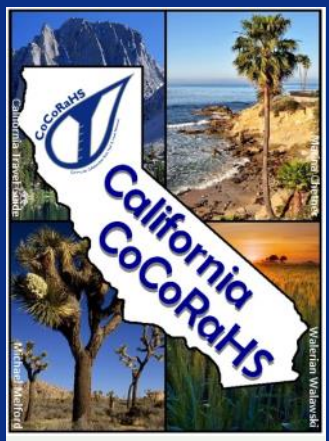

California Cumulonimbus

Spring 2014

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Welcome Message

by Jimmy Taeger

Map of California divided up into different CoCoRaHS regions. Each region has one or more coordinators. *(Source: CoCoRaHS)*

Flowers are in bloom and the days are getting longer which means...it's time for another edition of the *California Cumulonimbus*! The *California Cumulonimbus* is a biannual newsletter for California CoCoRaHS observers that is issued twice a year; once in the spring and once in the fall.

This edition contains articles on the summer climate outlook, march madness, the CA drought, atmospheric rivers, the El Niño Watch, drought impacts in Sonoma and Marin counties, the new CoCoRaHS iPhone app and an observer spotlight.

If you're not a CoCoRaHS volunteer yet, it's not too late to join! CoCoRaHS, which stands for Community Collaborative Rain Hail and Snow network is a group of volunteer observers who report precipitation daily. Not only is it fun, but your report gives vital information to organizations and individuals such as the National Weather Service, River Forecast Centers, farmers, and others.

Visit cocorahs.org to sign up, or e-mail Jimmy.Taeger@noaa.gov for additional information.

Enjoy the newsletter!

CoCoRaHS March Madness 2014

by Stefanie Sullivan

It's that time of the year again – March Madness! No, I'm not referring to college basketball. It's the annual CoCoRaHS recruiting contest! Every year from March 1st to March 31st, each state competes to see who can recruit the most new volunteer observers. There are two categories in the contest – the Traditional Count, which is for the greatest number of new observers in the state, and the Per Capita Count, which is for the greatest number of new observers per one million people in the state's population. The prize is the coveted CoCoRaHS Cup – a trophy the winning states get to keep and display for the year.

CoCoRaHS National Director, Nolan Doesken, holding the CoCoRaHS Cup. *(Source: CoCoRaHS)*

California, being the big, beautiful, and climatically diverse state that it is, needs more observers. This is especially true in rural areas where we may have little or no observers! Observation sites don't have to be limited to your backyard. Schools, gardens, nurseries, residential communities, or even your own office could participate. Talk to your friends, family, co-workers, and neighbors about joining! Overhear someone at the water cooler talking about the rain (or lack thereof)? Talk to them about CoCoRaHS. Who wouldn't want to know how much rain fell at their house? Remember – all you need to participate is a four inch rain gauge and a the internet! Not only will you be able to earn bragging rights amongst friends when you get most rain out of a storm, you'll be helping with weather and climate research and operations by providing your valuable data. Let's join recruiting forces and lead CA to a CoCoRaHS cup victory!

California's Drought Worsens

by Cindy Palmer

On January 17, 2014, Governor Jerry Brown declared California in a Drought State of Emergency, and asked all Californians to reduce their water usage by 20%. At that time, the US Drought Monitor showed more than 2/3 of California in an Extreme Drought (D3) classification, meaning that "major crop and pasture losses are common, the fire risk is extreme, and widespread water shortages can be expected, requiring restrictions." Two months later, the central California Coast and the San Joaquin Valley were upgraded to an Exceptional Drought (D4) classification, which means "widespread crop and pasture losses, fire risk, shortages of water in reservoirs, streams, and wells that creates water emergencies."

