California Climate Watch

A monthly newsletter monitoring California climate

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

Summary of the Month

by Laura Edwards
California Climate Specialist
Western Regional Climate Center

November 2004 was cooler and drier than normal statewide. The average temperature was 1.9 degrees below normal at 49.5 degrees. This was dominated by cooler than normal maximum temperatures, about -3.1 statewide. Monthly precipitation averaged statewide was 0.55 inches, or 78% of normal. Precipitation was below normal in all areas except for the southeast region.

Overall, a strong ridge in the eastern Pacific dominated the weather pattern, leaving most of the state high and dry, a stark contrast from October.

The story of the month was extreme precipitation in the Southeast Desert climate division on Nov 21-22. This division averaged 329% of normal precipitation for the month, with Twentynine Palms leading at 629%, 1.11 inches above the normal 0.21 inches. Almost all of the precipitation in this region fell during these two days.

Thanksgiving weekend of November 28-29 brought some snow to the Sierra Nevada eastward, due to some polar air coming down from Canada around the Pacific high. Many ski areas in the Tahoe area and southward welcomed the new blanket of white.

The Northern Sierra 8-Station Precipitation Index accumulated 2.6 inches for November, 41% of the average 6.3 inches.

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

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

Tree Rings Tell A Story of Climates Past

By Laura Edwards
Western Regional Climate Center

Many people are familiar with the concept of tree rings and their storytelling abilities of years gone by. Grade school students learn that the number of rings coincide with the age of the tree. But tree rings can tell us so much more than just age—they are a proxy record for climate. This area of tree ring studies is dendroclimatology.

Dendroclimatology is particularly useful because of its long record. Some trees in California can live thousands of years, and cores have been studied that date back to the 1600s. California is home to the oldest known trees, the bristlecone pine. Because settlement in the area occurred in the 18th and 19th centuries, the observational record is short. Tree rings can then be used not only to piece together long precipitation and temperature trends, but also carbon dioxide and anthropogenic effects on climate change. The ring date analyses can be crossdated with other climate records in the same area and then verified.

Figure 1. Cross section of a douglas fir. Credit: H. D. Grissino-Mayer.

Tree ring widths and density are sampled by taking cores from living trees, or cut cross-sections from fallen trees. Climate variability and change can be detected by knowing growth rates for various species under different precipitation, temperature, and other atmospheric conditions. Wider rings generally indicate wetter, more favorable growing conditions.

Certain species are preferred for different climate variables. For example, in California, foxtail pine (*P. balfouriana* Grev. and Balf.) has been used to study timberline changes at Cirque Peak in the Sierra Nevada (1). These trees are good temperature indicators, a primary factor in migration of timberline up and down a mountain range. As temperature increases, the timberline rises. As temperature cools, timberline lowers. The rising and lowering of the timberline can also signify glacial retreat and advance. Other studies have been performed in the White Mountains that correlated to the foxtail pine at Cirque Peak. There were periods of foxtail pine timberline decline about 3400, 2400 and 1400 yr before present.

Jeffrey pine (*Pinus jeffreyi*) and big-cone Douglas fir (*Pseudotsuga macrocarpa*) in southern California were used to help describe North Pacific decadal climate variability (2). The multiannual climate fluctuations in these species correlated well with Pacific Decadal Oscillation (PDO) period of ~23 years.

***TREE RINGS** continued on page 2.*

TREE RINGS (continued from page 1):

