Coast to Cactus Weather Examiner

National Weather Service - San Diego

Volume 15 Number 3 **weather.gov/sandiego** **July 2008**

A Wacky May Day by Steven Vanderburg

Two of the four tornadoes to touch down near Moreno Valley on May 22, 2008. AP Photo

An unseasonably cold late-season storm hit Southern California on May 22, 2008. Strong instability along and behind a backdoor cold front led to the development of widespread thunderstorms at the lower elevations and snow in the mountains. Several thunderstorms became severe, including one storm in Moreno Valley that produced at least four tornadoes, nickel-size hail, and flash flooding. One tornado picked up a semi truck and blew over nine railroad cars as it crossed the 215 freeway near March ARB. This tornado was on the ground for 21 minutes and was rated EF-2 with wind speeds of approximately 120 mph. This is the first EF-2 tornado in California since the new scale was implemented in February 2007, and the first F2 tornado in California since the 1998 Sunnyvale tornado.

Additional thunderstorms in Orange County over the Santiago Burn Area resulted in damaging flash floods and debris flows in Modjeska Canyon and along Live Oak Canyon Road east of Cook's Corner. At least two homes suffered major damage and several roads were closed due to debris and high water. Doppler radar indicated greater than one inch of rain in less than 30 minutes with this storm.

Light snow fell in the mountains above 5000 feet with several inches reported in the wilderness areas. While snowfall accumulations at local resorts were light, icy conditions were a problem for people traveling through the mountains.

Inside this issue:

Wacky May Day	1
California Thunderstorms	2
Rip Current Project	4
Quarterly Summary	5
Seasonal Rainfall	7
Late Summer Outlook	8
Spotter and Skywarn News	9

This is the first F2 tornado in California since the 1998 Sunnyvale tornado.

Thunderstorms in Southern California

Be weather wise!

Thunderstorms in Southern California usually occur during cold winter storms from the coast to the mountains, and during the late summer monsoon season mainly in the mountains and deserts. During the winter, very cold air aloft, usually behind a strong cold front, destabilizes the atmosphere allowing thunderstorms to develop and grow. During the late summer the warm sun effectively heats the ground generating rising thermals of air. The monsoon flow brings in moisture from Mexico and Arizona. It is the combination of moisture and rising motion that produces thunderstorms.

A severe summer thunderstorm over Borrego Springs (view from Rancho Bernardo San Diego). Photo by Miguel Miller

Two mechanisms are at work to produce thunderstorms: wind shear and buoyancy. Wind shear is the change in wind speed and direction with height as you go up from the ground. Buoyancy is a measure of rising and accelerating motion. When the wind shear is weak, single cell or pulse-type thunderstorms can result. When the wind shear strengthens (greater speed increase and veering wind direction with height), more organized convection results with longer lasting supercell characteristics (figure 1).

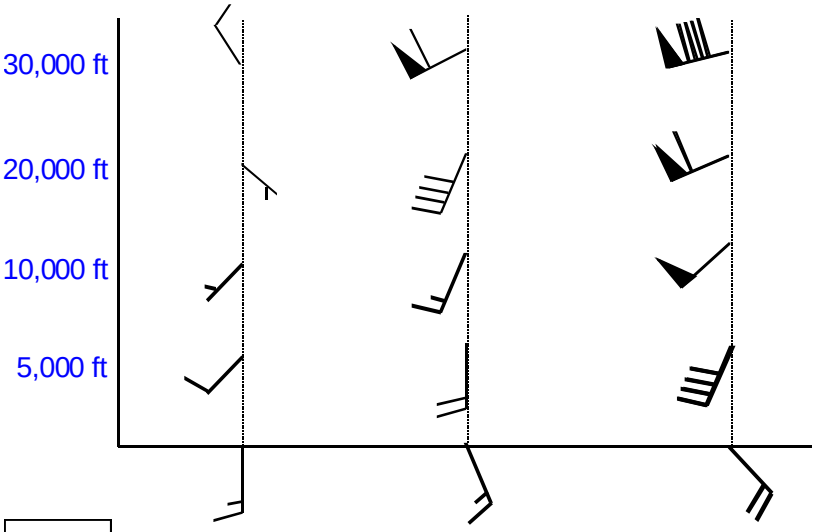


figure 1

Different kinds of thunderstorms are produced based on the strength of the buoyancy vs. the strength of the wind shear (figure 2). Storms with strong buoyancy with weak wind shear will be pulse-type severe. Storms with strong wind shear but weak buoyancy will be weak multicell. The combination of strong buoyancy and strong wind shear produces the most dangerous storm of all: the supercell. These are the Texas style storms that can produce the most violent tornadoes and the largest hail. These are also

