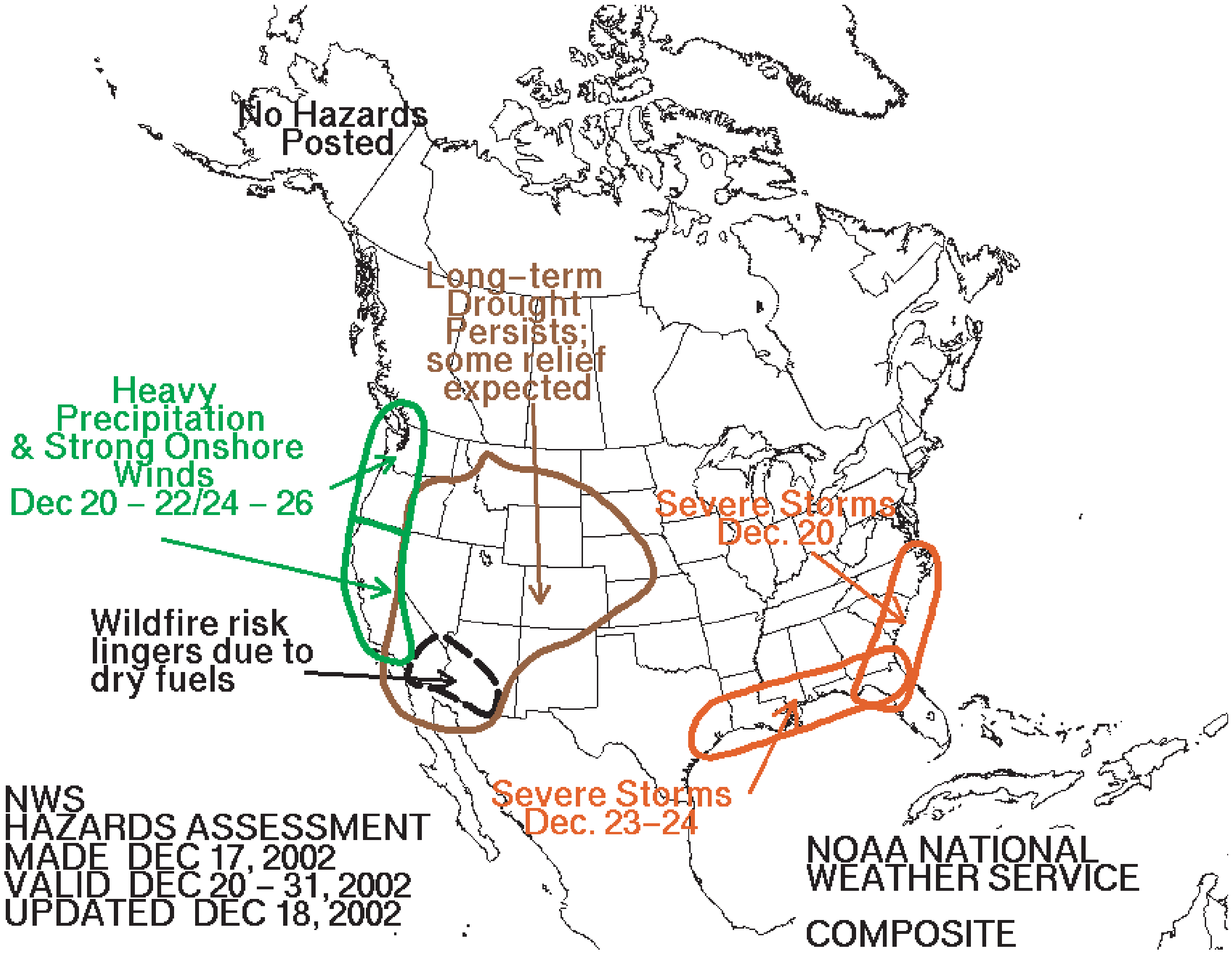


Notes: The National Wildland Fire Outlook (Figure 13) considers climate forecasts and surface-fuels conditions to assess fire potential. It is a subjective assessment, based on a synthesis of monthly regional fire danger outlooks. It is issued monthly by the National Interagency Coordination Center (NICC) at the National Interagency Fire Center (NIFC).

