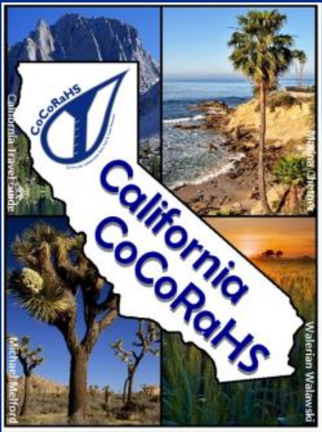


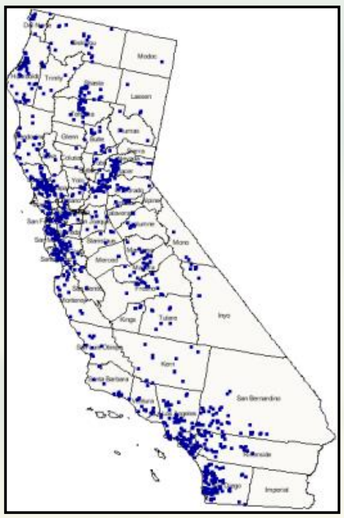
California Cumulonimbus

Articles in this Edition:

Fall 2019

Welcome Message

By Jimmy Taeger



Map of current CA CoCoRaHS observers as of October 16th, 2019. *(Source: CoCoRaHS)*

Leaves are turning and days are shorter 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 a dedicated observer, last season's California snowpack, how to become an evapotranspiration observer, the CA winter climate outlook, an overview of atmospheric rivers and the need for additional mountain observers.

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 email Jimmy.Taeger@noaa.gov for additional information.

Enjoy the newsletter!

Observer Spotlight: Dave Tyler

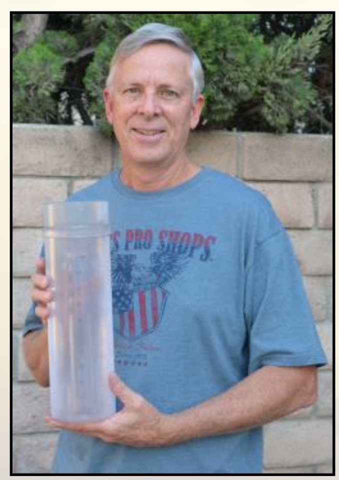
By Jimmy Taeger

Dave is a high school computer science teacher, with a Bachelor's degree in Geography and a Master's degree in Education. He loves the outdoors! Some of Dave's favorite activities include hiking, car camping, and fishing in the Sierra Nevada Mountains. He holds a commercial pilot license and an amateur radio - extra class license (KF6DQ). Dave met his wife while snow skiing at Mammoth Mountain, and have been married for 28 years. They have one daughter together.

Dave has been interested in meteorology for as long as he can remember. His parents began logging rainfall in 1972 at their home in Woodland Hills. Dave has been logging rainfall at his home in Thousand Oaks since 1992. He discovered CoCoRaHS when he was looking for a precision rain gauge 11 years ago, and has been recording and reporting regularly ever since.

Dave enjoys taking his daily observations, especially when there is precipitation in his gauge. He finds it interesting comparing the CoCoRaHS precipitation maps with the national weather charts to see the frontal systems and the resulting precipitation.

Thank you, Dave, for your daily dedication to CoCoRaHS!



Dave with his rain gauge.