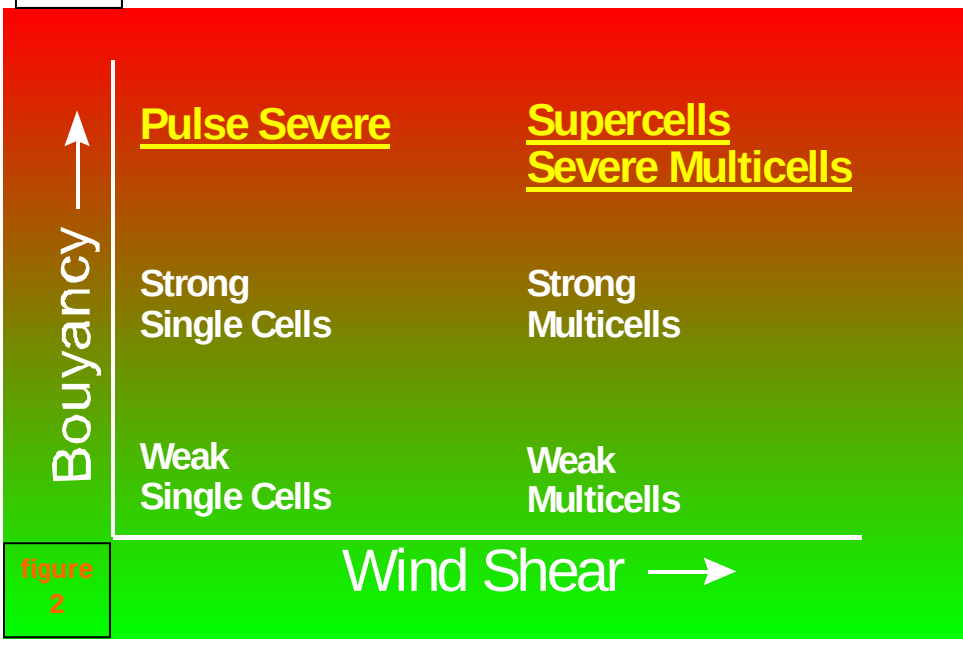


figure 2

Thunderstorms in Southern California—continued

the longest lasting storms.

A summer thunderstorm over the Cuyamaca Mountains. Photo by weather spotter Tim Augustine

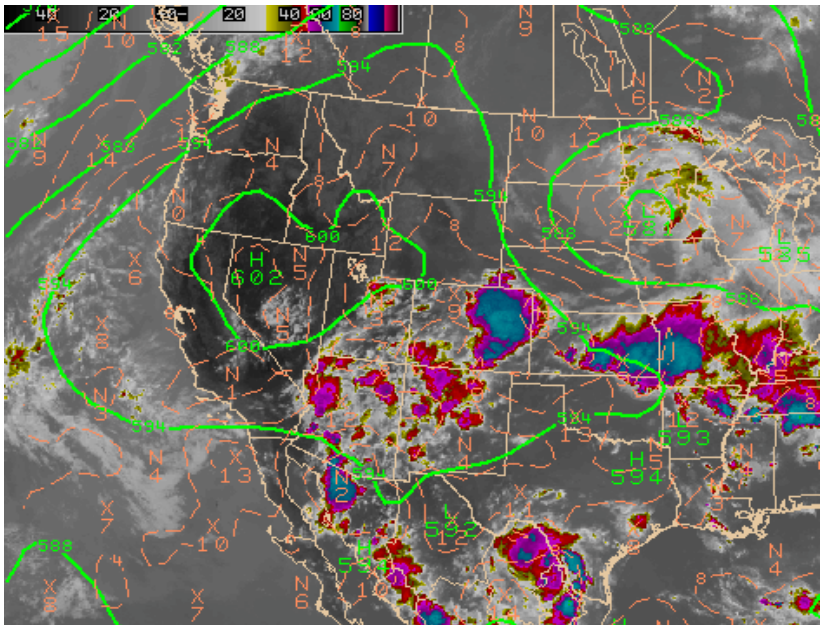
The majority of thunderstorms in Southern California are the pulse type thunderstorms. The kind of wind shear needed for multicell or supercell thunderstorms is not very common, and usually occur during a strong winter storm. Pulse type thunderstorms depend on the heating of the day and, therefore, occur mostly in the afternoon and early evening. They usually last less than 20 minutes and cover less than a few square miles of area. Because of the weak winds aloft, they do not move rapidly and are sometimes quite stationary. In rare cases, a pulse type thunderstorm can intensify enough to become severe, but not for long.

