

Summary of the Month

On February 2, Punxsutawney Phil predicted 6 more weeks of winter... as it turns out, he was right, at least where California is concerned. The month came and went with a bang, with DWR's North Sierra 8-station precipitation index ending the month at 14.4", 180% of average. Above average precipitation and lower than average temperatures were the trend for the month.

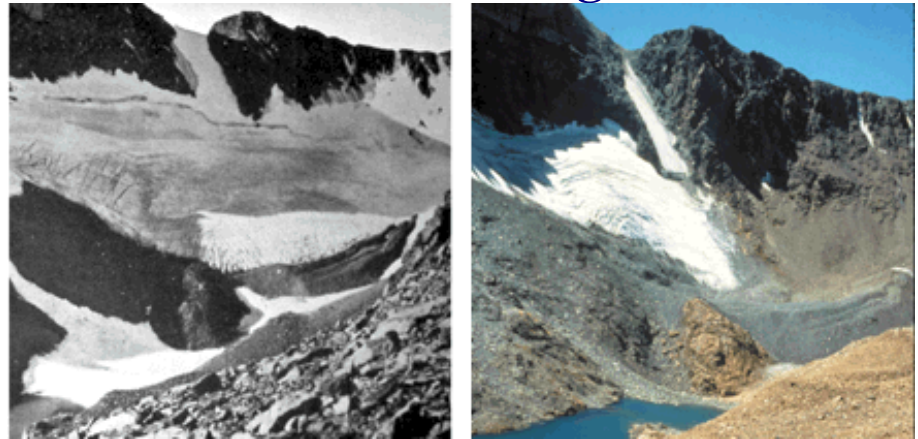
The first days of February brought a strong cold front that plowed through California, with heavy rain and winter storm warnings covering the state. Precipitation varied from 0.5 to over 3.5 inches for the 2-day event. Ojai tied a record low of 27, and Fresno and Bakersfield had record precipitation on the 2nd.

Feb 8-11 brought cold temps to the southern coastal regions, with Santa Barbara reporting record lows for all 4 days. President's Day weekend brought a subtropical system with heavy rain and some snow across the state, with Stouts Meadow in the Shasta area coming in the lead with 9.00" precipitation for Feb 13-17, with an additional 6.24" Feb 17-18. On a warmer note, Wild Animal Park, CA tied a record high with 85F on the 17th.

On Feb 21-22, record low maximum temps were reported in the south, with 14 records tied or broken. A few days later, another strong winter storm made news Feb 25-26 with feet of snow in the mountains, record rain in the south, and flooding in the SF Bay area. This precipitation brought monthly totals up above normal, with 164% of average precipitation statewide.

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Glaciers as Climate Change Indicators



20th century retreat. Photographs of the Dana Glacier, Sierra Nevada, California (3660 m, 37° 54' N, 119° 13' W) in 1883 (*left*) and 1985 (*right*) show how the glacier has retreated since the late 19th century.

CREDIT: LEFT, U.S. GEOLOGICAL SURVEY; RIGHT, SCOTT STINE

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By Laura Edwards

Whether or not California's climate is changing is a question to which many want the answer. One way in which climate can be monitored to aid in answering this question is through changes in the state's glaciers.

Glaciers are good indicators of climate change, as they are very sensitive to slight increases and decreases in average temperature and precipitation. Both cold temperatures and snow over a long period of time are needed to form and maintain a glacier. There are many high altitude locations in nearby states that are cold enough to maintain glaciers, but there is not enough precipitation in these areas to form a mass of ice.

Photography of glaciers in California has been important in monitoring changes in glacier size and movement. Archived glacier photographs from early explorers have been compared to recent photographs from similar vantage points over periods of several decades up to more than 100 years. It has been found recently by these photographic comparisons that the 7 glaciers on Mt. Shasta have been growing, but glaciers in the Sierra have been retreating. Glaciers in the Sierra Nevada are especially sensitive to climate change as their ice temperatures are very close to freezing year-round.

Some argue global warming would increase water vapor and increase precipitation locally, which could positively affect California's glaciers. On the other hand, if the climate warms as predicted by the IPCC, average snow level will rise and melting will occur at higher altitudes, shrinking the glaciers. As a result, the future of California's hundreds of glaciers is uncertain, but they are sure to show signs of California's changing climate.

