California Climate Watch

A monthly newsletter monitoring California climate

September 2004
http://www.calclim.dri.edu

Summary of the Month

by Laura Edwards
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Editor's Note: Bill Mork is on vacation this month.

A fairly uneventful September was punctuated by a record rainfall event in Sacramento on the 19th. The 1.93 inches in two hours on that date broke four records: all-time and September 1-hour rainfall (1.81"), September 2-hour rainfall (1.93"), September 30-minute rainfall (1.08"), and September 10-minute rainfall (0.38"). Most of these totals crushed previous records, with 10- to 10000-year return periods.

Overall the state average temperature was close to normal, coming in at 68.7 F, just 0.5 degrees above normal. Warmer maximum temperatures and cooler minimums statewide contributed to the near-normal conditions.

Most climate divisions had mixed results with stations recording positive and negative temperature anomalies in each division. Some remarkable stations include Richmond, Redwood City and San Francisco airport all averaging over 3 degrees above normal in the Central Coast. Porterville and Yosemite were both below normal for the month, with –3.4 and –2.8 degree departures respectively.

Precipitation statewide was around 22% of normal. The North Coast region reported the smallest precipitation departure with 31% of normal, and the Northeast Interior had the largest deficit with only 2% of normal precipitation reported.

***WEATHER** continued on page 2.*

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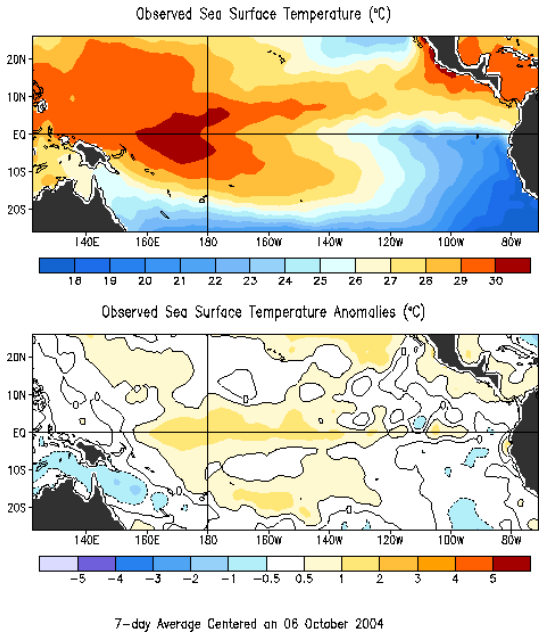
El Niño Effects on California Precipitation

By Laura Edwards

Now that El Niño has been officially declared (1), it is time to refresh ourselves on what this really means for Californians. Does this mean flood or drought? What impact can we expect on the current drought situation in the West, and California? There is always talk of impending doom and gloom, but let's take a look at past El Niño events and try to straighten out the story.



First of all, how is El Niño defined? In answering this question, El Niño is only part of a larger phenomenon called El Niño-Southern Oscillation (ENSO). Early research in ENSO used the barometric pressure difference between Tahiti and Darwin, Australia to define to Southern Oscillation Index El Niño is the warming of eastern Pacific tropical waters, and La Niña is the cooling of these waters, which is closely linked to the pressure.

ENSO prediction has come a long way since then. Sea surface temperatures (SST) can now be remotely sensed by satellite, and from sources like buoys in the TOGA/TAO array in the equatorial Pacific. Currently, the official definition of El Niño from the Climate Prediction Center (CPC) is three consecutive months of average SST of at least 0.5 degrees Celsius above normal in a specific region of the Pacific Ocean around the equator. The months of June, July and August have fulfilled this requirement. This year, CPC predicts a weak El Niño event, so its effects may not be as significant, or memorable, as El Niños past, such as in 1982-3 and 1997-8. But, as the saying goes, anything can happen.

This warming of oceanic waters many miles away can force a large portion of the Pacific's atmosphere to change its pattern for periods of months to years. For California this means a southward shift in the subtropical jet stream and storm tracks. In addition, faster zonal (west to east) flow is produced. These three things add up to increased storminess and moister air. This brings mixed consequences for winter precipitation across the state.

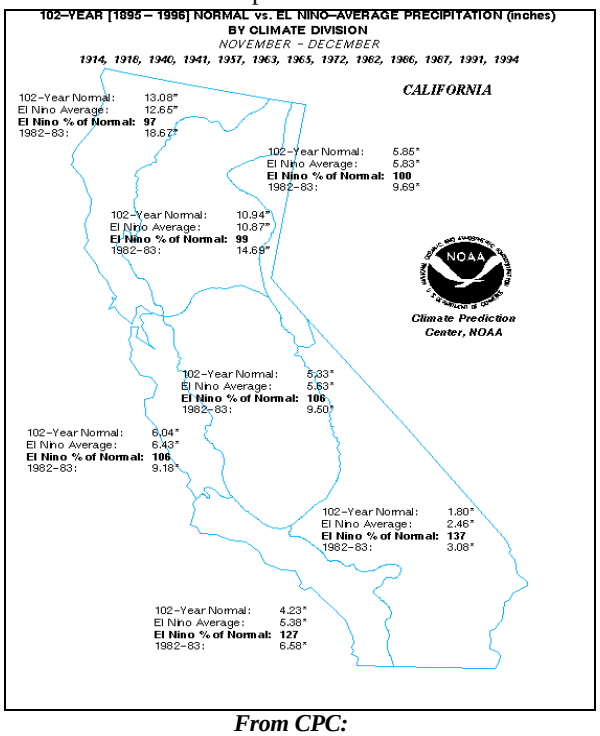
***ENSO** continued on page 2.*

WEATHER (continued from page 1):