The majority of thunderstorms in Southern California are the pulse type thunderstorms.

Severe thunderstorms are defined as a thunderstorm that presents one or more of the following hazards:

- Flash floods caused by intense rainfall
- Lightning, which can strike and destroy objects, knock out power, injure or kill people, or start fires
- Large hail, which can damage property
- Strong damaging winds such as straight line winds, downbursts, squalls, gustnadoes, etc.
- Tornadoes and waterspouts

During the late summer the monsoon flow ebbs and flows into Southern California when a high pressure ridge is located to the north or east. The clockwise flow around such an upper high occasionally draws warm moist air from Arizona and Mexico into Southern California. The season runs generally from July through mid—September. For more information, see **www.cpc.ncep.noaa.gov/products/outreach/Report-to-the-Nation-Monsoon_aug04.pdf** and **www.wrh.noaa.gov/twc/monsoon/monsoon_info.php**.



A Southwest Monsoon pattern. NOAA satellite image.

The Rip Current Project by Noel Isla

At left, Robert Veria, Senior Lifeguard Supervisor, accepts the award from Dr. Steve Smith, Chief of MDL Decision Assistance Branch. Photo by Noel Isla.

The San Diego Forecast Office is on the cutting edge of rip current research being conducted by the National Weather Service Headquarters' Meteorological Development Laboratory (MDL). In the summer of 2007, the San Diego Forecast Office implemented a rip current reporting system with lifeguards at Encinitas' Moonlight Beach. The data is used to develop a computer model which will better predict the existence and strength of rip currents. This pioneering and life-saving project will spread north to Manhattan Beach this year. It will eventually be expanded to all coastal regions nationwide and has the strong support from NWS Headquarters. The two main architects of this project implementation were Dr. C.S. Wu, Coastal Wave Engineer at MDL, and Jennifer Chase, then summer student intern with the San Diego Forecast Office, and now a meteorologist intern at the Corpus Christi, Texas, Forecast Office.

On July 17, 2008, Noel Isla and Ivory Small from the San Diego Forecast Office and all Encinitas lifeguards, including Larry Giles, Lifeguard Captain, were given an award for the establishment of and cooperation in the rip current project. The award was signed by the Director of MDL and was presented by Dr. Steve Smith, Chief of the MDL Decision Assistance Branch.

Rip Currents 101

The National Weather Service is urging beachgoers to learn how to "Break the Grip of the Rip" before getting into the water. Rip currents are a deadly threat — accounting for more than 80 percent of lifeguard beach rescues.

Life guards rescue victim from rip current. NOAA photo.