Lake Oroville - January 2014. On January 31, 2014, Lake Oroville was at 36% of total capacity, and 54% of historical average. (*Source: Department of Water Resources*)

Currently this water year, California has only received roughly 50% of its normal precipitation. As of March 4, 2014, the automated snow sensors showed that the California statewide snowpack was 33% of normal. The Northern Sierra 8-Station Index, which is a compilation of eight locations across the Northern Sierra that measure rain and snow fall for the year, has records that date back to 1920. As of March 5th, the 8-Station Index observed 18.40 inches of precipitation, running a 15.3 inch deficit in December and January alone. To get back to normal for this year, it needs 31.6 inches of additional precipitation. The 8-Station Index is a good indicator of California's water supply because these gages are located in the watersheds that fill the major reservoirs in northern California. Now that the wettest months have come and gone, it will be very hard to make up any deficit.

The state uses historical averages to determine the status of our reservoirs. Ideally, a reservoir would be either at or higher than the average in the spring, while still keeping enough room for snow melt, and runoff from a possible wet storm. This year, the historical reservoir averages for mid-March are far from normal. Lake Shasta is at 58% of its historical average, Lake Oroville at 62%, and Folsom Lake at 68% of their historical averages. As scary as these numbers are for mid-March, the associated percent of capacity of the reservoirs is scarier – 45%, 45%, and 41% respectively. Meanwhile in southern California, Pyramid Lake and Castaic Lake are at 97% and 88% of their total capacity.

At this point in time, northern and central California are feeling this drought significantly more than southern California. This is partly because southern California gets its water from multiple sources, including the Colorado River system as well as from northern California through the California Aqueduct. For this reason, several local water districts are implementing mandatory water cutbacks, as well as limiting how often and what time of day people can water. As for local industries, the agricultural industry has been extremely hard hit, especially across the San Joaquin Valley where the Federal Central Valley Water Project and the State Water Project allocations are 0% to agricultural users south of the Delta. For this reason, farmers are either removing trees and permanent crops or leaving their lands unplanted. Ranchers are selling off cattle, because it is too expensive to feed and water them. Water allocations for all municipal and industrial users were reduced to 50%, and may face additional cuts if the dry weather continues.

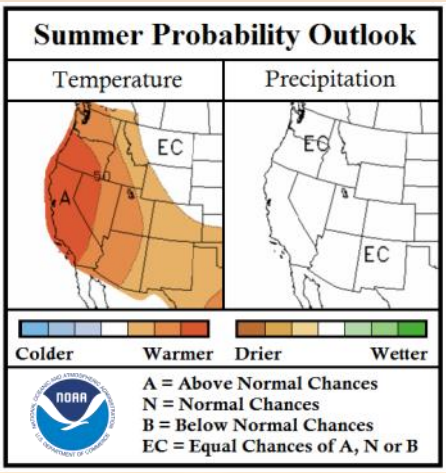
Fishing is a multibillion dollar industry within the State of California. Low river levels across northern California are starting to impact this industry as well. In fact, the Sacramento Bee published an article on March 11th, stating that the state and federal wildlife officials announced a plan to move hatchery raised salmon downstream by truck, because the Sacramento River and its tributaries could be too shallow and warm to sustain the fish if conditions do not improve. Similar impacts along the Feather, American, Mokelumne Rivers, and their tributaries could lead to trucking fish to the San Pablo Bay, as well. The last time the state and federal authorities trucked the fish to the bay area was during the drought of 1991-92.

Tips on how to Conserve Water

1. Check for leaks around the house, and have them fixed immediately.
2. Check your sprinkles frequently and adjust as need, because your sidewalk and house don't need to be watered.
3. Water in the early morning hours, and do not over water your yard.
4. Spreading a layer of organic mulch around your plants, helps them retain moisture.
5. Plant drought-tolerate plants.
6. Replace your shower head with a water saver shower head.
7. Take a short shower instead of a full bath. Shortening your shower by a minute or two can save up to 150 gallons per month!
8. Turn off your sink while brushing your teeth, and then turn it back on to rinse.
9. While waiting for hot water, collect the running water to water your plants.
10. Throw leftover ice cubes into your plants.
11. Report leaky fire hydrants and water abusers to your local public works department.

