# California Climate Watch

*A monthly newsletter monitoring California climate*

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


## Summary of the Month

The Golden State was again warmer and drier than average in May 2004, continuing the statewide trends for the third month in a row. The average temperature was 63.8 degrees, 1.6 above normal. Maximum temperatures were almost 2 degrees above average and minimum temperatures were just more than 1 degree over May's average.

Statewide precipitation was well below average for the month. Northern portions of the state fared better than the south, averaging more than 90% of normal in the Sacramento drainage. No precipitation was recorded in most Southland locations, signaling the start of the dry season.

May 1-4 brought record heat, with 116 record high temperatures set in the 4 day period. 102 of those records were in the southern regions. A sample of records on the 3rd include: 113 at Death Valley, 107 at Needles, 105 at Blythe and 104 at Imperial. Further north, temperatures reached the century mark at Bakersfield (101) and Fresno (100) on the 4th.

The first week of the month went out with a bang with thunderstorms in the north. Precipitation for the weekend of May 7-9 totaled over one inch in some locations, including 1.28 at Lassen Lodge and 1.17 at Stouts Meadow. 3.84 inches were reported for the 3-day period in Mineral after heavy thunderstorms on the 7th.

Mid-month brought little activity weather-wise, with little or no precipitation falling in most regions and near- to above-average temperatures.

Starting on the 17th, rain was again welcomed to NorCal, and temperatures started falling.

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


Editor: Laura Edwards
WRCC/DRI
2215 Raggio Parkway
Reno, NV 89512
Laura.Edwards@dri.edu


# What is California's Coastal Future?

**By Laura Edwards**

Pacifica, California, was the center of attention in early 1998 as ENSO storms roared through, erasing more than 30 feet of property for some cliff-side residents in a brief two week period. Ten homes were "red-flagged" and considered unsafe for habitation. Average coastal erosion rates in this region of central California had been 2 feet per year for almost 50 years previous to this event. Will this episodic coastal erosion plague California in the future?

***LEFT: Pacifica, CA coastline, January 8, 1998.*** **http://walrus.wr.usgs.gov/elnino/coastal/pacifica.html**

Sea-cliff erosion rates in California average 0 to more than 30 cm per year (1), but in the winter of 1997-98 ENSO enhanced typical storminess and high tides altered the cliffs and beaches. Several studies have shown that "the majority of sea-cliff erosion occurs during infrequent, energetic storm events" (1), such as during ENSO.

The costs of coastal and beach erosion are high. 86%, or 946 miles, of California's coastline is actively eroding. With 80% of the state's population living less than 50 km from the coast (2), there are a large number of homes and businesses at risk of being lost to the sea in the next 60 years. In addition, 32 million out-of-state vacationers head to the Pacific beach annually, bringing in billions of dollars of revenue (2). As a result of population growth and an ever-growing number of visitors, local, regional and state government have taken several measures to maintain beaches and coastal areas, including beach nourishment plans.

***RIGHT: Pacifica, CA coastline, February 17, 1998.*** **http://walrus.wr.usgs.gov/elnino/coastal/pacifica.html**

***EROSION*** *continued on page 2.*

**INSIDE THIS ISSUE: Climate Outlooks, Monthly Data & Climate Maps**

## WEATHER (continued from page 1):

A long wave trough and low pressure hung around the West coast for a few days to produce scattered thunderstorms throughout the mountainous areas until the 19th, with some areas not tapering off until the 21st. 24-hour precipitation totals of 0.50 inch for the 17th-18th were common in northern locations.

A short-lived warmer and drier trend began on the 24th. By May 27, thunderstorms were back in action with over an inch reported at Snow Mountain and Ebbetts Pass. Rain fell as far south as the Fresno/Harford area.

The end of May ended dry and warm, without any new records being set. Most of the state enjoyed climbing temperatures over Memorial Day weekend with few clouds to dampen picnics.