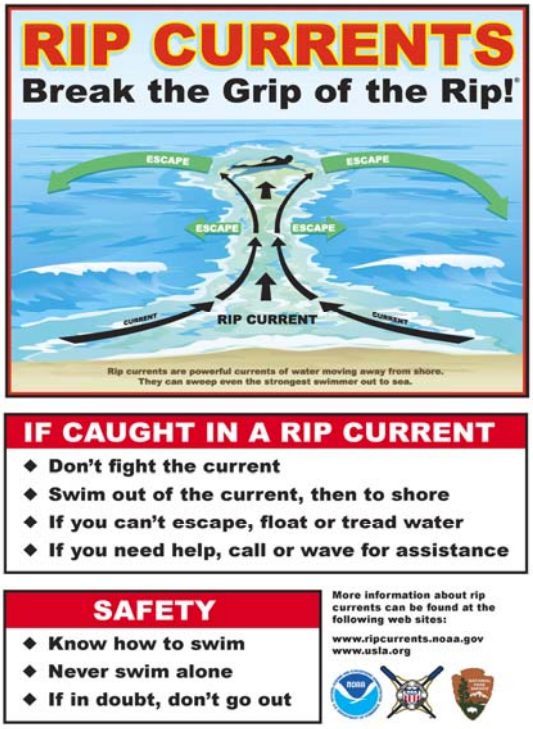
Rip currents are narrow channels of fast-moving water that pull swimmers away from the shore. They can occur at any beach with breaking waves, including the Great Lakes. Moving at speeds of up to eight feet per second, rip currents can move faster than an Olympic swimmer and can easily overpower a victim. Panicked swimmers often incorrectly swim straight back to shore — putting themselves at risk of drowning because of fatigue.

If caught in a rip current, don't fight it! Swim parallel to the shore and then swim at an angle – away from the current – toward shore.

"We have a constant education campaign about rip currents since many people visit the beach infrequently and may be unfamiliar with this leading surf hazard," said Timothy Schott, meteorologist with the National Weather Service Marine and Coastal Branch in Silver Spring,

Rip Currents—continued

Maryland. “This year, we have developed bilingual English-Spanish signs to reach a wider audience with life-saving instructions on how to break the grip.”



"Rip currents can be killers. The United States Lifesaving Association estimates that the annual number of deaths due to rip currents on our nation's beaches exceeds 100,” said Peter Davis, president of the Gulf Coast Region of the United States Lifesaving Association and chief of the Galveston Island Beach Patrol. “The greatest safety precaution that can be taken is to recognize the danger of rip currents and always remember to swim at beaches with lifeguards."

NOAA also offers the following safety tips:

1. Swim at lifeguard-protected beaches.
2. Never swim alone.
3. Speak to on duty lifeguards about rip currents and other expected water hazards.

Many coastal National Weather Service offices, including the San Diego Forecast Office, issue Surf Zone Forecasts that provide a low or high description of rip current risk. All National Weather Service offices include high risk of rip currents in their Hazardous Weather Outlook. Signs with the safety information have been posted at numerous popular beaches nationwide. More safety tips and educational materials are free and available to download at **www.ripcurrents.noaa.gov**.

Quarterly Summary

April

A weakening low pressure area moved over the region during the first week of the month bringing a few light showers. Otherwise, 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 for the first ten days of the month. The strong ridge of high pressure moved east over California around the middle of the month, bringing record heat to some areas. However, after just a few days, the broad trough was reestablished over the interior west, and seasonally cool weather returned and continued until around the 25th when offshore flow and high pressure aloft brought record heat to much of southwest California. Dry weather prevailed, with some cooling during the final days.

Temperatures averaged two to three degrees Fahrenheit above normal over northern sections, and near, to slightly below normal over southern area.

It was the driest April in 15 years for much of the region. The only synoptic storm system to affect the

San Diego - Lindbergh Field Data - April

	Max	Min	Avg	Rain
Actual	68.5	55.0	61.8	Trace
Normal	68.7	56.4	62.6	0.75
Anomaly	-0.2	-1.4	-0.8	-0.75
% of normal				0
Max	94	63		Trace
Min	59	49		

Quarterly Summary—continued

area weakened as it moved through on the 3rd, leaving only trace to isolated one-quarter inch amounts of rain. Any other precipitation logged was generated by the marine layer and confined to areas west of the mountain crests. All rainfall reports for the month were one-quarter inch or less, which was 15% or less of normal for the month. For the season so far, mountain and southern reporting sites had generally 75% to 100% of normal, while northern coastal, valley, and deserts areas reported between 60% and 75% of their seasonal normal.