California's Summer Climate Outlook

by James Thomas

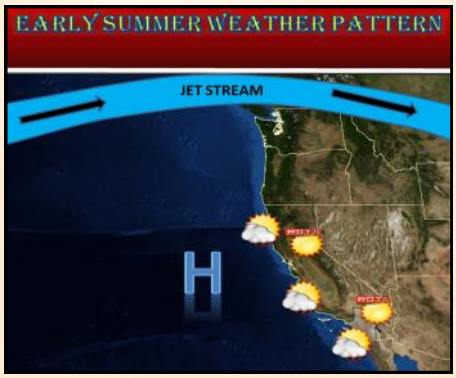


June, July and August temperature and precipitation probability outlooks from the CPC generated on March 20th, 2014. (*Source: CPC*)

The Climate Prediction Center (CPC) is forecasting above normal chances for warmer temperatures this summer across CA with equal chances of above normal, normal, or below normal precipitation. These conditions would be the result of a strong and persistent high pressure cell over the West Coast. Above normal temperatures, following a relatively dry rainy season, may be indicative of high fire danger. This issue will need to be monitored closely as summer draws near.

During the summer months across CA, temperature ranges can be extreme. Along the coast, high temperatures remain relatively cool, averaging between the upper-60s to mid-70s. A diurnal sea breeze develops in the afternoon, preventing coastal locations from heating. However, the sea breeze is often too weak to influence the Central Valley and Desert locations, where temperatures can soar well over 100 degrees F. Over the higher terrain, mild temperatures are the norm, with average highs ranging between the mid-70s to mid-80s.

Although rain is a relatively infrequent occurrence in the summer, thunderstorms containing brief heavy rain and gusty winds will occasionally develop. The monsoon season (seasonal wind shift bringing moist unstable air north and westward from Mexico) typically ranges from mid-July to mid-September. As upper level high pressure builds over the Four Corners region, clockwise (southeast) flow aloft develops over CA. Most thunderstorms that do occur are over the inland mountainous terrain. As the thunderstorms drift north during the afternoon, desert locations are affected as well. Rain is rarely experienced west of the mountains, as the storms tend to lose energy as they move down-slope into the lower foothills and valleys.



Typical weather pattern that usually keeps areas west of the mountains in CA dry in the early summer. (*Source: James Thomas*)

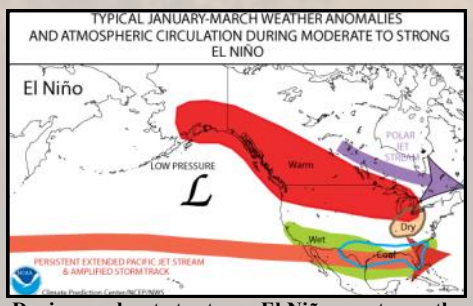
CPC Issues El Niño Watch

by Jimmy Taeger

On March 6, 2014, the CPC (Climate Prediction Center) issued an El Niño watch. An El Niño watch is issued when conditions are favorable for the development of El Niño within the next six months. Although all models are currently forecasting a warming of sea surface temperatures (SSTs) in the equatorial Pacific, uncertainty remains whether an El Niño will develop in the summer or fall.

El Niño's are characterized by above normal SSTs (greater than 0.5 degrees C above normal) in the central and east-central equatorial Pacific, with above normal temperatures persisting for three or more months. Weak El Niño's correspond with SSTs in the central and east-central equatorial Pacific between 0.5 to 0.9 degrees C above normal, moderate are between 1.0 to 1.4 degrees C above normal, and strong are 1.5 degrees C and above normal.

If an El Niño develops, there is no guarantee that conditions will change to help the drought CA is currently enduring. With weak to moderate El Niño events, studies have shown little to no correlation to an increased amount of precipitation over the Golden State. However, moderate to strong El Niño's do show a correlation to increased precipitation over the state, mainly in southern CA. CA will usually have around five atmospheric river events (storm systems that tap into tropical moisture and produce heavy rainfall) each winter, and in El Niño years, this number jumps to around eight.



