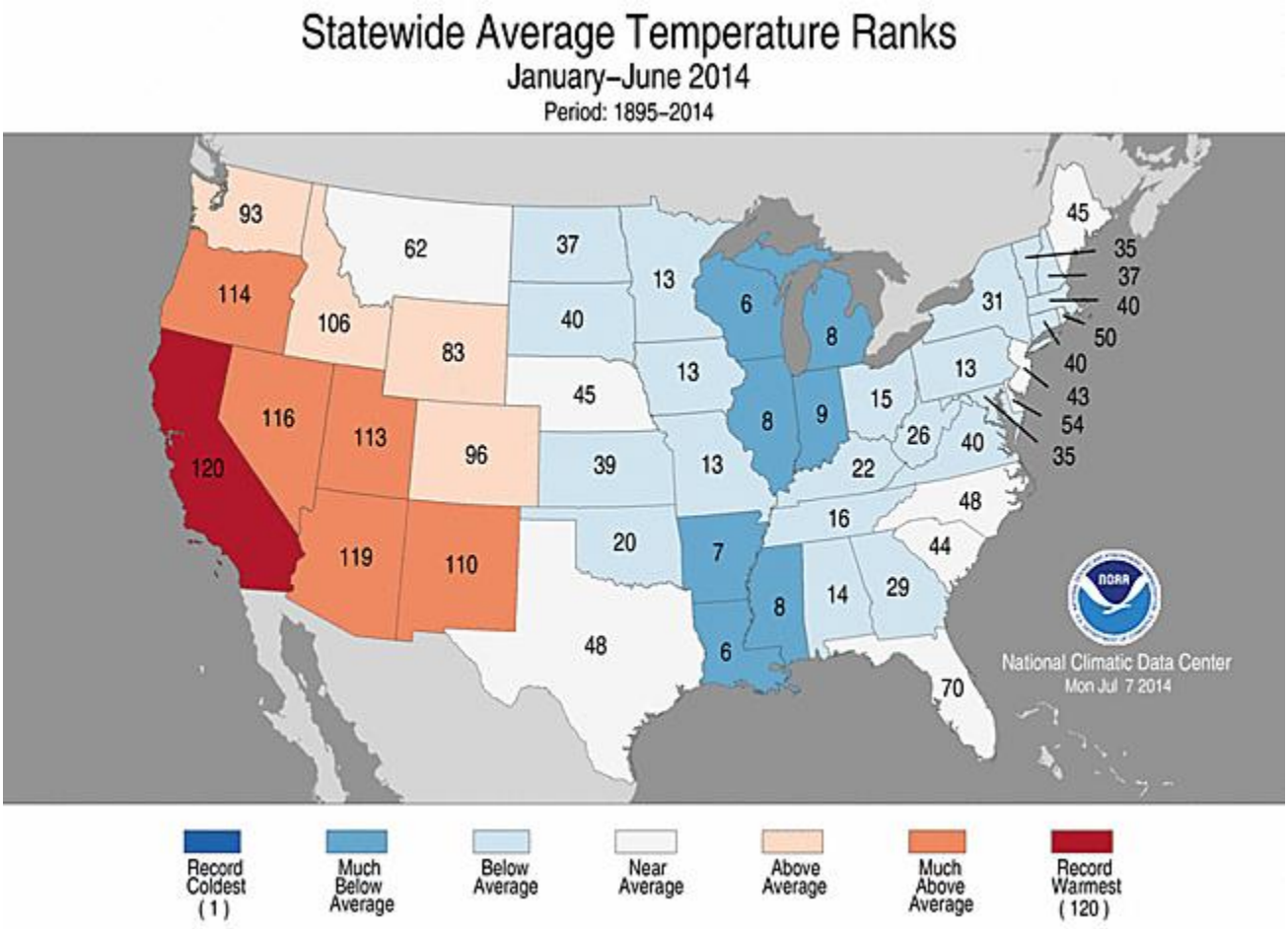
July 2014 Regional Climate Summary

For the San Francisco Bay Area and Monterey Bay Area

July 2014 was an unusual month. Widely scattered light showers occurred on several days as monsoonal moisture made frequent forays into California. There were even a few days with thunderstorms. In addition, unusually warm sea surface temperatures developed along the central California coast due to a temporary halt in typical summertime northwest winds and associated upwelling.

Warmest January-June on record for California

July started off with news that California's statewide average temperature for the first half of 2014 was the warmest January-June on record. Average temperatures for much of the western and southwestern United States were much above normal during the first half of 2014, while much of the eastern half of the county experienced cooler-than-normal temperatures.



Statewide Average Temperature Ranks for January-June 2014, showing California having its warmest January-June in the past 120 years.

The warm and dry conditions during the first half of 2014 heightened the risk of wildfires throughout California. On Tuesday, July 1, a wildfire started in extreme northern Napa County, off Butts Canyon Road in Pope Valley. Called the “Butts” fire, this fire consumed 4300 acres, destroyed two residences and seven outbuildings, and resulted in four injuries. The Butts fire was contained on July 7.