May

May began with a dry, northwest flow pattern, and then quickly changed by the end of the first week as low pressure developed and moved through southern California creating a deep marine layer and some light precipitation. Dry northwest flow returned for the second week, before a strong upper-level ridge developed around mid-month with heat wave conditions and some record high temperatures. By the end of the third week, the strong ridge had given way to a broad and unseasonably cold upper-level trough, which covered the entire western U.S. This system brought some unusual late season rain, and cool weather, which persisted for several days. A more typical spring weather pattern developed for the final few days of the month.

San Diego - Lindbergh Field Data - May

	Max	Min	Avg	Rain
Actual	68.4	58.3	63.4	0.23
Normal	69.3	59.8	64.6	0.20
Anomaly	-0.9	-1.5	-1.2	0.03
% of normal				110
Max	87	66		0.21
Min	60	53		

Very hot days during Santa Ana wind events helped boost Orange County's average temperatures as much as two degrees Fahrenheit above normal for the month, but for the remainder of the forecast area, temperatures were between one and three degrees below average.

After an almost total absence of precipitation through much of March and April, some light rain and drizzle developed west of the mountains on the 6th and 7th as upper-level low pressure moved over southern California. Amounts were less than one-tenth of an inch. Most of the precipitation occurred on the 22nd as a cold and deep upper-low pressure area brought unseasonably late rain, snow, and thunderstorms to the region on the 22nd through the 24th. (See summary in lead story). Most reporting stations west of the mountains reported over 100% of normal May rainfall. Deserts had closer to 50% for the month.

A house in Modjeska Canyon suffers damage from a debris flow on May 22, 2008. Photo courtesy Orange County Fire Authority.

For the season, Orange County, and most desert and Inland Empire sites, stood at 65% to 80% of normal, while mountain areas, and most of western San Diego County had 100% or more.

June

A persistent trough of low pressure along the west coast kept the weather dry and seasonable through the first half of June. Strong onshore flow and a deep marine layer brought some light precipitation west of the mountains on the 4th

Quarterly Summary—continued

and the 5th. The weather quickly warmed around mid month as a dome of high pressure built over the southwest U.S. and wiped out the marine layer. Numerous record high temperatures were recorded between the 16th and the 22nd. The heat wave broke during the third week as a weak trough aloft brought better onshore flow and cooler conditions.

Very hot days during weak offshore episodes and strong high pressure aloft helped boost average temperatures between two and four degrees Fahrenheit above normal for the month. But near the San Diego County coast, it was closer to normal.

San Diego - Lindbergh Field Data - June

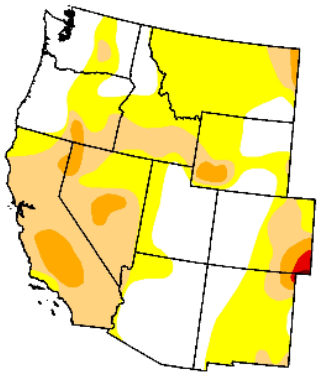
	Max	Min	Avg	Rain
Actual	72.2	61.6	66.9	0.02
Normal	72.2	62.6	67.4	0.09
Anomaly	0.00	-1.0	-0.5	-0.07
% of normal				22
Max	92	68		0.02
Min	62	58		

U.S. Drought Monitor
West

July 22, 2008
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	34.0	66.0	30.2	6.0	0.4	0.1
Last Week (07/15/2008 map)	41.1	58.9	33.3	7.3	0.4	0.1
3 Months Ago (04/29/2008 map)	32.9	67.1	36.6	8.7	0.0	0.0
Start of Calendar Year (01/01/2008 map)	26.3	73.7	54.7	33.1	2.7	0.0
Start of Water Year (10/02/2007 map)	22.0	78.0	62.3	44.7	12.4	0.0
One Year Ago (07/24/2007 map)	21.2	78.8	61.4	43.0	9.5	0.0



Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

Released Thursday, July 24, 2008
Author: Brad Rippey, U.S. Department of Agriculture

The governor of California made a statewide drought declaration early in the month. This was mainly due to conditions farther north in the state. Over Southern California, voluntary water conservation measures were being advertised in print and through the broadcast media, even though no water shortages were reported. Mandatory cutbacks have already started for farmers in San Diego County, and could be extended to others by early next year.