During moderate to strong El Niño events, southern CA usually receives above normal precipitation in the winter months. (*Source: CPC*)

At this time, it is too early to determine the strength of the possible El Niño, especially when it is not entirely certain that one will develop. Given the tools and forecast methods the CPC uses, confidence is increasing and there is about a 50% chance that an El Niño may develop over the summer or fall. One thing that remains certain is we should all continue to do our best to conserve water during this drought, even if confidence increases even more of a moderate or strong El Niño taking place later this year.

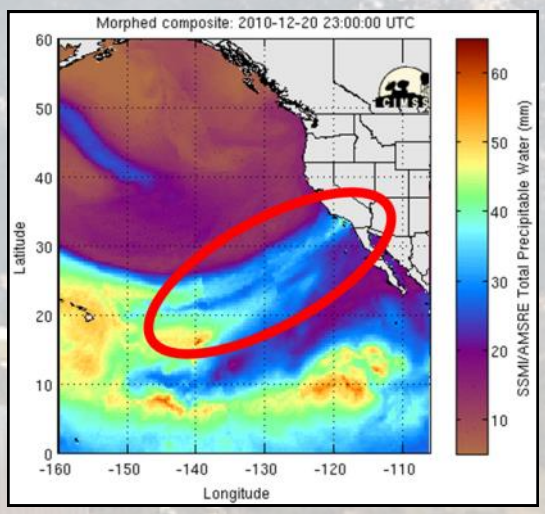
The 411 on Atmospheric Rivers

by Chris Stachelski

Usually at least once a winter, a phenomena known as an "atmospheric river" (AR) heads toward the Golden State from the Pacific unleashing precipitation, sometimes in hefty amounts, that can trigger flooding and mudslides. Although ARs can be destructive, they can also be beneficial. The precipitation they generate can greatly benefit California's water supply and bust stubborn droughts. ARs are nothing new, but the term was first coined back in the 1990s by researchers Reginald Newell and Yong Zhu of Massachusetts Institute of Technology. However, as the phenomena has become better documented and understood in recent years, usage of it's name has become more common especially by meteorologists.

Simply stated, an AR is a narrow region of enhanced moisture in the atmosphere located over the ocean. This narrow area of enhanced moisture is typically just ahead of a cold front and may be no greater than 250 miles wide. Usually this moisture originates over the ocean in the tropics or subtropics, which is why there is such high moisture content in the air mass. The vast majority of AR events impact the western coasts of continents in the northern hemisphere. In a typical winter season, an average of five AR events takes place across the West Coast of the United States between Washington and California, with some even extending into Nevada, Arizona and Utah.

AR events are efficient producers of precipitation because of the high moisture content they contain. Many years ago, the word Pineapple Express was coined in the television weather sector to describe a fetch of moisture stretching from near Hawaii toward the West Coast. The Pineapple Express existed as a colloquial term before the more scientific term AR came into more widespread use. It is still used by many today and refers to the same meteorological phenomena.



A satellite view of the plume of enhanced moisture reaching southern California during the December 2010 flooding event. (*Source: CIMSS)*

Marker in Yosemite Valley showing the height of the New Year's Flood of 1997. (*Source: Chris Stachelski)*

In California, AR events have a significant impact on the state from both a positive and negative perspective. From a positive note, they can bring beneficial precipitation that can easily account for a significant portion of the annual precipitation. For example, a major AR event that impacted central and southern California in the week before Christmas 2010 produced nearly 27% of the annual precipitation for San Diego for the 2010-2011 water year. This same event produced a record 186" of snow in just four days at Mammoth Mountain, which set the pace for a ski season that lasted into early July of 2011! However, this same event produced numerous reports of flash flooding and mudslides across central and southern California, including flooding Qualcomm Stadium in San Diego.

In northern and central California, AR events over the years have resulted in river flooding, notably the Russian River in the North Bay Area. In February of 1986, an event dumped 49.60" of rain at Bucks Lake between the 11th and 24th. What was known as the New Year's Flood of 1997 produced record flooding in Yosemite National Park on the Merced River and produced $1.6 billion in damages across California and Nevada, including damaging or destroying 20,000 homes.

