

Colorado CoCoRaHS Newsletter

Fall 2022

Peter Goble

Welcome: Happy fall everyone! If you are new to CoCoRaHS, welcome! I am your state coordinator, Peter. I write newsletters for Colorado volunteers periodically to introduce myself, reflect on the storms we have captured in our rain gauges, and look at what may be to come.

Some of you experienced your first snow of the year last week! Most of us in the Urban Corridor or Eastern Plains had to wait until January 1st to measure snowfall last winter. Even if you did not receive measurable snow last week, I think it is unlikely you will have to wait until January again this year.

For the most part, we have been enjoying a mild fall across the Front Range, and most of the Eastern Plains. We have already seen some cooler conditions in October on the Western Slopes. Our mountain snowpack is off to a somewhat promising start.

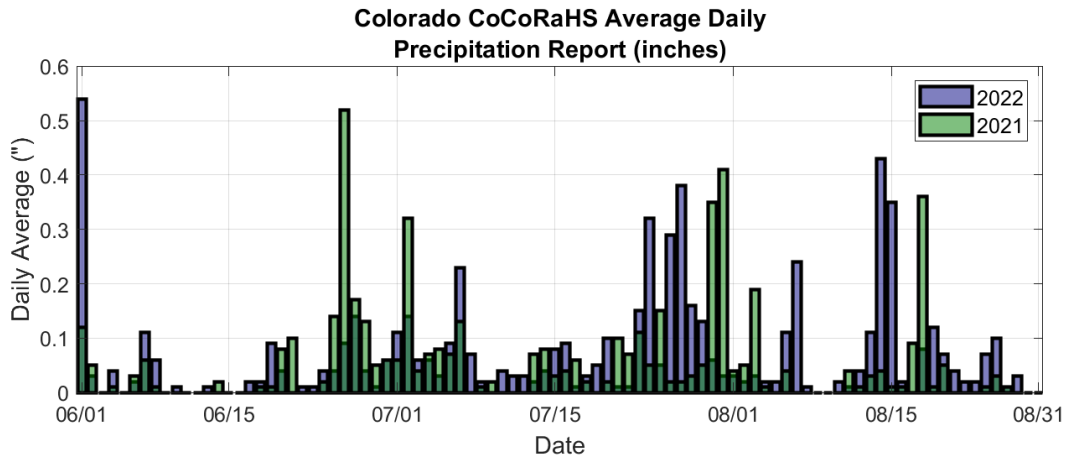
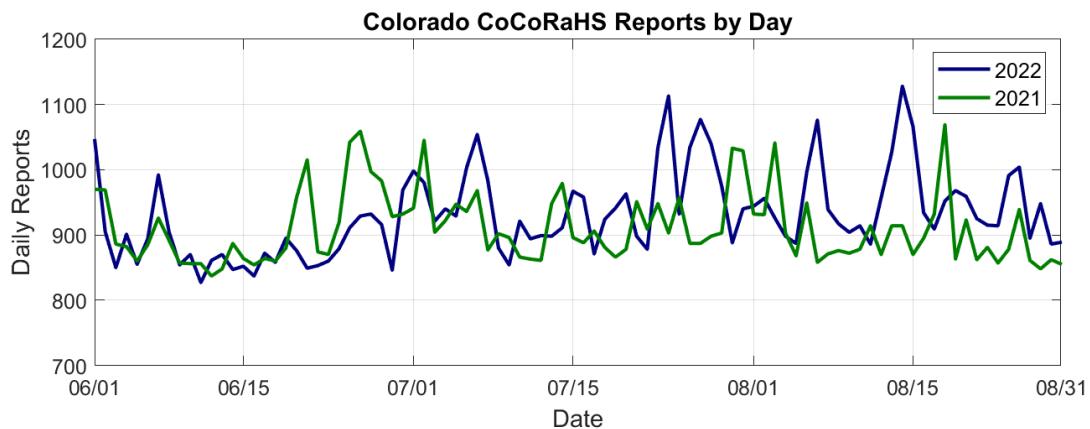


Marmot Point, Rocky Mountain National Park 10/30/2022. Photo Credit: Stephen Pretak.

Summer Reporting Numbers (A Cause for Concern?) Summertime is the best time to track whether CoCoRaHS participation is growing or fading in Colorado. This is because it is our time of highest weather

observer engagement. Most participants love check the rain gauge on a pleasant, sunny summer morning. Making more complicated snow measurements on a cold, dark winter morning may be less tenable.

