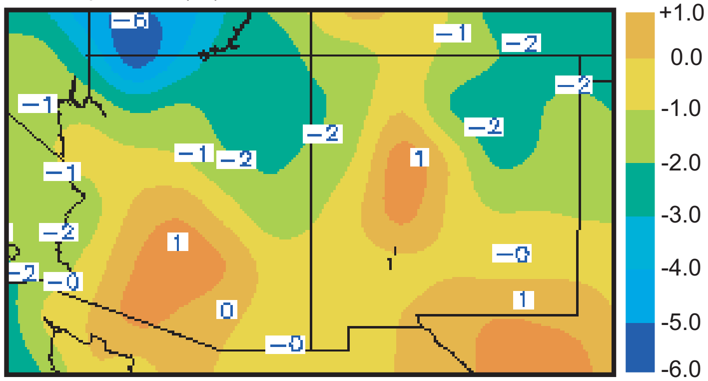
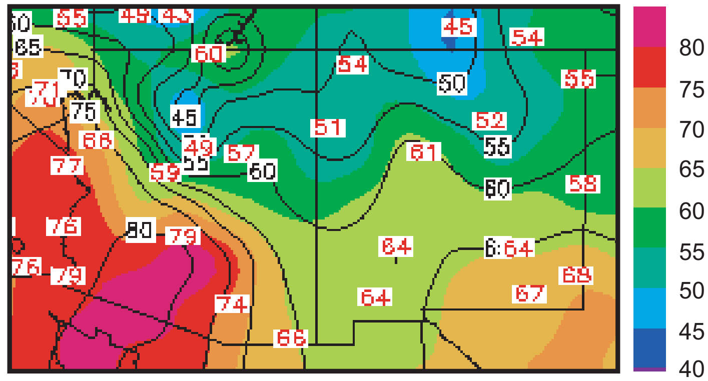
1. Recent Conditions: Temperature (up to 10/16/02) ♦ Source: Western Regional Climate Center

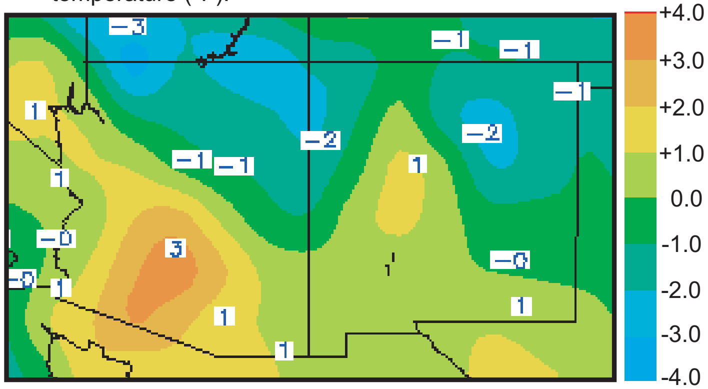
1a. Water year '02-'03 (through 10/16) departure from average temperature (°F).



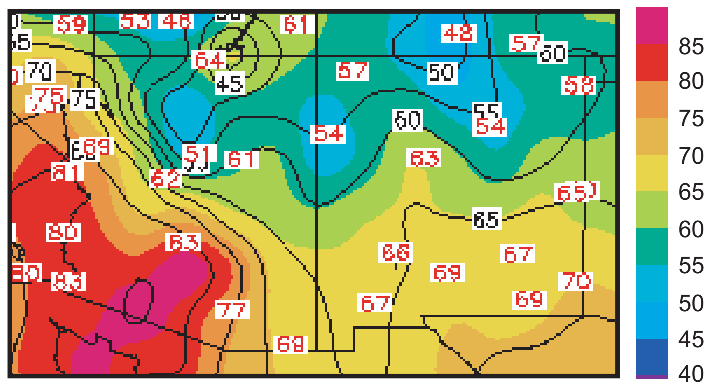
1b. Water year '02-'03 (through 10/16) average temperature (°F).



1c. Previous 28 days (9/19 - 10/16) departure from average temperature (°F).



1d. Previous 28 days (9/19 - 10/16) average temperature (°F).



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.

'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.

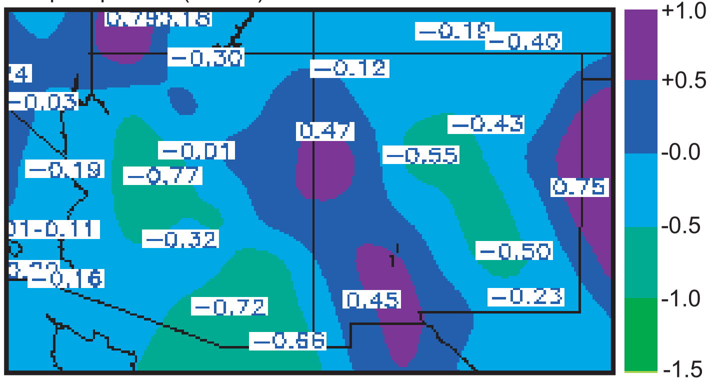
Highlights: The 2002-2003 water year began on October 1, 2002; temperature shown in Figures 1a-b are based on the first 16 days of the new water year. Temperatures for the new water year and for the previous 28-days (Figures 1a and 1c) have been much closer to average in southern Arizona and New Mexico than during previous months but remain below average in parts of northern Arizona and New Mexico. In the past 28 days, average temperatures have cooled by about 10°F in the Southwest. Phoenix and southwestern Arizona continue to stand out in the region for having the most above average temperatures for the period.

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

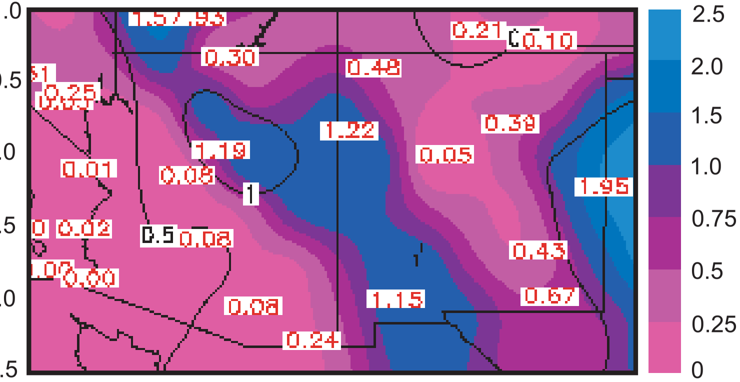
For information on temperature and precipitation trends, visit: http://www.cpc.ncep.noaa.gov/trndtext.htm

2. Recent Conditions: Precipitation (up to 10/20/02) ♦ Source: Western Regional Climate Center

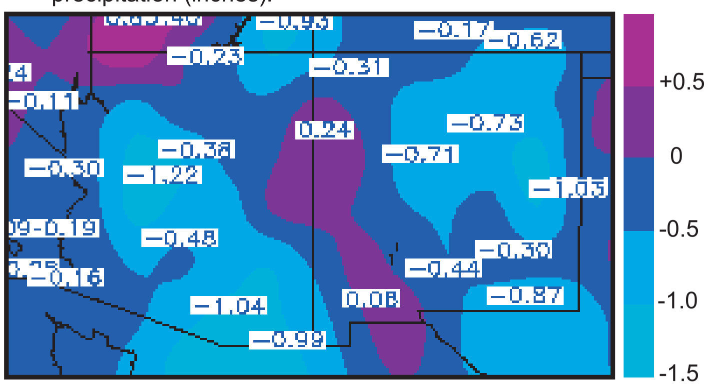
2a. Water year '02-'03 (through 10/20) departure from average precipitation (inches).



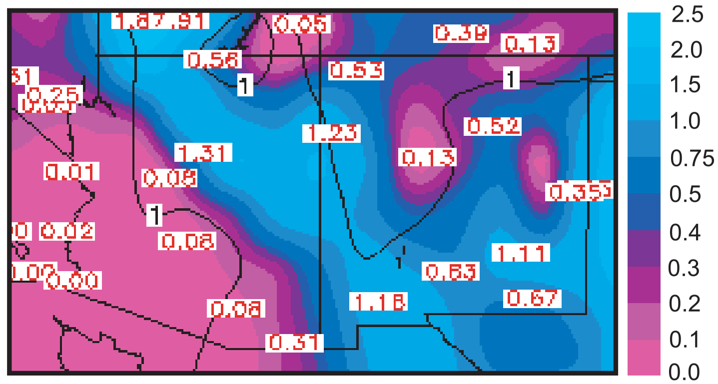
2b. Water year '02-'03 (through 10/20) total precipitation (inches).



2c. Previous 28 days (9/23 - 10/20) departure from average precipitation (inches).



2d. Previous 28 days (9/23 - 10/20) total precipitation (inches).



Highlights: Although we are only at the beginning of the new water year, precipitation in our region is already (and still!) below average (Figure 2a). Much of Arizona and New Mexico has received either less than an inch or zero precipitation in the past 28 days (Figure 2d). Last month, summer rainfall brought relief to northeastern Arizona and northern New Mexico. Both Arizona and New Mexico experienced much wetter conditions, compared to the 1971-2000 average for September. However, this month, these regions return to deficit status. Areas in southernmost Arizona and New Mexico continue to experience the largest deficits in precipitation.

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

'Average' refers to the arithmetic mean of annual data from 1971-2000.