2018-2019 California Observed Snowfall

by Bruno Rodriguez

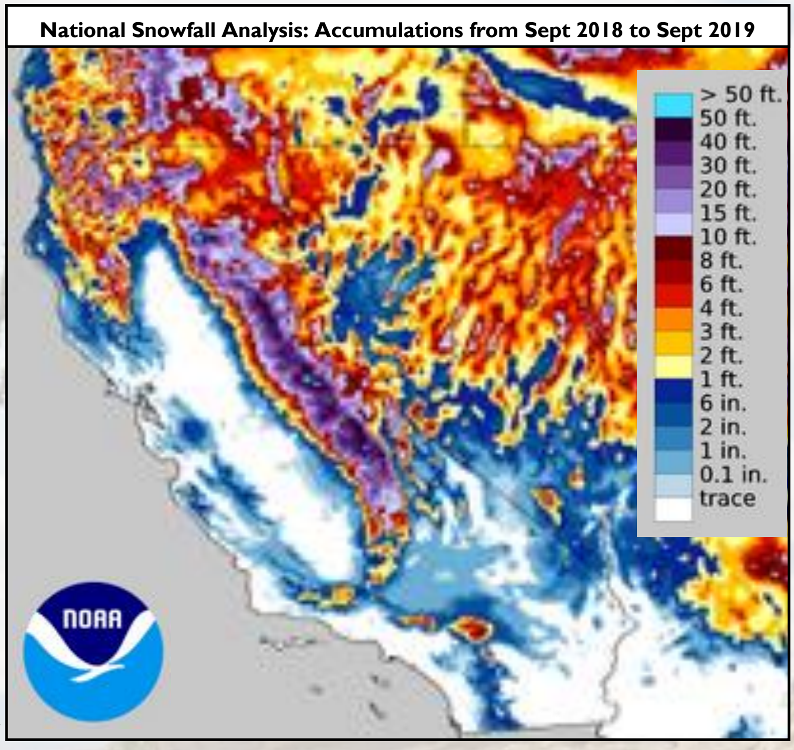


Figure 1) Snowfall accumulation from September 2018 to September 2019. (*Source: National Operational Hydrologic Remote Sensing Center)*

The California 2018-19 winter season got off to a slow start in terms of snowfall. Statewide snow water content (equivalent liquid measurement when snow is melted) remained below average through the first half of January. However, it didn't take much for Pacific storm systems to ramp up (see the **Fig. 2**). Numerous frontal systems and atmospheric rivers slammed California from late winter through much of Spring, with Northern California being hit especially hard.

For many, the constant stream of systems was a welcome sight, especially after the very dry 2017-18 season. Snowpack saw a significant increase through the months of February and March, and by April was just shy of that from the 2016-17 season, which was one of the wettest in California history. Satellite images taken in mid March showed the state shining bright – high elevations covered in bright white, and lower elevations in a vivid green, reflective of the plentiful new vegetation growth.

May was also notably snowy, especially in the Sierras. Mammoth Mountain received a record monthly 29 inches of powder, and the statewide snowpack saw a steady increase for a good portion of the month. By season's end, a few high-elevation locations had received over 50 feet of snow (Squaw Valley, for example, received a jaw-dropping 719 inches, or 60 feet!).

What will precipitation be like for California this winter? See page 4 for the winter outlook!