Photo of the Butts Fire taken on July 1, 2014

Monsoon Moisture and July Precipitation

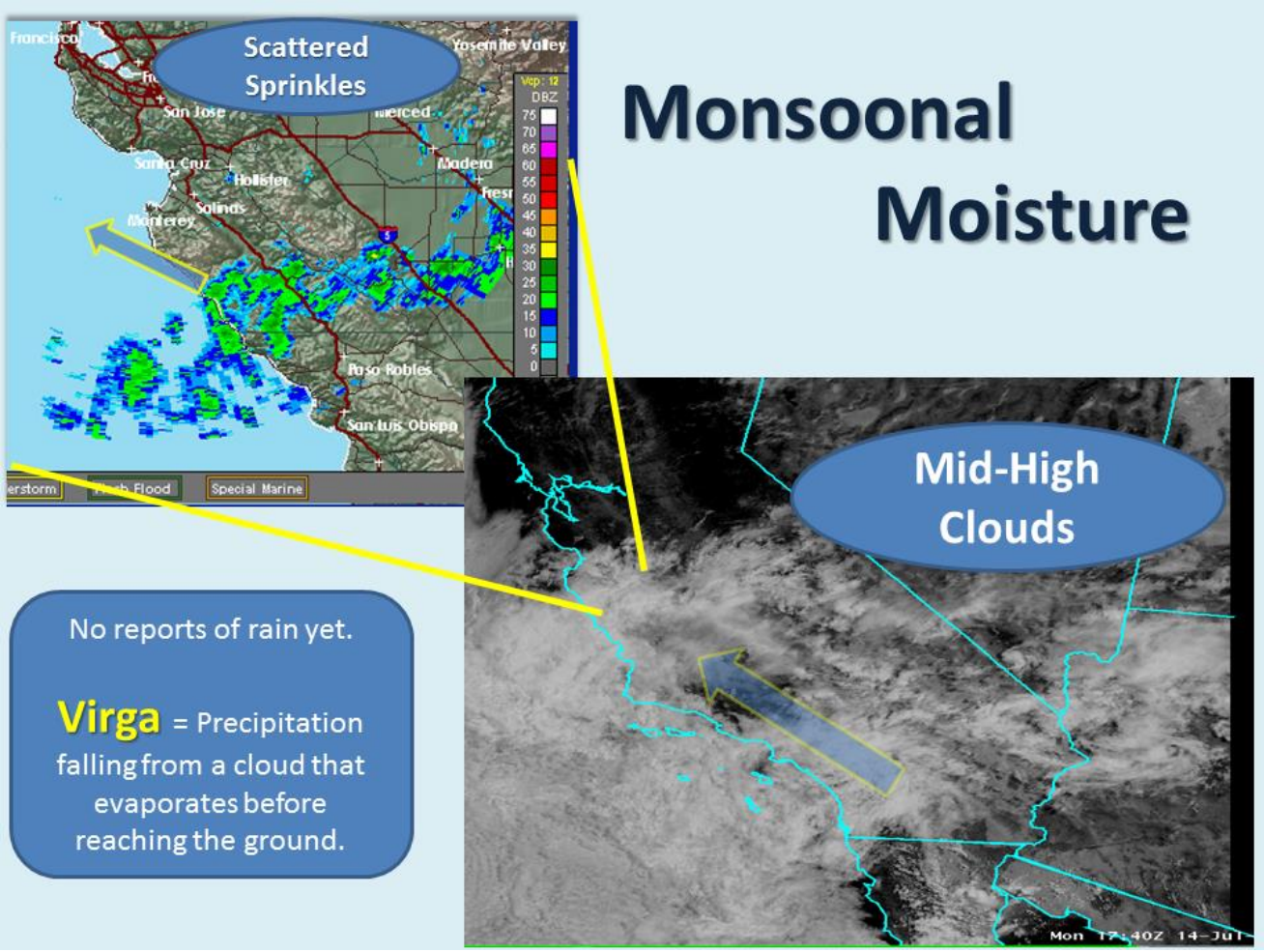
For much of July an upper level ridge of high pressure was centered over the Desert Southwest. On a few occasions this high extended westward into California and produced brief heat events. But for the most part, the high remained centered to the east of California, in a location that was conducive for moving monsoonal moisture northwestward out of Mexico and Arizona and across California. This resulted in widespread afternoon and evening thunderstorms across the higher mountains, especially the Sierra Nevada. On occasion, monsoonal moisture drifted far enough to the west to produce widely scattered light showers and isolated thunderstorms across the San Francisco Bay Area and Central California Coast, mainly at times when weak low pressure was in place offshore. The monsoonal moisture which flowed across the region was mostly in the mid and upper levels of the atmosphere, generally above 10,000 feet. Because the airmass below the monsoon moisture was typically very dry, most of the rainfall generated by the high-based showers evaporated prior to reaching the surface. Thus, rainfall amounts were mostly very light. However, a few of the heavier showers and thunderstorms did manage to produce brief heavy downpours in isolated areas.

Below is a summary of precipitation events during the month of July:

- Monday, July 7: The first monsoonal moisture event of the month produces widespread mid-level clouds over the area as well as several reports of sprinkles in the East Bay during the morning.

- Friday, July 11: A deep marine layer produces widespread drizzle during the morning. Drizzle is heavy enough to measure across portions of Sonoma, Marin and Santa Cruz counties. 0.11 of an inch is recorded at Occidental in Sonoma County and up to 0.08 is reported in Marin County.

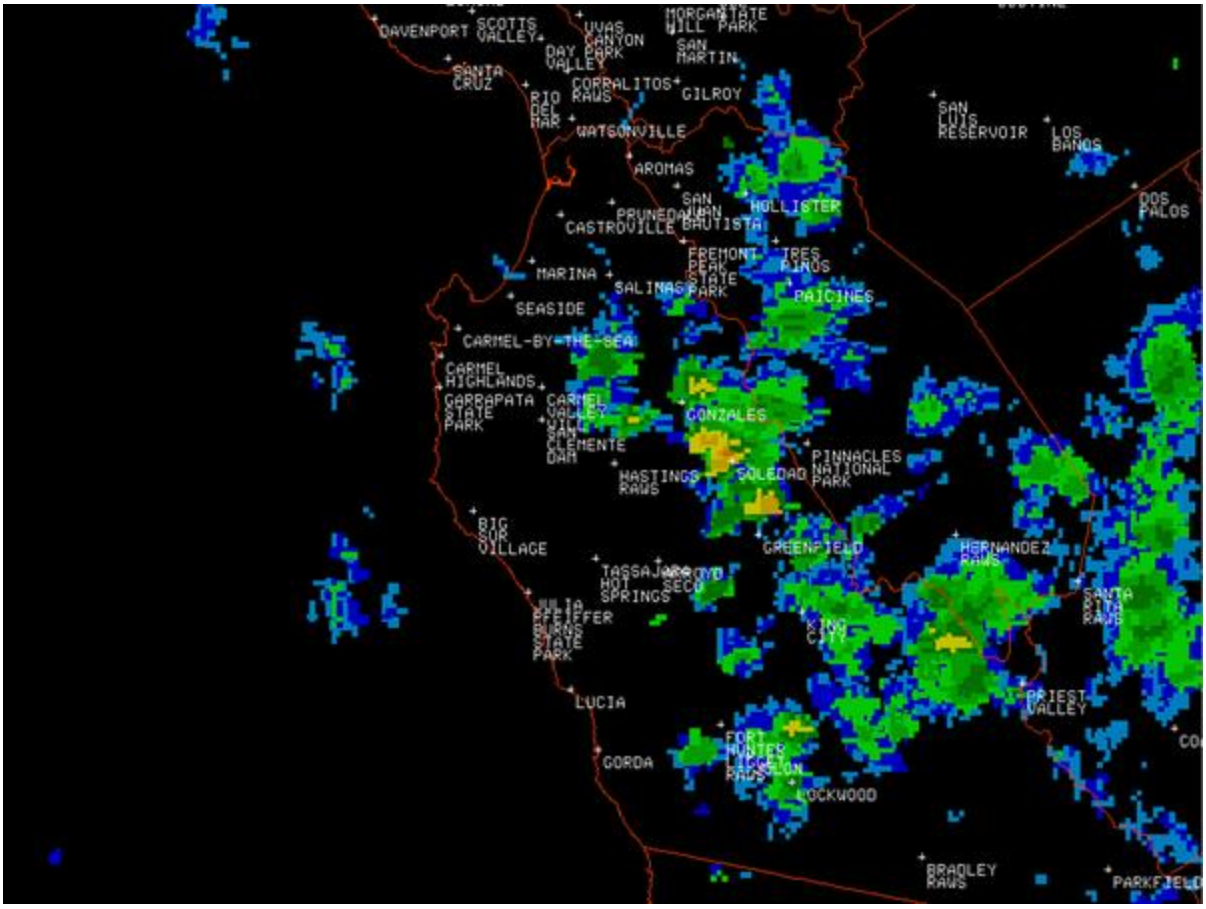
- Monday, July 14: Monsoon moisture returns across the southern half of the area. Sprinkles are reported in Monterey, Carmel, Salinas and Gilroy.



