December 2013 Regional Climate Summary
For the San Francisco Bay Area and Monterey Bay Area

December 2013 was a month of extremes. Record cold during the first half of the month was followed by record warmth during the second half. December was also very dry with only one rain event. December precipitation totals were less than 20 percent of normal at all climate stations and less than 5 percent of normal at a few locations. December capped off an exceptionally dry year. 2013 will go into the record books as the driest calendar year on record across the San Francisco Bay Area and Monterey Bay Area.

December Temperatures:

A prolonged cold snap during the first half of the month was followed by numerous record-breaking warm days during the second half of the month. Sixty-one daily temperature records were broken or tied during December, including thirty-seven (37) low temperature records and twenty-four (24) high temperature records. All but three of the 37 record lows occurred from the 5th through the 10th, and all but two of the record high temperatures occurred after the 21st (winter solstice).

The month got off to a warm start. On Sunday, December 1 there was a strong upper level high pressure ridge centered just offshore. This upper ridge, along with light offshore flow, resulted in very dry conditions and balmy afternoon highs in the 60s and 70s. December 1 was the warmest day of the month for some locations, but no daily temperature records were set or tied that day.

A dramatic change occurred over the next few days. A cold upper trough, originating near the northern coast of British Columbia, dropped south along the west coast on December 2 and 3, and then formed a broad and deep upper trough over the entire western half of the United States by December 4. The initial cold front swept south through northern and central California early on the morning of Tuesday, December 3. The front was mostly dry and only managed to produce a few hundredths of rainfall near the coast. Temperatures plunged after cold-frontal passage on the 3rd and then dropped still further after brisk northwest winds subsided late on the 4th. Thirteen record low temperatures occurred during the early morning hours of Thursday December 5 and another 15 occurred on the following morning. Freezing temperatures were widespread during the late night and early morning hours with inland low temperatures in the upper teens and 20s and coastal lows mostly in the 30s.

A reinforcing blast of cold arctic air, this one originating in the Yukon Territory, plunged south along the west coast on Friday December 6. The weather system associated with this second shot of cold air was able to swing just far enough offshore to pick up some moisture prior to reaching northern California. As a result, the cold front that swept through on that Friday night produced measurable rain across the entire region, with some light amounts of snow in the hills above 2000 feet. Most lower-elevation locations picked up between 0.25 and 0.75 inches of rain. Precipitation totals in the hills were moderately higher with several reports of between 0.75 and 1.25 inches in the coastal mountain ranges as well as a few spots in the East Bay Hills.

Cloud cover associated with the precipitation event on the night of the 6th help hold temperatures up above freezing for one night. But the airmass behind this second cold front was even colder than the airmass behind the cold front a few days prior. Temperatures quickly plunged back below freezing by the early morning hours of Sunday the 8th. And, temperatures were slow to recover during the day, even with plenty of sun. High temperatures on Sunday December 8 were only in the 40s across nearly the entire region. Sunday night was the coldest night of the month (and for all of 2013) for many locations. Morning lows on Monday December 9 included 19 at both the Sonoma County Airport and Napa Airport, 25 in San Jose, 36 in San Francisco, and 28 in Monterey.

Despite minimum temperatures on the 9th being the coldest of the December cold-snap at many locations, as well as the coldest of the year, only one daily low temperature record was set on the 9th (at San Jose). The reason: the same day back in 1972 happened to be even colder.

Daytime temperatures gradually warmed over the next several days. However, clear skies, dry air, and long December nights meant overnight lows were much slower to moderate, especially in the inland valleys where cold air remained trapped. Four more overnight low temperature records were set or tied on the 10th and overnight lows continued to drop below freezing in the inland valleys through the 14th.

An upper level high pressure ridge over the Eastern Pacific shifted eastward and over California by mid-December. This ridge then remained along or near the west coast for the remainder of the month. The ridge deflected all incoming Pacific storm systems will to the north of California and maintained unseasonably dry conditions across the region, along with persistent offshore flow. Most days during the second half of the month were sunny and warm. Sixteen daily high temperature records were set or tied from the 16th through the 31st. More than half of these record highs occurred during the week of Christmas, including record highs of 79 in Monterey and 80 at the Salinas airport on the day after Christmas. Although days were mild, the combination of very dry air and the long late December nights continued to result in very cool overnight lows, especially in the valleys. North Bay valley locations continued to see overnight lows near freezing or slightly below freezing through the second half of December, at a time when record daytime highs were being set.