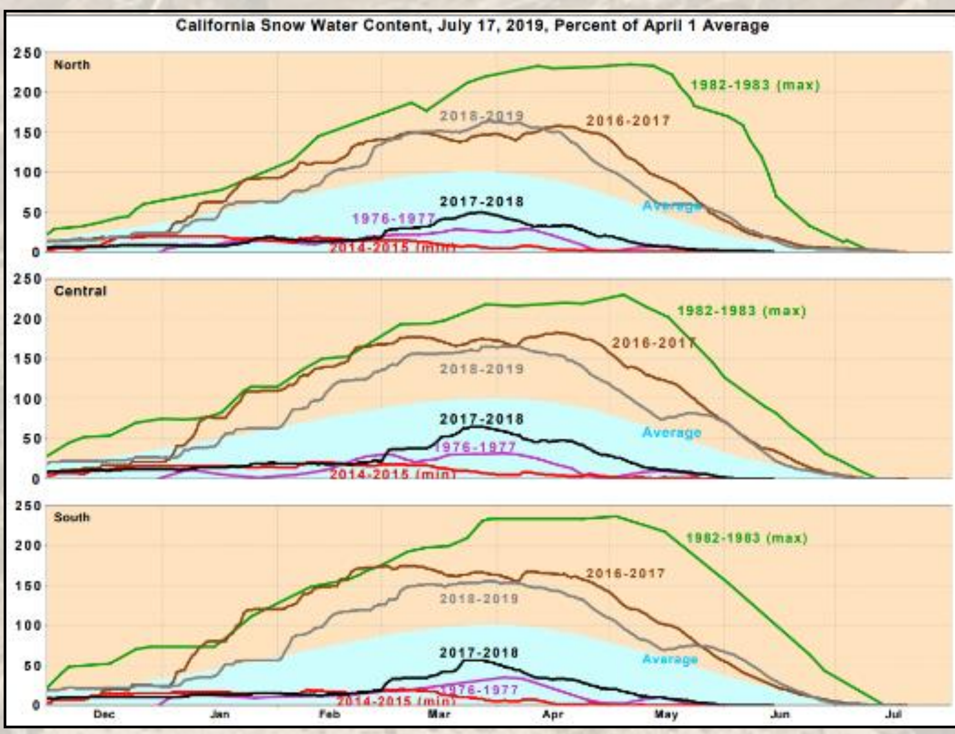


Figure 2) Graph of California Snow Water Content for notable years and recent years. (*Source: California Department of Water Resources)*

Become a Evapotranspiration Observer!

By Jimmy Taeger - Information from “Measuring Reference Evapotranspiration - The CoCoRaHS Guide”

Evapotranspiration (ET) is the water evaporated from the ground back to the atmosphere both as transpiration form the leaves of plants and also as a direct evaporation from open water and soil. Knowing how much water is leaving the soil and returning to the atmosphere is just as important, and the information is used for agriculture, lawn care, weather prediction, hydrology and more!

The ETgage is a simple evaporation device that simulates crop reference ET. It is a modified evaporimeter (atmometer) where the ceramic evaporating cup is covered with a green canvas/wafer to simulate crop color (albedo) and leaf properties (vapor diffusion resistance). This instrument has been used since 1984 in a variety of field studies and for operational irrigation scheduling and water management.

The ETgage is designed for measuring during the growing season. In warmer non-freezing climates, it can be left outside all year. You should wait until close to the date of your average last freeze to install the gage, as it can be damaged by prolonged subfreezing temperatures. Your location should consist of the prevailing representative vegetation of the area and preferably the vegetation is watered. An open location with adequate natural ventilation is ideal.

Interested in becoming a ETo observer?
Some things to consider as you apply:

1. CoCoRaHS is looking for "ideal" locations (*open exposures with surrounding vegetation that is representative of your area*) and highly motivated observers (*you have reported on a consistent daily basis for CoCoRaHS over time*).

2. You are up for the challenge of taking on a more complex daily observation.

3. You or a sponsoring organization are willing to make the substantial investment in purchasing this delicate instrument, the ETgage (*$255.25 plus tax and shipping from* weatheryourway.com).

Still interested? Please contact Noah at info@cocorahs.org with a photo of the site where you would install the gauge and he will follow up with you.

Figure 1) Noah Newman, with CoCoRaHS HQ, next to a newly assembled ET gauge. (*Source: CoCoRaHS.org)*