Social media posting during the late morning of July 14

- Tuesday, July 15: Scattered very light showers continue into the morning hours of the 15th, mainly across Monterey County. Big Sur picks up 0.01 inch.

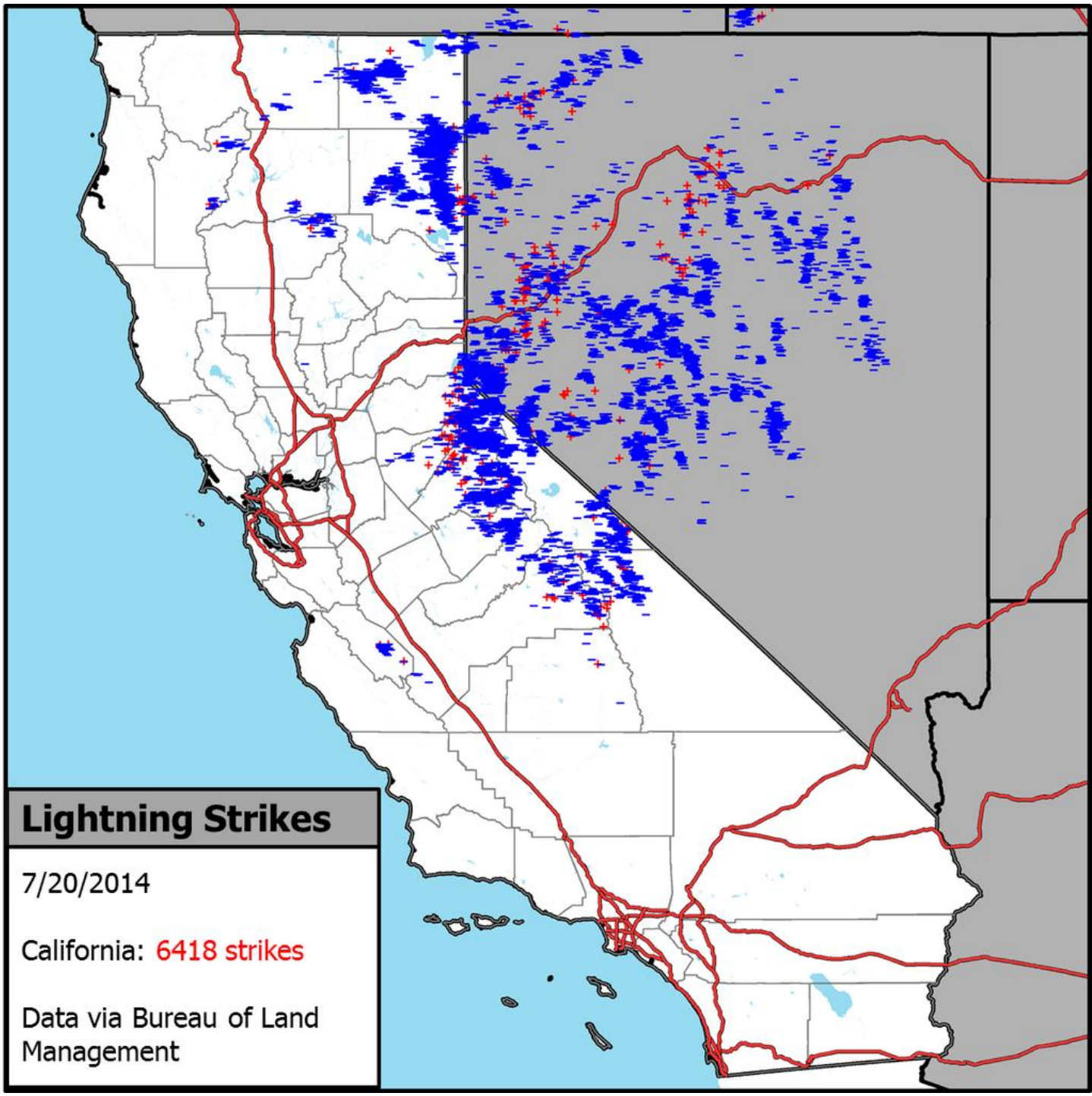
- Saturday, July 19: The start of a four-day monsoonal moisture event begins with late afternoon sprinkles across Monterey County along with a brief heavy shower in the Salinas Valley town of Soledad. Pinnacles National Park receives measurable rain (0.01). Lightning is reported in Fremont. Showers occur later that evening in Daly City, San Bruno and eastern Contra Costa County.



KMUX radar image of scattered showers across Monterey and San Benito counties during the late afternoon hours of July 19.