The total number of CoCoRaHS reports this summer (June 1st – August 31st) grew 2.2% over last summer. At first, I was both surprised and excited to see growth. I expected a small decrease as more folks traveled during summer 2022 than 2021. However, the average summer 2022 precipitation report was up 25% over 2021. Some observers do not report zeroes. It is more likely we witnessed a small decline in participation over the last year, but had more summer reports due to more exciting summer weather.



Number of daily Colorado CoCoRaHS reports, and average daily measurement for summers 2021 (green) and 2022 (blue).

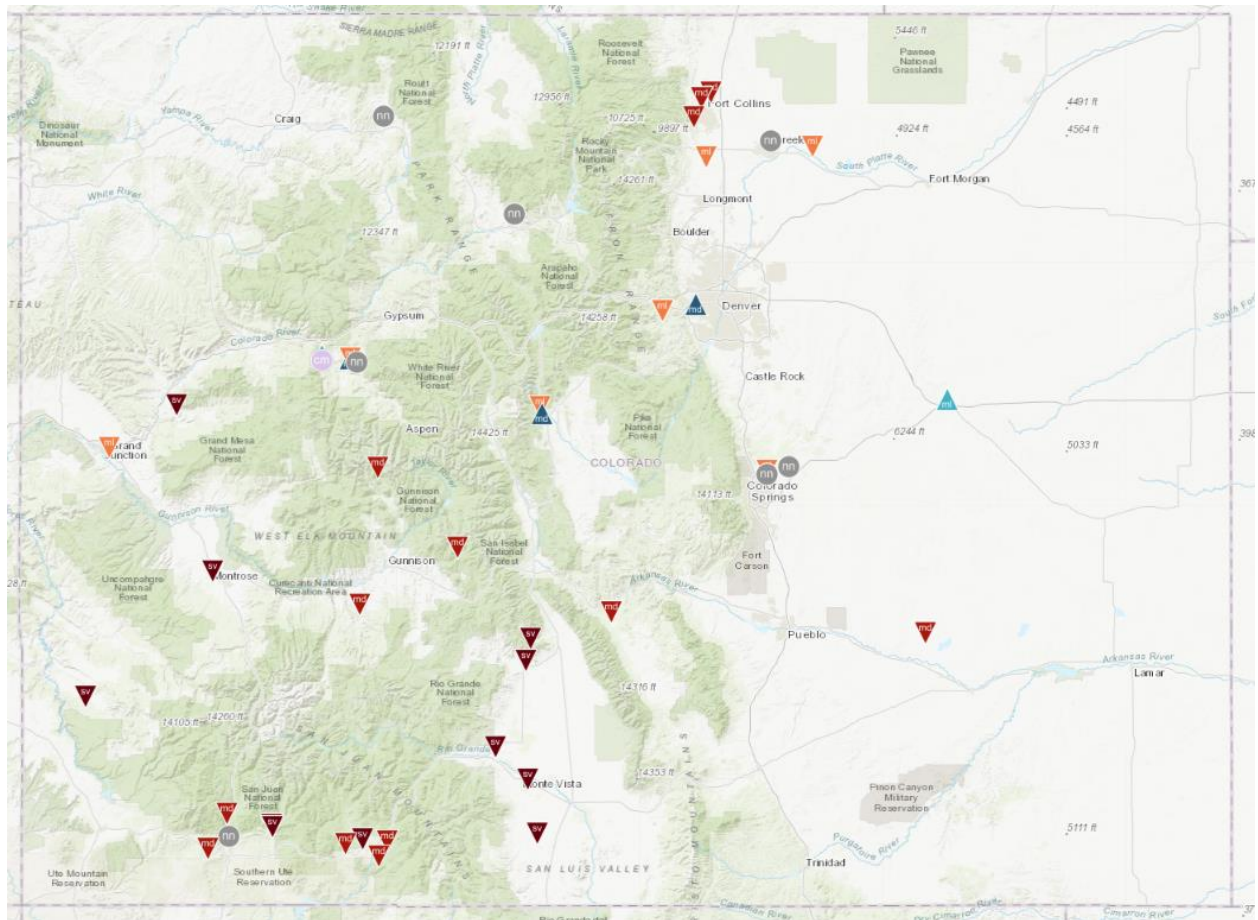
What you do as volunteers is so important to a myriad of people: The National Weather Service, climate scientists, insurance groups, city planners/flood control districts, those who develop satellite and radar algorithms, and more! Even so, we know we must keep working to keep growing. If you know any friends or family who may be interested in joining CoCoRaHS we certainly encourage sharing your hobby with them. Whatever questions they have can always be directed my way.