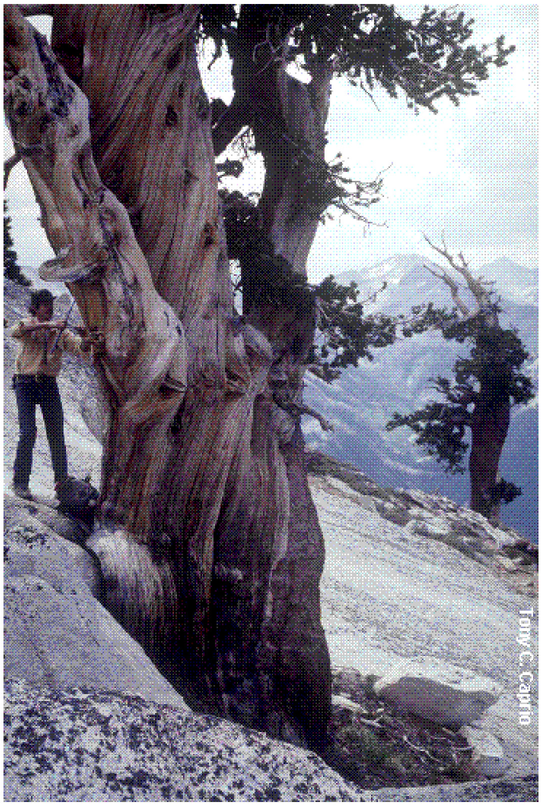


Figure 2. Coring a foxtail pine on Alta Peak, Sierra Nevada, California. Credit: A. C. Caprio on http://web.utk.edu/~grissino

Samples of different species in one ecosystem were used to investigate fire history in the southern Cascades in the Thousand Lakes Wilderness (3). This research study sampled a number of pine and fir species to describe fire regimes in the area. Through tree-ring analysis of each forest type, they defined seasons of fire occurrence, fire return interval, area affected by fire (fire extent), fire rotations and fire severity. Fire suppression has been in effect since 1905, but there is evidence of fires as far back as the 1650s, in the presettlement period.

Trees in California have similar water needs as agriculture, and this is evident in their rings. California's precipitation falls mostly in the winter season, but trees need water to grow in the warmer season. Because of this annual cycle, some California trees are ideal as recorders of precipitation, such as the California blue oak. A current CalFed project is underway to further analyze these unique trees that surround the Central Valley in the elevational range of 100-1000 meters (5).

Tree rings are just one part of the paleoclimate puzzle. In combination with surface observations, corals, ice cores and other proxy records, we can reveal climates of the past, and may be able to better predict the future.

1. Scuderi, Louis A. (1987). Late-holocene upper timberline variation in the southern Sierra Nevada. *Nature* 325, 15 Jan 1987, pp 242-244.
2. Biondi, F., A. Gershunov, D. R. Cayan (2001). North Pacific decadal climate variability since 1661. *J. Climate* **14**: 5-10.
3. Bekker, M. F. and A. H. Taylor (2001). Gradient analysis of fire regimes in montane forests of the southern Cascade range, Thousand Lakes Wilderness, California, USA. *Plant Ecology* **155**: 15-28.
4. Cook, E. R., D. M. Meko, D. W. Stahle, and M. K. Cleaveland (1999). Drought reconstructions for the continental United States. *J. Climate* **12**:1145-1162.
5. Redmond, K. T., D. W. Stahle, M. D. Therrell, D. R. Cayan, and M. D. Dettinger (2002). 400 years of California central valley precipitation reconstructed from blue oaks. American Meteorological Society 82nd Annual Meeting, 13th Symposium on Global Change and Climate Variations.

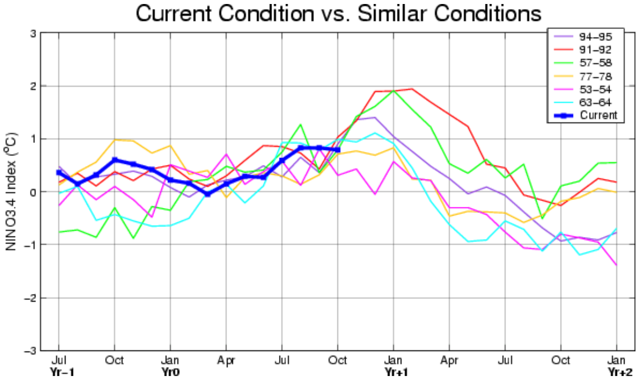
For further information:
The Laboratory of Tree-Ring Research:
http://www.ltrr.arizona.edu/
Ultimate Tree-Ring Web Pages: http://web.utk.edu/~grissino/