- Sunday, July 20: Isolated sprinkles and light showers are reported across portions of the region during the morning, but the main event is an intense thunderstorm that develops across remote portions of San Benito County that afternoon. A severe thunderstorm warning is issued for portions of San Benito County just prior to 3 pm. Radar indicates the thunderstorm is producing hail and likely producing severe hail (quarter sized or larger). For a complete summary of the July 20 San Benito County severe thunderstorm see: http://www.wrh.noaa.gov/mtr/stormSummary/Hail_7_20_14/hail_7_20_14.php

  Thirty-six cloud-to-ground lightning strikes are detected with the San Benito County thunderstorm. July 20 turns out to be a very active thunderstorm day across northern and central California, as can be seen in the graphic below:

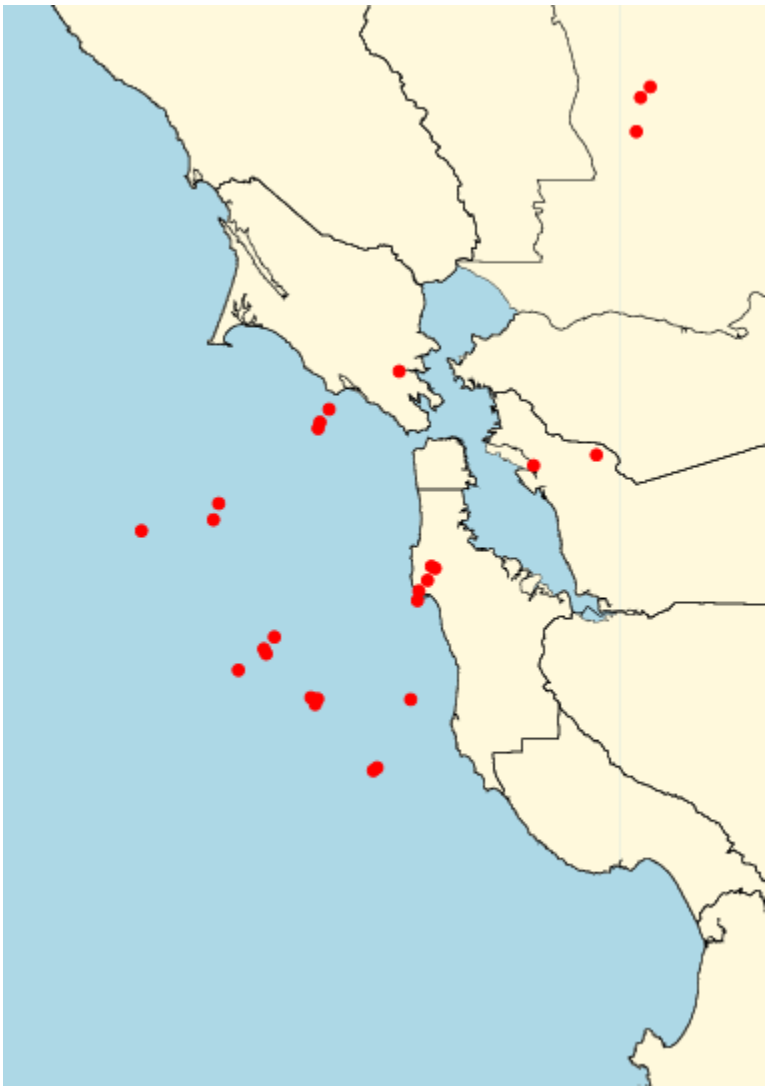


Lightning strikes across northern and central California on Sunday, July 20

- Monday, July 21: Scattered light showers continue across the North Bay into the early morning hours.

- Tuesday, July 22: An upper level disturbance off the southern California coast lifts to the northeast and interacts with existing moisture to produce scattered showers and thunderstorms during the morning of July 22. This event turns out to be the most active and widespread precipitation event of the month. Showers and isolated thunderstorms begin off the San Mateo county coast shortly after 4 am. Thunder is heard in Half Moon Bay by 4:20 am. Between 4:00 and 5:00 am several lightning strikes are detected near Half Moon Bay along with one strike near Oakland. Between 5:00 and 6:00 am three strikes are detected off the Marin County coast and at 7:35 am lightning strikes a redwood tree in the Marin County city of Kentfield. In addition, thunder and lightning are reported in San Francisco, Bonny

Doon, El Granada, Santa Cruz, and Bolinas. All told, 23 cloud-to-ground lightning strikes are detected over the San Francisco Bay Area and adjoining coastal waters on the morning of July 22. Downtown San Francisco picks up 0.04 inches of rain, the greatest one-day rain total in the City since April 27. The most rainfall recorded in the Bay Area on July 22 is 0.08 at Twin Peaks in San Francisco.



Graphic depiction of cloud-to-ground lightning strike locations in the San Francisco Bay Area on the morning of Tuesday, July 22

- Sunday, July 27: The final monsoonal moisture event of the month begins late on the evening of July 26 when lightning is detected over the coastal waters west of Point Conception. This area of convection moves gradually north overnight. Between 4:00 and 6:30 am on the 22nd lightning is detected off the Big Sur coast. Sprinkles are reported in San Francisco at 6:00 am. By 9:00 am isolated showers and thunderstorms move through the Watsonville area and by 10:00 am there is a lightning strike detected southwest of Gilroy. A few light showers linger over far southern Monterey County through the early morning hours of July 28.

July is climatologically the driest month of the year throughout the region. In fact, rainfall is so infrequent in July that average monthly rainfall is zero at several area climate stations, including Downtown San Francisco. Although showers or thunderstorms occurred on several days in July 2014, nearly all of the precipitation events produced only isolated light rainfall amounts. Therefore, most climate stations stayed true to form and ended the month with little or no measurable rainfall. Some of the locations that did have measurable rainfall picked up several times their normal July rainfall average. The climate station with the greatest July total was Occidental with nearly a quarter of an inch. Santa Cruz had the second greatest total with 0.13.