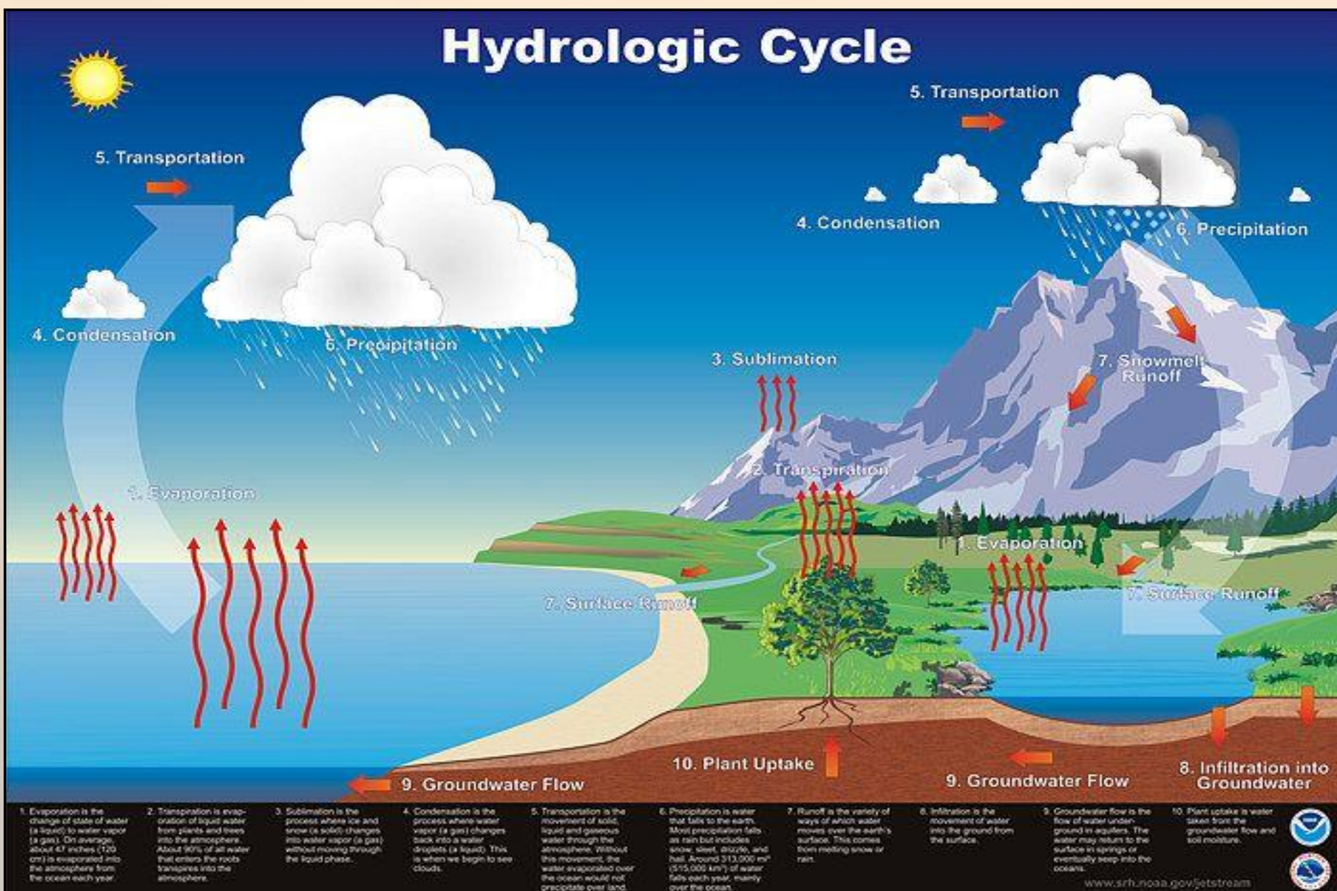


Figure 2) Graphic displaying the hydrologic cycle. (*Source: National Weather Service)*

California Winter Climate Outlook

By Colin McKellar

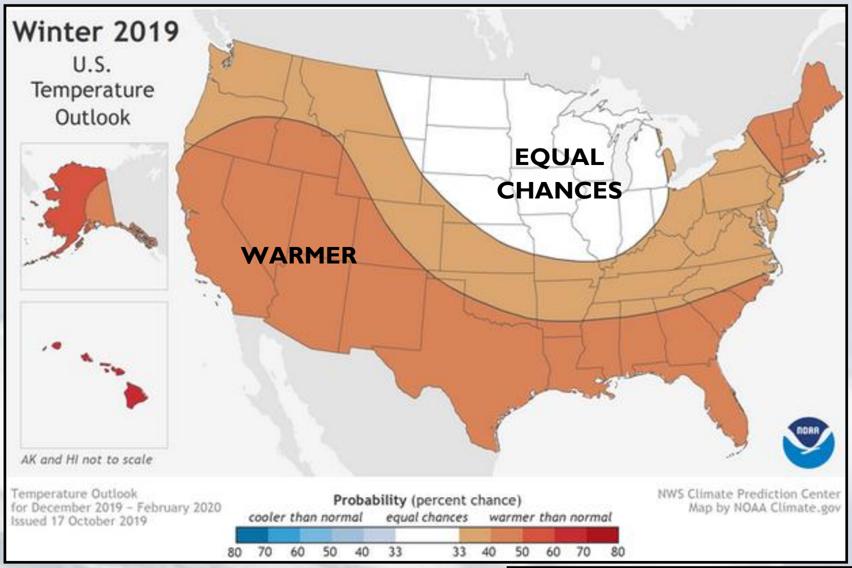


Figure 1 (left): Winter 2019-2020 temperature outlook for December through February from the Climate Prediction Center (made 17 Oct 2019). All of California is favored for above normal temperatures through the period. (*Sources: Climate Prediction Center and Climate.gov*)