Given the abundance of both record low temperatures and record high temperatures during December, and persistent dry conditions with lack of cloud through most of the month, it's no surprise that average December low temperatures were below normal while average December highs were above normal. Overnight lows were significantly below normal, especially at valley locations were average lows were as much as 8 degrees colder than normal. Average low temperatures at six climate stations ranked as one of the coldest on record (see table below):

Location	**Average Dec. Low Temp**	**Rank**	**Years of temperature records**
Ben Lomond	28.1	Coldest	77
Napa	33.1	2nd coolest	118
Salinas	35.4	3rd coolest	56
Pinnacles National Monument	27.6	3rd coolest	75
Redwood City	34.5	5th coolest	83
San Jose	35.4	6th coolest	115

Interesting fact for December 2013: Average low temperatures at both Salinas and Pinnacles National Park were the 3rd **coldest** on record. **And**, average high temperatures at these same two climate stations were the 5th **warmest** on record.

The extremes of warm days and cold nights in December ended up canceling each other out when considering the overall average temperature for the month, which includes both nighttime lows and daytime highs. In the San Francisco Bay Area the negative departures from normal for minimum temperatures were generally larger than the positive departures for maximum temperatures. Therefore, the month as a whole was slightly cooler than normal. In the Monterey Bay area, the maximum and minimum departures were more evenly matched and so the average monthly temperatures (considering both highs and lows) came out very close to normal.

December Regional Temperature Summary

Location	Average High	Normal High	Departure from Normal	Average Low	Normal Low	Departure from Normal
North Bay						
Calistoga	64.7	58.5	6.2	27.7	36.4	-8.7
Kentfield	58.5	54.8	3.7	37.5	41.3	-3.8
Napa	61.2	57.1	4.1	33.1	39.6	-6.5
Napa Airport	59.0	55.6	3.4	27.6	36.0	-8.4
San Rafael	58.5	54.3	4.2	37.7	41.8	-4.1
Sonoma County Airport	60.9	56.3	4.6	28.2	36.5	-8.3
San Francisco Peninsula						
Half Moon Bay	60.6	59.0	1.6	39.4	41.9	-2.5
Redwood City	61.2	58.1	3.1	34.5	40.3	-5.8
San Francisco Airport	58.2	56.6	1.6	41.3	44.6	-3.3
San Francisco Downtown	58.6	57.1	1.5	44.9	46.1	-1.2
East Bay						
Concord Airport	58.9	55.6	3.3	31.8	39.8	-8.0
Fremont	59.9	57.8	2.1	36.4	42.5	-6.1
Hayward Airport	58.8	57.5	1.3	37.1	42.6	-5.5
Livermore	58.5	56.4	2.1	33.2	39.1	-5.9
Livermore Airport	61.4	56.2	5.2	33.7	37.7	-4.0
Oakland	62.4	58.3	4.1	40.8	44.7	-3.9
Oakland Airport	58.0	56.4	1.6	34.8	41.5	-6.7
South Bay and Santa Cruz County						
Moffett Federal Airfield	60.8	58.9	1.1	36.8	42.9	-6.1
San Jose	60.3	58.0	2.3	35.4	41.9	-6.5
Watsonville Airport	64.8	60.0	4.8	34.2	39.7	-5.5
Monterey and San Benito Counties						
Carmel Valley	65.8	61.6	4.2	36.4	38.6	-2.2
Hollister	61.0	59.9	1.1	29.8	37.7	-7.9
Monterey Airport	62.2	60.5	1.7	38.5	42.3	-3.8
Pinnacles National Park	66.5	61.4	5.1	27.6	32.1	-4.5
Salinas	67.2	62.3	4.9	35.4	39.6	-4.2
Salinas Airport	65.7	61.1	4.6	37.7	40.8	-3.1

December Precipitation:

A strong upper level ridge of high pressure resided over the Eastern Pacific during the first half of the month and near the West Coast during the second half of the month. This ridge prevented nearly all Pacific weather systems from reaching California. The only rain event of significance occurred during the night of December 6 and 7, and that rain event only produced light to moderate amounts of precipitation. As a result, December 2013 precipitation was well below normal – anywhere from 5-15% of normal at most climate stations and less than 5 percent of normal at some North and East Bay locations. December 2013 was one of the driest Decembers on record. San Francisco, with 165 years of rainfall records, experienced its sixth driest December with only 0.39 inches of rain for the month. In addition, December 2013 was the second driest December at Half Moon Bay and Santa Cruz, the third driest at Oakland and San Jose, and the fourth driest at Kentfield and Monterey.

December Regional Precipitation Summary

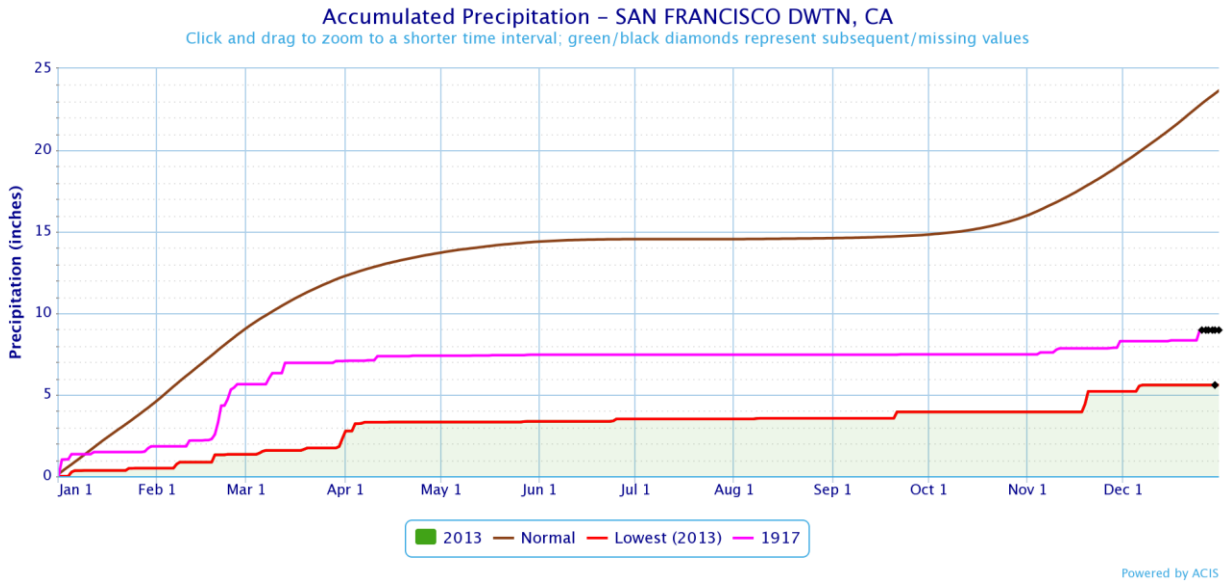
Location	December Rainfall	Normal Dec Rain	Percent of Normal
North Bay			
Calistoga	0.10	7.88	1
Cloverdale	0.36	8.45	4
Kentfield	0.84	9.91	8
Napa	0.71	5.23	14
Napa Airport	0.47	3.79	12
Occidental	0.48	11.57	4
Petaluma Airport	0.38	4.94	8
San Rafael	0.50	7.59	7
Sonoma County Airport	0.41	7.03	6
San Francisco Peninsula			
Half Moon Bay	0.23	5.28	4
Redwood City	0 .44	3.84	11
San Francisco Airport	0.35	4.03	9
San Francisco Downtown	0.39	4.56	9
East Bay			
Concord	0.52	3.38	15
Concord Airport	0.46	3.14	15
Fremont	0.25	2.82	9
Hayward Airport	0.32	3.12	10
Livermore	0.38	2.58	15
Livermore Airport	0.39	2.68	15
Mount Diablo Junction	0.79	4.39	18
Newark	0.20	2.56	8
Oakland	0.15	4.48	3
Oakland Airport	0.28	3.66	8
South Bay and Santa Cruz County			
Ben Lomond	1.14	9.88	12
Gilroy	0.62	3.70	17