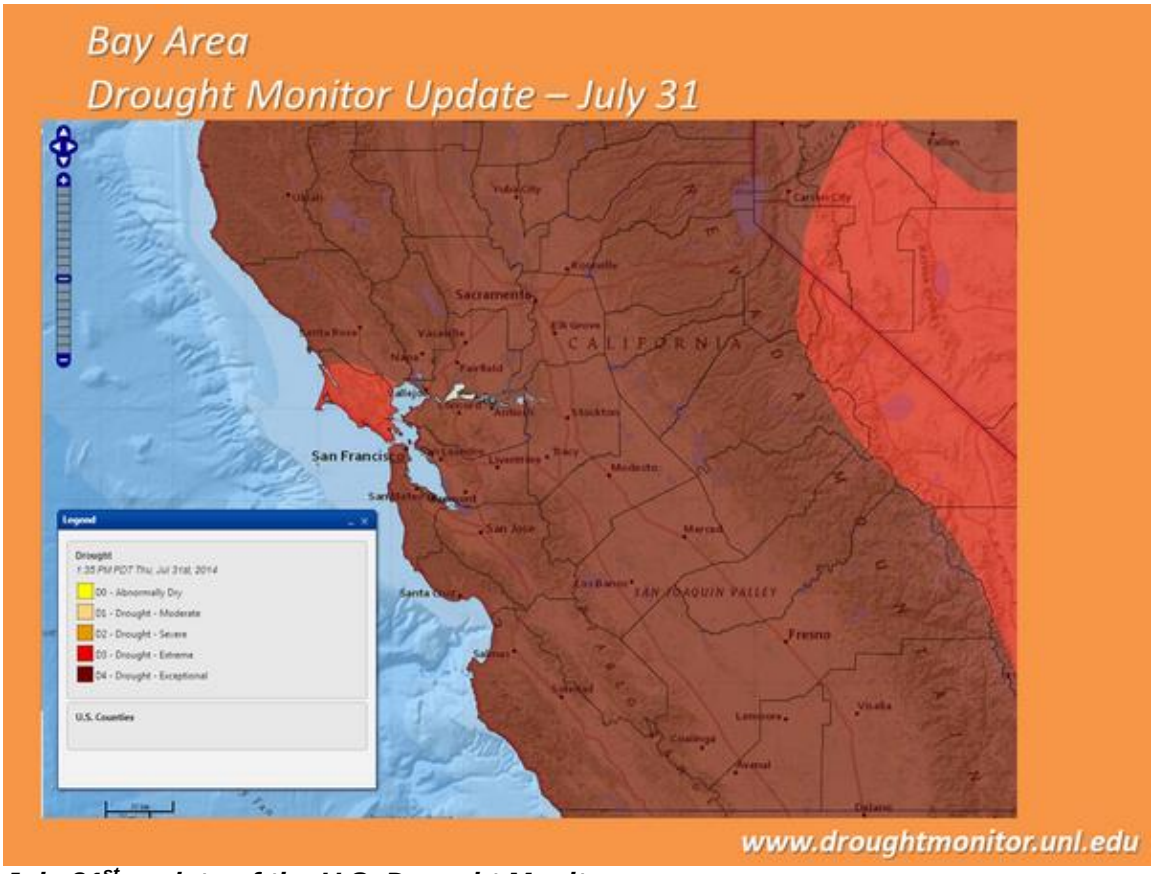
Downtown San Francisco's total rainfall in July was 0.08 inches, enough to rank July 2014 as the 7th wettest July out of the past 165 years.

July Regional Precipitation Summary:

Location	July Rainfall	Normal July Rainfall	Percent of Normal
North Bay			
Angwin	0.00	0.01	0
Calistoga	0.00	0.03	0
Cloverdale	0.00	0.01	0
Kentfield	0.01	0.00	
Muir Woods	0.09	0.05	180
Napa	0.00	0.00	
Napa Airport	0.00	0.00	
Occidental	0.24	0.01	2400
Saint Helena	0.00	0.00	
San Rafael	0.02	0.00	
Sonoma County Airport	0.00	0.01	0
San Francisco Peninsula			
Half Moon Bay	0.06	0.14	43
Redwood City	0.00	0.00	
San Francisco Airport	0.00	0.00	
San Francisco Downtown	0.08	0.00	
East Bay			
Antioch	0.00	0.00	
Concord Airport	0.00	0.00	
Fremont	0.00	0.00	
Hayward Airport	0.00	0.00	
Livermore	0.00	0.00	
Livermore Airport	0.00	0.00	
Martinez	0.00	0.00	
Mount Diablo Junction	0.00	0.01	0
Newark	0.00	0.00	
Oakland	0.00	0.00	
Oakland Airport	0.01	0.01	100
Richmond	0.00	0.00	

South Bay & Santa Cruz County			
Ben Lomond	0.05	0.01	500
Gilroy	0.00	0.01	0
Los Gatos	0.00	0.00	
Moffett Federal Airfield	0.00	0.02	0
San Jose	0.00	0.02	0
Santa Cruz	0.13	0.01	1300
Watsonville	0.05	0.01	500
Watsonville Airport	0.06	0.02	300
Monterey and San Benito Counties			
Carmel Valley	0.01	0.01	100
Hollister	0.01	0.00	
King City	0.00	0.01	0
Monterey	0.04	0.05	80
Monterey Airport	0.01	0.01	100
Salinas	0.02	0.00	
Salinas Airport	0.01	0.00	

Widely scattered light rainfall in July did nothing to alleviate ongoing drought conditions across the region. On July 31 the U.S. Drought Monitor released its latest update which showed that more than half (58%) of California was now in the most intense drought category (D4 – exceptional). The North Bay counties of Napa and Sonoma were re-classified from the D3 drought category (extreme) to D4. With that change, the entire San Francisco Bay Area, with the exception of Marin County, was now in the D4 category. Marin County remained in the D3 (extreme) category.