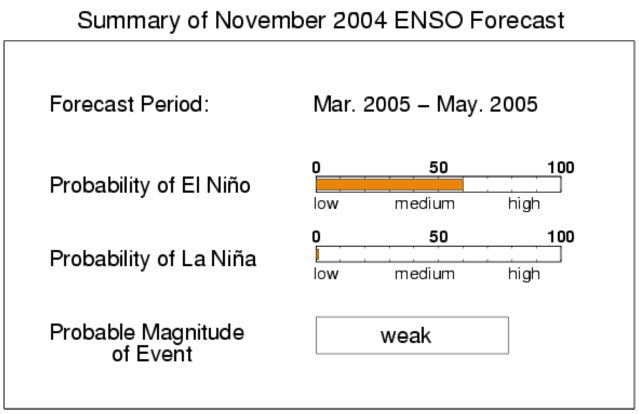
Hydrological Update and Forecast:

As of December 6, 2004, the Northern Sierra 8-Station Index has received 91% of average precipitation for the water year up to that date. Average precipitation is 10.70 inches and the Index accumulated 9.70 inches. This adds up to 19% of average for the entire water year. December has started out dry, but forecasts call for wetter conditions in the weeks ahead. The monthly forecast issued by the Climate Prediction Center shows equal chances of above, average, or below average precipitation. The Sierra Nevada and eastward are predicted to be warmer than average. So far, we have not seen the traditional wetness associated with typical El Niño conditions. Most models are trending toward a drier and warmer long-range forecast.

CLIMATE FORECASTS & OUTLOOKS

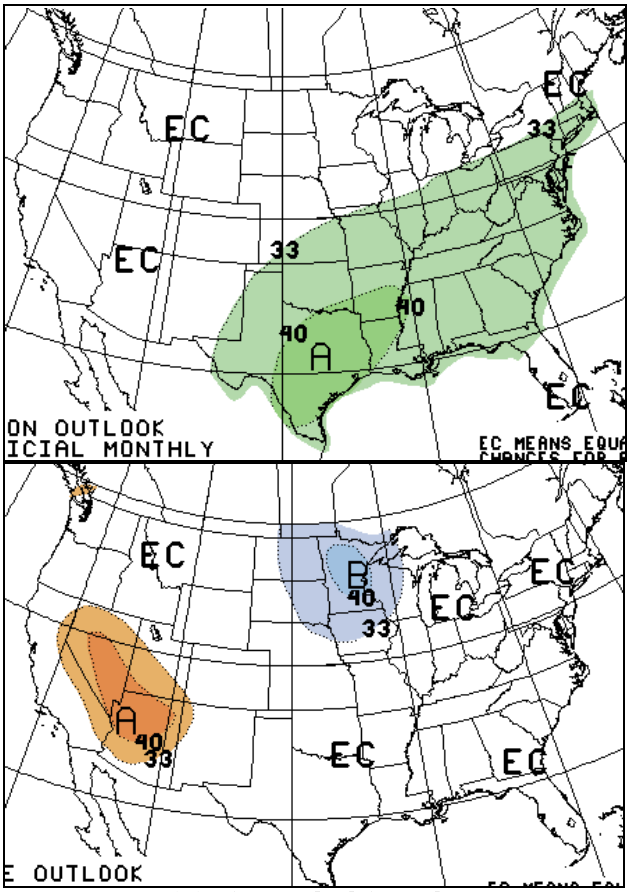
ENSO November forecasts:





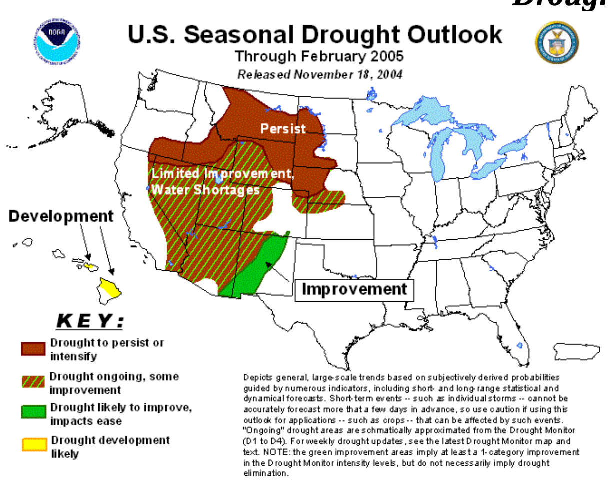
Based on sea surface temperature departures from the long-term average over the "Nino 3.4" region (120-170W, 5S-5N).
http://iri.columbia.edu/climate/ENSO/currentinfo/QuickLook.html