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## EROSION (continued from page 1):

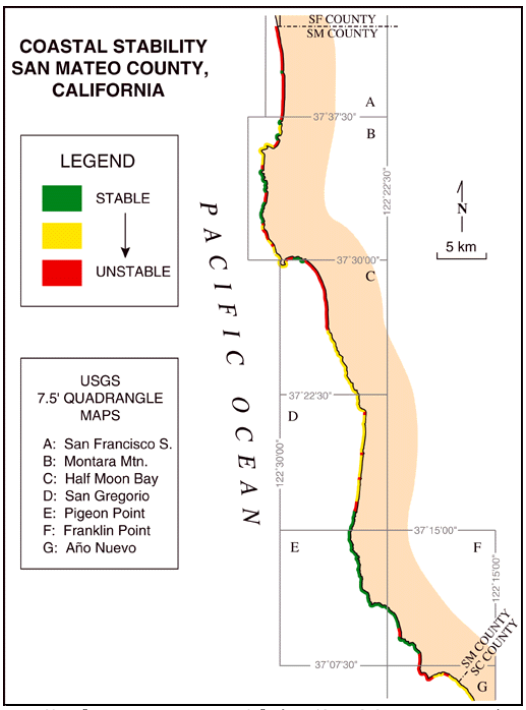
Sand for beaches is provided naturally by rivers and streams, as well as by lateral movement up and down the coast and in and out perpendicular to the shoreline. In the winter, sand moves seaward with increased storminess. In the summer, gentler waves bring sand back towards the shore to produce wider beaches.

In the last century, inland dams have been constructed on almost all of the rivers and streams that flow to the ocean. These dams now collect sediments that have historically supplied 80-90% of sand for the coast, making them the primary cause of sand-starved beaches (3). Other "hard" structures, such as jetties and groins, have been built to improve beach conditions and make passable channels for ships, but can have a deteriorating effect on longshore transport, preventing sand from moving along the shoreline. In Santa Barbara, sand is transported from one side of the groin to the other to clear the shipping lane. In other areas, sand is brought from behind the dams, which improves both the reservoir and beach areas.

A recent article by Zhang et al. (4) investigated the potential effects of global warming on coastal erosion. They showed that global rising sea levels, predicted to be about 3 mm per year, can be an enabler of long-term beach erosion, particularly in the case of sandy beaches. Their view is that rising sea level allows waves to act further up the beach profile as well as moving more sediment seaward. This was experienced at California's rocky and steep shorelines during the ENSO event of 1997-98 where higher sea level combined with high tides to have devastating effects.

Sandstones and shales (sedimentary rocks) are more prone to erosion by waves than granites and basalts (igneous) rocks. This has a mixed bag of results for California's combination of shore composition.

Only time will tell who has the last word: natural coast and beach erosion, or manmade structures and enhancements.




***http://walrus.wr.usgs.gov/elnino/SMCO-coast-erosion/coaststabl-lg.html***

*Kenneth R. Lajoie and Scott A. Mathieson*

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**References:**


1. Storlazzi, C. D. and G. B. Griggs, 2000. *Influence of El Nino-Southern Oscillation (ENSO) events on the evolution of central California's shoreline.* GSA Bull., 112**(2)**, 236-249.

2. Resources Agency of California, 2001. *Draft policy on coastal erosion planning and response and background material.* Sacramento, CA. http://resources.ca.gov/ocean/coastal_erosion_draft.html

3. Inman, D. L., P. M. Masters, S. A. Jenkins, 2002. *Facing the coastal challenge: modeling coastal erosion in southern California.* Presented at California and the World Ocean '02 Conference, October 2002. http://repositories.cdlib.org/sio/cmg/12

4. Zhang, K., B. C. Douglas, S. P. Leatherman, 2004. *Global warming and coastal erosion.* Clim. Change, **64**, 41-58.

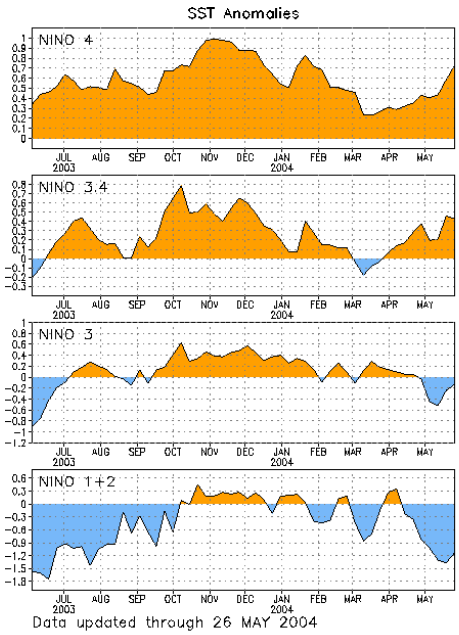
5. California Beach Restoration Study, http://www.dbw.ca.gov/beachreport.htm