Outside of the localized record precipitation event in Sacramento, most of the state was below normal for the month. Of the remaining stations reported in this *Climate Watch*, only Oakland Museum and Thermal airport had above normal precipitation.

ENSO (continued from page 1):

In southern California, most El Niño events (warm ENSO events) bring anomalously wet conditions in the winter season (2, 3, 4). According to the CPC on their website (4), climate divisions in southern California received 106-137% of normal precipitation during warm ENSO events since 1895 for the months of November and December. Climate divisions in the north receive near-normal precipitation, 97-100% of normal for the same period.



From CPC:
http://www.cpc.noaa.gov/products/predictions/threats2/enso/elnino/jfmpstat/ca0.gif

CPC also found that for the January-March period, precipitation has averaged above normal in all climate divisions in California, varying from 106% of normal in the northeast to 144% of normal in the southeast desert.

Castello and Shelton (3) found above average precipitation at all U.S. Pacific coastal locations south of 43°N (just north of the California-Oregon border) for El Niño events between 1948-95.

The work of Schonher and Nicholson (2) agrees as well. They examined 11 ENSO events between 1950 and 1982 finding that six of 11 events produced unusually wet conditions in California. Their percent of normal calculations were higher than those of CPC, with 160-185% of normal in the south and 120-125% of normal in the north.

All of these sources point to above-average precipitation for California, with perhaps a slightly more pronounced anomaly in the southern regions. Does this mean we'll all be swamped under water? Well maybe if you live in southern coastal California.

Andrews et al (5) found that "floods are significantly larger during an El Niño phase than a non-El Niño phase" in coastal areas south of 35°N, around the San Luis Obispo/Santa Barbara county line. In addition, they found flood magnitude does not have a strong correlation with the relative strength of the El Niño phase. CPC is currently predicting a weak El-Niño, but this only signals above-average precipitation, and does not give us much information regarding coastal flooding.

Despite what these published research studies tell us, this year's El Niño is might prove to be a drier event than usual. Precipitation can vary with each event, and is hard to predict. With each ENSO event, warm, cool, or neutral, the research community learns something new about this phenomenon and its effects on California and the West. The current drought will require consecutive years of above-average precipitation to regain normal conditions, but this year's El Niño may help the region begin to recover. Stay tuned to the links below at CPC for regular updates on the current El Niño this season.

For more information:
Climate Prediction Center (CPC) ENSO page:
http://www.cpc.noaa.gov/prodcuts/analysis_montiroing/lanina/

CPC Jan-Feb-Mar 2005 precipitation prediction:
http://www.cpc.noaa.gov/products/precip/Cwlink/ENSO/plot/p.outlook.3.gif

Weekly ENSO update:
http://www.cpc.noaa.gov/products/analysis_monitoring/enso_update/index.html

Climate Diagnostics Center ENSO page:
http://www.cdc.noaa.gov/ENSO/#forecasts

References:

1. CPC ENSO Diagnostic Discussion October 7, 2004, http://www.cpc.noaa.gov/products/analysis_monitoring/enso_advisory/index.html

2. Schonher, T. and S. E. Nicholson, 1989. The relationship between Califonia rainfall and ENSO events. *Journal of Climate*, **2 (11)**: 1258-1269.

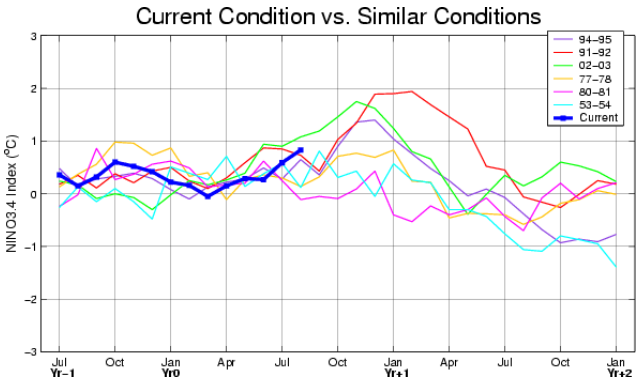
3. Castello, A. F. and M. L. Shelton, 2004. Winter precipitation on the US Pacific coast and El Niño-Southern Oscillation events. *International Journal of Climatology*, **24:** 481-497.