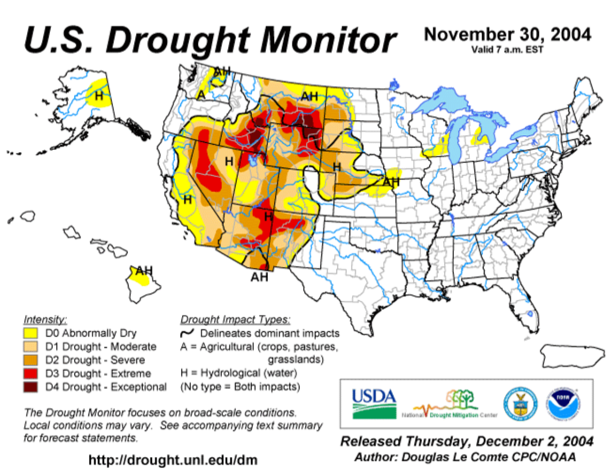
Precipitation and Temperature Outlooks:



Precipitation Outlook is on the top, Temperature Outlook is on the bottom. "A" means above climatology, "B" means below climatology, and "EC" means equal chances of above, normal, or below climatology.
Source: Climate Prediction Center, http://www.cpc.noaa.gov/

Drought Conditions:





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

November 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	PP
North Coast	**49.3**	**-1.3**	**58.6**	**-1.3**	**0**	**68**	**40.0**	**-1.3**	**0**	**43**	**2.08**	**-3.54**	**0**	**0.73**	**40**
Crescent City	49.8	0.5	56.6	-0.1	0	64	42.9	0.9	0	32	2.58	-7.26	0	0.95	26
Eureka	48.9	-2.1	55.7	-2.3	1	61	42.1	-1.8	1	54	1.87	-3.91	0	0.63	32
Arcata/Eureka	48.3	-2.7	57.1	-0.9	0	65	39.6	-4.3	0	27	1.69	-4.09	0	0.55	29
Fort Bragg 5N	48.7	-2.5	56.4	-2.8	2	65	41.0	-2.1	2	52	1.37	-4.05	2	0.52	25
Kentfield	52.7	-1.5	60.6	-2.8	0	68	44.7	-0.3	0	55	2.96	-4.51	0	1.05	40
Napa	53.3	-0.2	62.8	-1.3	0	72	43.7	0.8	0	55	2.51	-1.21	0	1.06	67
Santa Rosa	51.6	-2.6	62.8	-2.5	0	75	40.3	-2.7	0	52	2.71	-1.60	0	0.67	63
Ukiah AP	50.3	-0.8	62.6	0.8	0	75	37.9	-2.5	0	26	1.83	-3.57	0	0.68	34
Yreka	40.5	0.1	52.9	0.4	0	63	28.2	-0.1	0	38	1.17	-1.63	0	0.43	42
Sacramento Drainage	**45.1**	**-0.4**	**55.5**	**-1.1**	**1**	**65**	**34.8**	**0.2**	**1**	**32**	**2.09**	**-2.62**	**2**	**0.68**	**49**
Alturas	34.8	-2.4	47.9	-3.1	0	65	21.8	-1.5	0	-4	0.77	-0.70	0	0.21	52
Adin Ranger Stn	39.8	-1.1	51.6	-0.2	0	69	27.9	-2.1	0	42	2.18	0.36	0	0.78	120
Blue Canyon	41.5	-1.2	48.1	-1.3	0	63	35.0	-1.2	0	21	4.17	-4.80	0	1.22	46
Burney	37.8	0.0	49.4	-3.4	2	60	26.2	3.4	2	42	1.66	-1.70	2	0.78	49
Dunsmuir Treatment	46.8	2.4	59.6	3.0	0	74	33.9	1.7	0	46	1.34	-6.56	0	0.42	17
Grass Valley	45.6	-1.1	56.7	-1.4	1	70	34.6	-0.7	1	46	3.73	-3.35	2	1.38	53
Marysville	50.6	-2.9	60.6	-3.9	0	71	40.6	-1.9	0	27	2.54	-0.26	0	1.26	91
Mineral	37.7	1.0	47.9	0.6	1	65	27.5	1.4	1	36	1.50	-5.67	3	0.54	21
Mount Shasta	40.4	0.5	50.3	0.4	0	65	30.5	0.6	0	16	1.27	-3.81	0	0.43	25
Paradise	52.9	1.5	60.8	0.9	1	76	45.1	2.2	1	51	2.43	-5.00	1	0.90	33
Portola	35.6	-0.6	48.8	-0.9	11	61	22.5	-0.2	11	34	0.45	-2.05	19	0.26	18