Highlights: The forecast map indicates near-normal fire potential for all of the western U.S. Short-term fire danger rating data (U.S. Forest Service Wildland Fire Assessment System – WFAS) indicate very low fire danger during the week of December 22-28. Images of vegetation greenness (NIFC) and live fuel moisture (U.S. Forest Service WFAS) show that fuels are still relatively dry in much of Arizona and across southern New Mexico. Fuel moisture status should improve somewhat with late December precipitation in the Southwest. New Mexico and Arizona federal land management agencies continue to use favorable weather conditions to support prescribed fire operations. The Southwest is remains at fire preparedness level 2, which means that regional resources are adequate to manage all wildfires and prescribed fires.

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/

14. U.S. Hazards Assessment Forecast ♦ Source: NOAA Climate Prediction Center



Notes:

This hazards forecast is for the period December 20th through December 31st, 2002.

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

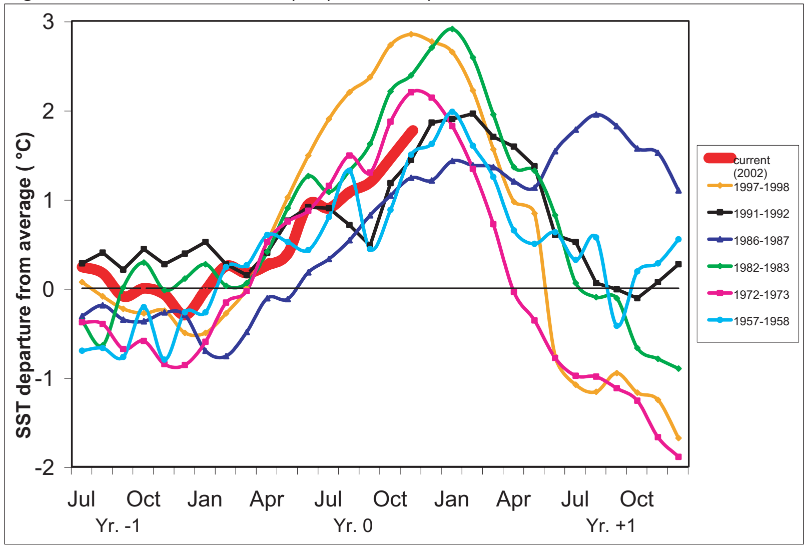
Soil and/or Fire:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/s_threats.gif

Highlights: The U.S. Hazards Assessment indicates long-term, persistent drought for Arizona and for northwestern New Mexico. Drought-related wildfire danger is expected to persist in western Arizona, but with rapidly diminishing severity as a result of late-December precipitation.

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

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

Figure 15a. Past and current (red) El Niño episodes.

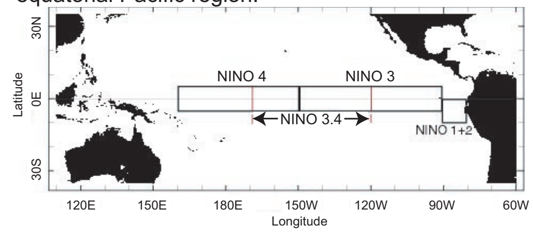


Notes:

The graph (Figure 15a) shows sea-surface temperature (SST) departures from the long-term average for the Niño 3.4 region (Figure 15b). 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).

Figure 15b. ENSO observation areas in the equatorial Pacific region.



This year's SST departures are plotted as a red line (Figure 15a). 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.

Figure 15c. 7-day averaged South Pacific sea surface temperature anomalies (°C) for December 8th - 14th, 2002.