With a better understanding of how ARs behave, meteorologists today are able to better track and warn on the impacts of this phenomenon across California allowing residents and visitors to better prepare for how to deal with the water they bring.

"In February of 1986, an [atmospheric river] event dumped 49.60" of rain at Bucks Lake between the 11th and 24th."

Local Drought Impacts in Sonoma and Marin Counties

by Debbie K. Clarkson

Here in Sonoma & Marin Counties, we are blessed with many different microclimates. We have a saying here that if you don't like the weather, drive twenty to thirty minutes in any direction and you will notice a change in the weather.

We have coastal hills, hidden valleys with redwoods, interior valleys and coastal mountains. We have cities, towns, and various forms of agriculture from cheese making, dairy cows, sheep, wineries and various ranches. We have a National Park, a National Seashore and many State Parks. Therefore, we have been affected by the drought in different ways. From Oct.1, 2013 to Jan. 30, 2014, five of our reporting CoCoRaHS stations (labeled here as stations A-E) observed rain totals of A) 5.28", B) 1.83", C) 3.15", D) 1.45" & E) 1.87". These amounts show how different our microclimates are.

In the beginning of February, along with much of California, we were classified as being in extreme drought. We receive most of our water from saved rainfall in Lake Sonoma in Sonoma County, and various lakes, such as Lake Nicasio, and the Russian River in Marin County. We were about 17" short from our normal rainfall, and the hills were still almost bare instead of being emerald green. Our normal rainfall averages 30-40" a year. However, some of our locations, like Cazadaro, have an average rainfall of almost 100". This meant ranchers and dairymen had to bring in hay for their livestock that should have been grazing on hills normally lush with new growth. In some instances, they were also having to haul in water. In vineyards, the warm dry weather was bringing bud break sooner than normal. This was cause for concern as nights were still in the 30's, with frost still possible through mid-April. Because of the lack of rain, the ponds that store water for frost protection were nearly empty, and Russian River water was now unavailable. Two towns in Northern Sonoma County that receive much of their water from the Russian River ordered mandatory 20% water cutbacks. Much of Marin County was asked to do 20% voluntary cutbacks.

Lake Sonoma at 67% capacity on 3-11-14. (*Source: Debbie K. Clarkson)*

During the weekend of Feb. 8-10th, we were blessed to be in the direct line of a much needed Pineapple Express. Yippee! Those same five stations received A) 18.36", B) 11.23", C) 13.15", D) 7.89" & E) 7.88" of rain. This one weekend event changed our status for the drought from extreme to severe. Finally, our hills turned green and with the sun that followed, growing started at last. One benefit of the drought was many neighborhoods that would have flooded with that much rain in a short amount of time didn't because the Russian River was so low; it didn't come close to flood stage. Towns along the River were spared. The Laguna de Santa Rosa wetland drains into the Russian River and can back-up during precipitation events. Luckily this time, it was able to continue draining due to the low river level. We did have some minor street flooding, though. We all wish we could have 3 or 4 more of these direct hit Pineapple Express.

Holstein cows enjoying some water and new green grass in west Sonoma county on 3-08-14. (*Source: Debbie K. Clarkson)*

Unfortunately, there has been not much rain since, so our drought status changed back to extreme in mid-March. As days continue onward, the grass is still growing, just not to normal levels. Also, as the days go forward the water deficit continues to grow. For the Santa Rosa plain area, we are now again around 20" short of our average rainfall.

On a side note, I just came back from a trip to Nevada. We went up to Mt. Rose on the Mt. Rose Hwy so the little ones could play in the snow, but there wasn't snow on the ground until about 7,200'. A year earlier on the same snow trip we hit snow at about 5,000'. What a difference in a year!

CoCoRaHS iPhone App

by Jimmy Taeger

In early March, the greatly anticipated free iPhone app for CoCoRaHS observers was officially launched. The app allows volunteers to sign in to their account from anywhere they have cell service. Now taking daily observations will be even easier!