Quincy	40.7	-1.7	51.8	-4.7	0	65	29.5	1.3	0	44	2.43	-2.47	2	1.12	50
Redding AP	52.2	1.1	63.2	0.8	0	80	41.3	1.5	0	31	1.72	-2.31	0	0.46	43
Red Bluff AP	52.0	-0.7	62.1	-1.0	0	79	41.9	-0.4	0	30	2.06	-0.86	0	0.53	71
Sacramento AP	51.2	-2.1	60.1	-3.6	0	69	42.2	-0.6	0	28	2.69	0.50	0	0.76	123
Sacramento City	53.3	-1.8	61.9	-2.3	0	0	44.7	-1.2	0	0	2.76	0.17	0	0.00	0
Shasta Dam	54.1	1.7	61.9	2.0	0	80	46.3	1.4	0	51	1.84	-6.02	0	0.52	23
Northeast Interior	**47.6**	**-1.1**	**57.9**	**-2.6**	**1**	**69**	**37.2**	**0.5**	**1**	**44**	**0.93**	**-1.34**	**4**	**0.55**	**48**
Boca	34.8	-0.6	49.9	-1.2	4	62	19.7	0.0	4	33	0.43	-2.29	4	0.28	16
Bodie	28.7	-1.5	42.2	-5.9	2	58	15.1	2.8	2	37	0.35	-0.84	10	0.25	29
Bridgeport	32.8	-1.0	47.5	-3.8	2	64	18.0	1.9	2	34	1.26	0.40	9	0.31	147
Markleeville	38.2	0.8	50.4	-2.3	0	67	26.0	3.9	0	37	1.09	-0.93	19	0.59	54
Susanville 2 SW	38.7	-0.1	49.5	-1.2	0	67	27.9	1.0	0	44	1.22	-0.43	8	0.50	74
Tahoe City	34.8	-1.9	45.0	-2.9	16	55	24.6	-0.9	16	35	0.40	-3.85	20	0.40	9
Tahoe Valley AP	34.2	0.0	45.7	0.0	0	57	22.6	0.0	0	35	1.58	-0.94	4	1.22	63
Central Coast	**54.1**	**-1.3**	**63.3**	**-2.6**	**0**	**73**	**44.8**	**0.1**	**0**	**48**	**0.95**	**-1.38**	**1**	**0.57**	**45**
Hollister	52.5	-2.1	63.8	-4.1	0	73	41.1	-0.1	0	51	0.42	-1.45	0	0.14	22
King City	53.2	-1.6	66.1	-3.3	1	76	40.3	0.2	1	51	0.54	-0.69	1	0.30	44
Morro Bay	55.7	-0.2	63.2	-2.9	1	74	48.2	2.6	1	55	1.16	-0.38	1	0.85	75
Oakland Museum	55.5	-1.2	63.5	-0.4	0	72	47.6	-1.8	0	55	1.69	-1.45	0	0.84	54
Paso Robles AP	49.3	-3.3	62.2	-5.6	0	74	36.4	-1.1	0	22	1.46	0.34	0	1.30	130
Redwood City	55.3	2.2	64.5	1.3	1	73	46.1	3.2	1	54	0.22	-2.40	5	0.22	8
Richmond	55.6	0.0	61.9	-1.7	2	71	49.2	1.6	2	58	0.99	-2.48	3	0.59	29
Salinas AP	53.4	-2.1	63.9	-2.7	0	74	42.8	-1.5	0	27	0.38	-1.13	0	0.19	25
San Francisco	56.8	-0.7	62.9	-1.2	0	71	50.7	-0.1	0	55	2.03	-1.28	0	0.76	61
San Francisco AP	55.2	0.5	61.6	-0.4	0	70	48.9	1.4	0	37	1.22	-1.27	0	0.65	49
San Jose	54.3	-1.2	63.2	-2.1	0	71	45.3	-0.3	0	55	0.46	-1.27	0	0.34	27
San Luis Obispo	53.5	-5.3	65.0	-7.0	0	75	42.1	-3.4	0	54	0.51	-1.66	1	0.32	24
Santa Cruz	52.9	-1.5	61.6	-3.7	1	71	44.3	0.9	1	50	1.23	-2.85	1	0.92	30