4. CPC ENSO impacts on California: http://www.cpc.noaa.gov/products/predictions/threats2/enso/elnino/ca_bar.html

5. Andrews, E. D., R. C. Antweiler, P. J. Neiman and F. M. Ralph, 2004. Influence of ENSO on flood frequency along the California coast. *Journal of Climate* **17 (2)**: 337-348.

CLIMATE FORECASTS & OUTLOOKS

ENSO October forecasts:



Summary of September 2004 ENSO Forecast

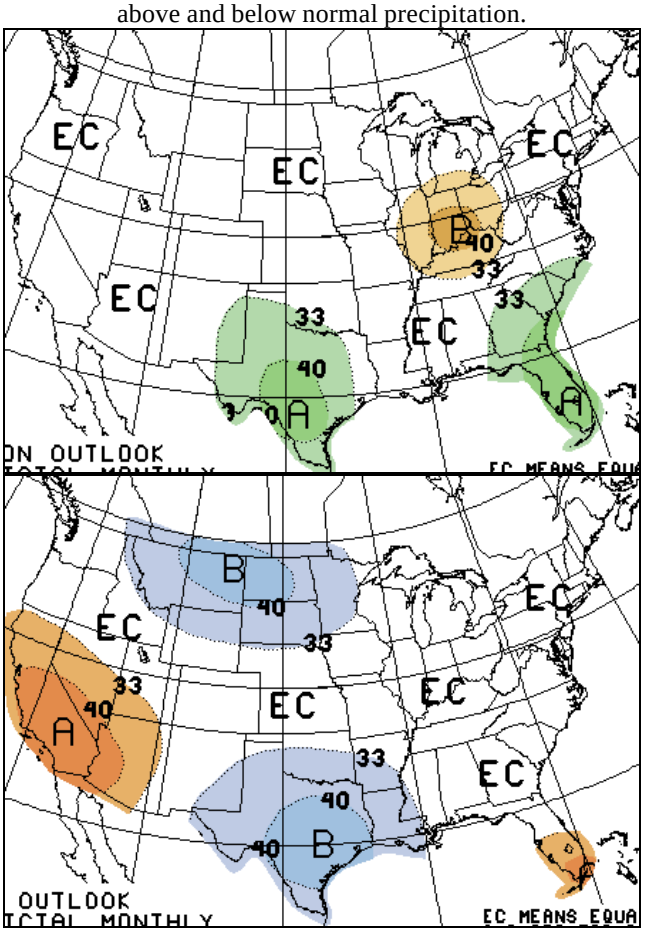
Forecast Period:	Jan. 2005 – Mar. 2005
Probability of El Niño	0 50 100 (low medium high)
Probability of La Niña	0 50 100 (low medium high)
Probable Magnitude of Event	weak

Based on sea surface temperature departures from the long-term average over the "Nino 3.4" region (120-170W, 5S-5N).

http://iri.columbia.edu/climate/ENSO/currentinfo/QuickLook.html

Precipitation and Temperature Outlooks:

The September climate forecast for October calls for above average temperatures across California, with equal chances of above and below normal precipitation.

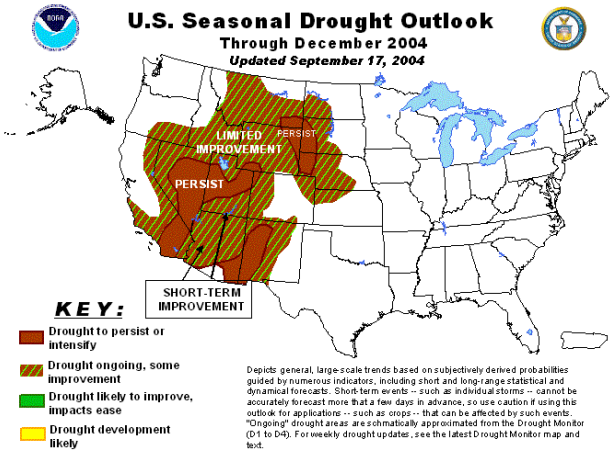


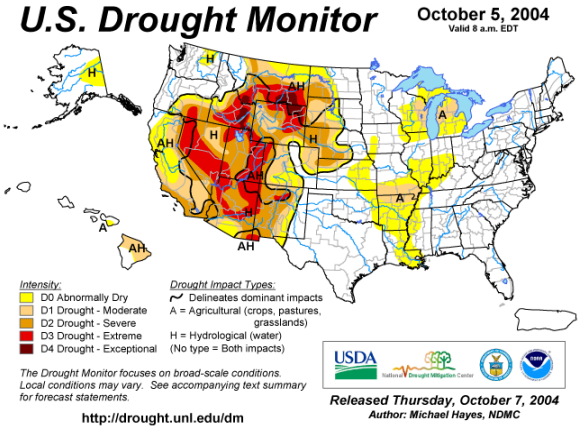
Precipitation Outlook is on the top, Temperature Outlook is on the bottom.

Source: Climate Prediction Center, http://www.cpc.noaa.gov/

Drought Conditions:

Agricultural and hydrological drought is widespread in California. Some relief may be in sight for most of the drought-stricken area, with the exception of a swath fromLos Angeles area to the Mojave.