6. Komar, P. D., 2000. *Shore leave.* The Sciences, Jan/Feb 2000, p. 20-24.

# Climate Forecasts & Outlooks

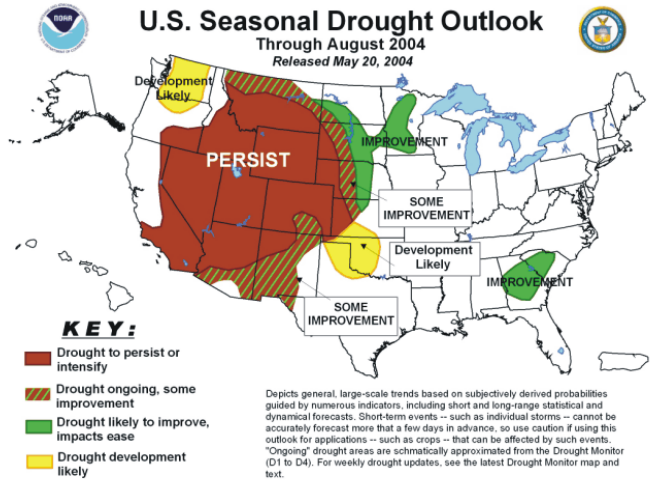
## *ENSO May forecast:*

ENSO-neutral conditions are projected through the next three months. Just over 50% of the forecasts call for ENSO-neutral through the summer and early fall, with the remaining forecasts predicting El Niño conditions.




## *Drought conditions:*

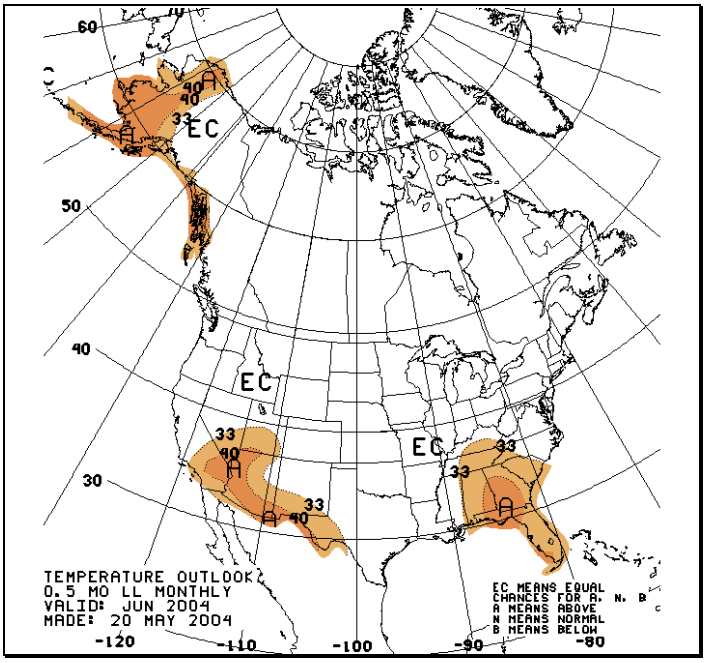
Dry conditions are expected to persist through most of southern and eastern California. Continued dry conditions and warm temperatures have contributed to these conditions, and are expected to carry through the next three months.

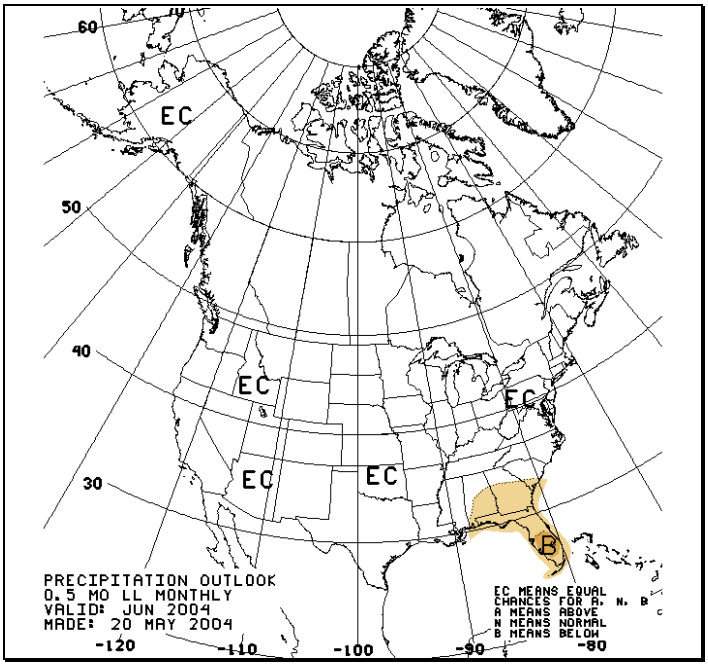



*Credit: CPC/NCEP*

## *Temperature and Precipitation Outlooks:*

The June monthly forecast calls for above normal temperatures in the southern portion of the state, continuing the months-long warm weather trend. Precipitation is forecast to be near normal for the month, with equal chances of above or below normal across the state.