San Joaquin	**46.6**	**-2.6**	**56.6**	**-4.3**	**1**	**68**	**36.5**	**-0.8**	**1**	**37**	**0.89**	**-1.18**	**3**	**0.47**	**52**
Bakersfield AP	52.3	-2.4	61.9	-3.4	0	74	42.8	-1.4	0	29	0.18	-0.41	0	0.09	31
Coalinga	51.1	-3.9	61.7	-6.4	7	71	40.4	-1.4	7	50	0.54	-0.10	7	0.46	84
Fresno	51.7	-1.0	59.8	-3.2	0	71	43.6	1.3	0	55	0.81	-0.29	0	0.32	74
Glennville	42.9	-3.2	56.8	-4.4	0	69	29.0	-1.9	0	42	0.91	-1.22	4	0.55	43
Grant Grove	38.3	-1.8	46.2	-1.9	2	57	30.4	-1.7	2	38	1.42	-2.89	6	0.80	33
Hanford	49.6	-2.8	60.1	-5.0	0	71	39.1	-0.5	0	24	0.44	-0.38	0	0.19	54
Lodgepole	32.7	-1.0	43.3	-2.3	0	54	22.1	0.3	0	32	2.37	-2.01	0	1.32	54
Madera	50.2	-2.2	59.2	-5.7	0	70	41.2	1.3	0	27	0.63	-0.61	0	0.27	51
Porterville	50.8	-4.9	60.7	-7.2	0	70	40.9	-2.6	0	50	0.46	-0.68	1	0.23	40
Stockton	51.2	-1.9	61.1	-2.9	0	70	41.3	-0.8	0	26	1.88	0.11	0	0.85	106
Yosemite	41.4	-3.1	52.2	-5.0	7	68	30.5	-1.3	7	39	0.12	-4.54	14	0.12	3
South Coast	**54.3**	**-3.1**	**64.6**	**-4.6**	**2**	**76**	**43.9**	**-1.6**	**2**	**47**	**0.56**	**-0.75**	**3**	**0.35**	**42**
Alpine	53.1	-5.9	63.9	-7.3	11	74	42.3	-4.5	11	52	0.65	-1.07	11	0.33	38
Anaheim	60.5	-1.8	70.8	-3.3	2	83	50.2	-0.3	2	62	0.46	-0.36	3	0.42	56
Big Bear Lake	34.4	-5.4	47.6	-6.7	8	58	21.2	-4.1	8	33	2.70	1.15	8	2.00	174
Burbank	56.7	-2.8	67.1	-6.4	0	78	46.4	1.0	0	53	0.47	-0.58	0	0.22	45
Campo	47.3	-5.0	60.4	-8.9	0	69	34.2	-1.1	0	27	0.94	-0.30	0	0.25	76
Culver City	58.9	-2.3	67.4	-4.2	2	75	50.4	-0.4	2	57	0.25	-0.69	15	0.20	27
El Cajon	58.1	-1.3	71.5	-2.0	5	78	44.8	-0.4	5	54	0.74	-0.44	5	0.34	63
Escondido 2	56.3	-3.8	68.2	-5.7	2	78	44.4	-1.9	2	55	0.48	-0.84	2	0.45	36
Idyllwild Fire D	42.7	-2.8	55.7	-4.5	7	64	29.7	-1.0	7	46	1.63	-0.65	7	1.01	71
Lompoc	54.9	-2.7	66.1	-5.0	1	78	43.8	-0.2	1	55	0.35	-0.99	1	0.33	26
Long Beach AP	58.1	-3.7	66.9	-6.5	0	77	49.4	-0.7	0	63	0.36	-0.76	0	0.26	32
Los Angeles/USC	59.1	-3.8	68.1	-5.1	0	77	50.1	-2.5	0	39	0.20	-0.85	0	0.09	19