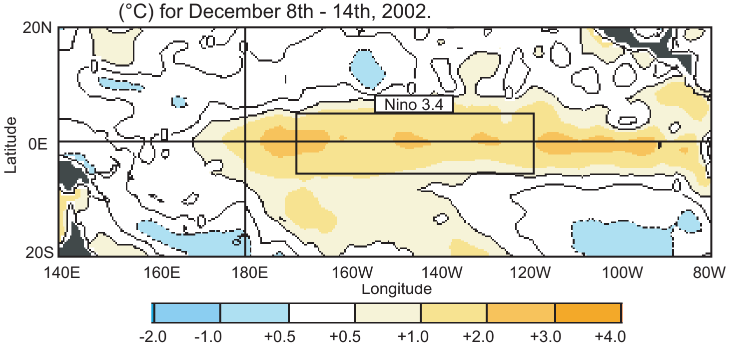
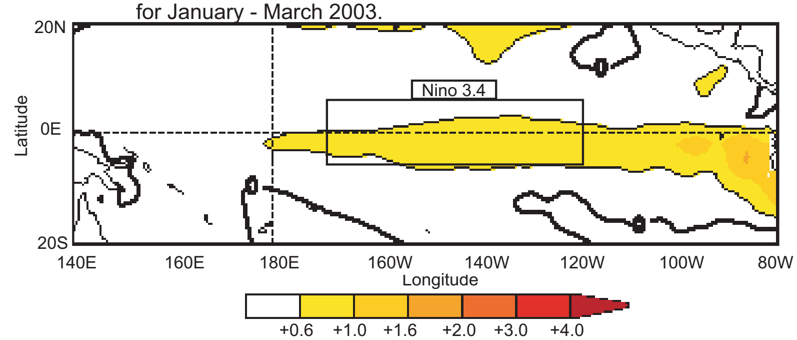


Figure 15d. Forecasted South Pacific sea surface temperature anomalies (°C) for January - March 2003.



Highlights: El Niño conditions continue to strengthen toward their typical winter maximum (Figure 15a), which will likely occur during December or January. During late-November to mid-December, sea surface temperature (SST) anomalies greater than 2°C appeared farther east in the equatorial Pacific (Figure 15c). Subsurface ocean temperatures warmed; these will tend to reinforce the currently warm SSTs. Atmospheric conditions associated with El Niño, including reduced easterly trade winds and large-scale westerly wind anomalies in the central equatorial Pacific Ocean, have been robust. ENSO forecasts by both the International Research Institute for Climate Prediction (IRI) and the NOAA Climate Prediction Center (CPC) indicate a high likelihood that El Niño (Figure 15d, courtesy of CPC) SST conditions will continue into spring 2003. Forecast skill for forecasts made in December, for projections through March, is higher than during other times of the year. Both the IRI and the CPC caution that this El Niño event is expected to be weaker than the 1997–98 El Niño event, though substantial climate effects are still possible in some locations.

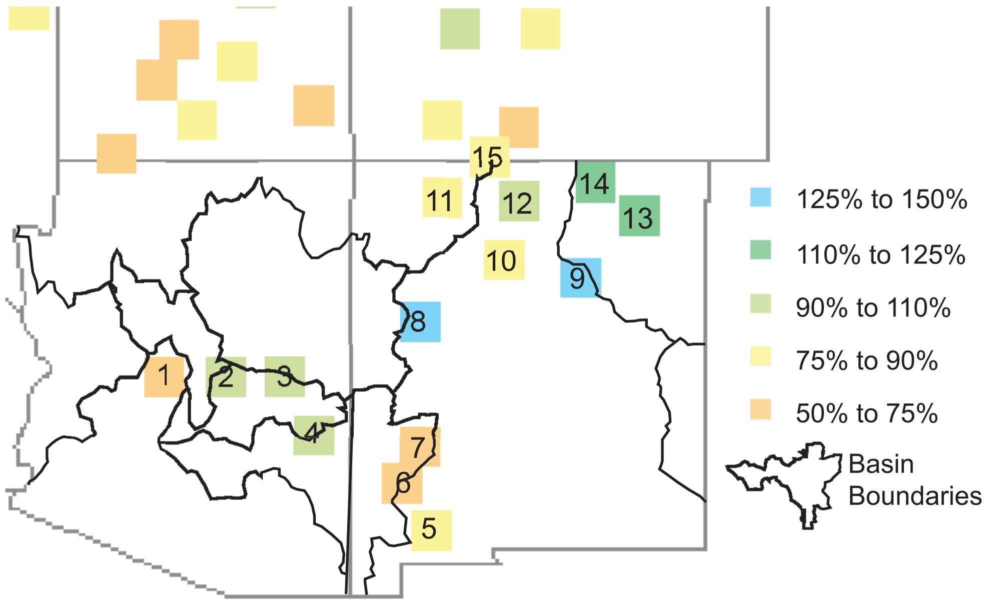
For a technical discussion of current El Niño conditions, visit: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

