California Climate Watch

A monthly newsletter monitoring California climate

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

Summary of the Month

by Bill Mork
California State Climatologist
California Department of Water Resources

A mean upper level trough of low pressure near the West Coast was deep and dominant enough to produce a fairly comfortable August in the Golden State. Preliminary data show the statewide average temperature in August to be 72.0 degrees, 0.4 degree above normal, and 0.4 degree cooler than July in California. Drainage area average temperatures ranged from 1.2 degrees above normal in the Sacramento basin to 1.1 degrees below normal on the South Coast.

Cities with the greatest average temperature departures from normal include plus 3.2 degrees at Burney, plus 2.9 degrees at San Francisco Airport, plus 2.7 degrees at Eureka, and plus 2.5 degrees at Quincy. Cities with average temperatures well below normal include minus 4.1 degrees at Santa Barbara Airport, minus 3.5 degrees at Twentynine Palms, minus 3.1 degrees at Long Beach, and minus 2.7 degrees at downtown Los Angeles. A strong upper level ridge of high pressure brought the warmest temperatures of the month to most of the State August 8 - 13. Some peak high temperatures in that period include 125 at Death Valley, 117 at Needles, 116 at Palm Springs, 114 at Blythe and Imperial, 107 at Paso Robles and Redding, and 106 at Bakersfield, Fresno, Red Bluff, and Sacramento. June Gloom conditions continued in the Southland with below normal temperatures on 30 days in Santa Barbara and a peak temperature of only 78.

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

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The Impact of Twenty-First Century Climate Change on Wildland Fire in California

By Dr. Tim Brown, *Director of Climate, Ecosystems and Fire Applications at Desert Research Institute*

Modern records are showing an overall increase in the number of large, catastrophic fires in California and the West. While anthropogenic practices are partly a cause, climate variability and change are also significant influences. The recent multi-year drought in the West may be an aberration of natural climate variability, and perhaps a part of something grander. Nonetheless climate change is on the minds of climate scientists, and increasingly on the minds of those in the fire community.

Southern California wildfires. October 2003

There is some evidence of fire history in California. Charcoal records from sediments in southern California show evidence of wildfire in the Santa Barbara basin during the past six centuries (1). Fire scars (burn marks from fire on tree trunks) are visible on giant sequoias in Yosemite National Park over the past 1,400 years (2). Over 400 years of fire history can be found in fire scars around Lake Tahoe (3), though these scars are virtually nonexistent following the 1860s and 1870s forest clearcut in the region.

Climate is one driving factor of fire. Simplistically, wet periods allow for increased fuel growth; dry periods allow for increased fire danger. The annual cycle of California's precipitation provides for both; winter snowpack and spring rains are followed by summer dry lightning, and in the south, autumn Santa Ana winds.

There are other driving factors of fire: lightning and humans. Lightning, humans and fire were once integrated, natural parts of the environment. Changing values, however, have made fire an anomaly, excluding it as a part of this system.

***FIRE** continued on page 2.*

WEATHER (continued from page 1):

Summer monsoonal activity was somewhat below normal except for one active period August 13 - 16. One of the lucky recipients was Big Bear Lake with 1.58 inches of rain August 13 - 14. Locally heavy rainfall produced extensive flash flooding in Death Valley National Park on August 15. Rainfall began along the eastern portions of the park, over the Black and Funeral Mountains, 7:30 - 7:45 PM. Flooding began about 8:00 PM with intense flooding at 8:30 PM. Radar rainfall estimates were 1 - 2 inches, but the cooperative station only received 0.33 inch. The worst flooding occurred along SR190 which runs along Furnace Creek Wash. Entire sections of the roadway were washed out, cars were pushed off the highway and flipped over, power lines were knocked down, and water pipelines were segmented. Two people were killed. This event is being compared to the floods of 1939, 1941, and 1985. A tornado was also reported at Victorville on August 15.