Los Gatos	0.39	4.01	10
Moffett Federal Airfield	0.16	2.56	6
Mount Hamilton	0.61	4.15	15
San Jose	0.13	2.61	5
Santa Cruz	0.29	5.68	5
Watsonville Airport	0.25	4.20	6
Monterey and San Benito Counties			
Big Sur Station	0.63	8.63	7
Carmel Valley	0.43	3.01	14
Hollister	0.22	2.13	10
King City	0.19	1.98	10
Monterey	0.32	3.41	9
Monterey Airport	0.27	2.34	12
Pinnacles National Park	0.26	2.78	9
Salinas	0.32	2.44	13
Salinas Airport	0.21	1.93	11

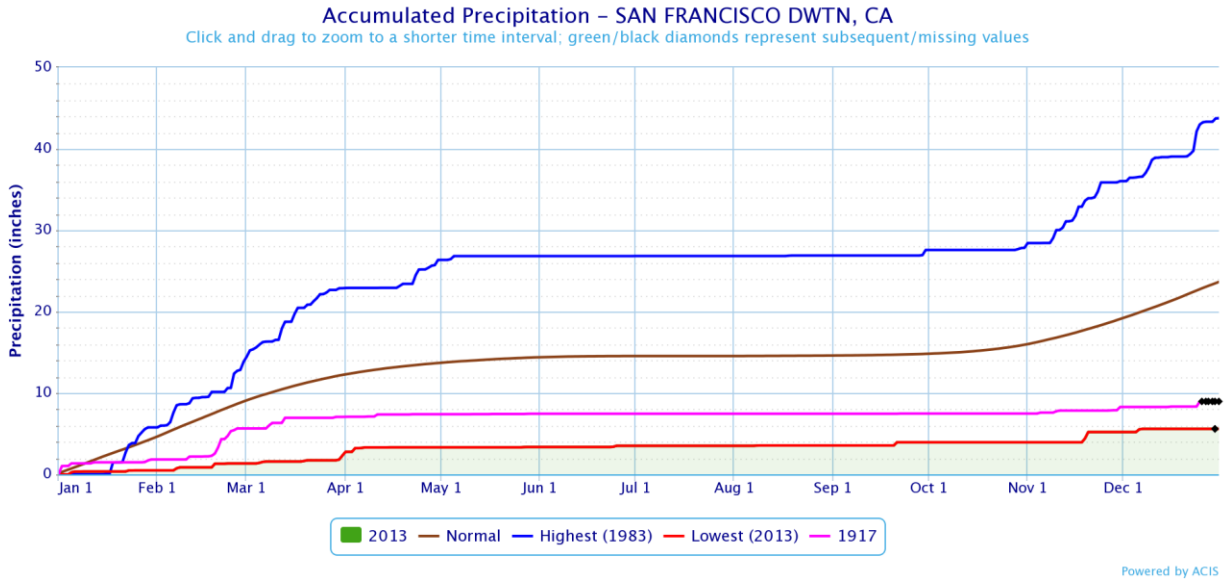
Calendar Year Precipitation:

The bulk of precipitation that falls across the San Francisco Bay Area and Central California Coast comes between late autumn and early spring – generally between November and April, what is typically referred to as the "rainy season." For this reason, the "rain year" in California begins on July 1 and ends on June 30. As of December 31st, with half the rain year complete, the year-to-date rain totals (July 1- December 31) were well below the 30-year average and ranged from 15 to 30 percent of normal.

Calendar year rain totals are typically not viewed with much interest in California. But 2013 was an exception. The last half of the 2012-2013 rain year (January-June 2013) was exceptionally dry. And the first half of the 2013-2014 rain year was also very dry. In fact, all six of 2013's rainy season months (January, February, March, April, November, and December) were much drier than normal. The result – 2013 was easily the driest calendar year on record across the entire region. San Francisco, which has the longest rainfall record of any climate station in the area, experienced its driest calendar year on record, by far. For all of 2013, San Francisco picked up a meager 5.59 inches of rainfall, only 24 percent of its normal 23.65 inches, and well below the previous dry calendar year record of 9.00 inches in 1917.