Credit: CPC/NCEP & http://www.drought.unl.edu/dm/monitor.html

September Station Data

All data is provisional and subject to change.

STATION NAME/ CLIMATE DIVISION	TAVG	DEP	TMAX	DEP	MGX	XMX	TMIN	DEP	MGN	XMN	PREC	PDEP	MGP	XPC	PPCT
North Coast	***65.9***	***0.9***	***81.7***	***2.2***	***0***	***94***	***50.2***	***-0.4***	***0***	***59***	***0.20***	***-0.39***	***0***	***0.16***	***3***
Eureka	58.1	0.7	65.6	2.0	0	70	50.5	-0.7	0	53	0.68	-0.18	0	0.37	7
Kentfield	68.4	1.1	82.5	0.4	0	98	54.3	1.8	0	73	0.17	-0.33	0	0.17	3
Napa	69.4	2.0	84.7	2.9	0	100	54.1	1.0	0	63	0.14	-0.27	0	0.14	3
Santa Rosa	68.3	1.1	86.8	5.0	0	99	49.8	-2.7	0	56	0.04	-0.45	0	0.11	
Ukiah AP	68.9	N/A	87.7	N/A	0	102	50.2	N/A	0	58	0.13	N/A	0	0.13	N/
Yreka	62.5	-0.4	82.9	0.6	0	96	42.2	-1.4	0	53	0.01	-0.74	0	0.01	
Sacramento Drainage	***61.6***	***0.3***	***79.2***	***0.2***	***2***	***90***	***43.9***	***0.5***	***2***	***54***	***0.16***	***-0.84***	***2***	***0.13***	***1***
Alturas	55.8	-1.9	77.1	-2.4	0	88	34.6	-1.2	0	50	0.34	-0.32	0	0.28	5
Adin Ranger Stn	60.6	-0.2	79.5	1.7	0	89	41.7	-2.0	0	52	0.09	-0.78	0	0.08	1
Blue Canyon	63.2	1.0	70.3	-1.1	0	82	56.2	3.1	0	66	0.41	-1.03	0	0.33	2
Burney	59.1	1.4	80.2	-1.5	0	91	38.0	4.4	0	44	0.28	-0.59	0	0.28	3
Dunsmuir Treatment	64.8	0.9	84.3	1.0	3	96	45.3	0.8	3	54	0.02	-1.33	3	0.02	
Marysville	72.3	-0.8	89.1	-0.6	0	100	55.6	-1.0	0	65	0.01	-0.39	0	0.01	
Mineral	56.5	1.4	75.8	2.6	10	86	37.2	0.1	10	44	0.00	-1.53	11	0.00	
Mt. Shasta	60.2	0.7	77.5	1.5	0	88	42.9	0.0	0	56	0.09	-0.78	0	0.06	1
Paradise	73.4	1.1	85.4	0.2	0	96	61.4	2.0	0	74	0.07	-1.05	0	0.07	
Portola	57.1	1.3	77.6	1.2	13	88	36.5	1.3	13	59	0.00	-0.78	4	0.00	
Quincy	61.9	1.0	84.1	-0.2	0	94	39.7	2.2	0	53	0.33	-0.51	1	0.25	3
Redding	73.8	0.4	89.4	-0.8	0	102	58.1	1.6	0	71	0.30	-0.18	0	0.30	6
Red Bluff FSS	74.2	-0.7	89.4	-1.1	0	102	59.0	-0.3	0	71	0.10	-0.58	0	0.10	1
Sacramento AP	72.1	0.4	87.8	0.3	0	101	56.4	0.6	0	66	0.17	-0.19	0	0.16	4
Sacramento City	74.2	0.4	89.6	1.0	0	103	58.9	-0.1	0	66	1.93	1.56	0	1.93	52
Shasta Dam	75.1	0.6	88.2	1.1	0	102	62.0	0.1	0	72	0.08	-1.55	0	0.07	
Northeast Interior	***56.0***	***1.6***	***76.0***	***2.5***	***4***	***86***	***36.0***	***0.8***	***4***	***49***	***0.01***	***-0.64***	***1***	***0.01***	***2***
Boca	52.3	-1.2	77.5	1.4	1	88	27.1	-3.9	1	39	0.21	-0.64	1	0.19	2
Bodie	47.7	-0.7	71.6	1.8	2	81	23.7	-3.3	2	35	0.07	-0.54	1	0.07	1
Bridgeport	52.3	-0.2	75.7	1.9	0	87	28.9	-2.4	0	44	0.00	-0.50	0	0.00	
Markleeville	61.3	5.4	78.7	3.4	0	90	44.0	7.4	0	63	0.00	-0.75	1	0.00	
Susanville 2 SW	62.0	1.9	78.9	0.5	0	90	45.1	3.3	0	55	0.00	-0.49	0	0.00	
Tahoe City	56.7	1.8	74.9	4.8	16	82	38.4	-1.2	16	49	0.05	-0.85	0	0.05	
Central Coast	***67.1***	***1.0***	***80.0***	***1.9***	***0***	***98***	***54.2***	***0.2***	***0***	***62***	***0.08***	***-0.22***	***0***	***0.08***	***2***
Gilroy	70.1	0.0	86.8	1.0	0	103	53.4	-0.9	0	61	0.17	-0.16	0	0.12	5
Hollister	67.8	1.1	84.3	2.5	0	102	51.4	-0.2	0	58	0.00	-0.21	0	0.00	
King City	67.4	-0.7	86.5	1.5	4	104	48.3	-2.9	4	54	0.00	-0.25	2	0.00	
Morro Bay	59.8	-0.4	64.9	-2.8	0	78	54.6	2.0	0	59	0.00	-0.37	2	0.00	
Oakland Museum	68.0	1.6	77.6	3.0	0	93	58.5	0.3	0	66	0.59	0.26	0	0.59	17
Paso Robles AP	68.9	-1.1	90.0	0.9	0	105	47.8	-3.0	0	55	0.00	-0.36	0	0.00	
Redwood City	69.5	3.7	82.4	3.9	0	99	56.7	3.5	0	66	0.13	-0.08	0	0.13	6
Richmond	68.0	3.2	78.1	4.7	0	96	57.9	1.8	0	71	0.00	-0.27	0	0.00	
Salinas AP	64.9	0.5	77.1	2.6	0	97	52.7	-1.7	0	59	0.01	-0.20	0	0.01	
San Fran MD	65.2	1.5	73.6	2.3	0	96	56.8	0.7	0	73	0.04	-0.24	0	0.04	1
San Francisco AP	67.3	3.4	77.2	4.5	0	94	57.5	2.4	0	68	0.04	-0.16	0	0.04	2
San Jose	70.0	0.6	82.8	0.6	0	97	57.1	0.4	0	65	0.06	-0.17	0	0.15	2
San Luis Obispo	67.7	0.4	82.2	0.4	0	104	53.2	0.4	0	60	0.00	-0.44	0	0.00	
Santa Cruz	64.6	0.7	76.6	1.0	0	98	52.5	0.4	0	59	0.02	-0.39	0	0.02	

