



Coast to Cactus Weather Examiner

National Weather Service - San Diego



The National Weather Service Spotter Newsletter for Extreme
Southwestern California

An Interesting Winter

The wet season of 2007-2008 will go down as interesting, to say the least. Last fall the Climate Prediction Center (CPC), the long term forecasters of the National Weather Service, predicted a moderate La Niña occurring over the equatorial Pacific Ocean. The climate response in Southern California has been nearly always a wet season that is drier than normal. In addition, a larger climate altering mechanism, the Pacific Decadal Oscillation (PDO), has been in place since the beginning of the century. The



Courtesy Stefanie Sullivan

PDO has been shown to influence long wave patterns across the northern Pacific that generally tend to produce lower than normal rainfall over the course of a few decades. And the PDO is expected to last a decade or two longer. These theories appear reasonable given that since the El Niño season of 1997-1998, above normal rainfall for the season has been recorded only once at San Diego’s Lindbergh Field, during the anomalously wet 2004-2005 season. On top of that, many Southern California climate stations had just endured their driest rainfall season on record in 2006-2007. Understandably, climate forecasters and local weather forecasters alike thought these two major climate players and the simple current dry trend would almost guarantee a wet season on the dry side once again for 2007-2008.

Then came the storms.

The first significant storm at the end of November brought 0.93 inches of rain to San Diego, the greatest daily rainfall in two and a half years (since March 4, 2005). Several storms struck in December, but did not keep pace with normal rainfall. In January two very wet episodes early and late in the month each produced rainfall that brought the seasonal rainfall to just above seasonal normal to date. January overall received nearly one and a half times the normal rainfall. San Diego received less rainfall

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than all other official stations, so most of Southern California stations had seasonal rainfall actually running well above normal during January.

Then the storms stopped. Or at least they became much less wet.

The pace of seasonal rainfall lost ground with a February that received only half the normal rainfall. Then the seasonal rainfall rate decelerated even further when March ended up with only 0.26 inch. Only 21 Marches have been drier since 1850.

So what happened? Why was the early winter so wet and the late winter so dry? The answer may be the MJO, the Madden-Julian Oscillation.

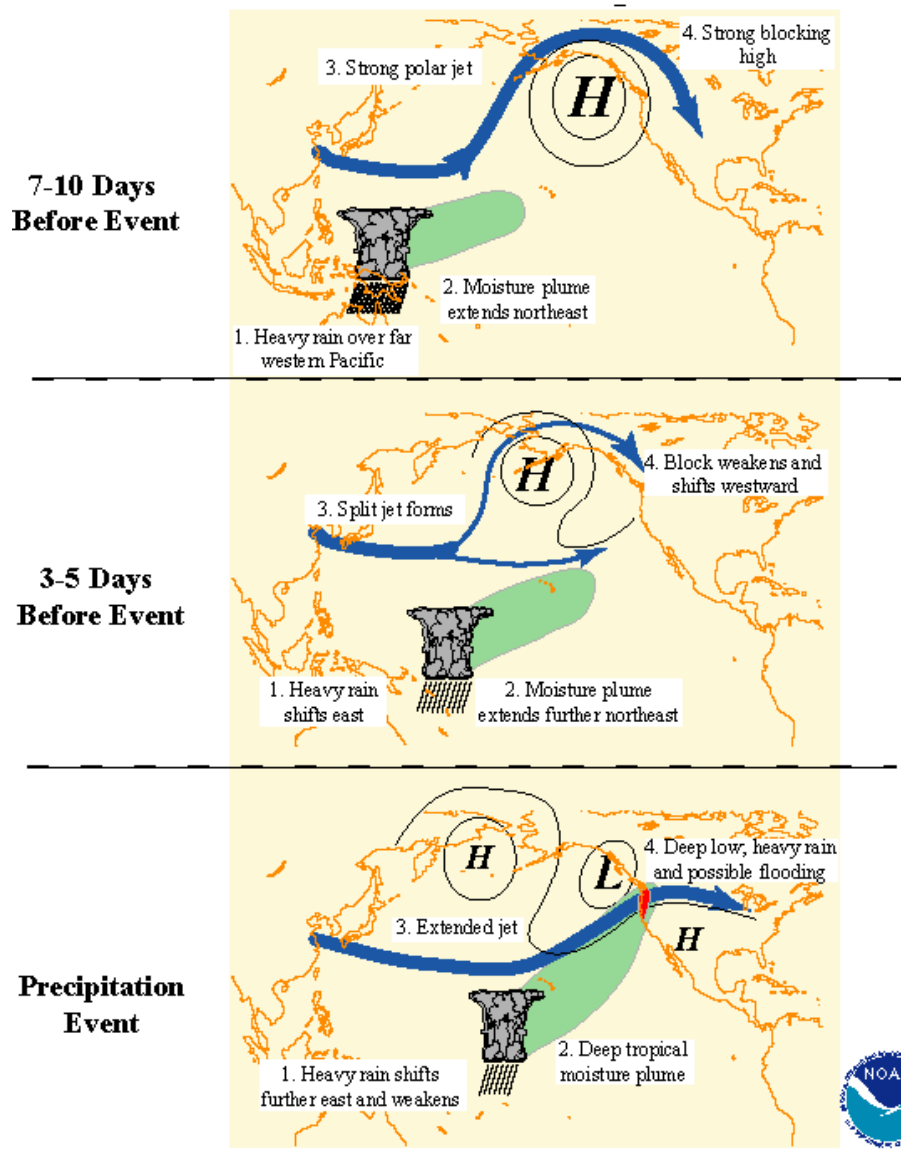
Yes, we've got another "oscillation" for you to think about!