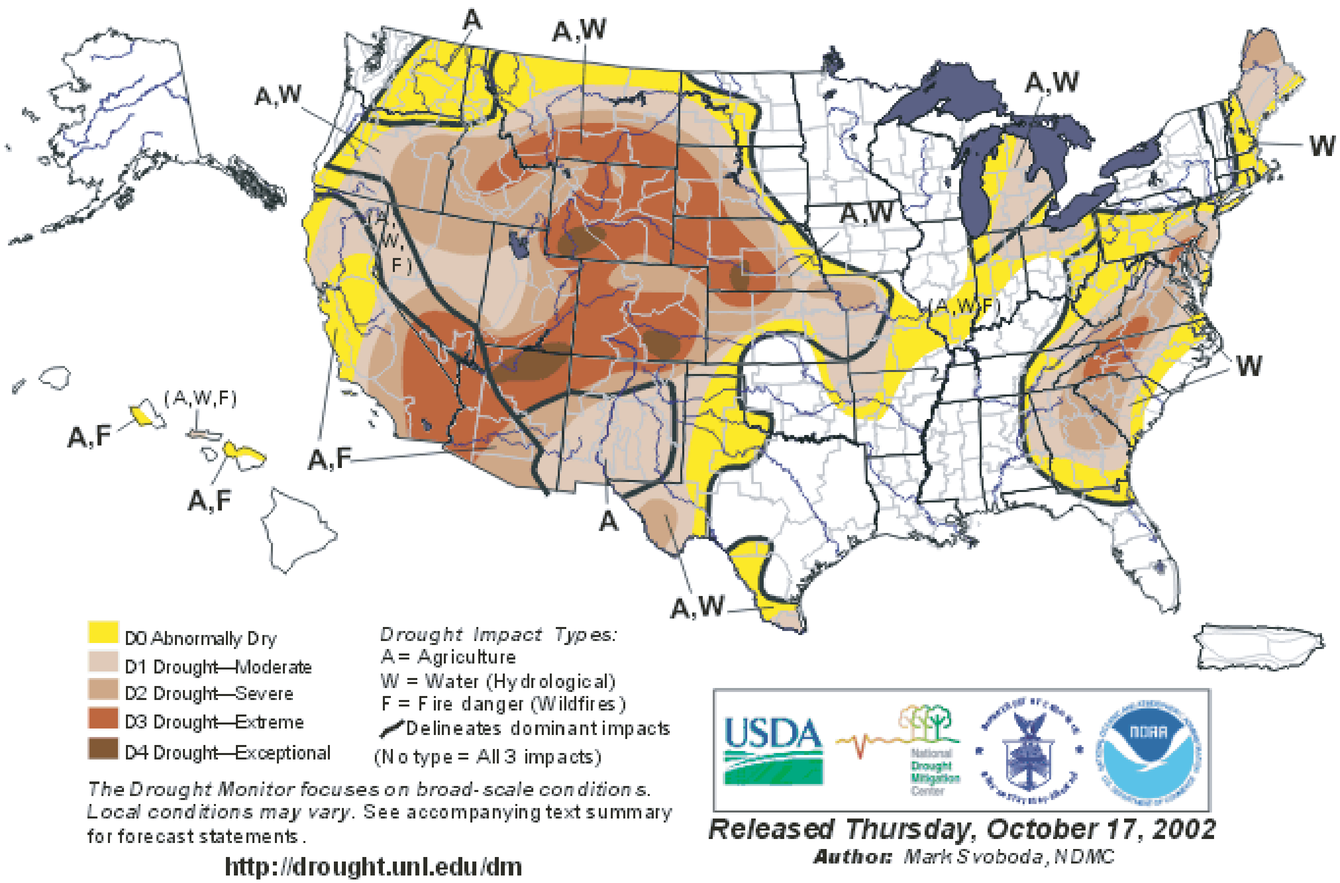
The data are in inches of precipitation. **Note: The scales for Figures 2b & 2d are non-linear.**

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 (10/15/02)



Notes:

The U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. This monitor was released on 10/17 and is based on data collected through 10/15 (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.

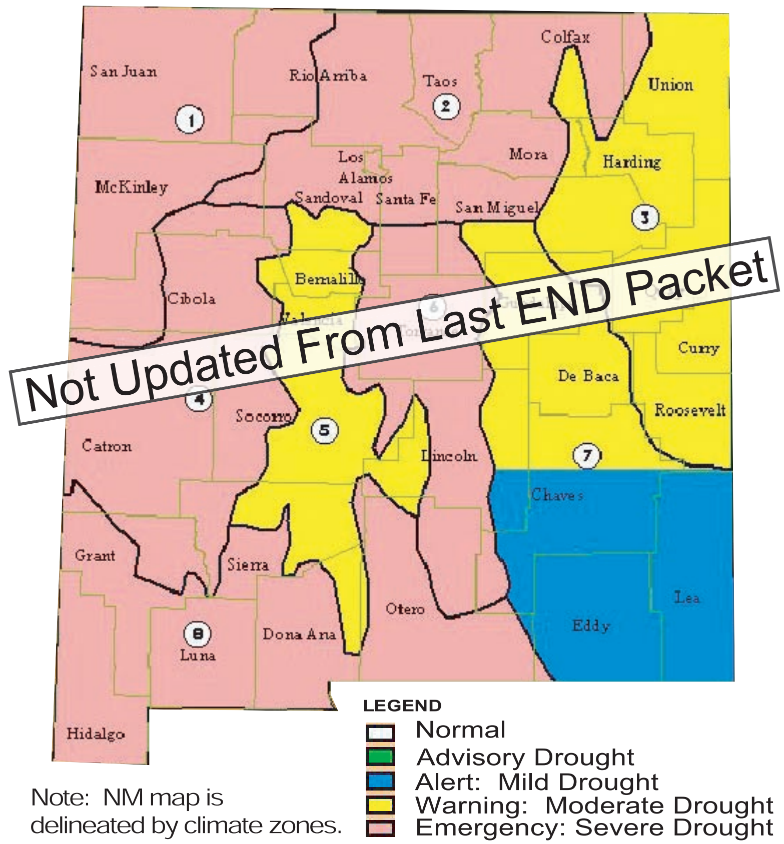
Highlights: Compared to a month ago, the drought designation for much of Arizona and New Mexico remains unchanged; moderate to exceptional drought conditions persist over the entire region due to minimal summer and early fall precipitation. However, the areal extent of "exceptional" drought conditions in northern Arizona has diminished somewhat; note that some parts of the area have been downgraded to "extreme." Agricultural drought impacts continue to affect Arizona and New Mexico. Hydrological impacts are also important in northern parts of both states and wildfire danger is present in western Arizona.

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 September 12, 2002



Note: NM map is delineated by climate zones.

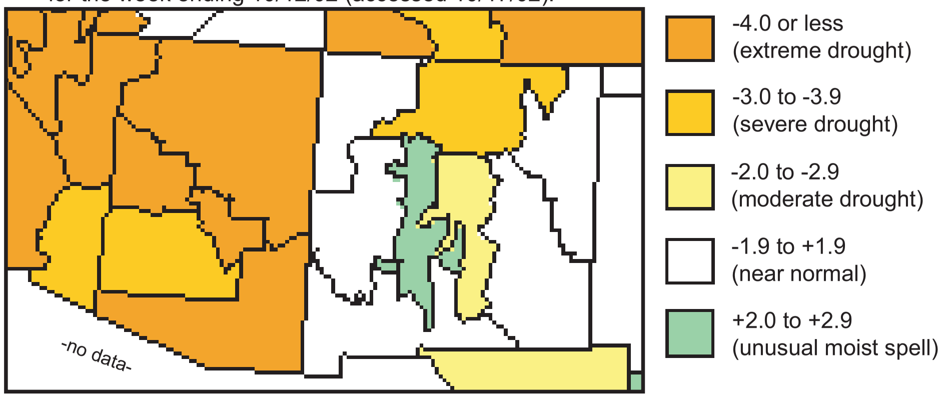
Source: NM Natural Resources Conservation Service (2002)

Notes: The New Mexico drought map above, provided by the New Mexico Natural Resource Conservation Service (NMNRCS), has not been updated since September 12, 2002 and is the same map as the one provided in the September END Insight packet. An updated New Mexico Drought Map will be available on the NMNRCS web site (http://www.nm.nrcs.usda.gov/snow/Default.htm) by October 30. We were unable to determine if the Arizona Division of Emergency Management (ADEM) had updated the Arizona drought map from the most recent one obtained (May 31, 2002) and, therefore, the Arizona map was again not included. The ADEM map can be obtained by contacting Matt Parks at ADEM at (602) 392-7510.

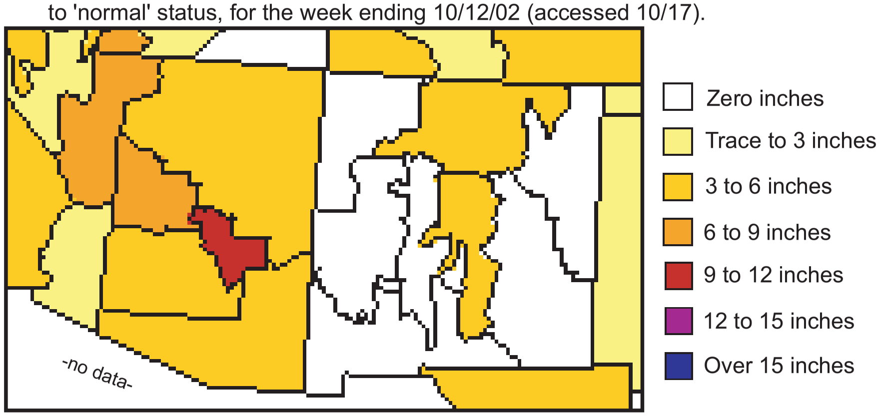
The New Mexico map currently is produced monthly, but when near-normal conditions exist, it is updated quarterly. The Arizona drought declaration map, a recent product of the ADEM, is not yet produced on a regular basis.