For further reading: [Glaciers of California](#), Bill Guyton, 1998, University of California Press. See also USGS Professional Paper 1386-J, [http://pubs.usgs.gov/prof/p1386j/and www.yosemite.org/newsroom/clips2003/october/1012a03.htm](http://pubs.usgs.gov/prof/p1386j/and/www.yosemite.org/newsroom/clips2003/october/1012a03.htm).

**INSIDE THIS ISSUE: Climate Maps,
Monthly Station Data, Snow & Hydrological update**

February Station Data

Station Name	# msg Temp	Ta (F)	Ta dep	Tx (F)	Tx dep	Tn (F)	Tn dep	# msg prec	pmo (in)	pdp (in)	% norm
North Coast											
Eureka	0	49.2	0.1	53.8	0.7	41.8	-0.6	0	8.12	3.09	161
Kentfield	0	50.6	-0.7	58.3	-2.4	42.9	0.9	0	11.20	2.93	135
Manzanita Lake*	12	32.1	-0.1	40.4	-3.1	23.8	2.8	13	7.23	1.68	130
Napa	0	51.2	-0.7	60.0	-2.8	42.4	1.3	0	6.40	2.09	148
Santa Rosa	0	49.9	-1.2	60.0	-3.0	40.2	0.8	1	10.36	5.55	215
Yreka	0	39.0	-0.1	49.8	-1.0	28.1	0.9	1	3.22	1.17	157
Sacramento											
Alturas	0	34.4	0.9	43.4	-3.0	25.6	4.9	0	1.71	0.40	131
Adin Ranger Stn	0	36.6	1.6	45.2	-1.6	27.9	4.8	1	5.35	3.45	282
Blue Canyon	0	34.5	-4.2	38.9	-6.4	30.1	-1.9	0	11.37	0.65	106
Burney	0	35.6	-0.4	43.8	-5.9	27.5	5.1	0	9.83	6.02	258
Dunsmuir Tmt Plt	3	40.9	-1.5	50.0	-3.5	31.9	0.6	3	16.36	6.26	162
Marysville	0	50.1	-1.3	58.3	-3.1	42.0	0.6	0	5.68	2.24	165
Mineral	1	31.6	-1.8	40.4	-3.3	22.8	-0.3	2	10.81	2.80	135
Mt. Shasta	0	37.4	-0.4	44.6	-2.8	30.3	1.9	0	13.06	8.11	264
Quincy	0	38.8	-0.4	47.7	-5.3	29.9	4.6	0	13.74	7.45	218
Redding	0	48.8	-0.1	57.1	-3.8	41.2	3.5	0	10.09	7.38	372
Red Bluff FSS	0	49.0	-1.7	57.4	-3.2	40.9	-0.1	0	7.61	4.09	216
Sacramento City	0	52.2	-1.3	60.7	1.0	43.7	-0.3	0	4.84	1.07	128
Sacramento AP	0	50.8	0.2	59.3	-0.5	42.5	0.9	0	5.01	1.85	159
Shasta Dam	0	47.4	-1.4	54.1	-2.8	40.8	-0.1	0	19.40	9.94	205
Northeast Interior											
Bodie	2	23.3	-0.8	36.1	-5.0	10.6	3.4	0	1.41	-0.51	73
Susanville 2 SW*	2	34.8	-0.7	44.1	-2.7	25.6	1.2	6	1.70	-0.28	86
Central Coast											
Gilroy	1	52.3	1.1	61.6	-1.8	42.9	3.9	1	5.31	1.85	153
Hollister	0	50.8	-1.0	60.6	-3.2	41.0	1.2	0	4.13	1.70	170
King City	1	51.6	-0.6	62.8	-3.7	40.5	2.4	0	4.09	1.78	177
Monterey FAA	0	51.4	-1.1	58.6	-1.9	44.4	-0.3	0	3.11	0.30	111
Oakland Museum	0	54.1	-0.4	61.0	-0.7	47.2	-0.1	2	4.17	0.17	104
Paso Robles AP	0	48.4	-1.5	59.2	-3.8	37.6	0.8	0	3.15	0.39	114
Redwood City	0	53.1	0.8	61.4	-1.3	44.7	2.9	0	3.77	0.14	104
Richmond	3	52.0	-1.5	58.8	-3.1	45.2	0.2	2	4.50	0.75	120
Salinas AP	0	51.3	-1.1	59.6	-2.9	43.1	0.8	0	3.15	1.02	148
San Fran MD	0	52.2	-0.6	59.3	-0.7	48.0	-0.5	0	6.05	2.82	187
San Francisco Apt	0	52.3	0.3	58.0	-1.2	46.7	1.8	0	4.57	1.08	131
San Jose	0	51.8	-1.2	60.6	-2.2	45.4	-0.3	0	2.93	0.45	118
San Luis Obispo	0	51.2	-2.7	61.0	-3.8	41.5	-1.6	0	5.54	0.57	111
Santa Cruz	1	51.1	-0.7	59.5	-3.3	42.8	1.9	1	5.61	0.26	105
San Joaquin											
Bakersfield	0	53.2	-0.1	63.2	-0.7	43.6	0.5	0	1.63	0.50	144
Fresno	0	50.5	-0.5	59.3	-2.2	42.0	1.2	0	1.69	-0.31	85
Glennville	0	41.6	-2.9	52.9	-5.4	30.3	-0.5	1	4.86	1.67	152
Hanford 1 S	2	48.9	-1.2	59.2	-2.5	38.7	0.3	0	2.32	0.71	144
Lodgepole	1	25.8	-3.0	36.5	-4.4	15.0	-1.5	1	9.32	-0.26	97
Madera	0	49.2	-0.7	58.7	-2.5	40.3	1.1	0	2.31	0.40	121
Porterville	0	49.6	-2.6	59.1	-4.6	40.0	-0.5	0	2.11	0.12	106
Stockton WSO	0	49.7	-0.9	59.4	-1.3	40.1	-0.4	0	3.68	1.42	163
Yosemite	3	37.8	-3.8	47.7	-7.0	27.9	-0.6	0	8.46	1.77	126