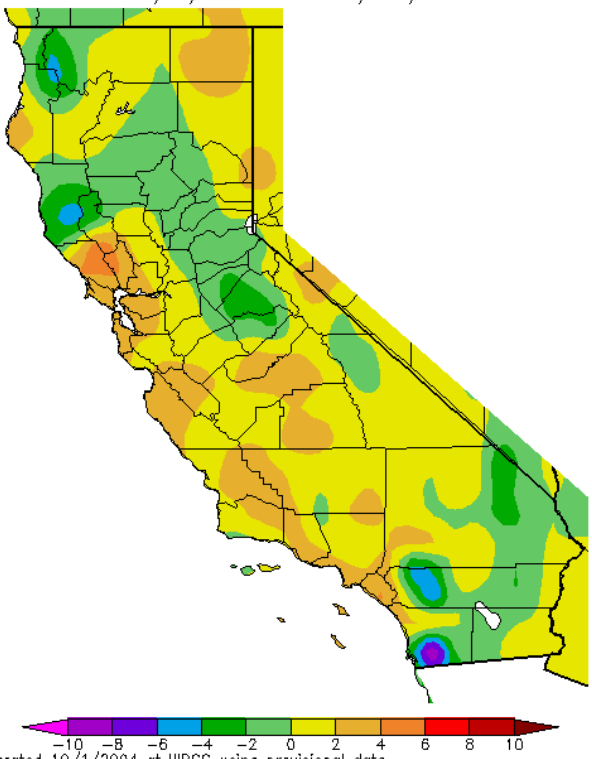
STATION NAME/ CLIMATE DIVISION	TAVG	DEP	TMAX	DEP	MGX	XMX	TMIN	DEP	MGN	XMN	PREC	PDEP	MGP	XPC	PPC
San Joaquin	***68.6***	***-0.9***	***85.0***	***0.2***	***1***	***97***	***52.3***	***-2.0***	***1***	***63***	***0.03***	***-0.52***	***1***	***0.02***	
Bakersfield	76.4	-0.3	90.5	1.1	0	103	62.4	-1.5	0	78	0.00	-0.15	0	0.00	
Coalinga	74.0	-2.2	90.0	-2.5	0	103	58.0	-2.0	0	66	0.00	-0.32	1	0.00	
Fresno	75.9	1.3	90.8	2.0	0	105	61.0	0.6	0	69	0.00	-0.26	0	0.00	
Glennville	62.4	-1.5	81.7	-0.6	4	92	43.0	-2.4	4	53	0.00	-0.53	6	0.00	
Grant Grove	59.3	1.7	70.9	3.2	2	83	47.7	0.2	2	58	0.17	-1.08	2	0.17	1
Hanford 1 S	72.4	-0.9	91.1	1.8	0	101	53.8	-3.5	0	66	0.00	-0.25	0	0.00	
Lodgepole	52.9	-0.1	69.2	0.9	1	81	36.6	-1.1	1	46	0.17	-1.34	1	0.07	1
Madera	72.3	-1.1	90.2	0.4	0	104	54.4	-2.6	0	63	0.02	-0.21	0	0.02	
Porterville	73.1	-3.4	89.9	-1.9	0	100	56.3	-4.9	0	68	0.00	-0.35	0	0.00	
Stockton WSO	72.2	-0.5	89.3	1.1	0	102	55.2	-2.2	0	65	0.02	-0.31	0	0.00	
Yosemite	64.0	-2.8	81.2	-3.0	5	96	46.8	-2.6	5	58	0.00	-0.92	6	0.00	
South Coast	***71.2***	***1.2***	***82.8***	***1.5***	***3***	***98***	***59.5***	***0.9***	***3***	***69***	***0.03***	***-0.28***	***3***	***0.03***	
Alpine	73.7	0.2	86.8	0.4	7	99	60.5	-0.1	7	72	0.00	-0.42	5	0.00	
Anaheim	75.7	2.5	86.6	2.0	4	97	64.7	3.0	4	72	0.00	-0.06	4	0.00	
Big Bear Lake	58.1	1.0	74.4	0.8	7	85	41.7	1.1	7	60	0.02	-0.51	7	0.01	
Burbank	75.2	1.7	86.6	-0.5	0	100	63.9	4.0	0	73	0.00	-0.30	0	0.00	
Campo	67.4	-1.3	86.1	-2.7	3	101	48.6	-0.1	3	66	0.00	-0.40	3	0.00	
Culver City	74.9	4.2	85.0	4.8	16	101	64.9	3.6	16	68	0.00	-0.08	16	0.00	
El Cajon	75.6	1.7	86.7	0.2	5	101	64.6	3.3	5	101	0.00	-0.15	4	0.00	
Escondido 2	75.3	1.3	89.2	2.3	12	101	61.4	0.3	12	70	0.00	-0.22	11	0.00	
Idyllwild Fire D	64.4	1.7	82.0	3.7	9	92	46.8	-0.3	9	57	0.56	-0.46	9	0.56	5