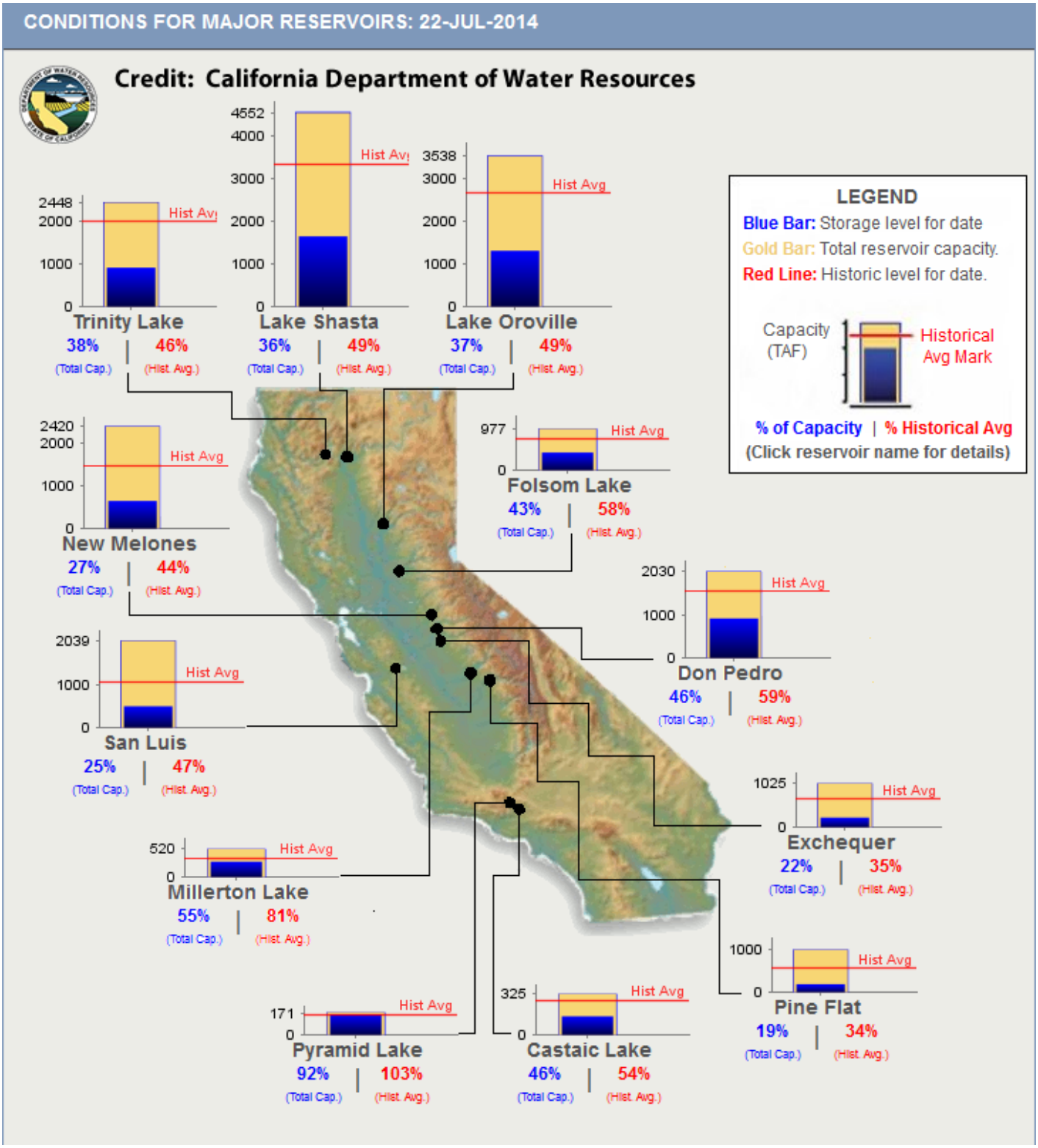


July 31st update of the U.S. Drought Monitor

Text from the USDA Drought Monitor (USDM):
Increasingly, drought indicators point to the fact that conditions are not appreciably better in northern California than in central and southern sections of the state. In addition, mounting evidence from reservoir levels, river gauges, ground water observations, and socio-economic impacts warrant a further expansion of exceptional drought (D4) into northern California. For California's 154 intrastate reservoirs, storage at the end of June stood at 60% of the historical average. Although this is not a record for this time of year—the standard remains 41% of average on June 30, 1977—storage has fallen to 17.3 million acre-feet. As a result, California is short more than one year's worth of reservoir water, or 11.6 million acre-feet, for this time of year. The historical average warm-season drawdown of California's 154 reservoirs totals 8.2 million acre-feet, but usage during the first 2 years of the drought, in 2012 and 2013, averaged 11.5 million acre-feet.

Given the 3-year duration of the drought, California's topsoil moisture (80% very short to short) and subsoil moisture (85%) reserves are nearly depleted. The state's rangeland and pastures were rated 70% very poor to poor on July 27. USDA reported that "range and non-irrigated pasture conditions continued to deteriorate" and that "supplemental feeding of hay and nutrients continued as range quality declined." In recent days, new wildfires have collectively charred several thousand acres of vegetation in northern and central California.

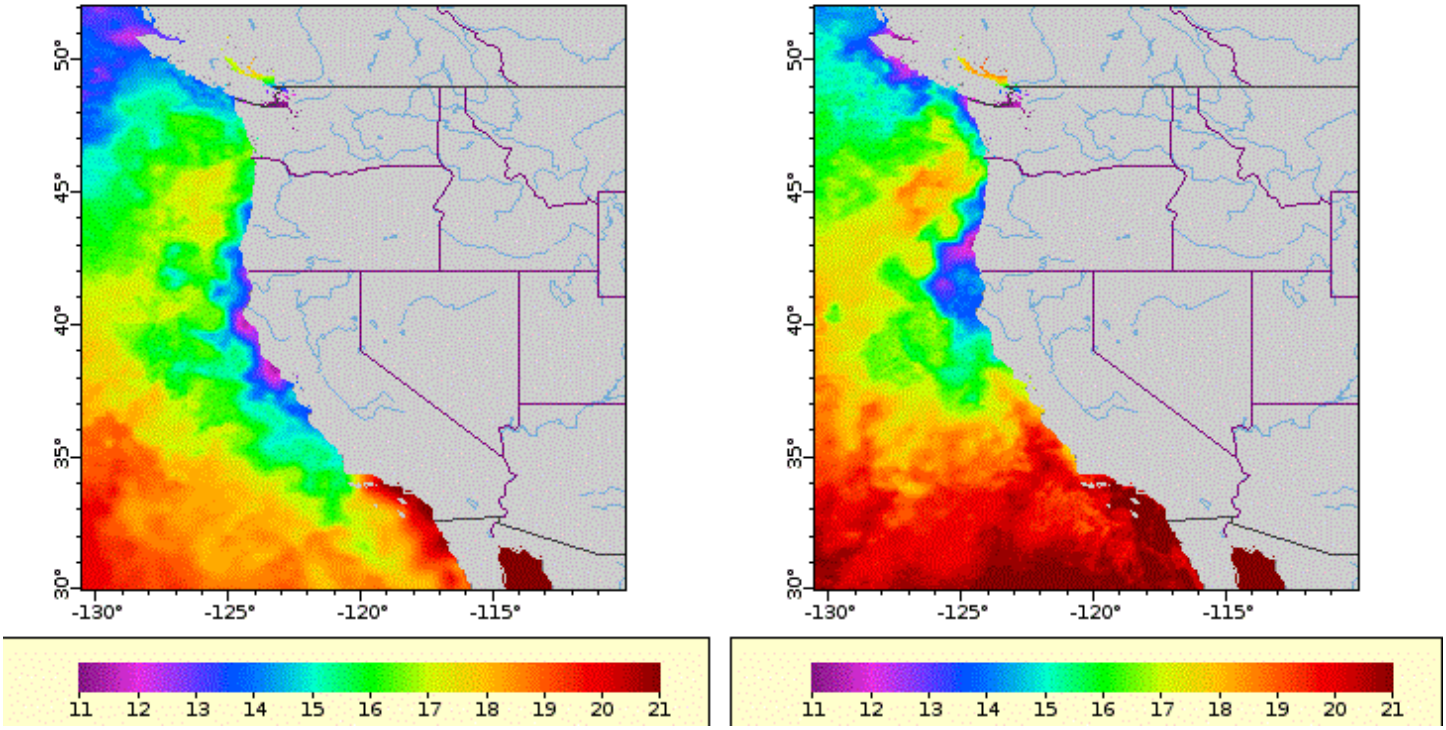
A California Department of Water Resources (DWR) reservoir status update near the end of July showed that reservoirs across northern and central California were filled to levels that were only about half their historical average for this time of year.