5. PDSI Measures of Recent Conditions (through 10/12/02) ♦ Source: NOAA Climate Prediction Center

5a. Current weekly Palmer Drought Severity Index (PDSI), for the week ending 10/12/02 (accessed 10/17/02).



5b. Precipitation needed to bring current weekly PDSI assessment to 'normal' status, for the week ending 10/12/02 (accessed 10/17).



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 remain virtually unchanged for some parts of New Mexico and Arizona, compared to last month (Figure 5a). However, conditions in southeastern Arizona have worsened, resulting in "extreme" meteorological drought status. New Mexico continues to show improvement, with conditions in the north-central part of the state downgraded to "severe" from "extreme" drought status. Most of New Mexico is experiencing near-normal conditions and even positive PDSI values for parts of the Rio Grande valley. Rio Grande water levels, however, remain below average, due to dry conditions in its headwaters to the north. Figure 5b shows that all of Arizona continues to require an extraordinary amount of precipitation to bring our drought status back to normal within one week. Much of New Mexico, however, is already at "normal" status and does not require additional precipitation to remain at near-normal meteorological drought 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 end of September 2002) ♦ Source: USDA NRCS

	Current Storage*#	Last Year Storage*	Average Storage*	Basin/ Reservoir Capacity*	Current as % of Capacity	Last Year as % of Capacity	Average as % of Capacity	Current as % of Average	Current as % of Last Year
Salt River Basin System	531	742	1072	2335	22.7	34.9	48.0	47.0	64.8
Verde River Basin System	77	161	138	310	24.8	52.8	43.9	51.5	42.8
San Francisco - Upper Gila River Basin									
San Carlos	46	93	306	875	5.3	12.9	36.2	15.0	49.4
Painted Rock Dam	0	0	65	2492	0.0	0.0	2.6	0.0	N/A
Total of 2 Reservoirs	46	93	371	3367	1.4	3.4	10.1	12.4	49.4
Little Colorado River Basin									
Lyman Reservoir	2	5	11	30	6.7	20.7	39.3	17.9	40.0
Show Low Lake	2	3	3	5	39.2	64.7	51.0	80.0	66.7
Total of 2 Reservoirs	4	8	14	35	11.4	27.1	41.0	29.2	50.0
Northwestern Arizona									
Lake Havasu	573	567	571	619	92.6	94.0	93.7	100.4	101.0
Lake Mohave	1563	1610	1504	1810	86.4	92.2	86.1	103.9	97.1
Lake Mead	17099	19873	21728	26159	65.4	77.0	82.7	78.7	86.0
Lake Powell	14470	19135	19933	24322	59.5	79.4	83.7	72.6	75.6
Total of 4 Reservoirs	33705	41186	43736	52910	63.7	78.8	83.4	77.1	81.8

* units are in thousands of acre-feet

This information was not yet available on the NRCS reservoir report webpage as of 10/21/02. For more information, contact Tom Pagano at NRCS (tpagano@wcc.nrcs.usda.gov).

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). Arizona's report was updated through the end of September, as of 10/17/02.

Highlights: Not surprisingly, reservoir levels in Arizona continue to be below average and lower than last year at this time. All reservoirs are below capacity, although the dam lakes in northwestern Arizona are not as badly affected as the other basins. Compared to last month, reservoir levels continue to decline and will not begin to improve until fall and winter precipitation begins.

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

	Current Storage*	Last Year Storage*	Average Storage*	Basin/ Reservoir Capacity*	Current as % of Capacity	Last Year as % of Capacity	Average as % of Capacity	Current as % of Average	Current as % of Last Year
Canadian River Basin (Conchas Reservoir)	29.5	55.7	189.2	254	11.6	21.9	74.5	15.6	53.0
Pecos River Basin									
Lake Avalon	1.3	1.3	1.8	6	21.7	21.7	30.0	72.2	100.0
Brantley	12	13.6	23.6	147.5	8.1	9.2	16.0	50.8	88.2
Santa Rosa	11.9	13.8	57.9	447	2.7	3.1	13.0	20.6	86.2
Sumner	3.9	1.4	28.9	102	3.8	1.4	28.3	13.5	278.6
Total of 4 Reservoirs	29.1	30.1	112.2	702.5	4.1	4.3	16.0	25.9	96.7
Rio Grande Basin									
Abiquiu	46.8	115.7	126.9	554.5	8.4	20.9	22.9	36.9	40.4
Caballo	26.2	12.2	65	331.5	7.9	3.7	19.6	40.3	214.8
Cochiti	48.8	48.2	58.4	502.3	9.7	9.6	11.6	83.6	101.2
Costilla	0.9	2.9	3.4	16	5.6	18.1	21.3	26.5	31.0
El Vado	7.6	104.4	103.4	186.3	4.1	56.0	55.5	7.4	7.3
Elephant Butte	308.7	853.7	1199.8	2065	14.9	41.3	58.1	25.7	36.2
Heron	166.4	339.1	313.5	400	41.6	84.8	78.4	53.1	49.1
Total of 7 Reservoirs	605.4	1476.2	1870.4	4055.6	14.9	36.4	46.1	32.4	41.0
San Juan River Basin (Navajo Reservoir)	878.8	1409.2	1367.8	1696	51.8	83.1	80.6	64.2	62.4

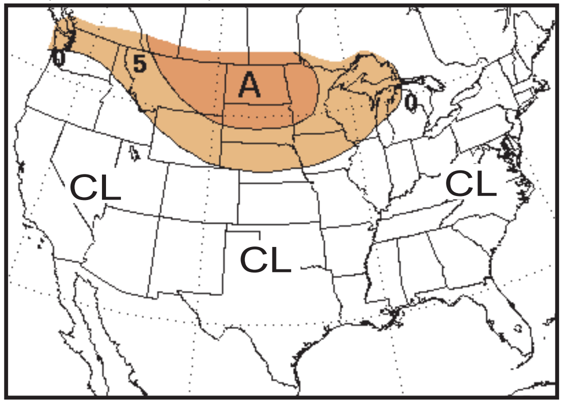
*units are in thousands of acre-feet

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 September, as of 10/17/02.

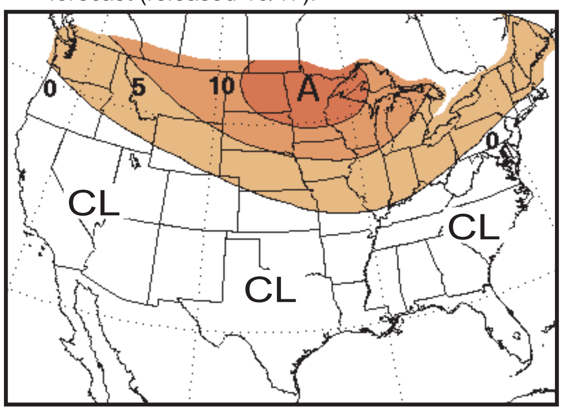
Highlights: Similar to Arizona, New Mexico reservoir levels continue to be below average although levels at a few reservoirs in the Rio Grande Basin are higher than last year at this time. Improvements in reservoir levels will not occur until fall and winter precipitation is recieved.

8. Temperature: Monthly (Nov.) and 3-Month (Nov ’02 -Jan. ‘03) Outlooks ♦ Source: NOAA CPC

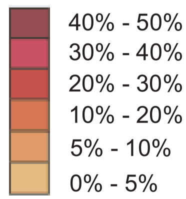
8a. November 2002 U.S. temperature forecast (released 10/17)



8b. November 2002 - January 2003 U.S. temperature forecast (released 10/17).



Percent Likelihood of Above Average Temperatures*



*CL 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.

Climatology (CL) 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.

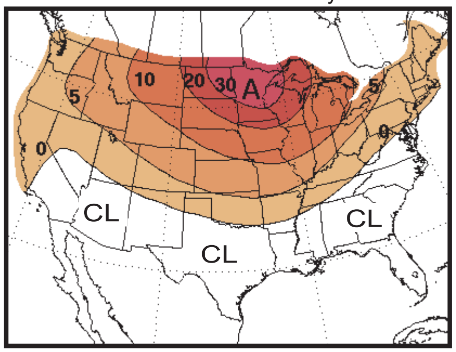
Highlights: The CPC temperature outlook for November (Figure 8a) and for the next three months (November–January; Figure 8b) indicates increased probabilities of above average-temperatures for northern areas of the United States. While no forecast (“CL”) is made for the Southwestern United States for November or for November through December, this is no assurance that temperatures are likely to be “average.” Indeed, for the past 28 days (Figure 1c), Arizona and New Mexico have experienced warmer than average conditions in the south and cooler than average conditions in the north. These predictions are based chiefly on long-term temperature trends in our region, along with results of statistical models. 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.

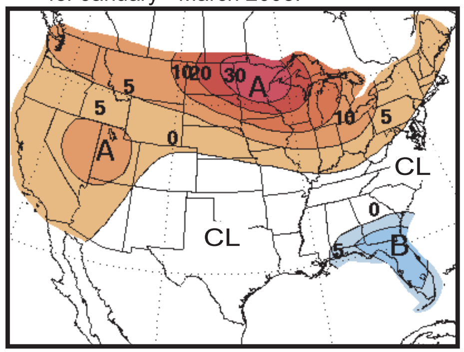
9. Temperature: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead temperature forecasts (released 10/17/02).