Graph of accumlated calendar year precipitation at Downtown San Francisco. Brown line is average accumlated precipitation. Red line shows driest year (2013) and pink line shows the previous driest year (1917).



Same graph as above, except with the addition of the wettest calendar year (1983).

The record dryness of 2013 was even more pronounced at other climate stations. For example, at Ben Lomond, in the Santa Cruz Mountains, 7.71 inches of rain fell in 2013, which is only 15% of Ben Lomond's average annual rainfall of 50.48 inches. The new calendar year record of 7.71 inches at Ben Lomond beat the previous dry calendar year record of 20.45 inches (1976) by more than 12 inches! The table below lists 2013 calendar year rainfall statistics for several climate stations across the region, all of which experienced their driest calendar year on record. In most cases, the driest calendar year on record prior to 2013 was 1976.

Location	2013 Calendar Year Total (inches)	Normal Yearly Rainfall (inches)	Percent of Normal	Previous Driest Calendar Year and Amount		Length of Climate Record (years)
San Francisco Bay Area:						
Calistoga	6.13	40.87	15	1976	12.43	86
Cloverdale	8.67	43.13	20	1976	14.52	57
Gilroy	2.56	20.54	12	2007	11.18	67
Half Moon Bay	6.58	29.00	23	1976	13.15	72
Kentfield	7.80	47.98	16	1939	20.30	112
Livermore	4.50	15.23	30	1976	6.41	111
Moffett Federal Airfield	3.08	14.68	21	1947	5.99	68
Mount Diablo Junction	6.56	25.04	26	1976	8.91	61
Mount Hamilton	6.61	26.13	25	1959	7.76	64
Napa	6.74	27.71	24	1939	10.39	116
Newark	3.36	15.09	22	1976	6.90	71
Oakland Museum	4.11	23.96	17	1976	10.02	42
Oakland Airport	4.89	20.81	23	1976	8.65	50
Occidental	15.45	56.99	27	1976	20.76	69
Redwood City	3.36	20.32	17	1976	8.03	85
San Francisco Airport	3.38	20.65	16	1953	9.22	68
San Francisco Downtown	5.59	23.65	24	1917	9.00	164
San Jose	3.80	14.90	26	1929	6.04	119
San Rafael	5.59	35.23	16	1990	13.41	65
Monterey Bay Area:						
Ben Lomond	7.71	50.48	15	1976	20.45	77
King City	1.98	12.06	16	1953	3.14	104
Monterey	4.19	21.10	20	1953	8.96	72
Pinnacles National Park	2.70	17.24	16	1947	6.08	77
Salinas	3.94	15.54	25	1961	7.33	55
Salinas Airport	3.27	12.83	25	1953	5.76	82
Santa Cruz	5.07	31.35	16	1929	11.86	121

Miscellaneous December Climate Information:

Daily Low Temperature Records for December 2013			
Date	**Location**	**Record Min Temp**	**Previous Record and Year**
12/05	Kentfield	26	28 in 1972
12/05	San Rafael	30	31 in 1972
12/05	Napa	25	26 in 1972
12/05	San Francisco Downtown	40	40 in 1972
12/05	Oakland Museum	34	35 in 1972
12/05	Oakland Airport	30	35 in 2006
12/05	Richmond	33	34 in 1972
12/05	Moffett Federal Airfield	32	33 in 1998
12/05	San Jose	29	29 in 1972
12/05	Gilroy	26	27 in 1972
12/05	Santa Cruz	28	29 in 1972
12/05	Salinas	25	29 in 1968
12/05	Salinas Airport	27	29 in 1942
12/06	Kentfield	28	28 in 1921
12/06	San Rafael	30	32 in 2009
12/06	Napa	25	29 in 1948
12/06	San Francisco Downtown	40	40 in 2009
12/06	San Francisco Airport	37	37 in 1972
12/06	Oakland Museum	37	38 in 2005
12/06	Richmond	35	35 in 1967
12/06	Livermore	26	26 in 2009
12/06	Moffett Federal Airfield	33	34 in 2005
12/06	San Jose	30	32 in 1931
12/06	Gilroy	22	28 in 1959
12/06	Santa Cruz	29	29 in 1912
12/06	Salinas Airport	30	30 in 1934
12/06	Salinas	27	29 in 1960
12/06	King City	20	22 in 1941
12/08	Salinas	29	29 in 2011
12/09	San Jose	25	26 in 1972
12/10	Moffett Federal Airfield	29	29 in 1972
12/10	Santa Cruz	27	27 in 1972
12/10	Salinas	30	31 in 1972
12/10	King City	21	21 in 1956
12/14	Oakland Airport	31	31 in 1972
12/15	Oakland Airport	33	33 in 1975
12/28	Oakland Airport	31	32 in 1962