See key on next page for column definitions. All data is provisional and subject to change.

Station Name	# msg T	Ta (F)	Ta dep	Tx (F)	Tx dep	Tn (F)	Tn dep	# msg p	pmo (in)	pdp (in)	% norm
South Coast											
Anaheim*	9	57.5	2.6	67.0	0.6	48.0	4.6	9	3.55	-0.15	96
Big Bear Lake	4	31.8	-2.9	44.2	-4.0	19.4	-1.8	4	3.02	-1.18	72
Burbank	0	53.9	-2.8	63.3	-6.6	44.4	0.9	0	4.65	0.90	124
Campo	0	44.9	-3.9	57.4	-6.6	34.5	-1.2	0	3.60	0.98	137
Culver City*	6	55.8	-2.4	64.7	-3.9	46.9	-0.8	7	3.38	1.10	148
El Cajon	3	55.6	-1.5	67.8	-2.6	43.5	-0.4	3	3.31	0.79	131
Escondido 2	2	54.7	-2.2	67.4	-2.1	42.1	-2.4	3	6.71	2.83	173
Idyllwild Fire Dept*	2	38.5	-3.1	50.8	-4.3	26.3	-1.9	7	4.84	0.28	106
Lompoc	2	52.5	-1.7	62.1	-4.1	42.9	0.7	2	5.71	2.60	184
Long Beach AP	0	55.4	-1.8	64.7	-2.8	46.2	-0.8	0	3.74	1.01	137
Los Angeles Down	0	56.2	-3.6	65.2	-4.0	47.6	-3.2	0	4.89	1.53	146
Los Angeles AP	0	55.6	-2.0	63.3	-2.4	47.9	-1.5	0	4.61	1.91	171
Mt Wilson No 2	0	42.0	-2.8	50.6	-2.5	33.4	-3.2	0	6.51	-2.09	76
Newport Beach Harbor	1	55.0	-1.1	60.4	-3.2	49.5	1.1	1	2.52	0.26	112
San Diego AP	0	56.7	-1.9	63.7	-2.7	49.7	-1.0	0	2.81	1.08	162
Sandberg WSMO	0	39.3	-4.0	45.6	-4.4	33.2	-3.5	0	4.22	1.58	160
Santa Ana Fire S	0	57.3	-1.1	68.0	-1.7	46.5	-0.6	0	4.33	1.18	137
Santa Barbara	0	50.9	-3.0	62.0	-2.6	40.1	-3.3	0	4.91	1.05	127
Santa Maria AP	0	50.2	-2.3	60.8	-3.6	40.0	-1.0	0	4.40	1.57	155
UCLA	1	56.1	-2.7	63.5	-3.3	48.6	-2.1	1	6.92	3.00	177
Southeast Desert											
Bishop	0	39.7	-2.6	52.4	-5.9	27.1	0.7	0	1.31	0.28	127
Blythe	0	56.0	-2.8	68.1	-4.1	44.0	-1.5	0	0.58	0.22	161
Daggett AP	0	49.3	-4.3	59.6	-6.2	38.9	-2.3	0	1.89	1.46	440
Imperial	0	55.2	-5.2	69.2	-4.9	41.1	-5.5	0	1.33	1.01	416
Lancaster	0	45.6	-2.1	57.5	-3.3	33.6	-0.9	0	3.77	2.20	240
Needles AP	0	54.9	-2.9	65.0	-5.1	44.8	-0.7	0	1.53	1.07	333
Palm Springs	0	56.9	4.1	67.7	8.9	46.6	-0.5	0	1.52	0.58	162
Thermal AP	0	54.3	-4.9	69.8	-5.1	39.3	-4.5	0	0.71	0.21	142
Twentynine Palms	1	48.7	-4.9	64.3	-4.1	33.0	-5.6	1	0.91	0.53	239
total # missing:	66	out of	2146					84	out of	2146	
Averages:		47.7	-1.5	57.2	-3.1	38.4	0.0		5.25	1.77	164