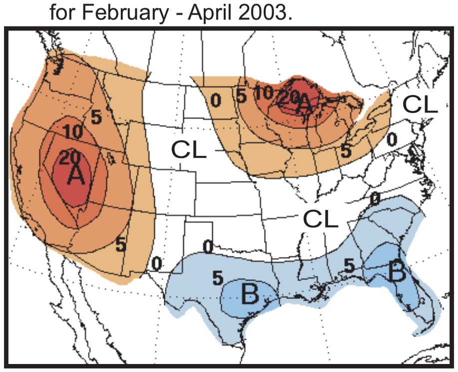
9a. Long-lead U.S. temperature forecast for December 2002- February 2003.



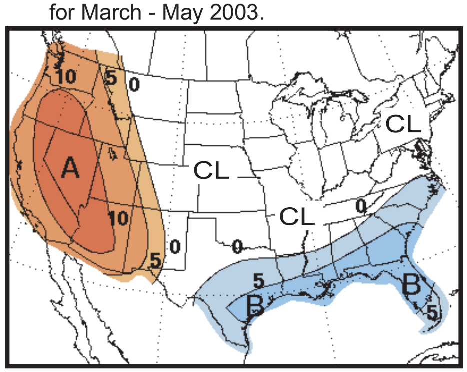
9b. Long-lead U.S. temperature forecast for January - March 2003.



9c. Long-lead U.S. temperature forecast for February - April 2003.



9d. Long-lead U.S. temperature forecast for March - May 2003.



Percent Likelihood of Above/ Below Average Temperatures*

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

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

*CL indicates no forecast due to lack of model skill

Highlights: The CPC temperature outlooks for December 2002-May 2003 show increased probabilities of above-average temperatures for most of the northern United States in the winter and early spring (Figures 9a-b). The area of increasingly probable above-average temperatures becomes concentrated on the western United States as spring begins (Figures 9c-d). Springtime conditions in the southeastern United States have an increased probability of below-average temperatures. For the Southwest, the late winter and spring show increased probabilities of above-average temperatures, especially in Arizona (Figures 9c-d). No prediction ("Climatology") is offered for much of the region until January and even into February for New Mexico. These predictions are based on a combination of factors, including long-term trends, soil moisture, and moderate El Niño conditions. Long-term trends favor higher probabilities of increased temperatures, but forecasters have balanced this with the tendency for lower than average temperatures in the Southwest during an El Niño event. NOAA CPC climate outlooks are released on the Thursday, between the 15^{th} and 21^{st} 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.

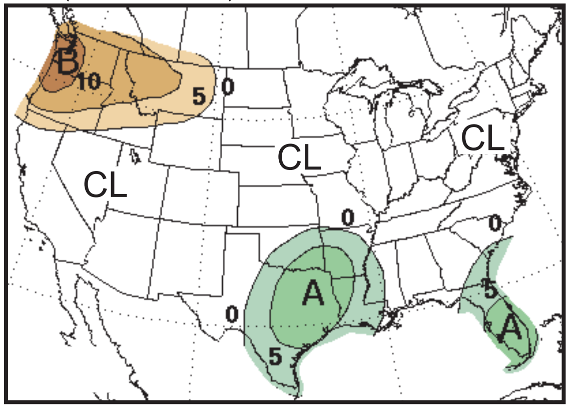
Thus, using the NOAA CPC excess likelihood forecast, in areas with light brown shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above average, a 33.3% chance of average, and a 28.3-33.3% chance of below average temperature.

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

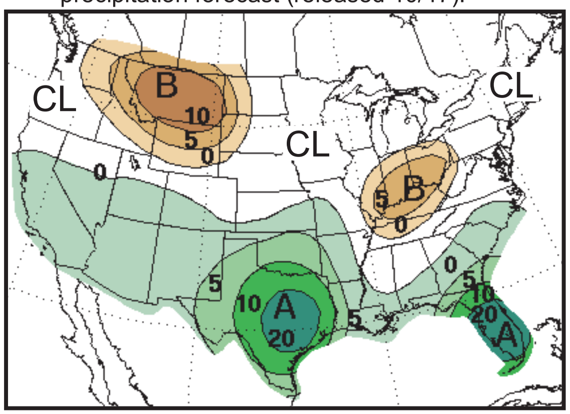
Climatology (CL) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no prediction is offered.

10. Precipitation: Monthly (Nov.) and 3-Month (Nov. ’02 - Jan. ‘03) Outlooks ♦ Source: NOAA CPC

10a. November 2002 U.S. precipitation forecast (released 10/17).



10b. November 2002 - January 2003 U.S. precipitation forecast (released 10/17).



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

*CL 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.

Climatology (CL) 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.

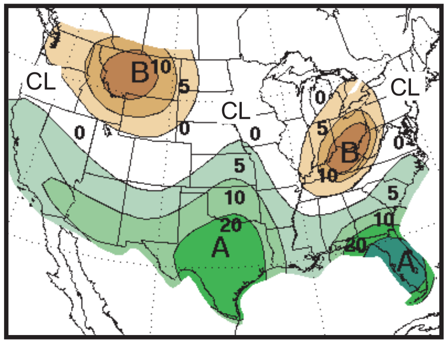
Highlights: The CPC has reserved judgment (i.e., “Climatology”) regarding November precipitation in Arizona and New Mexico (Figure 10a). The lack of forecast certainty during the fall reflects the complexity of forecasting when many factors must be taken into account. In this case, factors include not only El Niño influences but also late fall tropical storms and shifts in the jet stream track. While the effects of a moderate El Niño on the southwestern United States are uncertain (‘CL’) for November, a related increase in the probability of below-average precipitation for the northwestern United States is indicated (Figure 10a). The probability for above-average precipitation is 33.3-38.3% for Arizona and New Mexico for November through January (Figure 10b). For parts of Texas and Florida, the probabilities are as high as 53.3-63.3% for above-average precipitation (Figure 10b).

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.

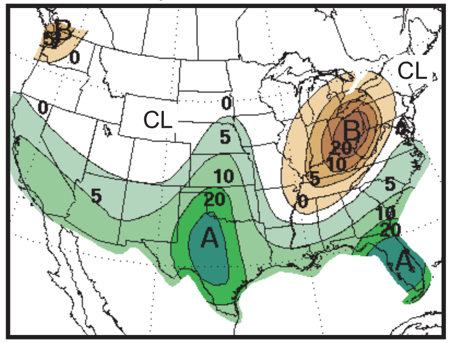
11. Precipitation: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead precipitation forcasts (released 10/17/02).

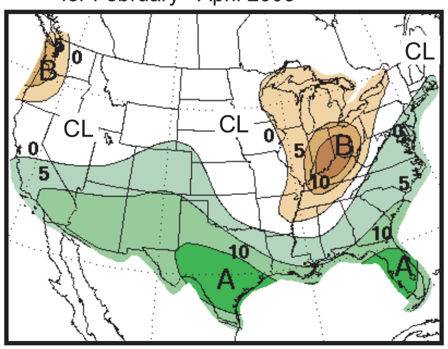
11a. Long-lead U.S. precipitation forecast for December 2002 - February 2003.



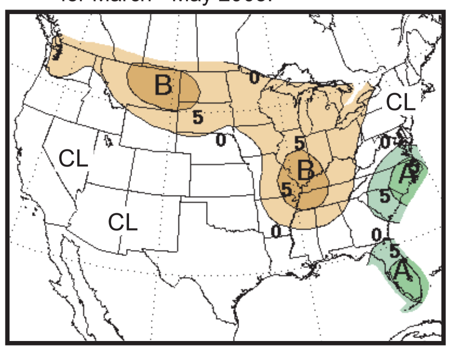
11b. Long-lead U.S. precipitation forecast for January - March 2003.



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



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



Percent Likelihood of Above or Below Average Precipitation*

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

*CL 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 early spring (Figures 11a-c). The greatest confidence in these predictions is centered over central Texas and Florida, with probabilities reaching 63.3-73.3% for above-average precipitation. The probabilities for above average precipitation in Arizona and New Mexico range between 33.3 and 43.3% from November through April. By mid-spring, no forecast ("Climatology") is offered for most of the western United States (Figure 11d). These predictions are based chiefly on the historical tendency for above-average precipitation in the Southwest during an El Niño event. However, El Niño-related winter precipitation in the Southwest is highly variable. While many high-precipitation winters in the Southwest have occurred during El Niño events, El Niño also has produced below-average precipitation in our region. Decision makers are advised to monitor the strength of the El Niño event as it progresses. 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.

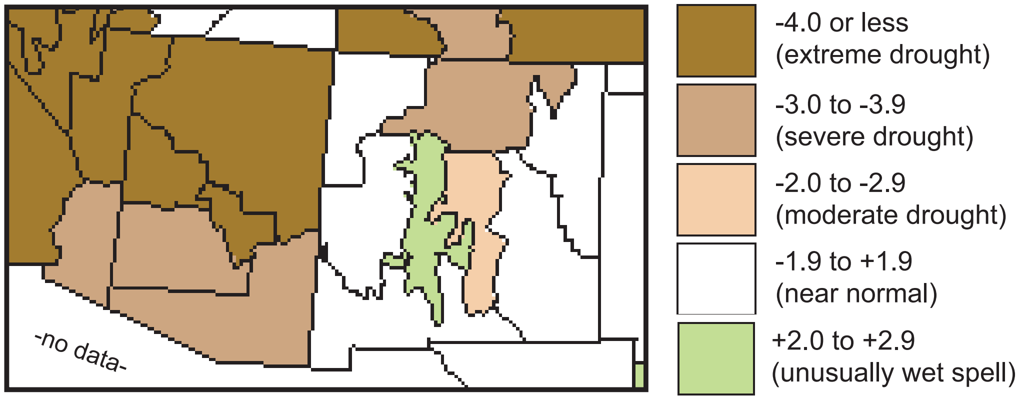
Thus, using the NOAA CPC excess likelihood forecast, in areas with light green shading (0-5% excess likelihood of above-average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average precipitation.