Rainfall for the 2007-2008 Season

The 2007-2008 season included periods of near normal rainfall mixed with long periods of very dry weather. The late summer and fall of 2007 was seasonally dry until the last day of November when a very wet storm dropped copious rainfall across the entire region. Many stations recorded their greatest daily precipitation of the season. The early winter held close to normal through January. Then the latter half of winter and spring turned out to be among the driest periods on record.

What happened? No one knows for sure, but the best theory among the experts is that the La Niña prevailed, bringing California less than normal rainfall in general. During December and January, however, a

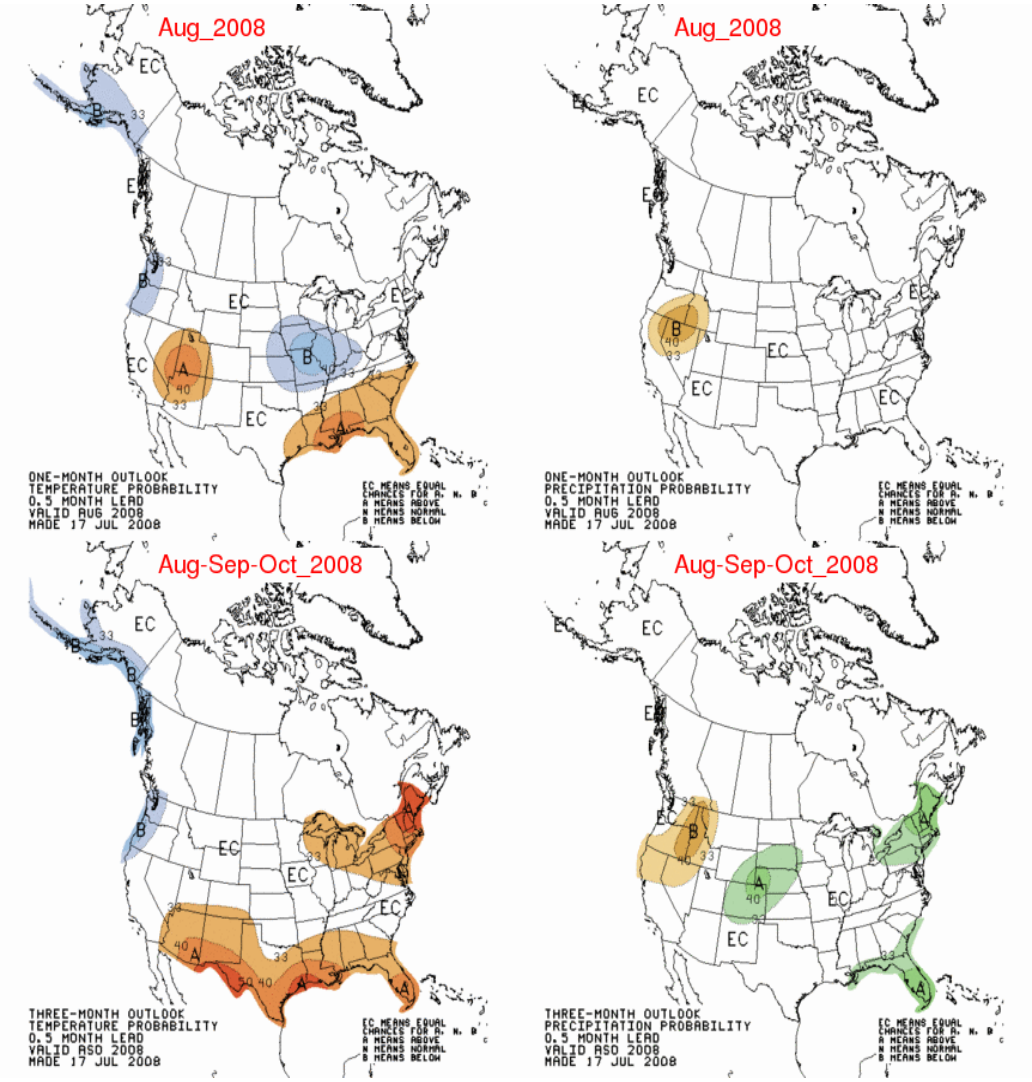
Location	Rainfall	Normal	PON
Los Angeles	13.53	15.14	89
Tustin Irvine	10.42	13.87	75
Riverside	6.87	10.72	64
El Mirage	3.73	5.78	65
Big Bear Lake	24.32	20.97	116
Idyllwild	24.91	27.80	90
Palm Springs	5.40	5.23	103
San Diego	7.25	10.77	67
Ramona	17.15	16.43	104
Lake Cuyamaca	27.59	35.83	77
Borrego	4.89	6.91	71