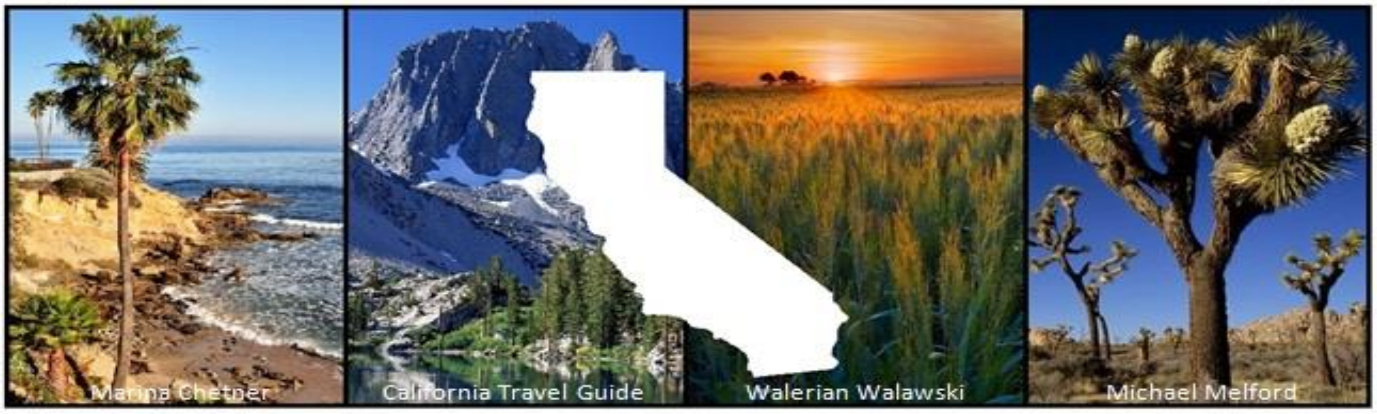
The app requires the phone software iOS 7.0 or later, and is compatible with the iPhone, iPad, and iPod touch. The app is only 1.0 MB in size, so it will not use much space on a phone.

Not only will observers be able to quickly submit observations, they can also view old reports. This can be useful to ensure previous reports were entered correctly.

To download the app, click the link below. https://itunes.apple.com/us/app/cocorahs-observer/id827714558?mt=8

Precipitation report screen from the iPhone CoCoRaHS app.

California CoCoRaHS



California Cumulonimbus

Observer Spotlight: Mike Archer

by Jimmy Taeger

A dedicated CoCoRaHS observer since 2008, Mike Archer enjoys observing precipitation daily in his backyard. Mike, born in Santa Monica and currently residing in Scotts Valley for over 19 years now, was a pilot in the Air Force and managed a large private community for many years. Mike is one of three CoCoRaHS observers located in Scotts Valley, which is a small city of about 11,600 people and located around 6 miles north of Monterey Bay, CA.

Mike isn't the only one in his family interested in the weather. His two sons, one of which has a master's degree in Meteorology, are also part of the CoCoRaHS community, and report precipitation.

Mike not only reports precipitation, but he also includes detailed notes about the current weather. This is valuable information for many organizations.

Thank you, Mike and your sons, for being an active part of the CoCoRaHS network!!

Spring 2014 California Cumulonimbus Contributors

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What is CoCoRaHS?

CoCoRaHS, which stands for Community Collaborative Rain Hail and Snow Network, is a non-profit group of volunteer precipitation observers. Anyone can join, and it's easy to report the information. All you need is a 4 inch rain gauge, the internet, and a few minutes each day. The website is easy to navigate and has different instructional materials for anyone to learn how to record an observation.

The site also has daily maps of observer's reports showing where precipitation fell the day before. It's fun to compare the different amounts of precipitation that can fall in an area from just one storm. Not only is the information interesting to look at, it is very valuable for organizations such as the National Weather Service, hydrologists, farmers and many others.

Visit cocorahs.org to sign up, or e-mail Jimmy.Taeger@noaa.gov for questions. Join CoCoRaHS, today!

Rain gauge required for the program.

cocorahs.org California CoCoRaHS weather.gov