*Averages do not include these stations with 5 or more missing days of data.

All data is provisional and subject to change.

KEY:

msg Temp = number of missing daily temperature values dn = average minimum temperature departure in Fahrenheit
Ta = average temperature in Fahrenheit # msg prec = number of missing daily precipitation values
da = average temperature departure from normal in Fahrenheit pmo = total monthly precipitation in inches
Tx = average maximum temperature in Fahrenheit pdp = monthly precipitation departure from normal in inches
dx = average maximum temperature departure in Fahrenheit % norm = monthly precipitation percent of normal
Tn = average minimum temperature in Fahrenheit

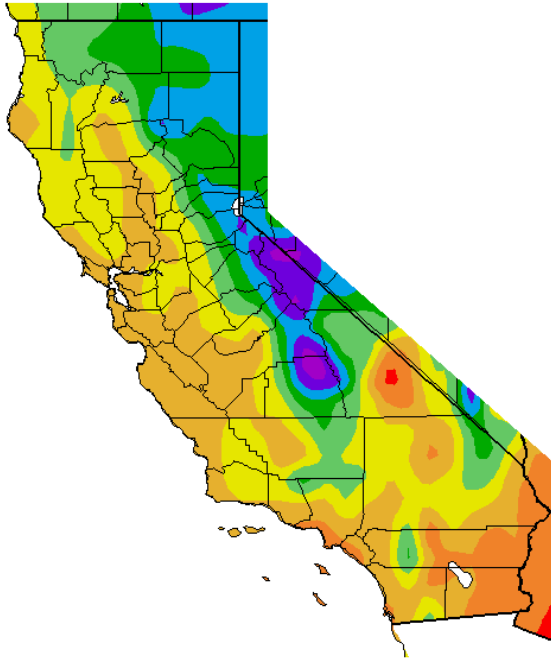
Snow and Hydrological Update

Of California's Department of Water Resources 10 Hydrologic Regions, all reported above average precipitation in February. Four of the regions (North Coast, San Francisco Bay, Sacramento River and South Lahontan) reported above average precipitation for the water year thus far, October 1 to February 29. The driest region this season has been the South Coast with 64% of average precipitation, and the wettest has been South Lahontan with 149% of average. Through Feb 29, the northern Sierra has recorded 117% of average precipitation with 40.69", which is 81% of average for the entire water year.

California DWR will release their Bulletin 120 and forecasts the second week of March.