Lompoc	65.5	-0.2	77.4	-0.4	2	97	53.7	0.1	2	62	0.00	-0.24	1	0.00	
Long Beach AP	74.1	0.7	83.2	0.1	0	102	64.9	1.2	0	71	0.00	-0.24	0	0.00	
Los Angeles Down	74.6	0.6	84.2	0.9	0	101	65.0	0.4	0	71	0.00	-0.32	0	0.00	
Los Angeles AP	72.5	2.4	79.8	3.3	0	101	65.2	1.6	0	71	0.01	-0.25	0	0.01	
Riverside Citrus	76.3	1.2	93.4	2.8	3	105	59.1	-0.5	3	68	0.00	-0.26	0	0.00	
Newport Beach Ha	71.1	3.0	76.9	4.0	0	91	65.3	2.1	0	71	0.00	-0.30	0	0.00	
San Diego AP	72.6	1.0	78.1	1.1	0	96	67.1	1.0	0	73	0.00	-0.21	0	0.00	
Sandberg WSMO	68.6	-0.6	78.6	-0.4	0	92	58.6	-0.9	0	72	0.01	-0.24	0	0.01	
Santa Ana Fire S	75.1	2.0	87.1	3.7	1	104	63.1	0.2	1	70	0.00	-0.34	1	0.00	
Santa Barbara	66.5	-0.9	78.2	0.0	0	95	54.8	-1.8	0	63	0.04	-0.38	0	0.01	1
Santa Maria AP	64.6	0.7	77.6	2.7	0	98	51.6	-1.3	0	59	0.04	-0.27	0	0.01	1
UCLA	72.7	2.5	81.6	3.7	4	100	63.7	1.3	4	69	0.00	-0.32	3	0.00	
Southeast Desert	***79.6***	***-0.8***	***96.4***	***0.0***	***0***	***108***	***62.9***	***-1.7***	***0***	***76***	***0.13***	***-0.26***	***1***	***0.11***	***2***
Bishop	66.0	-1.2	87.2	-0.4	0	100	44.8	-2.1	0	54	0.00	-0.28	0	0.00	
Blythe	85.6	-0.4	100.2	0.6	0	112	70.9	-1.5	0	83	0.13	-0.37	0	0.11	2
Daggett AP	80.1	0.7	94.6	-0.1	0	108	65.6	1.5	0	76	0.11	-0.22	0	0.08	3
Imperial	84.5	-0.7	100.1	0.5	0	110	68.8	-1.9	0	83	0.00	-0.36	0	0.00	
Inyokern	74.8	-1.4	93.1	-1.0	1	105	56.5	-1.8	1	69	0.00	-0.25	5	0.00	
Lancaster	73.2	0.7	90.8	2.4	0	105	55.7	-1.1	0	77	0.00	-0.20	0	0.00	
Needles AP	87.8	0.4	100.9	0.1	0	111	74.8	0.7	0	93	0.16	-0.44	0	0.08	2
Palm Springs	85.0	-0.9	98.6	-2.7	1	110	71.3	0.8	1	84	0.09	-0.30	1	0.09	2
Thermal AP	82.7	-1.7	100.0	-0.6	0	110	65.4	-2.9	0	79	0.69	0.28	0	0.69	16
Twentynine Palms	76.7	-3.7	98.2	0.9	1	109	55.2	-8.3	1	65	0.07	-0.48	1	0.07	1
STATEWIDE AVERAGE	**68.7**	**0.5**	**83.7**	**1.1**	**2**	**97**	**53.6**	**-0.1**	**2**	**64**	**0.11**	**-0.40**	**1**	**0.10**	**2**