The MJO is characterized by an eastward progression of large regions of both enhanced and suppressed tropical rainfall, observed mainly over the Indian Ocean and Pacific Ocean. These wet and dry "waves" slowly progress across the Pacific Ocean. During wet waves or phases, which contain enhanced convection, northern Pacific weather systems at mid-latitudes can grab this moisture and produce enhanced rainfall along the U.S. west coast. The wet phase of enhanced convection and precipitation is followed by a dry phase where convection is suppressed and northern Pacific storms have less available moisture. Each cycle lasts about two or three months.

The MJO influences both precipitation and surface temperature patterns across the US. The two most significant impacts over the US during Northern Hemisphere winter are an increase in the frequency and intensity of heavy precipitation events along the US west coast and an increase in the frequency and intensity of cold air outbreaks across the eastern US. The MJO also influences tropical cyclone activity in both the eastern Pacific and Atlantic basins during the Northern Hemisphere summer.

The MJO may be the mechanism behind the colloquialisms "Pineapple

Typical Wintertime Weather Anomalies Preceding Heavy West Coast Precipitation Events



Climate Prediction Center/NCEP/NWS

Express” or “Pineapple Connection,” which have been used to identify periods of persistent storms containing copious tropical moisture.

Rob Krier, the weather beat writer for the San Diego Union-Tribune, and also a fellow weather spotter, asked some questions of local and national climate experts. He discovered that probably the MJO was connected to the storms of late December and early January when the MJO appeared to connect with storm systems in the Gulf of Alaska.

“I do think the MJO is playing a significant role with what is occurring this winter,” said Mike Halpert, a meteorologist with the Climate Prediction Center. “It is certainly co-opting the typical La Niña effects. It has helped you [Southern California] out.” Halpert said there are times when the MJO seems to enhance the La Niña signal, and there are times when it opposes La Niña. So far this year, the MJO has apparently opposed the signal. Sometimes MJO pulses go on for a while; sometimes they die out quickly, Halpert said. “There's a lot about this we don't know,” he said. “We have a way to go to see what the end result will be.” But Halpert said the winter could still end up with typical La Niña impacts -- meaning drier than average in Southern California, the Southwest and the Southeast.

The rainfall of the last two months seems to support him.

Some long-range forecasters are less willing to assign blame or credit for rainfall fluctuations to the MJO. A few of the storms this winter did appear to tap into tropical moisture, but normal variability could explain the rains, said Tim Barnett, a climate researcher at UCSD's Scripps Institution of Oceanography. “Don't get excited about what happens over a couple of weeks,” Barnett said. “You need to look at time scales of months.” Like Halpert, Barnett thinks the season is likely to end up drier than normal because La Niñas are pretty reliable. “The odds strongly favor typical La Niña impacts here,” Barnett said. “The odds are greater than 90 percent.”