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

16. Snow Water Equivalent for Southwest River Basins (as of December 23, 2002)

Sources: USDA NRCS Weather and Climate Center and Western Regional Climate Center (WRCC)

16. Basin average snow water content (SWC) monitoring sites (% of average).



Arizona Basins

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

New Mexico Basins

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

Highlights: As of December 23, 2002, snow water content (SWC) varies greatly throughout Arizona and New Mexico. Arizona river basin SWC is below the 1971-2000 average for this time of year. The highest SWC is in the Salt River Basin, which is at 97% of average. Late December precipitation (as this packet goes to press) is likely to bring SWC up to average at several Arizona SNOTEL sites. New Mexico SWC is more varied; most north-central and northeastern New Mexico basins are at or above average, whereas southwestern New Mexico basins are below average for this time of year. Note that most southern Utah and southwestern Colorado basins, which contribute runoff to the Colorado and Rio Grande river basins, have below average SWC – a chief concern of water supply managers in the southwestern states.

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 information at individual sites.

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

The SWC in Figure 16 refers to the snow water content found at selected SNOTEL sites in or near the 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 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 16. 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.

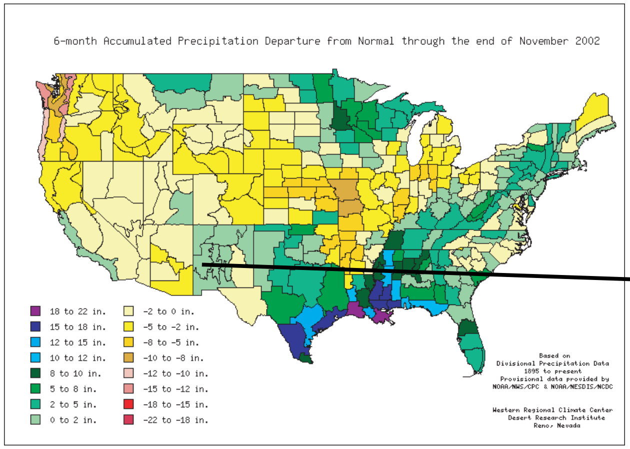
These data are provisional and subject to revision. They have not been processed for quality assurance. However, they provide the best available land-based estimates during the snow measurement season.

17. Standard Precipitation Index: Additional Information ♦ Source: Western Regional Climate Center

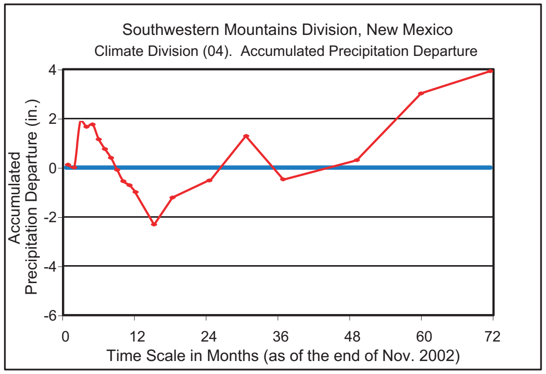
17a. Table of time-averaged precipitation information available at WRCC's SPI page.