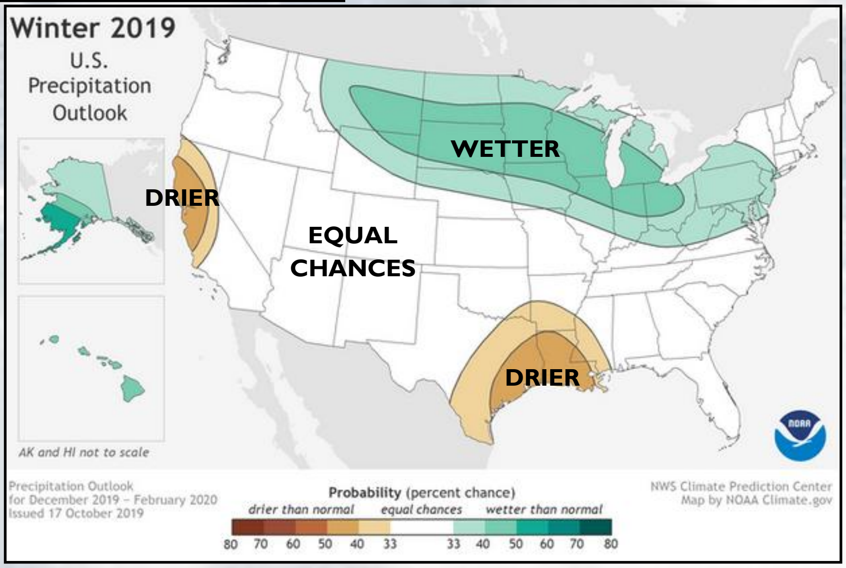


Figure 2 (right): Winter 2019-2020 precipitation outlook for December through February from the Climate Prediction Center (made 17 Oct 2019). A good amount of northern and central California is favored for below normal precipitation, while all of southern California is favored for equal chances of above, below or normal precipitation through the period. (*Sources: Climate Prediction Center and Climate.gov*)

The Climate Prediction Center (CPC) has recently issued the 2019-2020 winter outlook. But before we dive into the details, let's first understand some basics of how the seasonal outlooks are constructed and how to interpret their meaning. The winter outlook is constructed by examining larger scale climate patterns such as El Niño/La Niña, as well as trends in surface temperatures and pressure. For California, one important control on winter-time variability is the El Niño/Southern Oscillation or ENSO. The CPC has predicted ENSO-neutral conditions for the upcoming 2019-2020 winter. As a result, temperature and precipitation patterns will be less influenced by the variability generated by ENSO, and may be more dependent on other forms of shorter term variability such as the Arctic Oscillation.

Now that you know what goes into the winter outlook, how are these outlooks computed and interpreted? The CPC computes seasonal temperature and precipitation by using a combination of numerical models, statistical models, as well as current climate patterns and trends. These values are compared to a 1980-2010 climatic average, and then divided equally into a 3-category probabilistic format; which is above average (A), below average (B), and near average (N). EC stands for "Equal-Chances" and is used when probabilities cannot be determined.

The current winter outlooks call for a 40% to 50% probability of above average temperatures for the entire state of California. For reference, the 1980-2010 winter average temperature for Los Angeles is 57.5°F and San Francisco's average temperature is 50°F. The CPC has a slight 40% probability of below average precipitation for Northern California, especially for the Bay Area. As a reference, the winter time precipitation average for San Francisco is 12.02 inches. There are equal chances for most of Southern California. This means that there is no strong climate signal for above, below, or neutral precipitation. For reference, the average winter precipitation for Los Angeles is 7.23 inches.