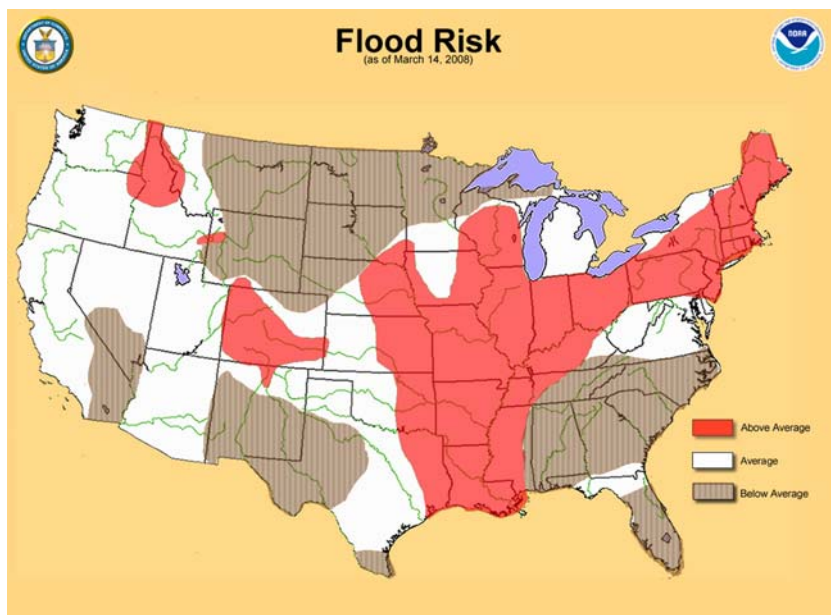
Ivory Small, top scientist and forecaster at the NWS in San Diego, explained that the MJO can be one component of several that could enhance the rainfall in a storm within a weather system noting, “You'd almost have to look at each individual storm to determine if the increased moisture was a result of the MJO or not.” He said the MJO alone does not produce our storms, but only adds moisture to them while in its wet phase. “You'd have to go back and look at the actual data,” for example, observations from the surface and upper air, satellite, and radar data.

Spring Outlook

Spring Flood Outlook

Above-normal flood potential is evident in much of the Mississippi River basin, the Ohio River basin, the lower Missouri River basin, Pennsylvania, New Jersey, most of New York, all of New England, and portions of the West, including Colorado and Idaho:

- Heavy winter snow combined with recent rain indicates parts of Wisconsin and Illinois should see minor to moderate flooding, with as much as a 20 to 30



percent chance of major flooding on some rivers in southern Wisconsin and northern Illinois.