All data is provisional and subject to change.
Normal period is 1971-2000.

TAVG = average temperature in Fahrenheit
DEP = departure from average
TMAX = average maximum temperature in Fahrenheit
MGX = number of missing daily max temperature values
TMIN = average minimum temperature in Fahrenheit
MGN = number of missing daily min temperature values
MGP = number of missing daily precipitation values
PREC = total monthly precipitation in inches
PDEP = monthly precipitation departure from normal in inches
PPCT = monthly precipitation percent of normal

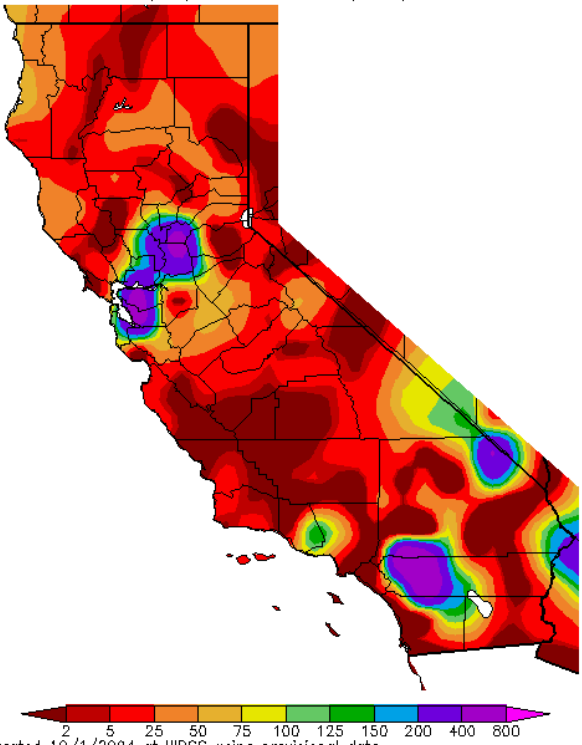
Climate Maps for September

Av. Max. Temperature dep from Ave (deg F)
9/1/2004 – 09/30/2004



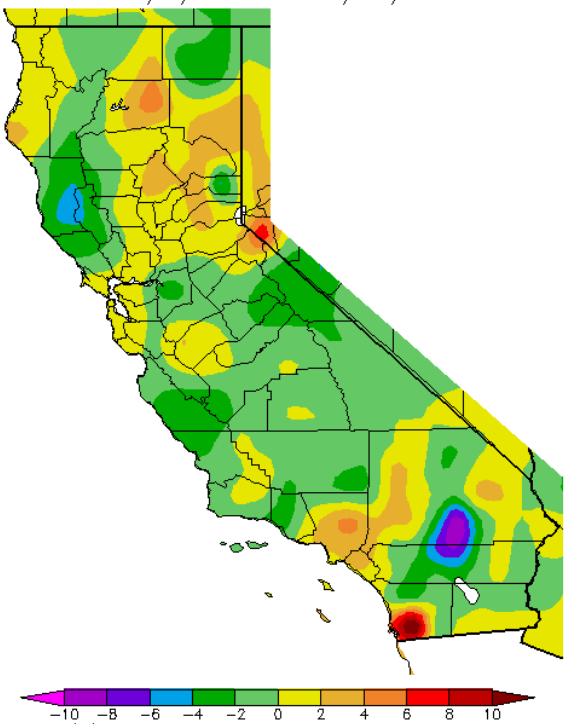
Generated 10/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Percent of Average Precipitation (%)
9/1/2004 – 09/30/2004



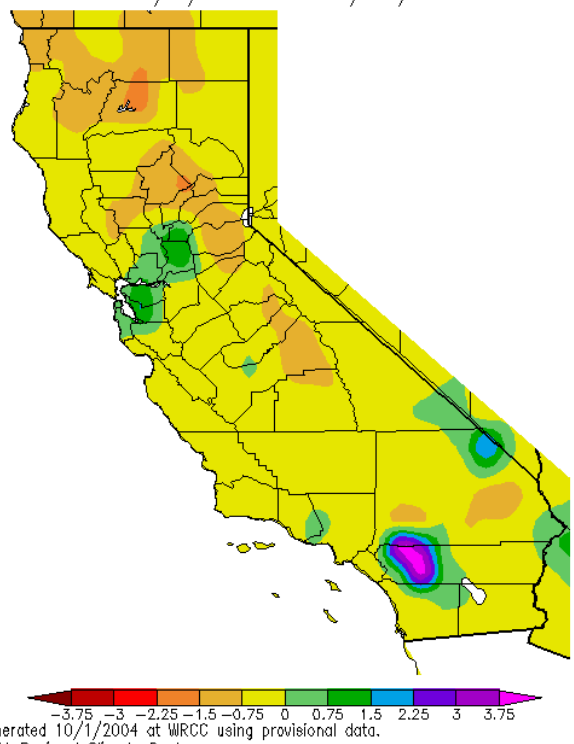
Generated 10/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Av. Min. Temperature dep from Ave (deg. F)
9/1/2004 – 09/30/2004