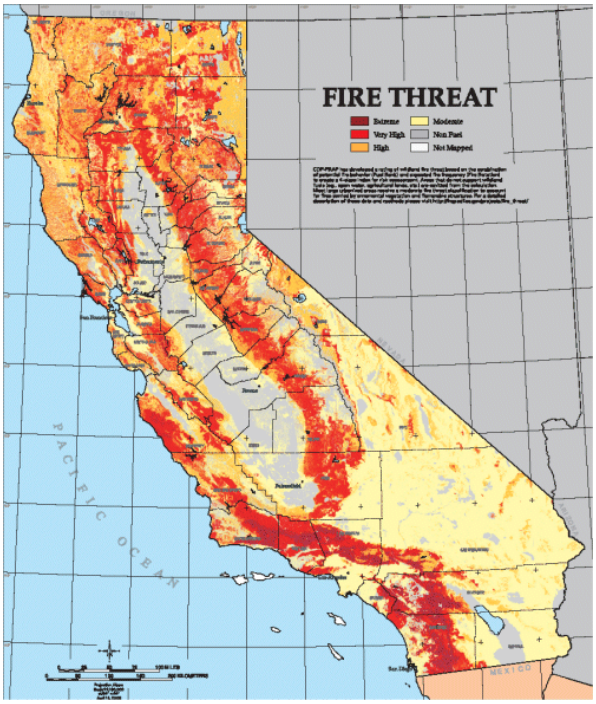
Monsoonal moisture worked northward up the Sierra with afternoon and evening showers and thunderstorms common along the crest and east of the mountains August 16 - 23. Some rainfall totals during this period include 0.57 inch at Bridgeport, 0.52 inch at Markleeville, and 0.30 inch at Bodie. Several strong Pacific weather systems brought heavy rain to the Pacific Northwest with leftovers into northwest California August 22 - 25. Some rainfall totals that period include 0.68 inch at Fort Dick, 0.63 at Crescent City, 0.48 at Gasquet, 0.42 at Arcata, 0.40 at Eureka, 0.29 at Hoopa, and 0.20 inch at Orleans. Additional nice totals for August include 0.80 inch at Alturas, 0.67 inch at Idyllwild, and 0.44 inch at Mount Shasta. As is the case in most summer months, the majority of California cities had no precipitation in August.

FIRE (continued from page 1):

The exodus of urbanites to rural areas poses significant management challenges. Today, few wildfires can burn without impacting a home or valued resource. Even fires that burn in wilderness, far away from the nearest house, can produce distant smoke of potential human impact. What two hundred years ago might have been considered a normal amount of fire and smoke, is now considered unacceptable by most.

October 2003 is a prime example of the combination of climate, landscape, humans and fire. Even though the Santa Ana winds were not especially strong, the combination of a hot and dry month, dense vegetation, and the sparks and flames from humans, led to one of the most destructive (in terms of loss of life, structures destroyed and area burned) seasons in California's history.

Since the early 1990's, improved computing capabilities have allowed for studies of climate change and its potential impact on forests and rangelands. The scenario can be simply described – the West is warming, and the consensus prediction of the climate models indicates this trend will continue during the 21st century. Likely changes in precipitation patterns, soil moisture, and evapotranspiration subsequently causing vegetation stress and even changing plant growth cycles and populations are reasonable possibilities.



http://frap.cdf.ca.gov/data/frapgismaps/select.asp

When relating this climate change directly to fire, two consistent attributes seem to fall out of the analysis. The West can expect longer and more severe fire seasons under the warming scenario. As a result, possible major consequences may need to be addressed: current desired outcomes of fuels treatment and management may be difficult to achieve, our expectations about ecosystem health may need to be altered, and fire management policy will likely have to be modified or completely rewritten to address the new 21st century change issues.

Two very recent studies have noted particulars about fire-climate change in California: southern California can expect an increase of up to two weeks in days with extreme fire danger in the next century (4); and reduced effectiveness of initial fire control even given the best suppression resources (5).

These results provide a formidable challenge to all – policy makers, climate scientists and the public – on how best to live in a place of fire danger. As many plant species have learned to adapt to fire and smoke, and even embrace it, humans too need to adapt to a changing environment. In California, no different than anyplace on Earth (expect maybe Antarctica), fire, climate and humans are inseparable. Each one affects the other two in some way.

References:

1. Mensing, S.A., J. Michaelson, and R. Byrne (1999). A 560-year record of Santa Ana fires reconstructed from charcoal deposited in the Santa Barbara Basin, California. Quaternary Research, 51, 295-305.

2. Swetnam, T.W., R. Touchan, C.H. Baisan, A.C. Caprio, and P.M. Brown (1990). Giant Sequoia fire history in Mariposa Grove, Yosemite National Park. Yosemite Centennial Symposium Proceeding - Natural Areas and Yosemite: Prospects for the Future. 6 pp.