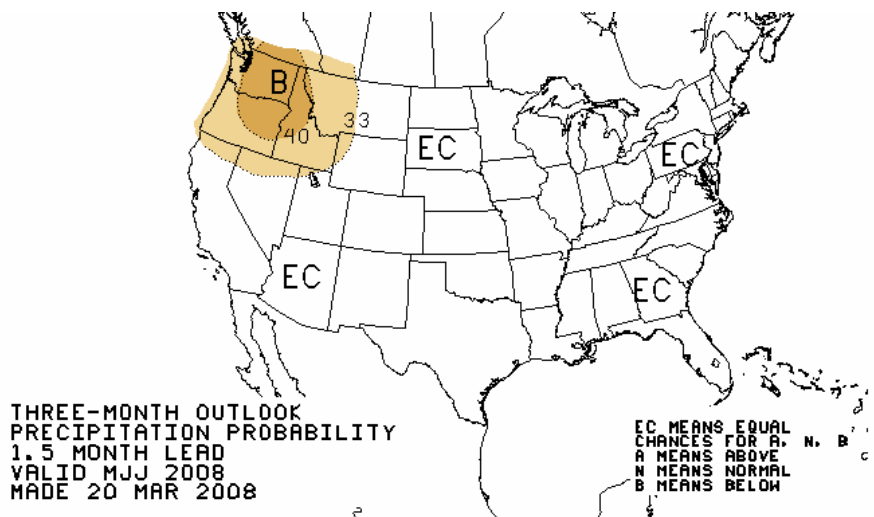
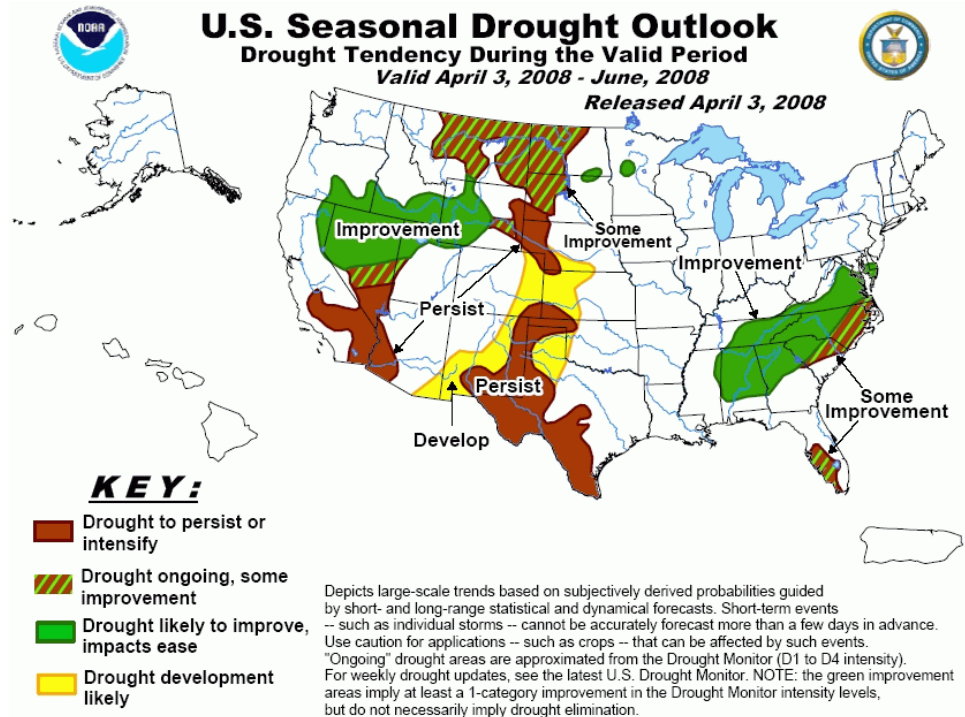
- Current snow depth in some areas of upstate New York and New England is more than a foot greater than usual for this time of the year, which increases flood potential in the Connecticut River Valley.
- Locations in the mountains of Colorado and Idaho have 150 to 200 percent of average water contained in snowpack leading to a higher than normal flood potential.

Snowfall has been normal or above normal across most of the West this winter; however, preexisting dryness in many areas will prevent most flooding in this region. Runoff from snow pack is expected to significantly improve stream flows compared to last year for the West.

Spring Drought Outlook

The drought outlook indicates continued general improvement in the Southeast, although some reservoirs are unlikely to recover before summer. Winter precipitation chipped away at both the western and southeastern drought. On the U.S. Drought Monitor, extreme drought coverage dropped from nearly 50 percent in mid-December to less than 20 percent in the Southeast for March.