Conditions at major California reservoirs as of July 22, 2014. Source: DWR

Warm Coastal Waters

Water temperatures along the central coast of California underwent an unusual warming during the first three weeks of July. The strongest warming took place between July 15 and 23, a period which coincided with a lack of typical summertime northwest winds over the coastal waters. Lack of northwest winds resulted in a significant reduction of upwelling along the coast and allowed much warmer water offshore and to the south to move in along the Central Coast.

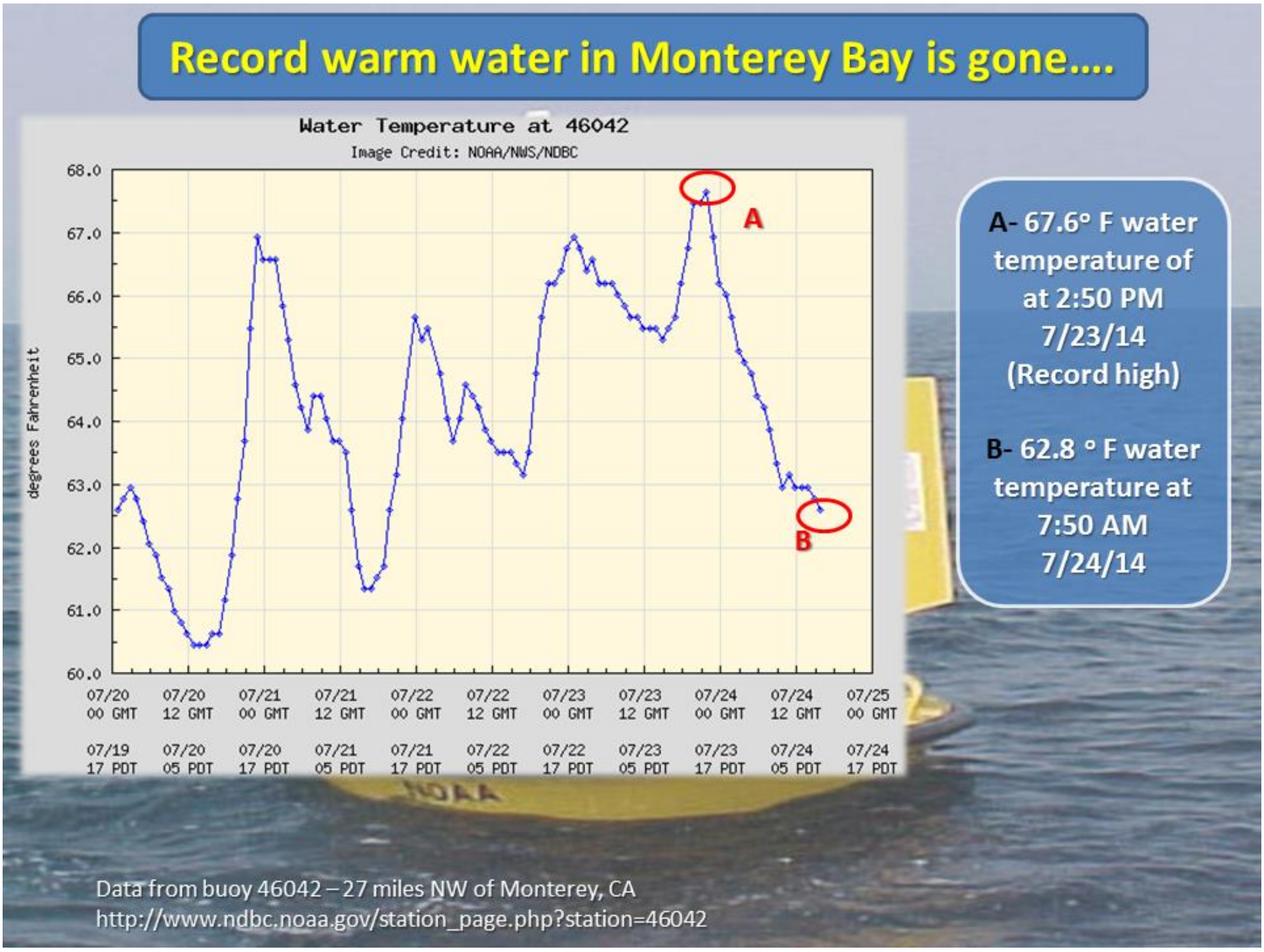


Observed sea surface temperature (deg C) on July 1 (left) and July 21 (right).

The sea surface temperature (SST) at Monterey Bay Buoy, located 30 miles west-northwest of Monterey, reached 68 degrees F on the afternoon of July 23.This was the warmest SST recorded at the Monterey Bay Buoy since SST record keeping started there in 1987. The previous warmest SST at this buoy was 66 deg F which occurred on August 5, 2003, on several occasions in August and September of 1997, and on September 22, 1990.

At Cape San Martin buoy, located 30 miles west of the Monterey-San Luis Obispo County line, an SST of 71 degrees F was reported on July 22, a record warm SST for this buoy. The previous record was 69 deg F in August 1993. SST data for this buoy goes back to 1983. However, it should be noted that SST data for this buoy is missing in August and September of 1997, which was a period of warm SSTs.

Northwest winds redeveloped over the coastal waters the by the early morning hours of July 24 and upwelling quickly ensued, causing rapid cooling of water temperatures. At Monterey Bay Buoy, the SST dropped from 68 deg F on the afternoon of July 23, down to 63 deg F by 8 am on the following morning.



Graph showing sea surface temperatures at Monterey Bay Buoy from July 20-24.