*Credit: Climate Prediction Center, http://www.cpc.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html*

# May Station Data

*All data is provisional and subject to change.*

| Station Name/ Climate Division | TA | DA | TX | DX | MGX | TN | DN | MGN | PMO | PDP | PCT | MGP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***North Coast*** | ***59.7*** | ***0.6*** | ***72.1*** | ***0.5*** | ***1*** | ***47.3*** | ***0.6*** | ***1*** | ***0.46*** | ***-0.66*** | ***34*** | ***1.2*** |
| Eureka | 56.7 | 3.1 | 63.2 | 3.6 | 1 | 50.2 | 2.6 | 1 | 1.37 | -0.25 | 85 | 0 |
| Kentfield | 61.3 | -1.2 | 72.3 | -3.7 | 1 | 50.3 | 1.4 | 1 | 0.10 | -1.10 | 8 | 1 |
| Napa | 63.3 | 1.2 | 76.3 | 0.9 | 1 | 50.2 | 1.4 | 1 | 0.05 | -0.73 | 6 | 2 |
| Santa Rosa | 61.2 | -0.3 | 74.6 | 0.4 | 1 | 47.7 | -1.0 | 1 | 0.03 | -0.80 | 4 | 1 |
| Yreka | 56.1 | 0.1 | 73.9 | 1.3 | 1 | 38.2 | -1.2 | 1 | 0.75 | -0.40 | 65 | 2 |
| ***Sacram. Drainage*** | ***59.9*** | ***0.8*** | ***74.1*** | ***0.5*** | ***0.5*** | ***45.6*** | ***1.2*** | ***0.5*** | ***1.70*** | ***0.00*** | ***94*** | ***0.79*** |
| Alturas | 51.4 | 0.0 | 67.9 | -0.9 | 0 | 34.9 | 0.8 | 0 | 1.61 | 0.29 | 122 | 0 |
| Adin Ranger Stn | 53.3 | 0.0 | 68.7 | 0.9 | 0 | 37.9 | -1.0 | 0 | 4.71 | 3.13 | 298 | 2 |
| Blue Canyon | 53.1 | 0.4 | 60.1 | -0.9 | 0 | 46.1 | 1.8 | 0 | 1.27 | -1.66 | 43 | 0 |
| Burney | 55.4 | 2.8 | 72.4 | 0.7 | 1 | 38.5 | 4.9 | 1 | 3.52 | 1.88 | 215 | 1 |
| Dunsmuir Treatme | 58.8 | 1.2 | 74.9 | 1.0 | 2 | 42.7 | 1.4 | 2 | 1.00 | -1.55 | 39 | 3 |
| Marysville | 68.1 | -0.4 | 83.5 | 0.8 | 0 | 52.6 | -1.7 | 0 | 0.05 | -0.71 | 7 | 0 |
| Mineral | 49.4 | 1.7 | 64.0 | 1.9 | 4 | 34.8 | 1.5 | 4 | 5.55 | 2.58 | 187 | 4 |
| Mt. Shasta | 54.7 | 1.5 | 68.6 | 1.3 | 0 | 40.8 | 1.8 | 0 | 1.35 | -0.52 | 72 | 0 |
| Quincy | 56.0 | 0.4 | 73.0 | -1.6 | 0 | 39.1 | 2.4 | 0 | 1.41 | -0.12 | 92 | 1 |
| Redding | 68.2 | 2.0 | 81.8 | 1.1 | 0 | 54.5 | 2.9 | 0 | 1.24 | -0.42 | 75 | 0 |
| Red Bluff FSS | 67.9 | -0.1 | 82.1 | 0.3 | 0 | 53.7 | -0.4 | 0 | 0.97 | -0.12 | 89 | 0 |
| Sacramento AP | 66.9 | 1.5 | 80.8 | 0.8 | 0 | 52.9 | 2.0 | 0 | 0.17 | -0.36 | 32 | 0 |
| Sacramento City | 68.6 | 0.7 | 82.5 | 0.9 | 0 | 54.7 | 0.6 | 0 | 0.08 | -0.52 | 13 | 0 |
| Shasta Dam | 66.2 | 0.1 | 77.7 | 0.3 | 0 | 54.7 | 0.0 | 0 | 0.87 | -1.93 | 31 | 0 |
| ***Northeast Interior*** | ***49.3*** | ***0.8*** | ***66.8*** | ***1.8*** | ***4.5*** | ***31.7*** | ***-0.1*** | ***4.5*** | ***0.51*** | ***-0.33*** | ***59*** | ***0*** |