Time Scale in Months Through the End of November 2002	1	2	3	4	5	6	7	8	9	10	11	12	15	18	24	30	36	48	60	72
Accumulated Precipitation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Accum. Pcpn. dep. from Normal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Percentage of Average	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Precipitation Percentile	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Standardized Pcpn. Index	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

17b. 6-month accumulated precipitation departure from average data through November 2002 by climate division.



17c. Accumulated precipitation departure from average values for western New Mexico.



Highlights:
In addition to providing Standard Precipitation Index values for individual climate divisions (see December END packet), the Western Regional Climate Center (WRCC) provides four additional types of precipitation information reflecting the interests of users of climate information: accumulated precipitation, accumulated precipitation departure, percent of average, and precipitation percentile. Each checked-box in Figure 17a provides a time-averaged climate division map of the United States for the precipitation data parameter desired (e.g., Figure 17b). These maps represent precipitation and drought information for the desired time scale, but also allow for the display of the last 72 months of the selected parameter for individual climate divisions. By selecting an individual climate division, the selected parameter is plotted for the past 72 months (Figure 17c).

For more Information, visit the WRCC SPI web page: http://www.wrcc.dri.edu/spi/spi.html.

Notes:
Four quantities are computed as part of the Standardized Precipitation Index procedure at the WRCC, allowing users to view the following types of information:

Accumulated Precipitation - The total precipitation that has fallen during the indicated number of months, through the end of the month displayed.

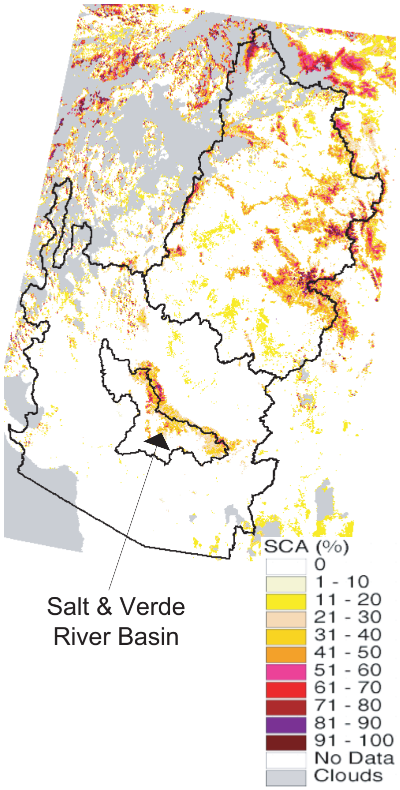
Accumulated Precipitation Departure - The difference between the amount of accumulated precipitation for the indicted number of months and the long-term (climatological) average for the same set of months.

Accumulated Precipitation Percent of Average - The observed accumulated precipitation, divided by the long-term average precipitation, and then multiplied by 100. A value of 0 indicates no precipitation at all, and a value of 100 percent indicates that the amount is equal to the climatological average for the same set of months.

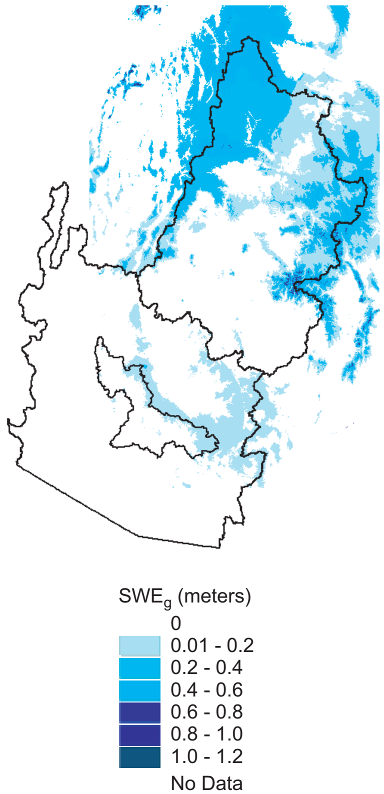
Precipitation Percentile - This quantity indicates how often a value of the magnitude observed occurs, i.e., its degree of *unusualness*. A value of 0 means that the value in question seldom if ever occurs. A value of 50 indicates that half of the historical values are higher and 50 percent are lower. A value of 75 indicates that 75 percent of the values are as low as this value, or conversely, that only 25 percent of the values are higher than the given value. A value of 99 means that 99 percent of the observed values are lower, and that this value is in the top 1 percent of all values.