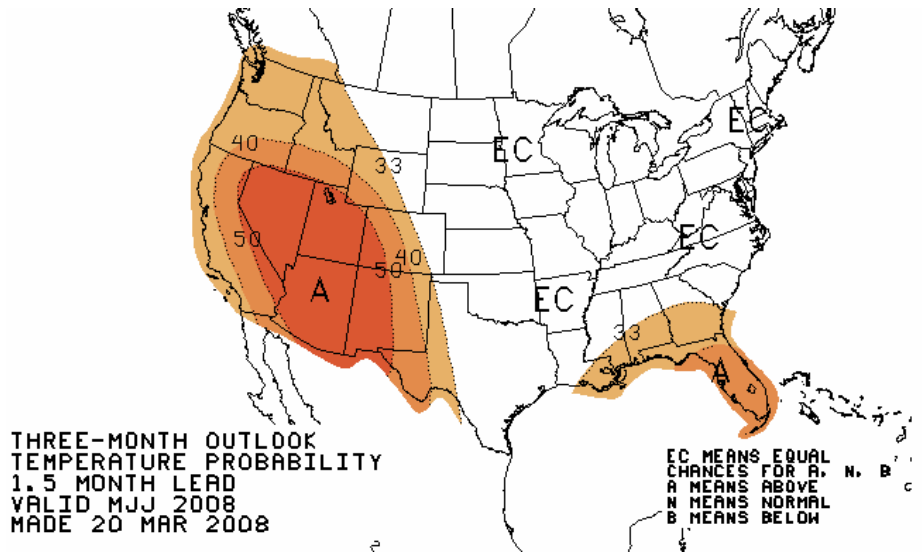
- Overall, the Southeast had near-average rainfall during the winter with some areas wetter than average. Nevertheless, lingering water supply concerns and water restrictions continue in parts of the region.
- Drought is expected to continue in parts of the southern Plains despite some recent heavy rain. Parts of Texas received less than 25 percent of normal rainfall in the winter, leading 165 counties to enact burn bans by mid-March. Seasonal forecasts for warmth and dryness suggest drought will expand northward and



westward this spring.

Temperature and Precipitation Outlooks

The Climate Prediction Center (CPC) outlook for Spring and early Summer shows a warm bias for the entire west, especially for the Great Basin and southwest desert. Precipitation is expected to be near normal, which is next to nothing for Southern California. The Pacific Northwest is forecast to be in a pattern that is drier than normal.



Quarterly Summary

January

High pressure during the first few days of the month quickly moved east of the area as low pressure developed along the west coast and ushered in several days of stormy weather to round out the first week. High pressure aloft and offshore flow developed and prevailed through the middle of the month with cool nights and mild, sunny days. During the third week low pressure aloft and onshore flow brought a return of the marine layer with periods of light rain and drizzle. Low pressure off the Northern California coast brought several days of rain and heavy mountain snow to the region during the fourth week, but northwest flow aloft brought drying and some sun during the last few days. It was a cool month, with all areas reporting 2 to 4 degree F monthly temperature departures from normal.

San Diego - Lindbergh Field Data

	Max	Min	Avg	Rain
JAN	61.1	47.7	54.4	3.34
Normal	65.8	49.7	57.8	2.28
Anomaly	-4.7	-2.0	-3.3	1.06
% of normal				146%
Max	76	56		0.88
Min	55	43		

Precipitation

A broad low pressure trough over the west coast brought several days of rain and locally heavy snow at resort levels in the mountains between the 4th and the 7th. Another broad and slow moving storm system brought several days of rain and mountain snow between the 21st and the 28th. By the end of the month, most reporting stations had between 100% and 300% of normal precipitation. For the season, most areas were well above 100% of normal.

January 4-7

A powerful storm swept through all of California with high winds, periods of heavy rain, and locally heavy snow. Strong upslope flow off the Pacific and a high freezing level fueled large amounts of rainfall on

the coastal slopes. The snow level fell late in the storm as colder air filtered in resulting in some heavy snowfall at elevations above 6000 feet. Numerous Flash Flood Warnings were issued as three waves of rain swept through the region. While some flooding and debris flows were observed, much of the runoff did not cause significant problems. Some rainfall amounts were impressive in the mountains of San Bernardino County and northern San Diego County.

January 21-28

Upper-level low pressure parked off the California coast produced several waves of rain and snow across the area. The storm tapped subtropical moisture on the 26th then followed through with colder showery precipitation and strong and gusty winds for the 27th and 28th. There were many reports of flooding and debris flows in and near recently burned areas including a major slide that completely blocked highway 76 in San Diego County. Numerous Flash Flood Warnings were issued. Very heavy snow fell during 21st through the 24th in the northern mountain areas. Then, warmer conditions changed most of the precipitation to rain briefly during the 26th and 27th before colder air brought more snow through the 28th. The combination of melting snow and moderate rainfall pushed significant flows into the Mojave River. Several feet of snow were recorded at high elevations in the San Bernardino Mountains, while less was reported farther south.