| Bodie | 43.5 | 1.0 | 63.5 | 3.5 | 7 | 23.5 | -1.4 | 7 | 0.17 | -0.63 | 21 | 0 |
| Susanville 2 SW | 55.0 | 0.6 | 70.1 | 0.0 | 2 | 39.9 | 1.2 | 2 | 0.85 | -0.03 | 97 | 0 |
| ***Central Coast*** | ***61.8*** | ***0.8*** | ***73.1*** | ***0.5*** | ***1.31*** | ***50.4*** | ***1.1*** | ***1.308*** | ***0.06*** | ***-0.36*** | ***14*** | ***1.31*** |
| Gilroy | 65.7 | 1.3 | 80.4 | 2.2 | 3 | 51.0 | 0.4 | 3 | 0.22 | -0.19 | 54 | 3 |
| Hollister | 61.4 | 1.2 | 75.3 | 1.5 | 1 | 47.5 | 0.9 | 1 | 0.06 | -0.30 | 17 | 1 |
| King City | 63.2 | 0.6 | 80.1 | 1.7 | 1 | 46.4 | -0.5 | 1 | 0.00 | -0.24 | 0 | 1 |
| Oakland Museum | 61.2 | 0.1 | 68.4 | -0.5 | 4 | 54.0 | 0.7 | 4 | 0.00 | -0.57 | 0 | 4 |
| Paso Robles AP | 63.9 | 0.7 | 82.1 | 1.0 | 0 | 45.7 | 0.3 | 0 | 0.00 | -0.23 | 0 | 0 |
| Redwood City | 62.5 | 1.0 | 72.9 | -1.1 | 1 | 52.1 | 3.2 | 1 | 0.14 | -0.29 | 33 | 1 |
| Richmond | 61.6 | 2.0 | 69.9 | 1.6 | 2 | 53.2 | 2.3 | 2 | 0.00 | -0.54 | 0 | 2 |
| Salinas AP | 60.0 | 1.0 | 69.3 | 1.3 | 0 | 50.6 | 0.5 | 0 | 0.03 | -0.20 | 13 | 0 |
| San Fran MD | 58.0 | -0.4 | 64.3 | -1.1 | 1 | 51.8 | 0.4 | 1 | 0.12 | -0.42 | 22 | 1 |
| San Francisco AP | 60.3 | 1.6 | 67.6 | 0.8 | 0 | 53.1 | 2.6 | 0 | 0.07 | -0.31 | 18 | 0 |
| San Jose | 63.0 | -1.2 | 73.5 | -3.2 | 1 | 52.4 | 0.6 | 1 | 0.07 | -0.37 | 16 | 1 |
| San Luis Obispo | 62.3 | 1.9 | 75.6 | 2.4 | 1 | 49.0 | 1.5 | 1 | 0.00 | -0.47 | 0 | 1 |
| Santa Cruz | 60.1 | 1.0 | 71.4 | 0.4 | 2 | 48.7 | 1.5 | 2 | 0.09 | -0.61 | 13 | 2 |
| ***San Joaquin*** | ***63.9*** | ***0.4*** | ***79.4*** | ***1.4*** | ***1.67*** | ***48.4*** | ***-0.5*** | ***1.667*** | ***0.16*** | ***-0.49*** | ***16*** | ***1.22*** |
| Bakersfield | 71.1 | 0.8 | 85.0 | 1.2 | 0 | 57.3 | 0.5 | 0 | 0.00 | -0.24 | 0 | 0 |
| Fresno | 70.8 | 2.0 | 85.2 | 2.5 | 0 | 56.5 | 1.6 | 0 | 0.07 | -0.32 | 18 | 0 |
| Glennville | 55.8 | -0.3 | 73.1 | -0.2 | 2 | 38.5 | -0.4 | 2 | 0.00 | -0.73 | 0 | 3 |
| Hanford 1 S | 69.4 | 1.1 | 85.2 | 2.1 | 0 | 53.6 | 0.2 | 0 | 0.02 | -0.24 | 8 | 0 |
| Lodgepole | 46.3 | 1.5 | 60.1 | 2.2 | 2 | 32.6 | 0.9 | 2 | 0.15 | -1.19 | 11 | 2 |
| Madera | 67.5 | -0.3 | 84.5 | 1.4 | 0 | 50.6 | -1.9 | 0 | 0.04 | -0.39 | 9 | 0 |
| Porterville | 68.4 | -2.4 | 85.1 | -0.2 | 5 | 51.7 | -4.7 | 5 | 0.00 | -0.42 | 0 | 0 |
| Stockton WSO | 67.0 | 0.3 | 82.4 | 1.1 | 0 | 51.5 | -0.6 | 0 | 0.16 | -0.34 | 32 | 0 |
| Yosemite | 58.8 | 1.1 | 74.4 | 2.3 | 6 | 43.1 | -0.1 | 6 | 1.03 | -0.55 | 65 | 6 |