Los Angeles AP	58.9	-2.6	66.9	-3.5	0	77	50.9	-1.8	0	41	0.11	-1.02	0	0.08	10
Mt Wilson No 2	47.1	-3.4	56.4	-3.1	0	67	37.9	-3.5	0	47	0.30	-2.93	1	0.13	9
Riverside Citrus	57.4	-2.1	71.0	-2.9	2	81	43.8	-1.2	2	55	0.38	-0.40	1	0.33	49
Newport Beach Harbor	59.3	-0.7	65.4	-2.3	0	78	53.2	1.0	0	59	0.65	-0.37	0	0.47	64
San Diego AP	60.1	-1.6	67.0	-2.9	0	79	53.1	-0.5	0	60	0.33	-0.74	0	0.13	31
Sandberg WSO	44.3	-4.8	51.7	-4.6	0	60	36.9	-5.1	0	23	0.06	-0.76	0	0.04	7
Santa Ana Fire	60.6	-1.8	71.6	-2.6	0	82	49.5	-1.0	0	59	0.19	-0.98	0	0.14	16
Santa Barbara AP	53.3	-4.2	65.9	-5.1	0	77	40.8	-3.2	0	30	0.07	-1.25	0	0.05	5
Santa Maria AP	52.8	-2.7	64.9	-4.3	0	106	40.6	-1.2	0	5	0.71	-0.53	0	0.30	57
UCLA	59.6	-2.7	67.3	-3.4	3	77	51.9	-2.0	3	60	0.24	-1.11	2	0.16	18
Southeast Desert	**54.1**	**-3.0**	**67.0**	**-5.1**	**0**	**78**	**41.1**	**-0.8**	**0**	**38**	**0.82**	**0.53**	**1**	**0.69**	**329**
Bishop	44.0	-0.8	57.6	-4.8	1	68	30.5	3.4	1	47	1.10	0.66	0	0.85	250
Blythe AP	58.7	-2.4	69.8	-4.9	0	81	47.5	0.1	0	34	0.33	0.14	0	0.28	174
Daggett AP	52.5	-2.9	64.0	-5.5	0	77	40.9	-0.2	0	27	0.94	0.76	0	0.65	522
Imperial AP	58.6	-3.7	71.9	-5.1	0	80	45.3	-2.3	0	32	0.84	0.65	0	0.84	442
Inyokern	51.4	-1.7	64.1	-5.1	0	76	38.7	1.8	0	56	0.00	-0.28	6	0.00	0
Lancaster	48.1	-1.9	62.4	-2.7	0	73	33.8	-1.1	0	15	0.16	-0.34	0	0.07	32
Needles AP	60.0	-2.1	69.4	-4.7	0	85	50.5	0.6	0	35	1.41	1.06	0	0.87	403
Palm Springs	60.2	-3.8	70.9	-7.3	0	81	49.5	-0.2	0	36	1.07	0.78	0	1.07	369
Thermal AP	57.8	-3.2	72.1	-6.3	0	84	43.5	0.0	0	60	0.99	0.78	0	0.99	471
Twentynine Palms	49.4	-7.0	67.8	-4.1	1	76	31.0	-9.9	1	40	1.32	1.11	1	1.29	629
STATEWIDE	**49.5**	**-1.9**	**60.0**	**-3.1**	**1**	**71**	**39.0**	**-0.6**	**1**	**41**	**1.16**	**-1.43**	**2**	**0.55**	**78**

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
PPCT = monthly precipitation percent of normal
PDEP = monthly precipitation departure from normal in inches
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

Climate Maps for November