February

Broad cyclonic flow covered the U.S. during the first week of the month, allowing a strong polar jet to traverse Southern California with a period of strong wind, rain, and snow. Then high pressure over the eastern Pacific nudged just close enough to keep us in a dry northwesterly flow aloft for much of the second week. A fast moving disturbance intensified on the east side of the Pacific high on Valentine's Day, mixing very cold continental air with moist Pacific air directly over southern portions of the region. Locally heavy rain and snow fell at unusually low elevations in the valleys and foothills of San Diego County. High pressure rebuilt aloft briefly through mid month before the polar jet moved south again and brought a series of systems through Southern California from the 20th to the 24th. High pressure aloft brought dry and warmer weather during the final five days of the month. It was a cool month in general, with most areas reporting monthly temperature departures from normal of from 1 to 4 degrees F.

San Diego - Lindbergh Field Data

	Max	Min	Avg	Rain
FEB	62.9	48.3	55.6	1.21
Normal	66.3	51.5	58.9	2.04
Anomaly	-3.4	-3.2	-3.3	-0.83
% of normal				59%
Max	77	54		0.45
Min	57	41		

Precipitation

Moderate amounts of rain and snow fell on the 3rd and 4th. Another fast moving storm hit portions of the region on the 14th with moderate to locally heavy rain and snow. Low pressure moving over the area from the east Pacific produced light to moderate rain on the 21st and 22nd. One-half, to one and one-half inch amounts were common over the region, except in the deserts where amounts were light. The heaviest rain fell in San Diego County from northern coastal areas into the mountains where from one and one-half to two and one-half inch amounts were common. Some local urban and small stream flooding was reported. A second system passing to the north brought some additional rain on the 24th.

For the month, upslope flow kept mountain areas close to or above 100% of normal rainfall, while many coastal, valley, and desert areas fell below 50% of normal or lower. A notable exception was San

Diego County where rainfall averaged between 75% and 100% of normal on the lower elevations. For the season, most areas remained near or above 100% of normal.

February 3-4

A cold storm dropped south over the region with powerful winds and moderate to locally heavy rain, and light snow. The winds did considerable damage in the mountains and deserts where gusts exceeded 75 mph at times. Rainfall ranged from around one-half, to one and one-half inches west of the mountains, and from one to three inches on the coastal mountain slopes and foothills. One of the wettest spots was Palomar Mountain where as much as four inches accumulated. Most snowfall amounts were light, except in the higher elevations of the San Bernardino Mountains, where local amounts up to one foot were reported. Very little rain fell in the deserts.

February 14

A surprise, targeted, and very cold storm developed over portions of the region after sunrise. A powerful disturbance dropping south along the coast teamed up with a cut-off low pressure system over the deserts, to create areas of heavy rain and snow over portions of San Diego County. Several inches of snow accumulated in the mountains and foothills of Riverside County in the morning, and then the rain and snow intensified through midday into San Diego County. Up to one and one-half inches of rain fell in the San Diego County Valleys, and eight inches of snow in the adjacent mountains. Unprepared road maintenance crews and travelers contributed to a rash of accidents and spin-outs. Scores of motorists were stranded for several hours on Interstate 8. Snow accumulated to several inches as low as 1800 feet with near white-out conditions reported. Several lightning strikes accompanied the snow. One Flash Flood Warning, and an Urban and Small Stream Flood Advisory were issued for central San Diego County. Most reports of flooding were minor, but a debris flow shut down highway 78 near San Pasqual.

March

Strong high pressure over the eastern Pacific and a broad trough of low pressure over North America kept California in a dry and cool northwest flow pattern through the first half of the month. Brief warming occurred around the 10th as the surface flow turned offshore. This was followed by a deep, cold trough around mid-month accompanied by light to moderate amounts of rain and mountain snow. A dry zonal pattern developed for the remainder of the month, punctuated by periods of dry and warm offshore flow. Another weak trough moved through with light rain at the end of the month. Temperatures averaged slightly below normal in San Diego County, but were between one and three degrees F above normal for most of the area.