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

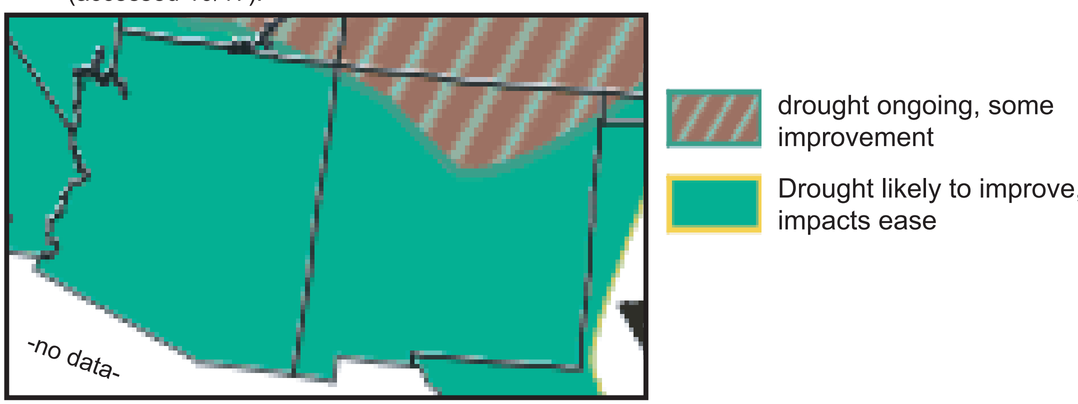
Climatology (CL) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no prediction is offered.

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

12a. Short-term Palmer Drought Severity Index (PDSI) forecast through 10/19/02 (accessed 10/17).



12b. Seasonal drought outlook through January 2003 (accessed 10/17).



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

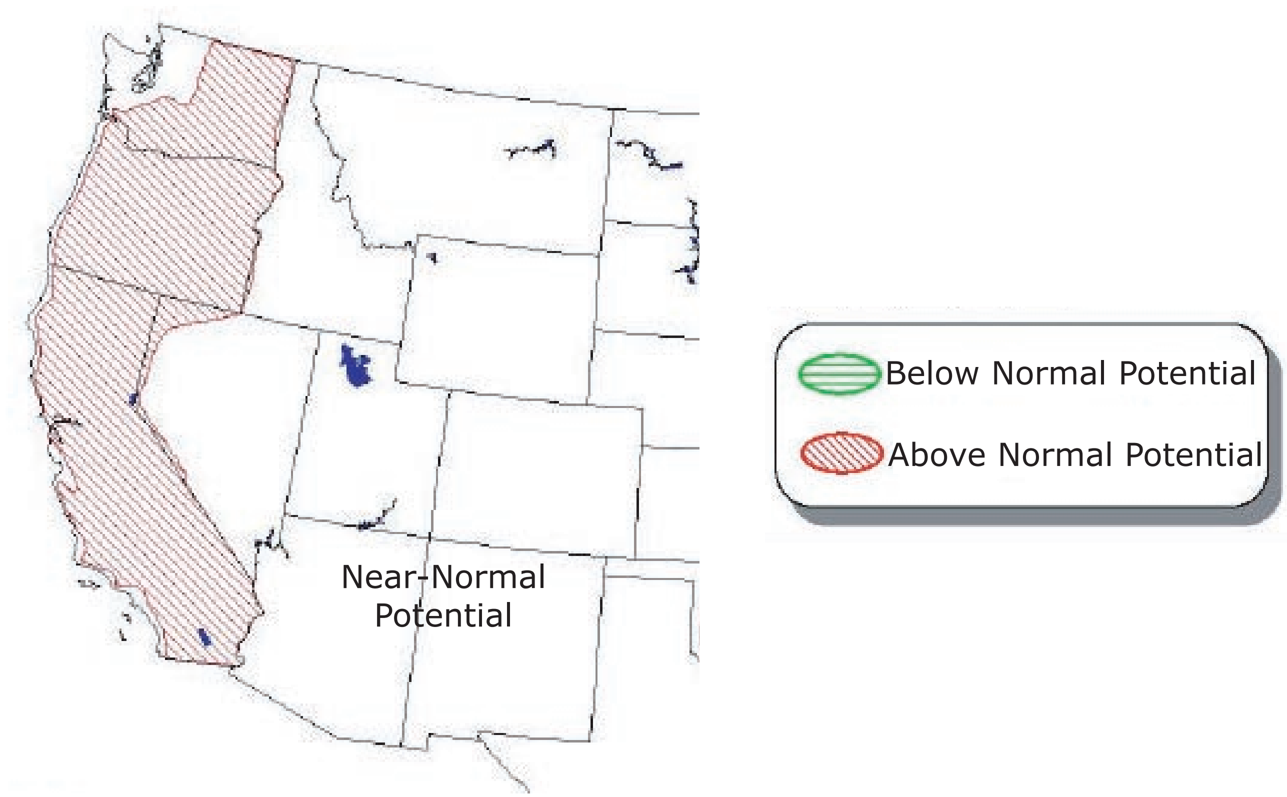
'Normal' on the PDSI scale is defined as amounts of moisture that reflect long-term climate expectations.

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 extreme to severe drought conditions for all of Arizona and north-central New Mexico; by contrast much of the rest of New Mexico is at near-normal conditions for this time of year. While the middle Rio Grande basin in central New Mexico received good summer rains, the PDSI is likely overstating the conditions on the Rio Grande (green climate division in Figure 12a). The seasonal drought outlook (Figure 12b) reflects the relief brought on by summer precipitation and by expectations of El Niño-related precipitation in the late fall and winter. Even so, drought conditions are likely to persist, as much of the Southwest is many inches below average precipitation for the calendar year.

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

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

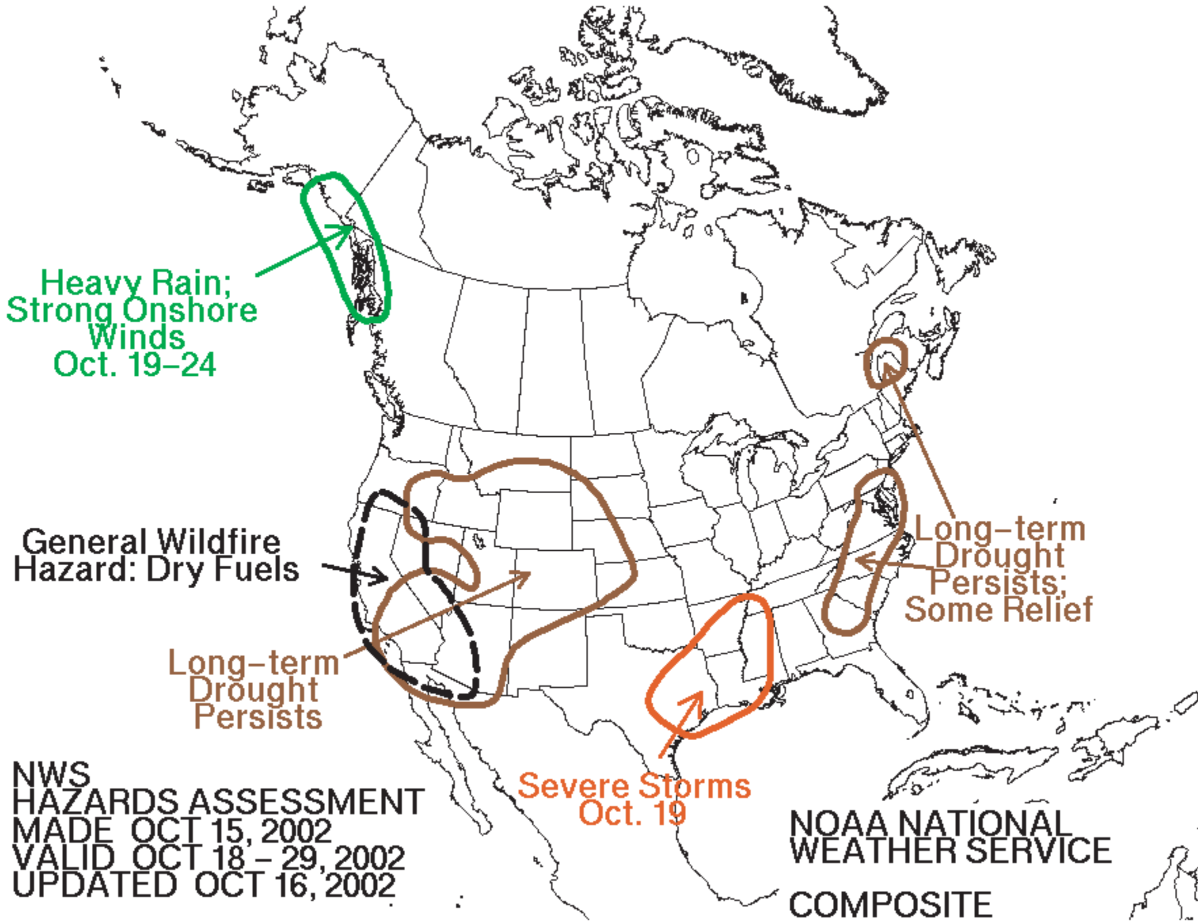


Notes: The National Wildland Fire Outlook (Figure 13) considers climate forecasts and surface-fuels conditions to assess fire potential. It is issued monthly by the National Interagency Fire Center.