NOAA's Southwest Fisheries Science Center in Santa Cruz posted a write-up on this warm SST event and it can be found here: A Remarkable Warming of Central California's Coastal Ocean

July Temperatures

Unusually warm coastal waters during the second half of July helped push average July temperatures above normal for much of the area, especially for coastal climate stations. Average July temperatures at most coastal locations were about 3 degrees above normal. Downtown San Francisco had its 9th warmest July on record. Overnight lows, in particular, were unusually warm during the second half of July. Downtown San Francisco's average low temperature of 57.1 degrees F was the third warmest average July low temperature in 140 years.

Average July temperatures for inland areas were closer to normal, but generally a bit warmer than normal.

There was only one brief heat event of significance during July. On Friday, July 25, temperatures climbed into the 80s near the coast and into the 90s to around 100 inland. Five daily high temperature records were set on the 25th including Downtown San Francisco with a high of 85 and Napa at 101.

July Regional Temperature Summary

Location	Average High	Normal High	Departure from Normal	Average Low	Normal Low	Departure from Normal
North Bay						
Angwin	85.0	86.0	-1.0	55.5	55.0	0.5
Calistoga	88.4	91.4	-3.0	56.5	52.5	4.0
Cloverdale	93.4	92.9	0.5	54.3	55.6	-1.3
Kentfield	83.4	82.7	0.7	55.7	53.0	2.7
Napa	83.9	82.9	1.0	57.8	55.1	2.7
Napa Airport	78.5	78.3	0.2	55.2	52.5	2.7
Saint Helena	88.7	89.1	-0.4	58.2	55.0	3.2
San Rafael	82.4	79.6	2.8	56.9	54.9	2.0
Sonoma County Airport	82.5	83.1	-0.6	54.5	51.9	2.6
San Francisco Peninsula						
Half Moon Bay	68.8	65.0	3.8	55.8	51.6	4.2
Redwood City	83.1	82.0	1.1	59.4	56.1	3.3
San Francisco Airport	74.9	72.0	2.9	58.9	55.4	3.5
San Francisco Downtown	68.5	66.5	2.0	57.1	54.1	3.0
East Bay						
Antioch	91.1	91.4	-0.3	61.5	59.3	2.2
Concord Airport	87.4	87.0	0.4	59.2	57.7	1.5
Fremont	79.8	78.1	1.7	58.9	56.6	2.3
Hayward Airport	77.9	73.0	4.9	58.8	57.4	1.4
Livermore	91.5	88.9	2.6	59.4	56.8	2.6
Livermore Airport	90.1	87.5	2.6	60.4	57.2	3.2
Martinez	86.4	88.7	-2.3	49.9	51.1	-1.2
Mount Diablo Junction	82.9	84.7	-1.8	63.5	60.3	3.2
Newark	78.9	77.1	1.8	60.0	57.8	2.2
Oakland	74.0	72.0	2.0	58.9	56.2	2.7
Oakland Airport	73.5	70.3	3.2	59.1	55.5	3.6
Richmond	73.3	70.9	2.4	57.8	55.5	2.3
South Bay and Santa Cruz County						
Gilroy	89.0	88.2	0.8	58.2	54.5	3.7
Los Gatos	86.9	84.8	2.1	56.6	55.4	1.2
Moffett Federal Airfield	78.5	77.1	1.4	60.8	59.1	1.7
San Jose	81.0	81.9	-0.9	59.7	58.1	1.6
Santa Cruz	78.1	75.3	2.8	57.7	54.0	3.7
Watsonville	72.8	71.6	1.2	57.9	53.7	4.2
Watsonville Airport	75.5	73.2	2.3	57.4	53.1	4.3

Monterey and San Benito Counties						
Carmel Valley	81.1	78.7	2.4	53.5	50.2	3.3
Hollister	80.5	81.0	-0.5	56.7	53.0	3.7
King City	85.4	85.4	0.0	55.6	53.1	2.5
Monterey	68.6	66.3	2.3	55.3	52.2	3.1
Monterey Airport	70.6	67.2	3.4	56.8	53.6	3.2
Salinas	73.1	71.0	2.1	56.4	53.3	3.1
Salinas Airport	72.0	71.0	1.0	58.0	55.1	2.9

Daily High Temperature Records for July 2014			
Date	**Location**	**Record Max Temp**	**Previous Record and Year**
7/25	San Francisco Downtown	85	82 in 1973
7/25	Moffett Federal Airfield	95	90 in 2005
7/25	Richmond	87	87 in 2005
7/25	San Rafael	99	98 in 1975
7/25	Napa	101	101 in 1975

‘Nuisance flooding’ Becoming More Frequent as Sea Levels Rise

On July 28 the National Oceanic and Atmospheric Administration (NOAA) released the findings of a study that show a large increase in coastal “nuisance flooding” frequency during the past 60 years. The increased frequency of coastal nuisance flooding was attributed, at least in part, to climate-related sea level rise. Eight of the top 10 U.S. cities showing the greatest increase in nuisance flooding frequency are on the East Coast, but San Francisco came in at number 8 on the list.

For details on the NOAA report, see:
http://www.noaanews.noaa.gov/stories2014/20140728_nuisanceflooding.html

July Sunsets

Mid and high level clouds were common in July, and coastal low clouds were less persistent than usual. This resulted in several evenings with spectacular sunsets across the region. Here are a few sunset photos, taken on the evening of July 19:

Sunset from Santa Cruz on July 19. Photo by Brian Bergtold.

July 19 sunset from Asilomar State Beach (Pacific Grove). Photo by Jason Chenoweth

Miscellaneous July Climate Information

Monthly Ranks for Downtown San Francisco		
Average High Temperature	68.5 deg	17th warmest July out of 140 years
Average Low Temperature	57.1 deg	3rd warmest July out of 140 years
Average Temperature	62.8 deg	9th warmest July out of 140 years
Precipitation	0.08 in	7th wettest July 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	7/25	7/06	n/a
	98 degrees	48 degrees	
San Francisco	7/25	7/06	7/22
	85 degrees	53 degrees	0.04 inches
Livermore Airport	7/25	7/05, 7/06	n/a
	102 degrees	54 degrees	
San Jose	7/25	7/03	n/a
	94 degrees	56 degrees	
Salinas Airport	7/25	7/05, 7/06	7/20
	79 degrees	52 degrees	0.01 inches

Note: This climatological data is preliminary. For official certified climatological data please contact the National Climatic Data Center at 828-271-4800 or http://www.ncdc.noaa.gov.
Official values as determined at the above web site may take several months for authentication and publication.