3. http://www.geog.psu.edu/vegdyn/lake_tahoe.html

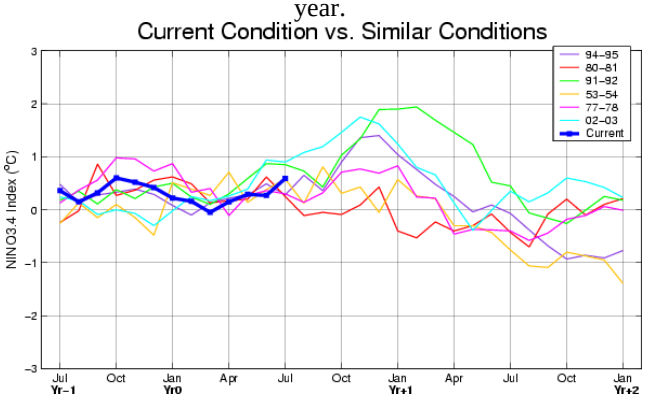
4. Brown, T.J., B.L. Hall, and A.L. Westerling (2004). The impact of twenty-first century climate change on wildland fire danger in the western United States: An applications perspective. Climatic Change, 62, 365-388.

5. Fried, J.S., M.S. Torn, and E. Mills (2004). The impact of climate change on wildfire severity: A regional forecast for northern California. Climatic Change, 64, 169-191.

CLIMATE FORECASTS & OUTLOOKS

ENSO September forecast:

A weak El Niño appears to be developing over the eastern Pacific Ocean. Sea surface temperatures are slightly above normal for the second month in a row, contributing to an almost 50% probability of an El Niño. Effects of this warm ocean anomaly will likely not be felt until late this year.



Summary of August 2004 ENSO Forecast

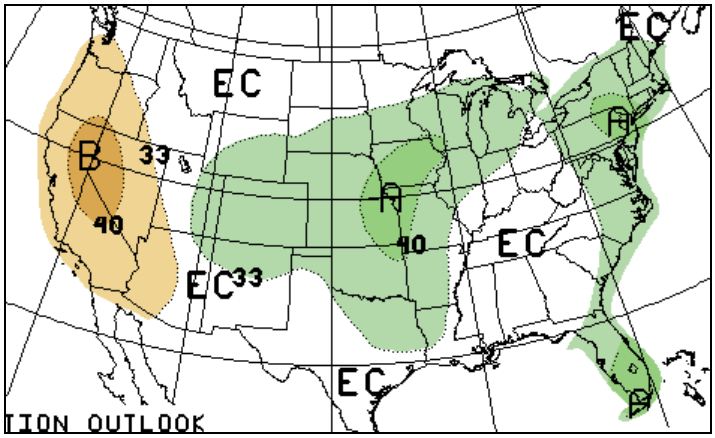
Forecast Period:	Dec. 2004 – Feb. 2005
Probability of El Niño	0 50 100 (low medium high)
Probability of La Niña	0 50 100 (low medium high)
Probable Magnitude of Event	weak

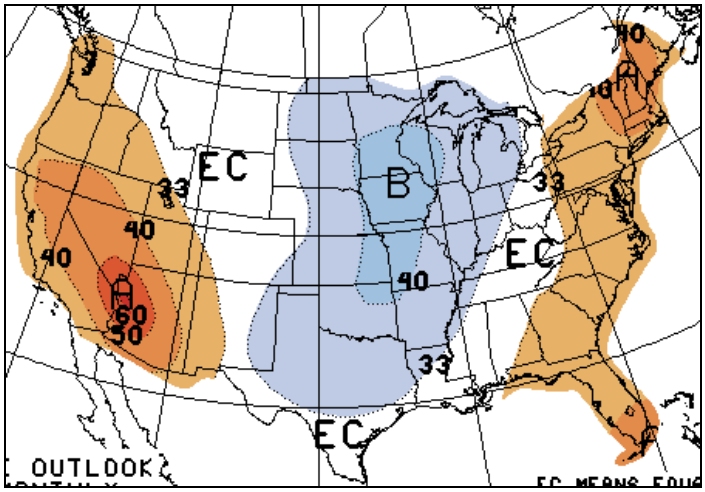
Based on sea surface temperature departures from the long-term average over the "Nino 3.4" region (120-170W, 5S-5N).

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

Precipitation and Temperature Outlooks:

Dry conditions are forecast to persist again in the Golden State, with below average precipitation in all regions. Above average temperatures are expected in September as well, with the largest departures in the desert southeastern region.