Highlights: The high fire danger present in the Southwest during the summer months further diminished in September and is near-normal for all of Arizona and New Mexico. According to the Southwest Coordination Center, weather conditions have allowed fire management agencies to resume prescribed burning throughout the Southwest. As of October 17, there were 7 and 10 prescribed burns underway or planned for New Mexico and Arizona, respectively, for October. Additional prescribed burns are planned for the spring, contingent upon average or above-average winter precipitation levels.

For more detailed discussions, visit the National Wildland Fire Outlook web page: http://www.nifc.gov/news/nicc.html
For more detailed information on regional fire danger, visit 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 October 18 through October 29, 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.

Highlights: The U.S. Hazards Assessment indicates long-term, persistent drought for Arizona and for northwestern New Mexico. This map shows fire danger as a continuing threat in western Arizona. Westerly wind shear (often associated with El Niño events) is expected to continue to inhibit the development of high-intensity tropical storms on the West Coast, as we move into the end of the official hurricane season.

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.

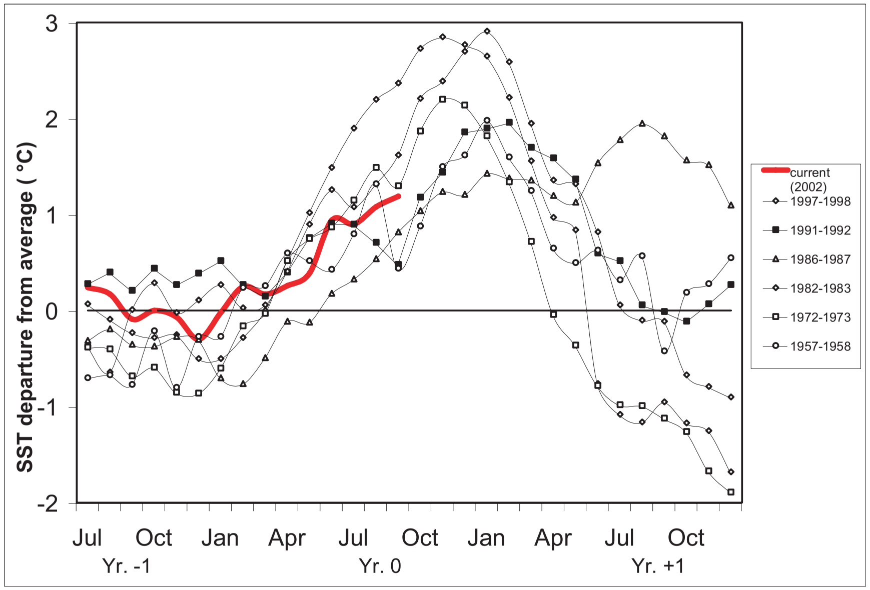
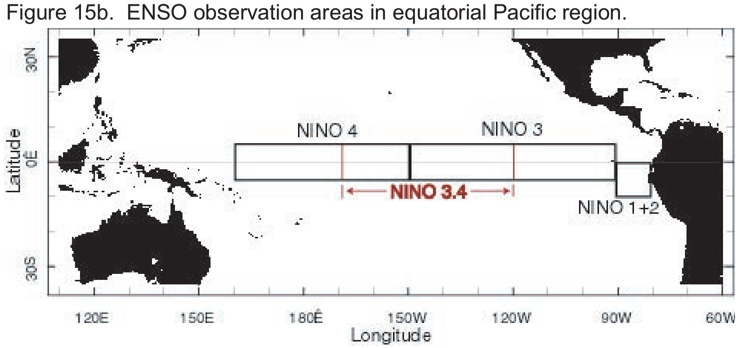


Figure 15b. ENSO observation areas in equatorial Pacific region.



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).

This year's SST departures are plotted as a thick red line. 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.

The probability of an El Niño is based on observations of sustained warming of sea surface temperatures (SSTs) across a broad region of the eastern and central equatorial Pacific Ocean, as well as the results of El Niño forecast models.

Highlights: Forecasts by both the International Research Institute for Climate Prediction (IRI) and the NOAA Climate Prediction Center (CPC) have not changed much since last month. The IRI concludes, in their October 16th forecast, that there is nearly 100% probability that El Niño conditions will continue for the remainder of 2002 and into early 2003 and that this will be a moderate El Niño event. The CPC forecast concurs with the IRI forecast and confirms that oceanic, atmospheric, and meteorological indicators of El Niño conditions have been present during the past month. Both the IRI and the CPC caution that the effects of this El Niño event are expected to be weaker than those associated with the 1997–98 El Niño event, though strong impacts 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. The Standard Precipitation Index: A Primer and Examples

The Standardized Precipitation Index (SPI) was formulated in 1993 by Tom McKee, Nolan Doesken, and John Kleist of the Colorado Climate Center. The SPI was designed to express the fact that it is possible to simultaneously experience wet conditions on one or more time scales and dry conditions at other time scales (and vice-versa). Consequently, a separate SPI value is calculated for each climate division for a selection of time scales, from one month to 72 consecutive months, ending on the last day of the latest month.

In calculating an SPI value, the historical "normal" (i.e., average) for each time scale listed above must be determined first by transforming the distribution of the historical data from its typical distribution to a normal, or bell-curve distribution (Figure 16a) using a mathematical function. Having data that are normally distributed is a prerequisite for statistical operations such as calculating the SPI. Once the data are normally distributed, standard deviations (S.D.) can be used to express the range of values in the distribution. It is this concept that is used for the SPI index and color scheme (Figure 16b). For example, one S.D. from the mean (in both directions) represents approximately 68% of all observations in a normal distribution and two S.D.'s away from the mean represents approximately 95% of all observations. Thus, the chance of a having an SPI value greater than +2 or less than –2 is only 5%.

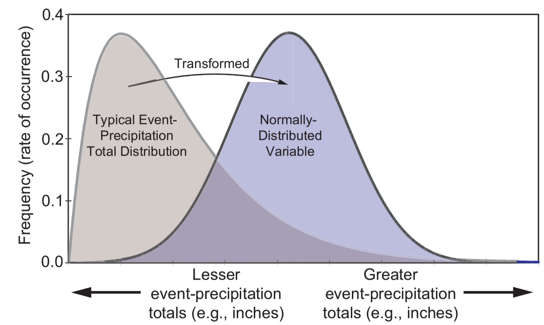
The SPI is especially useful for comparing recent conditions to historical conditions and comparing conditions across time scales. Figure 16c shows SPI values for the month of September 2002 and Figure 16d shows SPI values for the 12-month period October 2001 to September 2002. These two figures show that average to above-average precipitation received in the region during September (Figure 16c) does not make up for the lack of precipitation over longer time scales (Figure 16d). This type of information is difficult to ascertain using the PDSI index (see next page).

Maps of SPI for each climate division are created by the National Climate Diagnostics Center (NCDC) and are available at the following websites:

Western Regional Climate Center:
http://www.wrcc.dri.edu/spi/spi.html

National Climate Diagnostics Center:
http://lwf.ncdc.noaa.gov/oa/climate/research/prelim/drought/spi.html

Figure 16a. Typical precipitation distribution converted to a normal distribution.



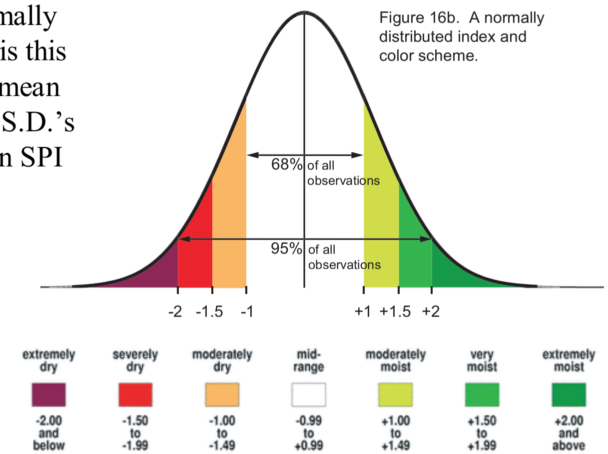
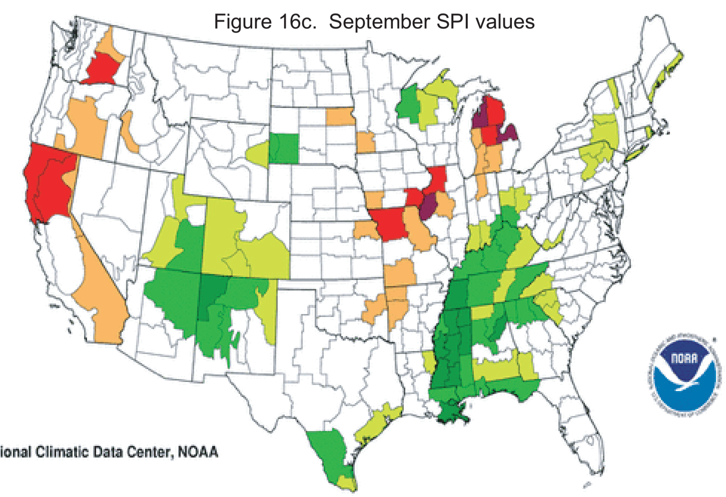


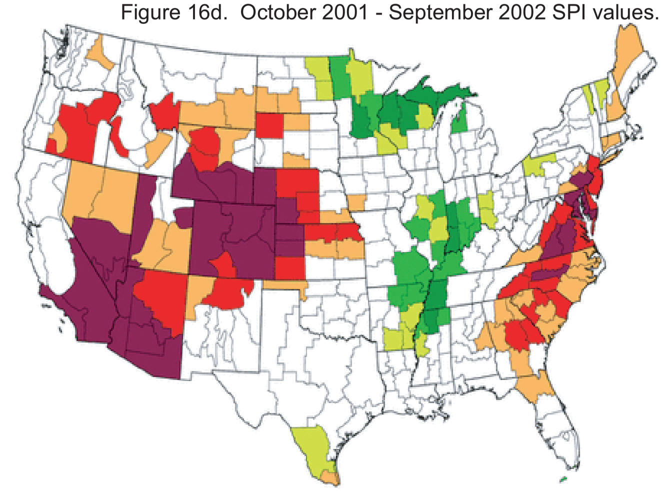
Figure 16b. A normally distributed index and color scheme.