Daily High Temperature Records for December 2013			
Date	**Location**	**Record Max Temp**	**Previous Record and Year**
12/16	Oakland Airport	66	65 in 1958
12/16	Santa Cruz	74	74 in 1923
12/22	San Jose	67	67 in 1919
12/22	Moffett Federal Airfield	68	68 in 1999
12/23	Oakland Museum	67	66 in 2004
12/24	San Rafael	66	63 in 1961
12/24	Moffett Federal Airfield	71	69 in 1969
12/24	Gilroy	72	72 in 1999
12/24	Salinas	75	75 in 2005
12/25	Oakland Museum	69	67 in 1972
12/25	Salinas	82	79 in 1985
12/26	Oakland Museum	67	64 in 1981
12/26	Gilroy	73	69 in 1980
12/26	Salinas	82	79 in 1980
12/26	Salinas Airport	80	80 in 1980
12/26	Monterey	79	77 in 1956
12/27	Salinas	77	75 in 1967
12/29	San Francisco Airport	68	65 in 1998
12/29	Oakland Museum	73	66 in 1997
12/29	Oakland Airport	72	63 in 1975
12/29	Moffett Federal Airfield	68	68 in 1975
12/30	Oakland Museum	64	63 in 1997
12/30	San Jose	66	66 in 1958
12/31	Gilroy	69	69 in 1997

Monthly Ranks for Downtown San Francisco		
Average High Temperature	58.6 degrees	28th warmest out of 140 years
Average Low Temperature	44.9 degrees	19th coolest out of 140 years
Precipitation	0.39 inches	6th driest out of 165 years

Monthly Extremes for Select Locations			
Location	Max Temp: Warmest Day(s)	Min Temp: Coolest Day(s)	Precipitation: Wettest Day(s)
Sonoma County Airport	12/01, 12/28	12/09	12/06
	71 degrees	19 degrees	0.41 inches
San Francisco	12/01, 12/16	12/09	12/06
	67 degrees	36 degrees	0.33 inches
Livermore Airport	12/01	12/05	12/06
	73 degrees	24 degrees	0.30 inches
San Jose	12/24	12/09	12/07
	70 degrees	25 degrees	0.09 inches
Salinas Airport	12/26	12/09	12/07
	80 degrees	26 degrees	0.18 inches

Fire Weather notes:

Record dry conditions in 2013 resulted in a much longer fire season than usual. The Pfeiffer Fire began in the Big Sur area of the Los Padres National Forest on December 17 and burned over 900 acres before it was contained on December 20. Thirty-four (34) residences and 4 outbuildings were damaged or destroyed in this fire. The image below shows the extent of the Pfeiffer Fire on December 18, when the fire was 50% contained.

Red Flag Warnings are issued when fuels are sufficiently dry and weather conditions are expected to reach specific criteria that will result in rapid fire growth. Red flag warnings are usually issued during the fire season, which typically runs from mid-summer through mid-autumn. But in 2013 the NWS office in Monterey issued Red Flag Warnings much earlier in the year and much later in the year than usual. The following occurred in 2013:

- The **earliest** issuance of a Red Flag Warning by the Monterey NWS office: **April 30th**
- The **latest** issuance of a Red Flag Warning by the Monterey NWS office: **Dec 28th**