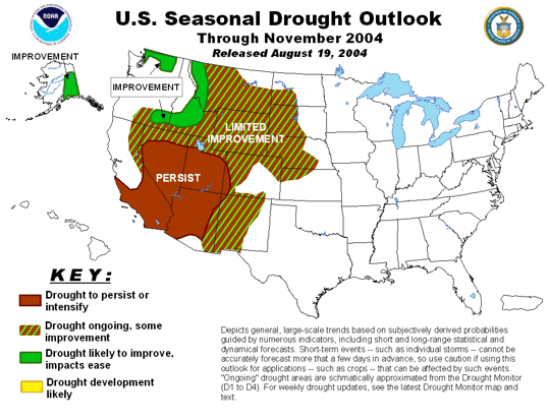


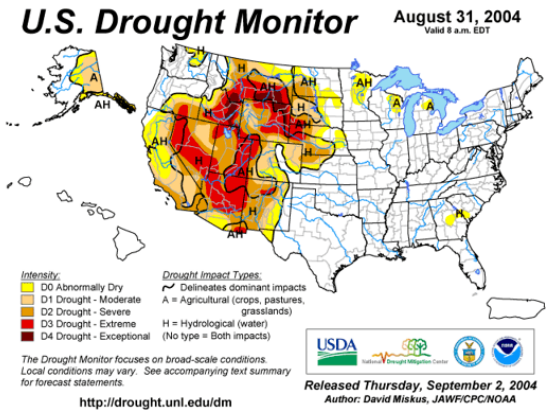
Precipitation Outlook is on the left, Temperature Outlook is on the right.

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

Drought Conditions:

Drought conditions are widespread in California, with 100% of rangeland rated poor or very poor. Water reservoirs are in good condition in the state. Continuing drought is expected in the south, with some limited improvement in the northeast region.





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

August Station Data

All data is provisional and subject to change.