Figure 16c. September SPI values



National Climatic Data Center, NOAA

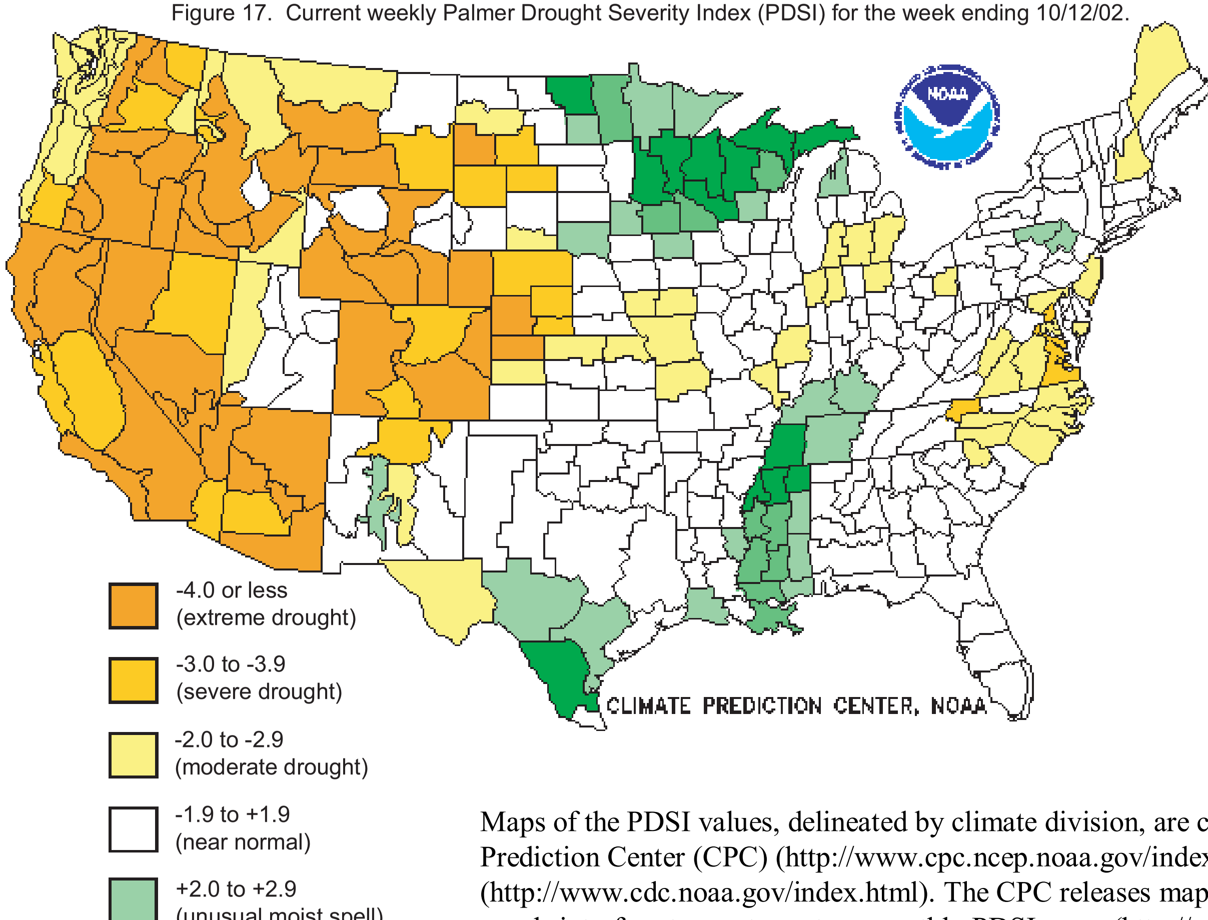
Figure 16d. October 2001 - September 2002 SPI values.



17. Explaining The Palmer Drought Severity Index (PDSI)

The Palmer Drought Severity Index (PDSI) is widely used as a tool to monitor and assess long-term meteorological drought in the United States and elsewhere. However, as demonstrated on page 15, it is clear that using the PDSI for locations other than where it was originally derived (i.e., Kansas) can produce less-than-accurate assessments of moisture conditions. The PDSI was specifically designed for semi-arid and dry subhumid climates where local precipitation is the primary source of moisture. As with any model, extrapolation to areas with different conditions can produce unreliable results.

Figure 17. Current weekly Palmer Drought Severity Index (PDSI) for the week ending 10/12/02.



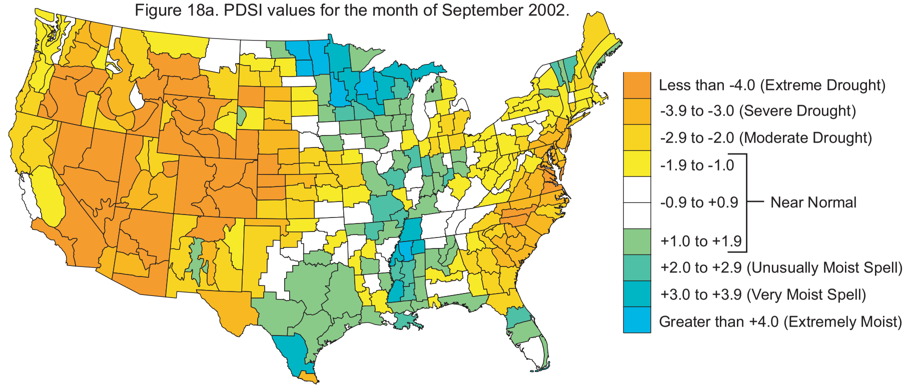
Deriving PDSI values involves the use of time-averaged (typically weekly or monthly but can also be daily) hydrological data to calculate potential and actual precipitation, evapotranspiration, and soil moisture-transfer estimates. Differences between potential and actual values are used to determine the amount of moisture required for "normal" weather during each time period. The difference between actual precipitation and that which is required for "normal" moisture conditions (based on modeled results) is used to derive indices of moisture anomalies (Figure 17). To determine the beginning, ending, and severity of drought (and wet) periods, the moisture anomaly index for the current time period is evaluated against the drought severity (and its trend) over the previous 9 time periods. From this, a probabilistic statement is formulated (ranging from 0% to 100%) indicating the likelihood that a wet or dry 'spell' has started or ended.

Maps of the PDSI values, delineated by climate division, are currently available from both the National Climate Prediction Center (CPC) (http://www.cpc.ncep.noaa.gov/index.html) and the Climate Diagnostics Center (CDC) (http://www.cdc.noaa.gov/index.html). The CPC releases maps with weekly PDSI values and the CDC provides a web-interface to create custom monthly PDSI maps (http://www.cdc.noaa.gov/USclimate/USclimdivs.html). Figures 5a, 5b and 17 were provided by CPC, and Figure 18a (following page) was provided by CDC.

18. Comparing PDSI and SPI Indices for Drought Assessment

Because the SPI and the PDSI are derived using different methodologies, yet both are used to represent moisture conditions, a comparison of the two indices is useful. While both the PDSI and SPI indices assess current conditions with respect to longer-term 'average' conditions, the SPI considers only long-term average and recent precipitation (up to last 72 months). The PDSI relies on hydrological modeling using measured precipitation calculations as inputs. In selecting which case to use, different factors should be considered. For example, the PDSI gives a snapshot in time of moisture conditions, but doesn't allow analysis across time. The SPI provides insight into moisture conditions for different time periods, but to obtain information about recent trends, multiple calculations across nested time scales must be made.

Figure 18a. PDSI values for the month of September 2002.