Rainfall for the 2007-2008 Season—continued

Madden-Julian Oscillation (MJO) contributed to greater rainfall. Season totals indicate no discernable pattern; some stations recorded only two-thirds of seasonal rainfall while other stations recorded slightly above normal rainfall. In addition, most storms during the season did not produce uniform precipitation across the region.

Late Summer Outlook

The Equatorial Pacific returned to ENSO neutral conditions during June 2008, as sea surface temperatures across the central equatorial Pacific Ocean warmed to near the climatological average. As with previous transitions from a La Niña to an ENSO neutral state, a weak La Niña atmospheric circulation continues over the tropical Pacific Ocean. SSTs in the eastern equatorial Pacific have been warming and in the last several weeks, above normal SSTs have extended westward from the South American coast. Below normal subsurface temperatures here have diminished in area, depth and magnitude. These observations suggest that the ENSO state has transitioned from La Niña to neutral conditions. A consensus of the forecasts maintains ENSO neutral conditions into the beginning of 2009.



The temperature outlook for August, September and October calls for above normal temperatures across most of the southern third of the U.S. Increased chances of below normal temperatures are predicted for the Pacific coasts of the Northwest, extending into southern Alaska.

There is an enhanced likelihood of above average precipitation for August, September and October for the northeast, parts of the high plains and the southeast coast. Below average precipitation is expected for parts of the Pacific Northwest.

Spotter and Skywarn News

How do you like the new *Coast to Cactus Weather Examiner***?** The new format is designed to reach a broader audience, including weather spotters, fire weather partners, emergency managers, and the broadcast media. We hope you'll find it as informative as always and welcome your comments, positive or negative, and suggestions for improvement.

We welcome all local weather photos depicting outstanding or beautiful weather in our region. If you would like to submit photos, feel free to email them to miguel.miller@noaa.gov. Please include the following details with each photo you send:

1. Name of photographer
2. Where and when it was taken
3. Brief description of photo
4. If we have permission to use it for training or publications

Oceanside lightning. Photo Steven Vanderburg

The weather spotter update finally became complete in June. We had nearly 1300 spotters before contacting all the spotters and now we are at 1023. We removed those who have moved on, reminded a few who had forgotten they are spotters, reconnected with those who are committed to continue, and refreshed everyone. Thank you for your assistance in this update. The weather spotter team of a thousand strong is more powerful and committed than ever to provide quality weather reports!

NWS San Diego Weather Spotter Program Manager and *Coast to Cactus* Editor: Miguel Miller, miguel.miller@noaa.gov

Contributors to this issue: Joe Dandrea, Michael Khuat, Steven Vanderburg, Noel Isla

National Weather Service

11440 West Bernardo Ct., Ste. 230

San Diego, California 92127

General calls: 858-675-8700

Spotter reports online: espotter.weather.gov

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

(*Coast to Cactus* can always be found on this page.)

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

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

Southwest California Skywarn© web site: swskywarn.org , e-mail: swskywarn@swSkywarn.org

Change of: Address (email or home)? Phone numbers? Equipment?, etc. Please email Miguel with the changes.

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

Be sure to include:

1. Name of photographer
2. Where and when it was taken
3. Brief description of photo
4. If we have permission to use it for training or publications