CLIMATE DIVISION/ STATION NAME	TAVG	DEP	TMAX	DEP	MGX	XMX	TMIN	DEP	MGN	NMN	PREC	DEP	PCT	MGP
North Coast	***68.0***	***1.1***	***81.0***	***0.4***	***1.4***	***94.0***	***54.8***	***1.8***	***1.4***	***48.2***	***0.1***	***-0.2***	***26.3***	***1.6***
Eureka WSO	61.3	2.7	67.0	3.1	0	74	55.2	1.8	0	47	0.43	0.05	113	0
Kentfield	68.1	-0.9	81.0	-3.4	1	96	55.1	1.5	1	50	0.00	-0.12	0	1
Napa	69.8	1.3	83.0	0.6	1	98	56.5	2.0	1	51	0.00	-0.11	0	1
Santa Rosa	68.6	0.8	82.1	-0.2	3	99	55.0	1.8	3	50	0.01	-0.10	9	4
Yreka	72.0	1.8	91.9	1.7	2	103	52.0	1.9	2	43	0.05	-0.49	9	2
Sacramento Drainage	***71.8***	***1.2***	***87.5***	***-1.1***	***2.0***	***93.0***	***55.0***	***2.4***	***2.0***	***44.2***	***0.1***	***-0.2***	***21.1***	***1.7***
Alturas	65.6	0.8	86.0	-1.6	1	98	45.2	3.2	1	38	0.80	0.43	216	1
Adin Ranger Stn	68.6	1.9	86.7	2.4	0	98	50.5	1.4	0	37	0.11	-0.32	26	0
Blue Canyon	69.3	2.0	76.2	-0.6	0	86	62.4	4.6	0	50	0.00	-0.43	0	0
Burney	67.2	3.2	88.2	0.0	3	98	46.1	6.3	3	36	0.00	-0.37	0	3
Dunsmuir Treatme	70.6	1.4	90.0	0.7	1	100	51.3	2.2	1	44	0.05	-0.31	14	1
Grass Valley	70.2	-0.1	84.7	-1.7	8	92	55.7	1.5	8	52	0.00	-0.23	0	8
Marysville	77.1	-0.3	94.4	-0.6	0	106	59.8	0.0	0	53	0.00	-0.08	0	0
Mineral	62.0	1.5	80.8	0.7	9	92	43.2	2.3	9	39	0.00	-0.47	0	9
Mt. Shasta	67.4	2.4	85.4	2.8	0	95	49.3	1.8	0	41	0.44	0.01	102	0
Paradise	77.1	0.2	89.3	-1.5	1	99	64.9	1.9	1	56	0.00	-0.26	0	2
Portola	63.2	1.3	83.2	-0.4	9	94	43.2	3.0	9	37	0.00	-0.43	0	3
Quincy	68.9	2.5	90.0	-0.5	1	101	47.9	5.5	1	40	0.00	-0.27	0	1
Redding	80.4	1.5	96.8	-0.1	0	107	64.0	3.2	0	58	0.00	-0.22	0	0
Red Bluff FSS	79.5	-0.2	95.7	-0.3	0	106	63.2	-0.2	0	56	0.00	-0.14	0	0
Sacramento AP	75.6	0.9	91.4	0.0	0	105	59.7	1.6	0	56	0.00	-0.06	0	0
Sacramento City	77.8	1.1	93.6	1.1	0	0	62.0	1.2	0	0	0.00	-0.05	0	0
Shasta Dam	80.6	0.6	94.3	0.6	1	104	67.0	0.6	1	59	0.00	-0.42	0	1
Northeast Interior	***62.0***	***1.1***	***81.6***	***0.5***	***4.2***	***91.5***	***42.5***	***1.7***	***4.2***	***34.2***	***0.2***	***-0.2***	***45.1***	***2.2***
Boca Reservoir	60.2	0.8	83.5	0.6	1	94	37.0	1.0	1	29	0.00	-0.50	0	1
Bodie	52.7	-2.2	75.1	-1.2	5	86	30.4	-3.1	5	22	0.30	-0.23	57	1
Bridgeport	60.1	0.4	82.1	1.7	2	91	38.1	-0.8	2	33	0.57	0.07	114	2
Markleeville	67.7	4.9	85.2	3.0	1	97	50.2	6.8	1	39	0.52	0.00	100	1
Susanville 2 SW	69.2	1.2	84.9	-2.4	3	94	53.6	4.9	3	42	0.00	-0.19	0	3
Tahoe City	62.3	1.4	78.6	1.6	13	87	45.9	1.1	13	40	0.00	-0.46	0	5
Central Coast	***67.1***	***0.6***	***77.2***	***-0.9***	***2.5***	***91.4***	***57.0***	***2.1***	***2.5***	***52.3***	***0.0***	***-0.1***	***5.2***	***2.7***
Gilroy	72.5	0.6	87.4	-0.5	2	98	57.5	1.7	2	54	0.00	-0.05	0	2
Hollister	67.8	0.5	81.2	-0.6	1	97	54.4	1.5	1	50	0.00	-0.06	0	1
King City	69.8	0.6	85.5	0.3	1	97	54.1	1.0	1	49	0.00	-0.05	0	1
Morro Bay	60.8	1.1	63.6	-2.4	23	67	57.9	4.6	23	57	0.00	-0.09	0	23
Oakland Museum	65.7	-0.2	72.7	-0.8	1	91	58.7	0.4	1	55	0.00	-0.10	0	2
Paso Robles AP	73.2	-0.5	92.6	-1.1	0	107	53.8	0.1	0	50	0.00	-0.06	0	0
Redwood City	69.0	1.3	78.9	-1.6	1	95	59.2	4.2	1	53	0.00	-0.10	0	1
Richmond	65.1	1.7	72.4	1.4	1	88	57.8	1.9	1	45	0.00	-0.09	0	1
Salinas AP	64.7	0.6	72.1	-0.4	0	91	57.3	1.6	0	53	0.01	-0.05	17	0
San Fran MD	62.9	0.4	68.4	-0.8	1	88	57.3	1.7	1	55	0.05	-0.04	56	1
San Francisco AP	66.5	2.9	74.0	2.3	0	90	59.0	3.5	0	55	0.00	-0.07	0	0
San Jose	70.4	-0.4	81.0	-3.0	1	96	59.9	2.2	1	56	0.00	-0.07	0	1
San Luis Obispo	67.0	-0.5	78.4	-3.3	2	83	55.6	2.3	2	50	0.00	-0.08	0	3
Santa Cruz	64.6	0.4	73.1	-2.4	1	91	56.1	3.1	1	50	0.00	-0.11	0	2
San Joaquin	***74.8***	***0.2***	***90.9***	***0.5***	***2.5***	***100.5***	***58.7***	***-0.1***	***2.5***	***52.5***	***0.0***	***-0.1***	***427.3***	***3.1***
Bakersfield	82.3	0.4	95.5	0.1	0	106	69.0	0.6	0	61	0.00	-0.08	0	0
Coalinga	81.8	0.4	98.4	0.7	3	105	65.2	0.1	3	60	0.00	-0.04	0	3
Fresno	81.3	1.4	96.7	1.9	0	106	65.9	1.0	0	61	0.47	0.46	4700	0