Measuring Snow: Snowfall makes observations a little more difficult. We lose a fraction of our observer base over the winter. We do appreciate those of you snow lovers who stick with us all winter long!

Some of you are new, and some of you will make mistakes when you measure snow. That is okay. If this is your first time measuring snow, and you have questions, know that CoCoRaHS has a bounty of resources available for you. We have a wonderful YouTube series on snow measurement: <https://www.youtube.com/user/cocorahs>. If you are more of a reader, we have written snowfall measurement instructions as well: <https://media.cocorahs.org/docs/MeasuringSnow2.1.pdf>. Please feel free to email me with any questions.

Condition Monitoring: I have said this many times before: I love reading your Condition Monitoring reports, especially during dry weather! Even when we know precipitation, snowpack, streamflow, etc. are low, it can be hard to understand drought severity without impact reports. CoCoRaHS observers make a valuable contribution to our understanding of drought impacts through Condition Monitoring reports. The richest part of these reports is the comments.

I know Condition Monitoring reports are not as habit forming, I have struggled to form the habit myself. If you can set a weekly, or even monthly, reminder to file a Condition Monitoring report, a little bit goes a long way. I have been running a monthly Condition Monitoring email campaign to western Colorado observers since May. This effort was motivated by a lack of reports in forested areas, and the looming threat of bad drought this summer out west. As it turns out, the summer monsoon performed quite well out west, and eastern Colorado suffered much worse. We ended up lacking Condition Monitoring reports out east too. Go figure!

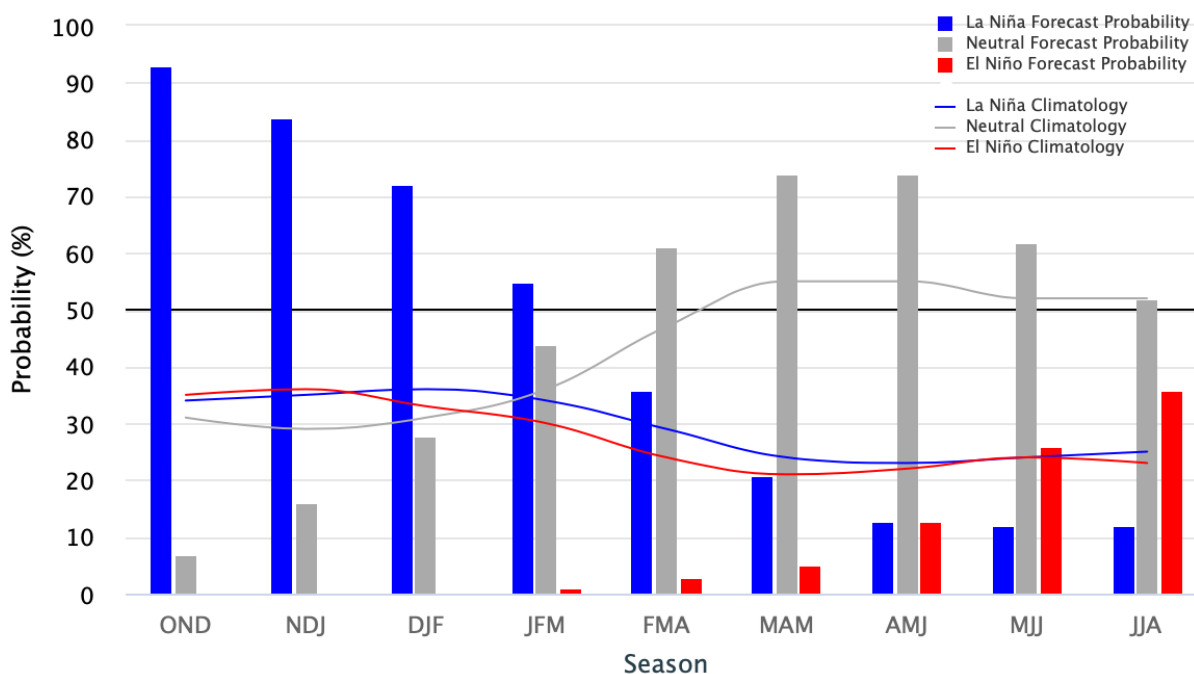


Colorado CoCoRaHS Condition Monitoring reports 5/17/2022-5/23/2022.