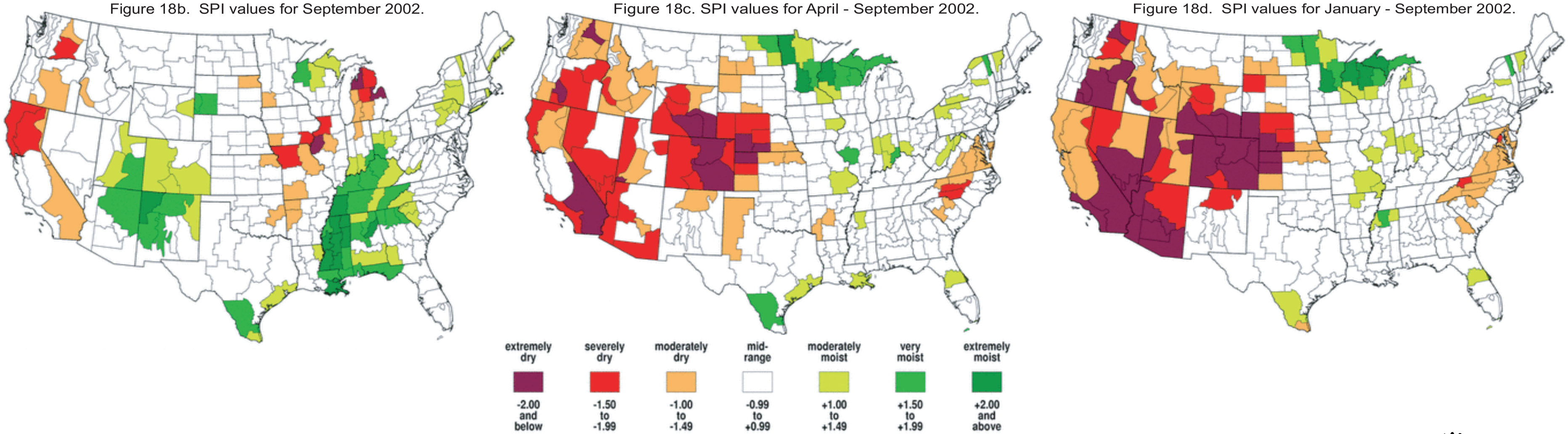


Example: Figure 18a shows climate division PDSI values for the United States for September 2002. Incorporated into the monthly PDSI values are the moisture conditions of the past 9 months. However, the trend over the past nine months is not necessarily evident in the index values. Figures 18b-d are SPI values for September, April through September, and January through September 2002, respectively. Creating such 'nested' SPI maps allows for the examination of trends in moisture availability over time. Each index provides useful information that the other may not provide or reveal clearly. A useful way to determine appropriate use of PDSI and SPI maps is to evaluate the information provided by each over several months in light of local conditions.

Figure 18b. SPI values for September 2002.

Figure 18c. SPI values for April - September 2002.

Figure 18d. SPI values for January - September 2002.



19. The Pacific Decadal Oscillation (PDO) ♦ Source: JISAO

Figure 19a. Typical SST, SLP, and windstress conditions for warm and cool phases of the PDO.

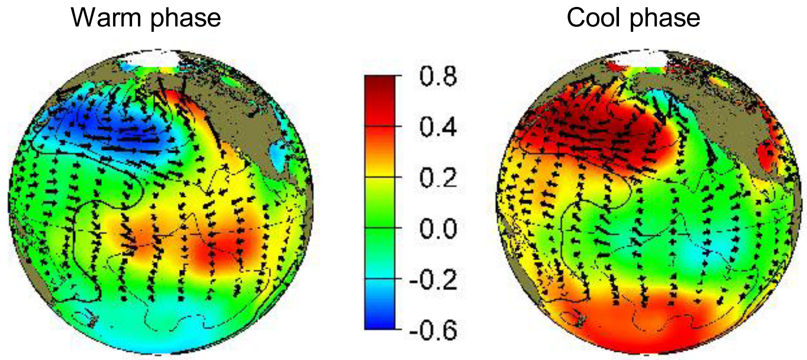
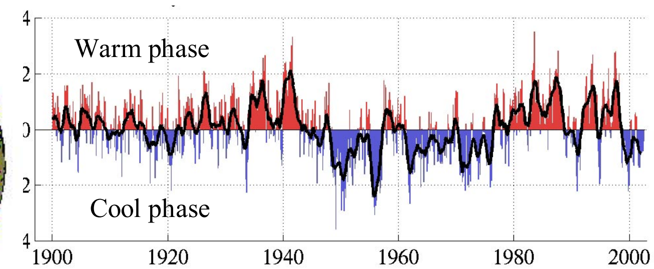


Figure 19b. Monthly values of the PDO Index from 1900–2002.



Highlights:

The Pacific Decadal Oscillation (PDO) refers to variability in sea-surface temperature (SST) in the northern Pacific Ocean, which may be anomalously cool or warm depending on location and time. Figure 19a shows typical conditions during what researchers have termed the "warm phase" and the "cool phase," respectively, of the PDO. During the warm phase, SSTs are above average along the North American Pacific Coast; during the cool phase, the Pacific Coast is cooler than average. These basin-wide temperature patterns are accompanied by characteristic sea-level pressure (SLP) and wind anomaly patterns (Figure 19a). The North Pacific remains in each phase for 20 to 30 years at a time (Figure 19b; notice the solid black line); however, within each cool or warm phase, there are often rapid temperature changes of short duration (Figure 19b; notice the abrupt changes between red and blue). Recent conditions in the northern Pacific suggest a possible reversal to cool PDO conditions in 1998; however, this may be a short-term reversal. Only time will tell! The PDO was first documented in the 1990s, and this is the first time that we might actually observe a shift.

PDO phase has been linked to major patterns in northeast Pacific marine ecosystems. Warm phases correspond with enhanced coastal ocean biological productivity (in other words, more fish and other critters, and concomitantly, higher catch levels for commercial fisheries like salmon) off Alaska and inhibited productivity off the U.S. West Coast, while cool PDO phases show the opposite pattern. PDO phase also is linked to North American (and Southwest) climate; this is discussed in the next background page.

Please see Nate Mantua and Steve Hare's website at http://tao.atmos.washington.edu/pdo/ for more information about the PDO.

Notes:

Figure 19a shows typical wintertime anomaly patterns for sea-surface temperature (SST) in color, sea level pressure (SLP) in contours, and surface windstress with arrows during the warm and cool phases of the PDO.

Figure 19b is based on seasonally averaged PDO Index values for North Pacific Ocean SSTs from 1900 through 2002. The solid black line depicts the 5-year running average of the index. The Pacific Decadal Oscillation Index is statistically constructed from monthly SST data in the Pacific Ocean poleward of 20°N and is based on 1900–1993 average SST conditions.

Much of the information presented here has been drawn from the work of Nate Mantua and Steve Hare of the University of Washington's Joint Institute for the Study of the Atmosphere and Ocean (JISAO). Figures 19a-b were obtained from the WWW, URL http://jisao.washington.edu/pdo/img on October 15, 2002.

20. The PDO and Climate Variability in the Southwest

Table 20a. Combined ENSO/PDO impacts on Southwest winter precipitation (after Gershunov and Barnett, 1998).

Warm PDO phase	Cool PDO phase
Enhanced El Niño impacts	Weak/inconsistent El Niño impacts
Weak/inconsistent La Niña impacts	Enhanced La Niña impacts

Notes:

Table 20a is summarized from Gershunov, Alexander, and T.P. Barnett, 1998. Interdecadal modulation of ENSO teleconnections. *Bulletin of the American Meteorological Society* 79:2715–2725.

Figures 20b and 20c, as well as much of the material presented in the Highlights section, is based on the work of Charles Liles, National Weather Service (Albuquerque office) and is used with his permission.

Figure 20b. Percent of average September–May precipitation in New Mexico during El Niño events (1900–2000).

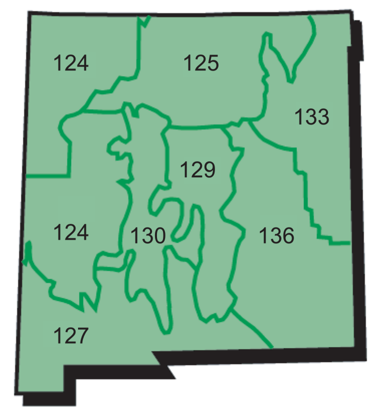
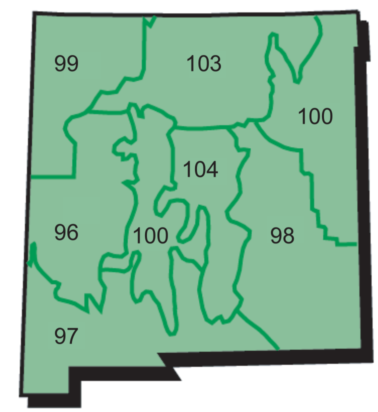


Figure 20c. Percent of average September–May precipitation in New Mexico during combined El Niño events and PDO cool phases (1900–2000).



Highlights: PDO phase has strong impacts on September–May precipitation and temperature in North America. With respect to the Southwest, these impacts vary between Arizona and New Mexico and with season. In New Mexico, PDO impacts on precipitation are most pronounced in the spring. Based on an analysis of climate division precipitation and the PDO Index from 1900–1999, cool phases of the PDO are associated with 79% of average precipitation and warm phases, with 142%. This effect increases from north to south in New Mexico. Generally speaking, PDO phase is not as strongly correlated with precipitation in Arizona, although more precipitation tends to fall when the PDO is in a warm phase and less when it is in a cool phase.

ENSO also impacts precipitation and temperature in North America (e.g., wet winters during El Niño events), so a logical question is, how are ENSO and the PDO related to one another? This month's newsletter article on the PDO discusses some of the current scientific ideas on this subject. Table 20a shows the combined effects of ENSO and the PDO on precipitation in the Southwest during the winter. When the PDO is in its warm phase, El Niño impacts on precipitation are strong and stable—in other words, it is much more likely that the Southwest will experience a wet winter. Possibly, the SST patterns associated with both El Niño and warm PDO phase are related to atmospheric conditions that steer more and wetter Pacific storms into the Southwest. Cool PDO phases strengthen La Niña impacts on winter precipitation in the Southwest—you can pretty much count on dry winters. By contrast, wintertime precipitation is variable with La Niña/warm PDO and El Niño/cool PDO combinations, making it difficult to predict winter rainfall in these cases. Figures 20b-c illustrate the confounding influence that PDO conditions (in this case, the cool PDO phase) can have on El Niño precipitation impacts in New Mexico.

For more information about the PDO and North American climate variability, see Nate Mantua and Steve Hare's website at http://tao.atmos.washing.edu/pdo