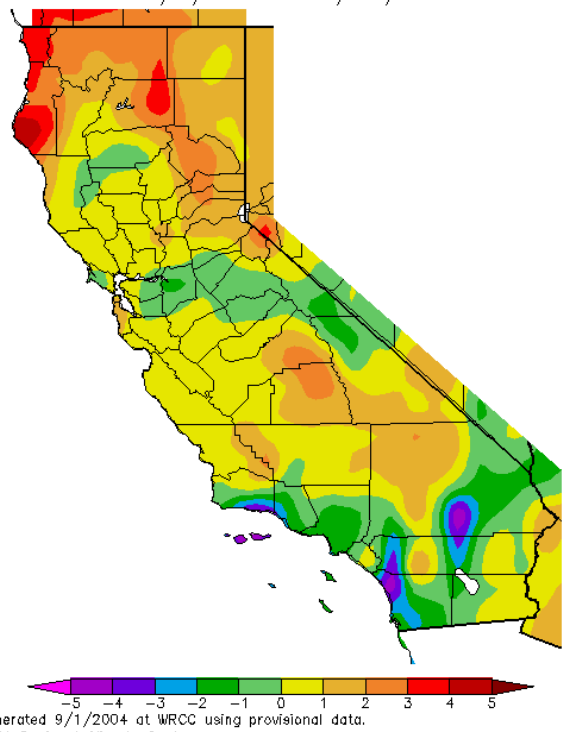
CLIMATE DIVISION/ STATION NAME	TAVG	DEP	TMAX	DEP	MGX	XMX	TMIN	DEP	MGN	NMN	PREC	DEP	PCT	MGP
Glennville	69.9	1.5	88.2	0.3	2	100	51.6	2.6	2	47	0.00	-0.16	0	7
Grant Grove	65.2	2.4	77.0	3.4	6	88	53.5	1.4	6	45	0.00	-0.11	0	6
Hanford 1 S	78.9	0.5	96.0	1.3	1	104	61.7	-0.3	1	58	0.00	-0.01	0	1
Lodgepole	60.0	1.0	75.5	0.5	3	87	44.4	1.4	3	34	0.00	-0.34	0	3
Madera	77.4	-1.2	95.4	0.1	1	104	59.4	-2.4	1	53	0.00	-0.02	0	1
Porterville	78.0	-3.4	94.3	-2.5	1	104	61.8	-4.3	1	55	0.00	-0.02	0	1
Stockton WSO	75.6	-0.8	92.6	0.0	0	103	58.6	-1.7	0	54	0.00	-0.05	0	0
Yosemite	72.6	0.0	90.1	-0.5	11	99	55.1	0.5	11	49	0.00	-0.21	0	12
South Coast	***70.9***	***-1.1***	***81.3***	***-1.8***	***3.1***	***89.4***	***60.4***	***-0.4***	***3.1***	***52.8***	***0.1***	***-0.1***	***12.9***	***3.0***
Alpine	74.0	-1.9	86.8	-2.6	6	97	61.2	-1.1	6	50	0.01	-0.26	4	6
Anaheim	74.5	0.0	84.6	-1.0	3	93	64.4	1.0	3	61	0.00	-0.01	0	3
Big Bear Lake	63.0	0.3	80.9	1.8	6	90	45.0	-1.3	6	0	1.58	0.60	161	6
Burbank	74.0	-2.1	85.1	-4.8	0	97	63.0	0.6	0	58	0.00	-0.18	0	0
Campo	71.5	-1.4	90.2	-3.4	2	101	52.8	0.5	2	41	0.01	-0.54	2	2
Culver City	69.9	-1.7	76.9	-4.2	4	87	63.0	0.8	4	59	0.00	-0.07	0	4
El Cajon	75.3	-0.6	87.4	-0.7	6	96	63.2	-0.6	6	59	0.00	-0.06	0	6
Escondido 2	73.9	-2.2	86.4	-2.7	11	94	61.5	-1.8	11	56	0.00	-0.02	0	10
Idyllwild Fire D	70.7	3.7	85.7	3.2	2	94	55.6	4.2	2	46	0.67	-0.28	71	2
Lompoc	64.6	-1.0	73.3	-3.4	2	80	55.8	1.3	2	42	0.00	-0.05	0	1
Long Beach AP	72.0	-3.1	79.5	-5.1	0	90	64.6	-1.0	0	62	0.00	-0.10	0	0
Los Angeles Down	72.5	-2.7	80.9	-3.9	1	88	64.0	-1.6	1	61	0.00	-0.13	0	1