| Station Name/ Climate Division | TA | DA | TX | DX | MGX | TN | DN | MGN | PMO | PDP | PCT | MGP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***South Coast*** | ***65.0*** | ***3.1*** | ***76.3*** | ***4.0*** | ***2.64*** | ***53.7*** | ***2.1*** | ***2.636*** | ***0.01*** | ***-0.33*** | ***2*** | ***2.68*** |
| Alpine | 68.0 | 5.1 | 80.8 | 5.7 | 7 | 55.2 | 4.5 | 7 | 0.00 | -0.47 | 0 | 7 |
| Anaheim | 70.5 | 5.0 | 81.0 | 5.7 | 0 | 60.0 | 4.3 | 0 | 0.00 | -0.13 | 0 | 0 |
| Big Bear Lake | 52.2 | 2.0 | 68.9 | 2.8 | 8 | 35.6 | 1.2 | 8 | 0.00 | -0.51 | 0 | 8 |
| Burbank | 69.0 | 3.1 | 79.7 | 2.2 | 0 | 58.3 | 4.1 | 0 | 0.00 | -0.37 | 0 | 0 |
| Campo | 60.2 | 0.5 | 78.8 | 0.7 | 2 | 41.7 | 0.4 | 2 | 0.00 | -0.26 | 0 | 2 |
| Culver City | 66.6 | 2.0 | 75.1 | 1.6 | 10 | 58.0 | 2.3 | 10 | 0.00 | -0.26 | 0 | 10 |
| El Cajon | 69.4 | 3.9 | 82.2 | 5.8 | 14 | 56.6 | 1.9 | 14 | 0.00 | -0.16 | 0 | 14 |
| Escondido 2 | 71.5 | 5.6 | 87.7 | 10.2 | 13 | 55.3 | 0.9 | 13 | 0.00 | -0.27 | 0 | 13 |
| Idyllwild Fire D | 56.6 | 3.7 | 74.0 | 4.9 | 3 | 39.3 | 2.6 | 3 | 0.00 | -0.77 | 0 | 3 |
| Lompoc | 60.8 | 0.9 | 71.5 | 0.3 | 1 | 50.2 | 1.5 | 1 | 0.00 | -0.31 | 0 | 1 |
| Long Beach AP | 69.4 | 3.5 | 78.4 | 4.4 | 0 | 60.5 | 2.7 | 0 | 0.00 | -0.23 | 0 | 0 |
| Los Angeles Down | 69.7 | 3.5 | 79.0 | 4.5 | 0 | 60.5 | 2.6 | 0 | 0.00 | -0.31 | 0 | 0 |
| Los Angeles AP | 66.7 | 3.6 | 73.8 | 4.5 | 0 | 59.5 | 2.6 | 0 | 0.04 | -0.20 | 17 | 0 |
| Mt Wilson No 2 | 59.3 | 1.7 | 69.4 | 1.5 | 0 | 49.2 | 1.9 | 0 | 0.00 | -0.97 | 0 | 0 |
| Riverside Citrus | 70.1 | 3.8 | 84.7 | 5.1 | 0 | 55.5 | 2.6 | 0 | 0.00 | -0.25 | 0 | 0 |
| Newport Beach Ha | 65.0 | 3.3 | 69.7 | 3.6 | 0 | 60.4 | 3.1 | 0 | 0.00 | -0.18 | 0 | 0 |
| San Diego AP | 68.5 | 3.9 | 73.7 | 4.4 | 0 | 63.2 | 3.4 | 0 | 0.00 | -0.20 | 0 | 0 |
| Sandberg WSMO | 59.4 | 2.0 | 70.4 | 3.3 | 0 | 48.5 | 0.8 | 0 | 0.00 | -0.28 | 0 | 0 |
| Santa Ana Fire S | 69.8 | 4.1 | 81.4 | 6.5 | 0 | 58.2 | 1.8 | 0 | 0.00 | -0.25 | 0 | 1 |
| Santa Barbara | 62.1 | 1.3 | 74.0 | 2.8 | 0 | 50.2 | -0.3 | 0 | 0.05 | -0.18 | 22 | 0 |
| Santa Maria AP | 59.0 | 1.2 | 70.7 | 2.1 | 0 | 47.3 | 0.4 | 0 | 0.04 | -0.28 | 13 | 0 |
| UCLA | 66.2 | 3.4 | 74.4 | 4.8 | 0 | 58.0 | 1.9 | 0 | 0.00 | -0.34 | 0 | 0 |
| ***Southeast Desert*** | ***76.5*** | ***2.2*** | ***92.7*** | ***2.6*** | ***0.78*** | ***60.2*** | ***1.7*** | ***0.778*** | ***0.00*** | ***-0.10*** | ***0*** | ***0.44*** |
| Bishop | 63.7 | 1.2 | 83.7 | 2.5 | 1 | 43.6 | -0.1 | 1 | 0.00 | -0.26 | 0 | 0 |
| Blythe | 81.6 | 2.7 | 97.6 | 3.7 | 0 | 65.7 | 1.8 | 0 | 0.00 | -0.03 | 0 | 0 |
| Daggett AP | 76.0 | 3.2 | 90.7 | 2.6 | 0 | 61.3 | 3.9 | 0 | 0.00 | -0.08 | 0 | 0 |
| Imperial | 79.0 | 2.4 | 95.9 | 3.5 | 0 | 62.0 | 1.3 | 0 | 0.00 | -0.04 | 0 | 0 |
| Lancaster | 69.3 | 3.3 | 83.5 | 4.2 | 0 | 55.1 | 2.3 | 0 | 0.00 | -0.12 | 0 | 0 |
| Needles AP | 83.8 | 3.4 | 96.5 | 1.9 | 0 | 71.0 | 4.8 | 0 | 0.00 | -0.11 | 0 | 0 |
| Palm Springs | 80.5 | 1.8 | 95.1 | 0.5 | 5 | 65.9 | 3.1 | 5 | 0.00 | -0.06 | 0 | 3 |
| Thermal AP | 80.2 | 1.4 | 96.5 | 1.2 | 0 | 63.9 | 1.6 | 0 | 0.00 | -0.06 | 0 | 0 |
| Twentynine Palms | 74.2 | 0.0 | 94.8 | 3.4 | 1 | 53.7 | -3.4 | 1 | 0.00 | -0.12 | 0 | 1 |
| **STATEWIDE** | **63.8** | **1.6** | **77.2** | **1.9** | **1.6** | **50.5** | **1.2** | **1.6** | **0.40** | **-0.29** | **27.1** | **1.4** |