Generated 10/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Precipitation Departure from Average (in.)
9/1/2004 – 09/30/2004



Generated 10/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

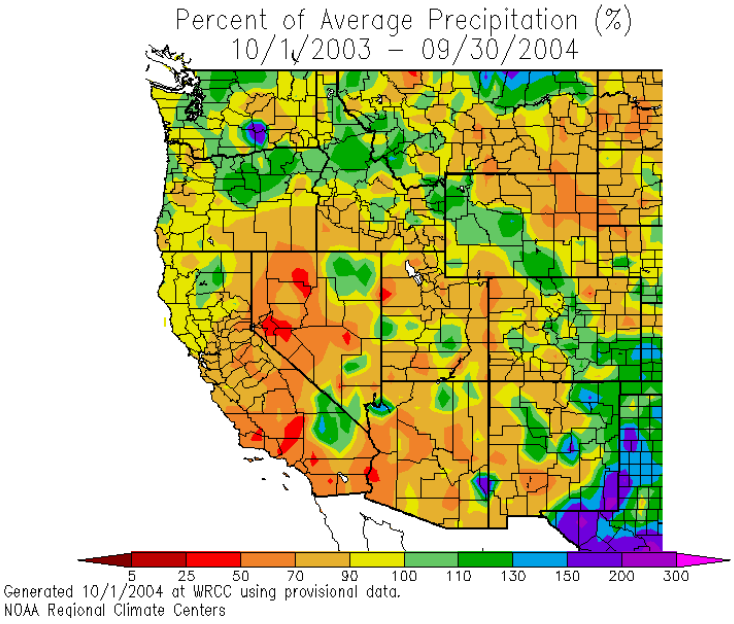
Water Year 2004 Summary & Highlights

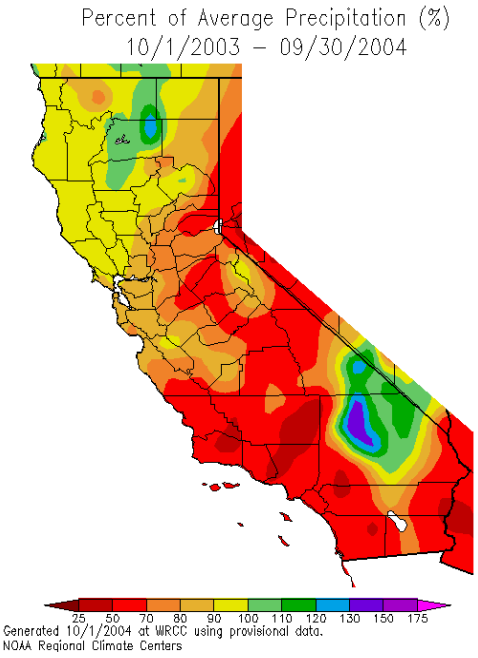
The first five months of Water Year 2004 (October 1, 2003-September 30, 2004) appeared to have set up the snowpack reserves for the year. On March 1, 2004, the snow water content was at 120% of average for the date. By April 1, snow water content had reduced to 85% of average for the date and by May 1, at 50% of average.

The record warm March this year set off record snowmelt early in the season. This record melt in combination with the required releases from the reservoirs for flood control, set the stage for below average storage for the remainder of the water year. The 8-station index reported 95% of normal precipitation for the year, with 47.30 inches out of a normal 50.00 inches. All of the major reservoirs have below average storage going into Water Year 2005, with low ground water levels and soil moisture. As of September 30, Pine Flat Reservoir on the Kings River was the lowest at 32% of average, using only 12% of its capacity. Don Pedro Reservoir on the Tuolumne River was at 98% of average, with 66% of its capacity in use. Trinity Lake on the Trinity River and Millerton Lake on the San Joaquin are also above 90% of average storage.

Water supplies are tight for southern California until the Lower Colorado River reservoirs can be replenished West-wide. The remainder of the state's reservoirs are beginning the new Water Year in good condition, despite their current below average storage.

Water Year 2005 Forecast:
The forecast for the Water Year 2005 is somewhat uncertain. A weak ENSO warm event, El Niño, is expected to have some effect on California this winter. El Niño conditions usually bring above normal precipitation to most of California, particularly the southern regions which have been in drought for five or more years. Climate Prediction Center's long-range forecasts also call for normal to above normal temperatures for the fall season.





For more information, visit the California Statewide Water Conditions page:
http://cdec.water.ca.gov/water_cond.html