Los Angeles AP	69.3	-1.3	74.5	-2.3	0	79	64.2	-0.3	0	62	0.00	-0.14	0	0
Mt Wilson No 2	72.8	0.5	83.3	1.7	22	91	62.2	-0.8	22	57	0.00	-0.29	0	22
Riverside Citrus	76.5	-1.7	92.6	-1.8	0	104	60.3	-1.7	0	55	0.00	-0.17	0	0
Newport Beach Ha	69.2	0.5	73.4	0.4	1	77	65.0	0.6	1	63	0.00	-0.09	0	1
San Diego AP	70.8	-1.6	74.8	-2.7	0	79	66.7	-0.7	0	63	0.00	-0.09	0	0
Sandberg WSMO	74.1	0.3	85.4	1.0	1	97	62.8	-0.4	1	53	0.00	-0.09	0	0
Santa Ana Fire S	72.8	-1.4	83.5	-0.7	0	91	62.2	-2.1	0	59	0.00	-0.12	0	0
Santa Barbara	64.5	-4.1	73.1	-5.6	0	78	56.0	-2.4	0	50	0.05	-0.06	45	0
Santa Maria AP	64.6	0.4	73.9	-0.3	0	79	55.4	1.2	0	48	0.00	-0.05	0	0
UCLA	68.3	-2.4	75.7	-2.5	2	84	60.9	-2.2	2	57	0.00	-0.16	0	2
Southeast Desert	***86.5***	***-0.4***	***102.7***	***0.0***	***0.4***	***112.3***	***70.3***	***-0.7***	***0.4***	***61.1***	***0.1***	***-0.3***	***13.3***	***0.5***
Bishop	73.7	-1.0	94.6	-1.2	0	105	52.8	-0.9	0	44	0.01	-0.12	8	0
Blythe	92.6	0.2	105.9	0.5	0	114	79.4	-0.1	0	69	0.02	-0.64	3	0
Daggett AP	87.7	1.4	102.5	0.2	0	112	72.9	2.5	0	66	0.20	-0.19	51	0
Imperial	91.3	1.1	106.4	2.1	0	114	76.1	0.1	0	68	0.00	-0.32	0	0
Inyokern	83.2	0.3	100.4	-0.7	1	110	66.0	1.2	1	58	0.00	-0.34	0	2
Lancaster	80.0	0.6	97.6	2.8	1	108	62.5	-1.6	1	54	0.00	-0.14	0	1
Needles AP	93.6	-0.8	105.5	-1.6	0	117	81.7	0.1	0	75	0.15	-0.55	21	0
Palm Springs	91.0	-0.5	104.9	-2.0	0	116	77.2	1.2	0	67	0.00	-0.40	0	0
Thermal AP	88.4	-1.6	105.4	-0.2	0	114	71.4	-3.1	0	58	0.00	-0.37	0	0
Twentynine Palms	83.3	-3.5	103.4	-0.2	2	113	63.3	-6.8	2	52	0.38	-0.38	50	2
STATEWIDE AVG	**72.0**	**0.2**	**85.6**	**-0.7**	**2.4**	**95.0**	**58.1**	**0.9**	**2.4**	**50.4**	**0.1**	**-0.2**	**70.0**	**2.3**