Triple Dip La Niña? La Niña conditions are present for the third winter in a row. For those unfamiliar, La Niña refers to a phase of the El Niño Southern Oscillation (ENSO) in which cooler than normal ocean surface temperatures emerge over the eastern and central equatorial Pacific Ocean. We care about ocean surface temperature patterns because they tell us where thunderstorm activity is likely to occur in the tropics, which has semi-predictable seasonal weather impacts across the globe. For North America, La Niña generally means high pressure off the Pacific Coast, forcing the Polar Jet Stream to the north. This often means the northern half of the US is wetter and cooler than normal, and the southern half is drier and warmer than normal. Colorado lies in the mid-zone where impacts can be convoluted, but our historical record does show some potentially predictable patterns. For instance, La Niñas tend to be dry in the shoulder seasons (fall, spring), but cool and wet in the northern Rockies during winter. We may see a late start to winter, but cooler conditions with lots of snow in the northern Rockies from about mid-December through early March.

Mid-October 2022 IRI Model-Based Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly
Neutral ENSO: -0.5 °C to 0.5 °C



International Research Institute probabilistic ENSO forecast. Blue = La Niña, red = El Niño, gray = neutral.

Second year, or “double-dip” La Niñas tend to be drier than first year events. Famous examples include 2000, 2012, and 2018. What about “triple dips?” We only have a few events on record. It is difficult to say anything definitively with such a small sample size. The closest analog year to winter 2023 in terms of being a “triple dip” is probably 1976, which was a dry winter.

Colorado Climate Futures: Colorado is warming, which is consistent with global trends, and climate model expectations. A professor from Denver University recently reached out to our office. She had played this video in class, which speculates about the most resilient locations in the US as the climate warms: <https://www.youtube.com/watch?v=tcj9IGY6Etg>. Students asked her which locations in Colorado were the most resilient. She forwarded the students’ inquiry to us. This was a fun thought experiment for us. I want to take the last section of this newsletter to share some of my thoughts on Colorado’s climate change resiliency, but feel free to skip if you are not interested. My thoughts below are speculation, not peer reviewed science. You have every right to disagree, and if you do, I would love to hear why.

In general, Colorado is well positioned to handle a warming climate. I would argue that we are currently on track for a world that is ~3 Celsius warmer than pre-industrial levels by 2100, and roughly 2 Celsius warmer than today. I hope to see that 3 Celsius figure improve as technology improves. Colorado’s average annual temperature now is in the mid-40’s (Fahrenheit), and ~50 in the most populated areas. Historically, humans have been most comfortable and productive in areas with an average annual temperature between 50 and 60. Colorado’s urban centers are likely to warm into the middle of that

range, not above it. Our mountains, while warmer, will still be cool. Factor in our lack of humidity, and Colorado may even be considered a place of refuge for those coming from warmer or wetter areas.

Climate change still presents challenges for Colorado. A warmer climate changes our water cycle, yielding shorter snow seasons with less snowpack, and higher evaporation, transpiration, and sublimation rates. Said another way, less water supply with more demand. Scientific papers suggest we will lose 3-10% of our water/degree Celsius the climate warms. The droughts we experience are likely to become worse in the absence of adaptation. As has been the case historically, this is likely to spur complex legal battles. Warmer temperatures also bring higher wildfire risk, summertime air quality issues, and potential for worse flash flooding when heavy rains do come. All these hazards merit planning and adaptation.

Back to the original question: which parts of Colorado are best suited to withstand climate change? This is where I could get myself in trouble. If your location does not make the list it is not a slight. For my money, the most crucial factors are having a stable water supply, a willingness to plan and adapt, and amenities that make Colorado desirable to begin with (e.g. recreation, beautiful views). With these criteria, and others, in mind, my picks for eastern Colorado would be Logan County and Prowers County. Some of my top western Colorado picks would be Chaffee, Eagle, Garfield, Grand, Routt, and Summit Counties. I think our Urban Corridor is well-positioned to deal with the challenges of warming too, but at the risk of sounding like a "homer," I like Larimer County best in the region =)