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

**KEY:**

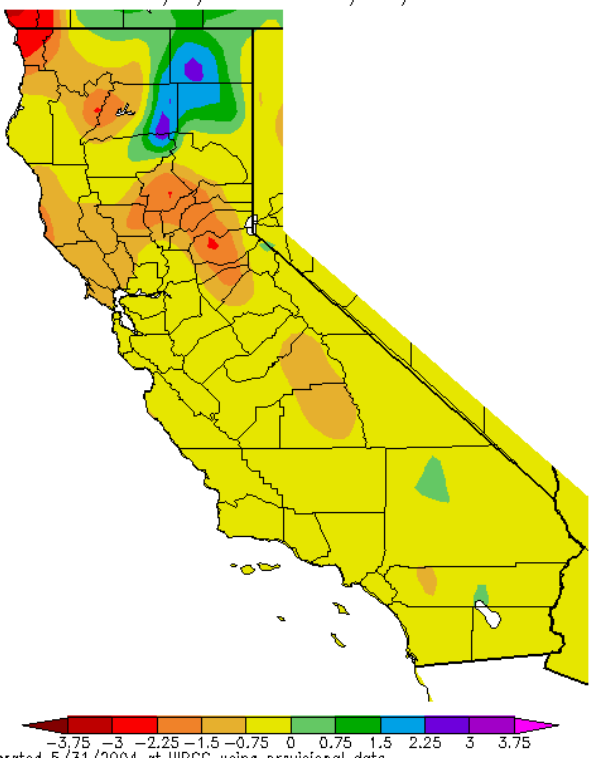
**TA** = average temperature in Fahrenheit
**DA** = average temperature departure from normal in Fahrenheit
**TX** = average maximum temperature in Fahrenheit
**DX** = average maximum temperature departure in Fahrenheit
**MGX** = number of missing daily max temperature values
**TN** = average minimum temperature in Fahrenheit
**DN** = average minimum temperature departure in Fahrenheit
**MGN** = number of missing daily min temperature values
**MGP** = number of missing daily precipitation values
**PMO** = total monthly precipitation in inches
**PDP** = monthly precipitation departure from normal in inches
**PCT** = monthly precipitation percent of normal