San Diego – Lindbergh Field Data

	Max	Min	Avg	Rain
MAR	65.9	51.9	58.9	0.26
Normal	66.3	53.6	60.0	2.26
Anomaly	-0.4	-1.7	-1.1	-2.00
% of normal				12%
Max	81	57		0.22
Min	57	46		

Precipitation

The biggest storm of the month occurred on the 15th and 16th as a cold trough moved through. The rainfall was showery in nature and was accompanied by thunder in some areas. Rainfall was mostly less than one-half inch, however some sites in the mountains reported between three-quarters and one inch. Thunderstorms produced locally heavy rain in southern San Diego County where two Flash Flood Warnings

were issued, however no flooding was observed. Snow levels fell to around 3000 feet. Most of the reported snowfall was light, however Pine Cove, in the Riverside County Mountains, reported seven and one-half inches.

Another weak trough moved through on the 30th with mostly light rain. All reports were one-quarter inch or less.

March was very dry. Just a fraction of the average precipitation for the month was recorded. While this detracted from the seasonal totals substantially, most areas remained near or above 75% of normal. In San Diego County, many areas west of the mountains remained at or above 100% of seasonal normal.

Spotter and Skywarn© News

Spotter Reporting

We've noticed some improvement in the numbers and the quality of spotter reports. Thank you! But now the winter storms have faded and spotters are left with little if anything to report. Spring and Summer bring some fog and hot weather before the monsoon season kicks into gear. This would be a good time to review the spotter reporting criteria. You can find a printable PDF copy at: www.wrh.noaa.gov/sgx/spotter/spotter.pdf.

Remember that the method to report online changed a couple years ago. We no longer support the old reporting web page. Espotter is the accepted and supported way to report online. You must register to use the system. If you haven't already, please take a few moments to register by going to: espotter.weather.gov. If you have trouble and cannot register or use the system, let me know at miguel.miller@noaa.gov.

Spotter Information Update

We are updating our spotter contact information database and the information update campaign is nearly complete. You may have been contacted by Daniel Dickstein or Miguel Miller recently. The spotter network began in 1997 and grew to more than 1300 members ten years later. But many spotters have not been in contact for years, have moved away, or some other status change has occurred which prevents them from continuing as spotters. By the time we finish the update, we'll have closer to 1100 spotters. Please respond to the emails or phone messages that are going out so we can make these updates. Also, **please make sure your spam filters will accept both miguel.miller@noaa.gov and cr.espotter@noaa.gov email addresses.** Thank you for your cooperation.

If you haven't been trained in years, or if you have forgotten what to report and why, we invite you to take the online training as a refresher. It only takes 30 to 60 minutes. You can find this training on our spotter home page: www.wrh.noaa.gov/sgx/spotter/spotter-info.php?wfo=sgx . Simply click on "become a spotter" to get started. You need not continue with the test or sign up unless you wish.

Skywarn© Training

The Skywarn© training CD is available for new and existing Skywarn© members to be able to receive the required Skywarn© training. By visiting our Spotter/Skywarn© page you'll notice the online weather spotter training has not changed. But now, by clicking on "become a Skywarn© member", you can request the additional training (by email), provided on a CD to be mailed. After requesting and receiving your CD, review the Skywarn© training and take the Skywarn© test (linked

from the CD). After passing the test, I'll receive notice and your training will be complete.

For current Skywarn© members, please contact me by email and request the Skywarn© CD (miguel.miller@noaa.gov). Don't forget to give me your current mailing address. In this way I hope to get the CDs to the right address, and to those who will complete the training.

Miguel Miller, Editor

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Weather Spotter web site: www.wrh.noaa.gov/sgx/spotter/spotter.php

Two online versions of *Coast to Cactus* can always be found on this page.

The *Weather Guide* online, a weather companion and reference:

www.wrh.noaa.gov/sgx/research/Guide/weather_guide.php?wfo=sgx

Southwest California Skywarn© web site: swskywarn.org

Change of: Address (email or home)? Phone numbers? Equipment? Ham radio status?, etc. Please email miguel.miller@noaa.gov with the changes.

Weather photos you wish to share? Email them to miguel.miller@noaa.gov.

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