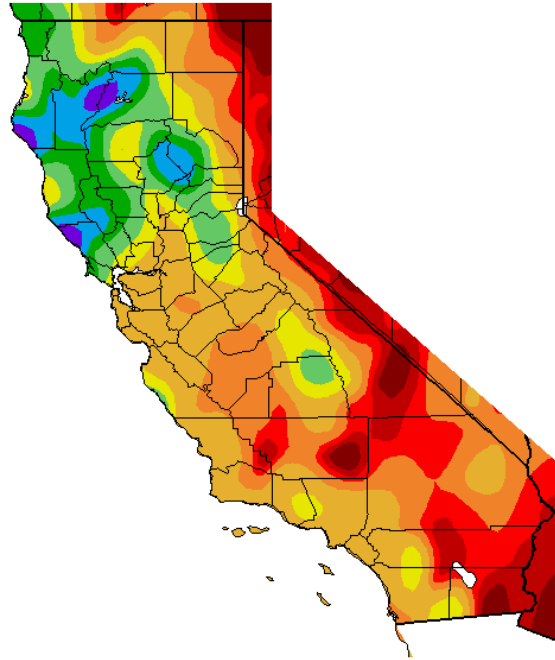
Climate Maps for February

Ave. Temperature (deg. F)
2/01/2004 – 2/29/2004



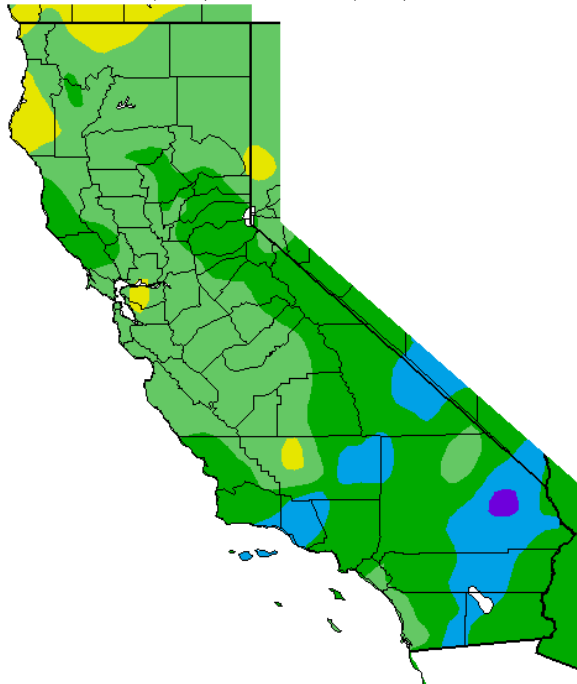
20 25 30 35 40 45 50 55 60 65 70
Generated 3/01/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Total Precipitation (in.)
2/01/2004 – 2/29/2004



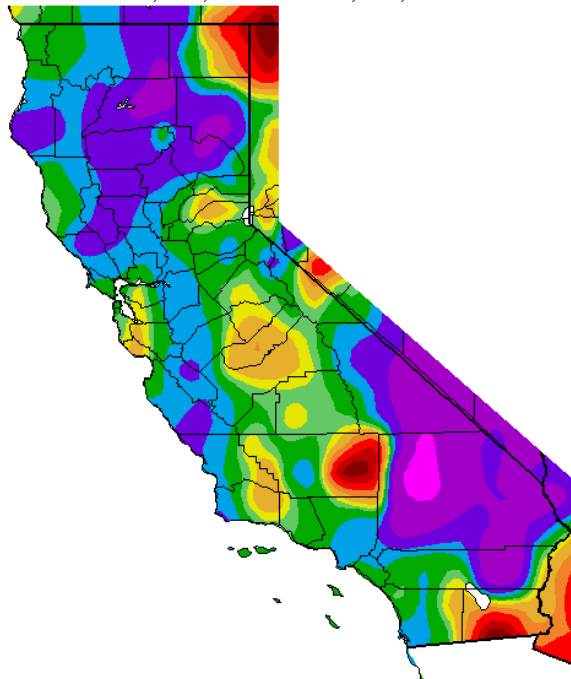
0.1 0.75 1.5 3 6 9 12 15 18 21 24
Generated 3/01/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Ave. Temperature departure from Normal
2/01/2004 – 2/29/2004



-10 -8 -6 -4 -2 0 2 4 6 8 10
Generated 3/01/2004 at WRCC using provisional data.
NOAA Regional Climate Centers

Percent of Average Precipitation (%)
2/01/2004 – 2/29/2004



5 25 50 70 90 100 110 130 150 200 300
Generated 3/01/2004 at WRCC using provisional data.
NOAA Regional Climate Centers