## Hydrological Summary

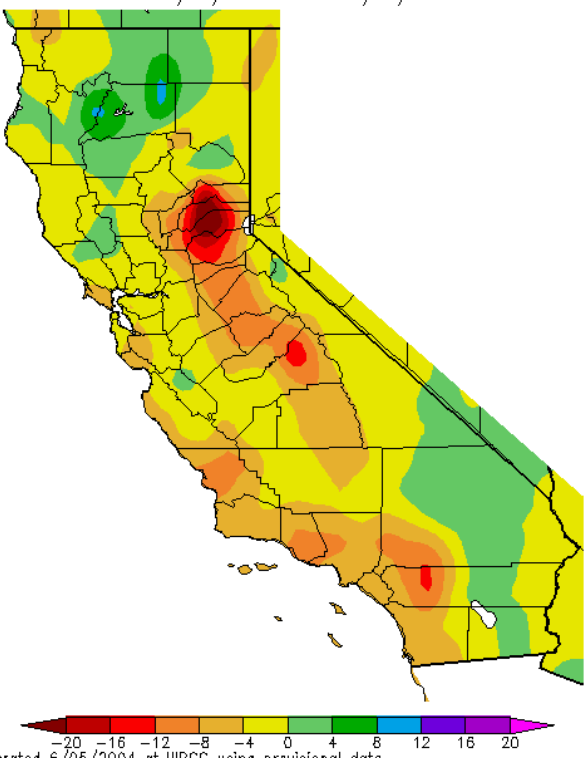
The Department of Water Resources 8-Station Index accumulated an additional 1.5 inches of precipitation in May 2004, 71% of normal for the month. For the water year since October 1, 2003, California has recorded 98% of average precipitation to date with 46.9 inches out of an average of 47.7. Reservoir storage is in good condition with most of the key reservoirs reporting more than 80% of normal capacity. As of June 1, Folsom Lake and San Luis Reservoir are the only 2 of the 12 key reservoirs that measured less than 80% of normal capacity at 76% and 71% respectively.

# Climate Maps for May

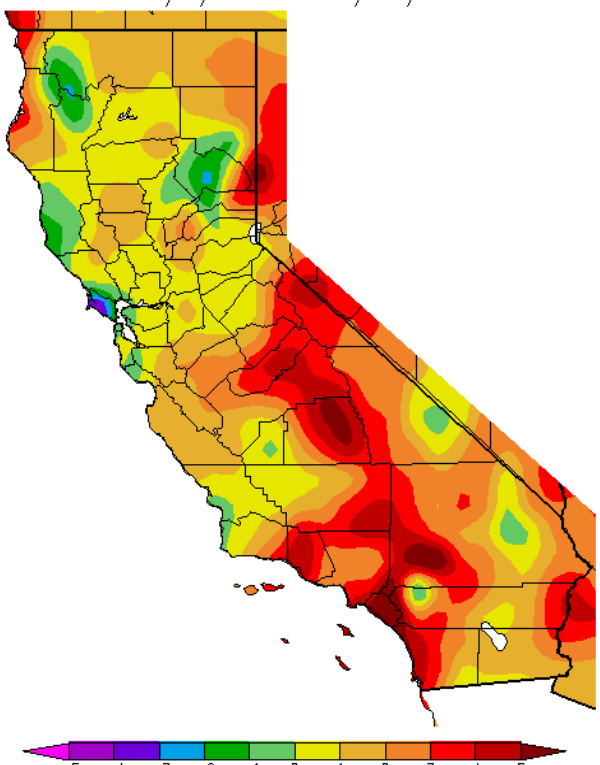
Precipitation Departure from Average (in.)
5/1/2004 – 5/31/2004




Precipitation Departure from Average (in.)
10/1/2003 – 6/4/2004




Av. Max. Temperature dep from Ave (deg F)
5/1/2004 – 5/31/2004




Av. Min. Temperature dep from Ave (deg. F)
5/1/2004 – 5/31/2004