Atmospheric Rivers: A General Overview

By Casey Oswant

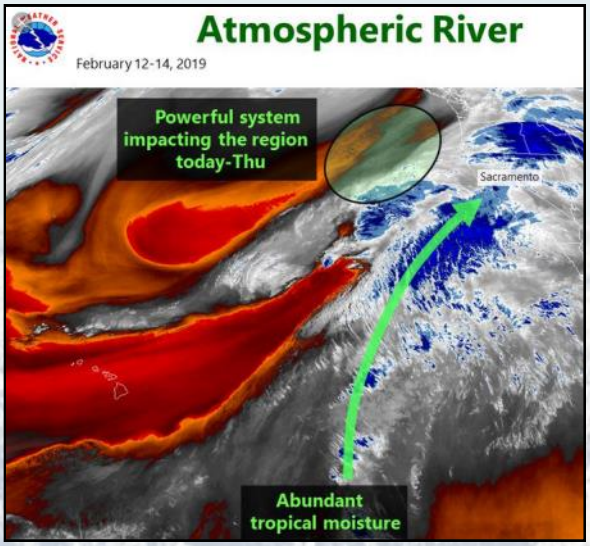


Figure 1) Satellite image of an atmospheric river impacting the West Coast. (*Source: National Weather Service Sacramento)*

Atmospheric Rivers (ARs) are one of the main weather features responsible for transporting atmospheric water vapor outside of the tropics and across the globe. ARs are formed when wind over the ocean forces water vapor into bands, or “rivers”. On average ARs are 250-375 miles wide and a strong AR can transport an amount of water vapor “roughly equivalent to 7.5 -15 times the average flow of liquid water at the mouth of the Mississippi River” (NOAA ESRL).

November through April is the time of year when the West Coast is most likely to be impacted by an AR. Rain/snowfall from ARs are very beneficial to California’s water supply and snow pack as they are responsible for 30-50% of the West Coast’s annual precipitation. Although ARs are mostly helpful, they have the potential to be very destructive. When strong ARs make landfall or stall over an area, they can cause destructive flooding and mudslides that threaten life and property. Forecast models, satellites, and radars are all tools that forecasters use to identify upcoming and monitor ongoing AR events. Local Weather Forecast Offices can start issuing watches and for heavy rain and flooding several days in advance if confidence is high.

There is still a lot to learn about ARs and research continues to be conducted by NOAA and its partners. One of the main projects scientists are working on is using observations from satellites, aircraft, and land-based AR observatories to help develop models that can more accurately predict AR intensity and duration. For more information on ARs check out the links below.