18. Improvements in Snow Measurement ♦ Source: Southwest RESAC

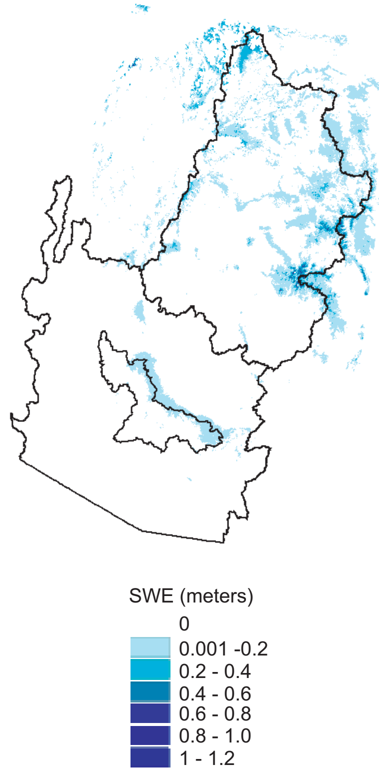
18a. Fractional snow covered area (SCA).



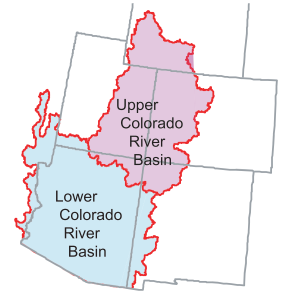
18b. Ground-based interpolated snow water equivalent (SWE_g).



18c. Total snowpack water equivalent.



18d. Location of Colorado River Basins



Highlights: Currently water-supply managers and streamflow forecasters base their forecasts and operational estimates in part on snow water equivalent (SWE) measurements produced using SNOTEL index stations. Statistical methods are used to interpolate individual station SWE measurements to the river basin scale. As the index stations only survey a few locations, and as they mostly survey relatively high-elevation locations, basin-wide maps of SWE are inherently inaccurate. Researchers associated with the Southwest RESAC have improved the methods used to create SWE estimates. In contrast to interpolation and statistical approaches, the RESAC scientists create process-based SWE estimates using physical parameters. In addition, the RESAC SCA scheme classifies the *percent snow covered area* for a sub-basin region, rather than the simple snow/no snow classification presently in operational use. They merge these physically-based estimates with SNOTEL data to produce fine spatial scale (1 km^2) basin-wide total snowpack water content maps. Although the RESAC estimates still have relatively high uncertainty (±20%), RESAC scientists are working on improvements, such as SCA mapping using more advanced satellites, and developing algorithms to estimate SCA under clouds and trees (one drawback to using satellite data).

For information on Southwest RESAC, visit: http://resac.hwr.arizona.edu/

Notes:

The experimental data for April 6, 1999 shown on this page are provided courtesy of the Southwest Regional Earth Science Applications Center (RESAC), a partnership between NASA, the University of Arizona, and Lawrence Berkeley National Laboratory.

Fractional snow-covered area data (SCA; Figure 18a) are generated using several bands of remotely sensed (satellite) data in combination with computer algorithms and human expertise in order to distinguish between areas in the satellite imagery obscured by clouds and those on the ground covered by snow.

Information about topography, land cover, and thermal characteristics are employed in the analysis in order to derive information at sub-pixel scale (<1 km^2) in the digital imagery.

Snow water equivalent data (SWE_g; Figure 18b) are generated from spatial interpolation of ground-based snowpack telemetry (SNOTEL) station data from individual sites.

Total snowpack water equivalent data (Figure 18c) are generated by multiplying SCA x SWE_g.