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

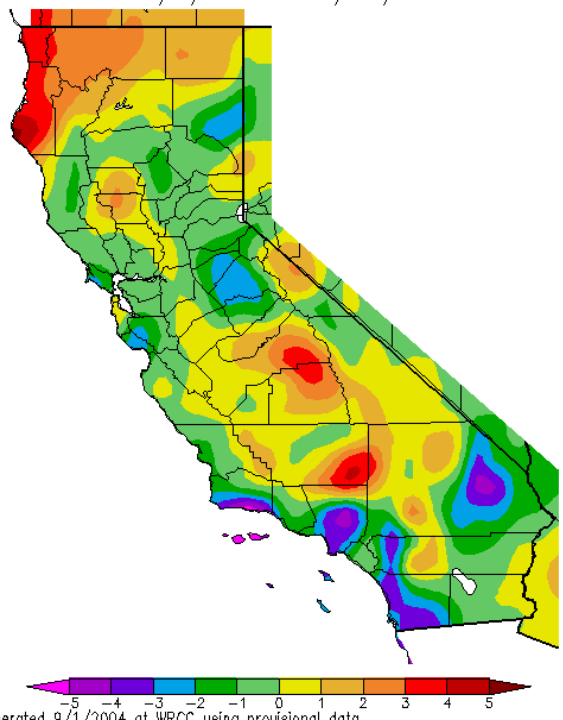
Climate Maps for August

Ave. Temperature dep from Ave (deg F)
8/1/2004 – 8/31/2004



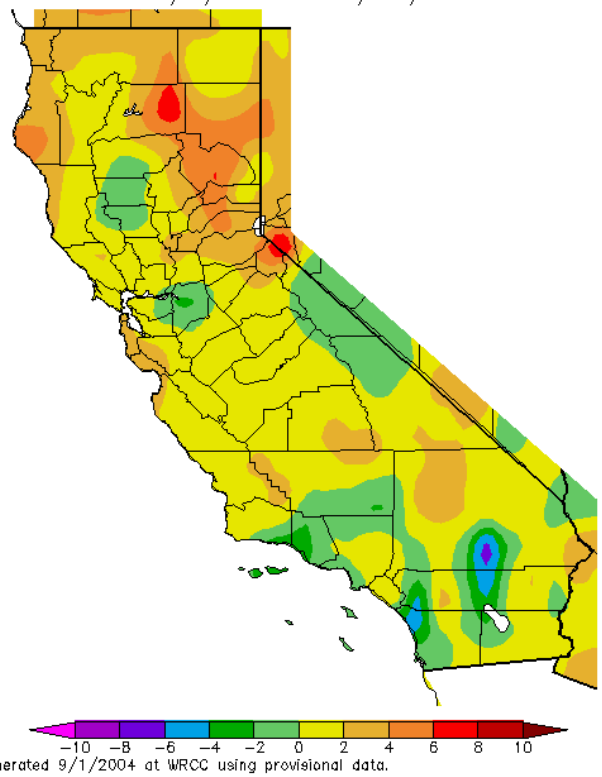
Generated 9/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Av. Max. Temperature dep from Ave (deg F)
8/1/2004 – 8/31/2004



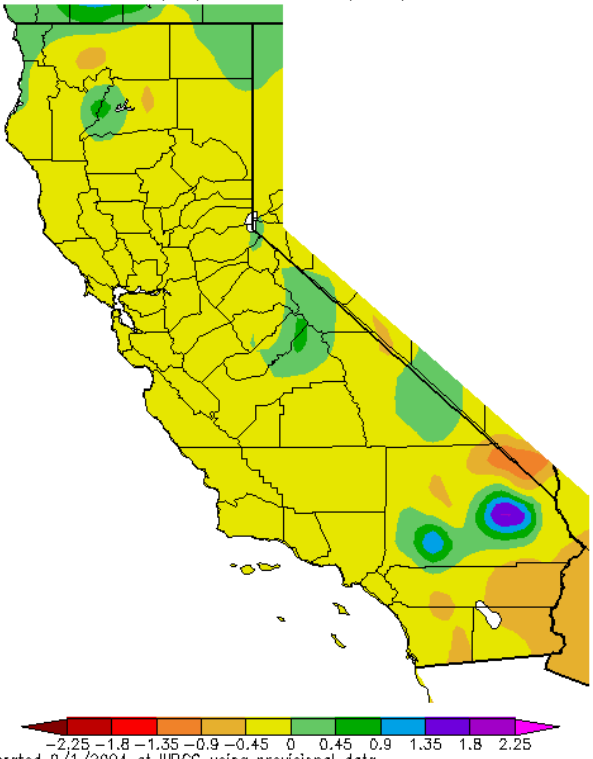
Generated 9/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Av. Min. Temperature dep from Ave (deg. F)
8/1/2004 – 8/31/2004



Generated 9/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Precipitation Departure from Average (in.)
8/1/2004 – 8/31/2004



Generated 9/1/2004 at WRCC using provisional data.
NOAA Regional Climate Centers