https://www.esrl.noaa.gov/psd/arportal/

https://www.nesdis.noaa.gov/content/noaa-satellites-keep-tabs-atmospheric-rivers

https://www.noaa.gov/stories/what-are-atmospheric-rivers

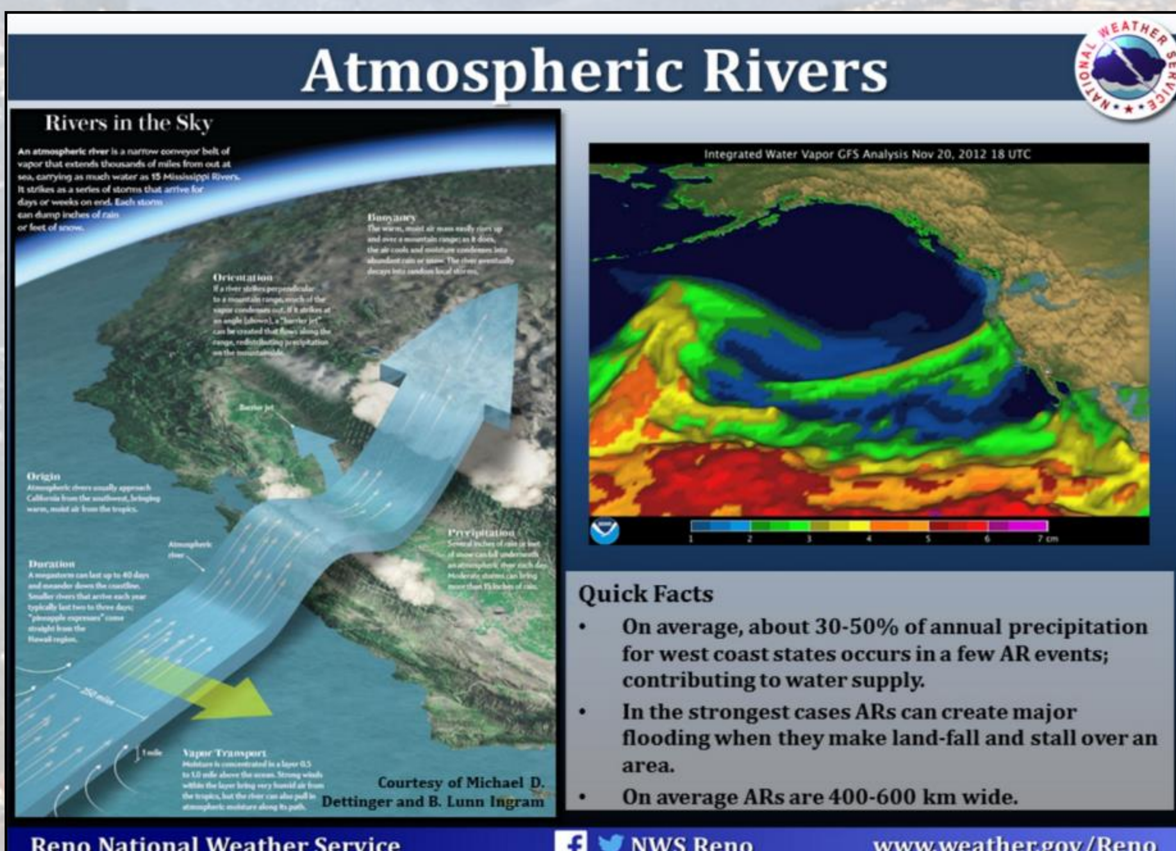
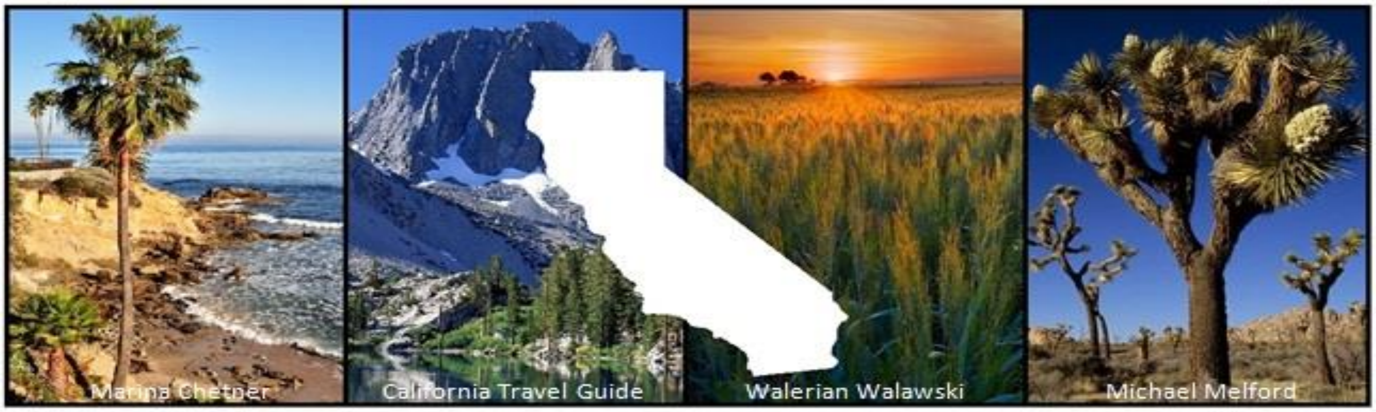


Figure 2) Graphic showing how atmospheric rivers impact the West Coast, and a view of it on Integrated Water Vapor Satellite. (*Source: National Weather Service Reno)*

California CoCoRaHS



California Cumulonimbus

Additional Mountain Observations Needed

By Jimmy Taeger


Source: CoCoRaHS)

The amount of CoCoRaHS observations in California have grown over the years, however observations in the mountains remain sparse. The terrain of California plays a large role in affecting how much precipitation falls as storms move across the state. Often times, areas of the mountains receive double or triple the precipitation than areas along the coast. Therefore, mountain observations are very important, and additional observations will help fill in gaps when assessing precipitation across California. If you know of anyone that lives in the mountains and who enjoys observing the weather, please encourage them to sign up for CoCoRaHS. Thank you!

Fall 2019 California Cumulonimbus Contributors

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- **Jimmy Taeger, California State Co-Coordinator:** Editor, Template Designer and Author
  Meteorologist - NWS San Diego

What is CoCoRaHS?


Rain gauge required for the program.

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!

cocorahs.org

California CoCoRaHS State Webpage

California CoCoRaHS

weather.gov