Colorado CoCoRaHS Newsletter Summer 2020

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Damage from wind burst in Akron, CO. Photo credit: Joel Schneekloth (CSU Extension).

COVID-19: Life changed suddenly since I last wrote you in March. All of us at CoCoRaHS wish you the very best in staying healthy and sane during this pandemic. Since epidemiology is not my area of expertise, we'll leave it at that; let's talk about the weather!

Colorado CoCoRaHS by the Numbers: Colorado CoCoRaHS reporting remains strong with over 1000 reports a day during high precipitation days. Our numbers are up slightly from 2018 and 2019. There is some evidence to suggest our numbers may have improved during stay-at-home orders. CoCoRaHS is social distance-safe, and does not require travel; feel free to tell your relatives.

Much Colorado has experienced a fairly hot, dry spring. Most of us have been reporting more zeros than we would like. The northern Front Range was the exception up until recently. My station in Berthoud has beaten its PRISM normal for all months from February-June, but has gone bone dry in July. Boulder has posted our highest post-lockdown accumulations with over 10" of accumulation at some stations since mid-March. Boulder also experienced a large number of big snow events over last cold season extending well into April. The city set a new seasonal snowfall record of 146", besting the 108-year-old mark of 142.2".

Our highest report in so far 2020 is 3.10". This report came from Woodrow, which is near Akron. As large a measurement as 3.10" may be, it's a soft state seasonal best. Typically, we see at least one 4+" report by this point in the season, and often a 5+" report will emerge on our maps. We see in the figure below that our highest daily reports often come in late July and August, so it is highly likely that one of you will beat this year's current max.

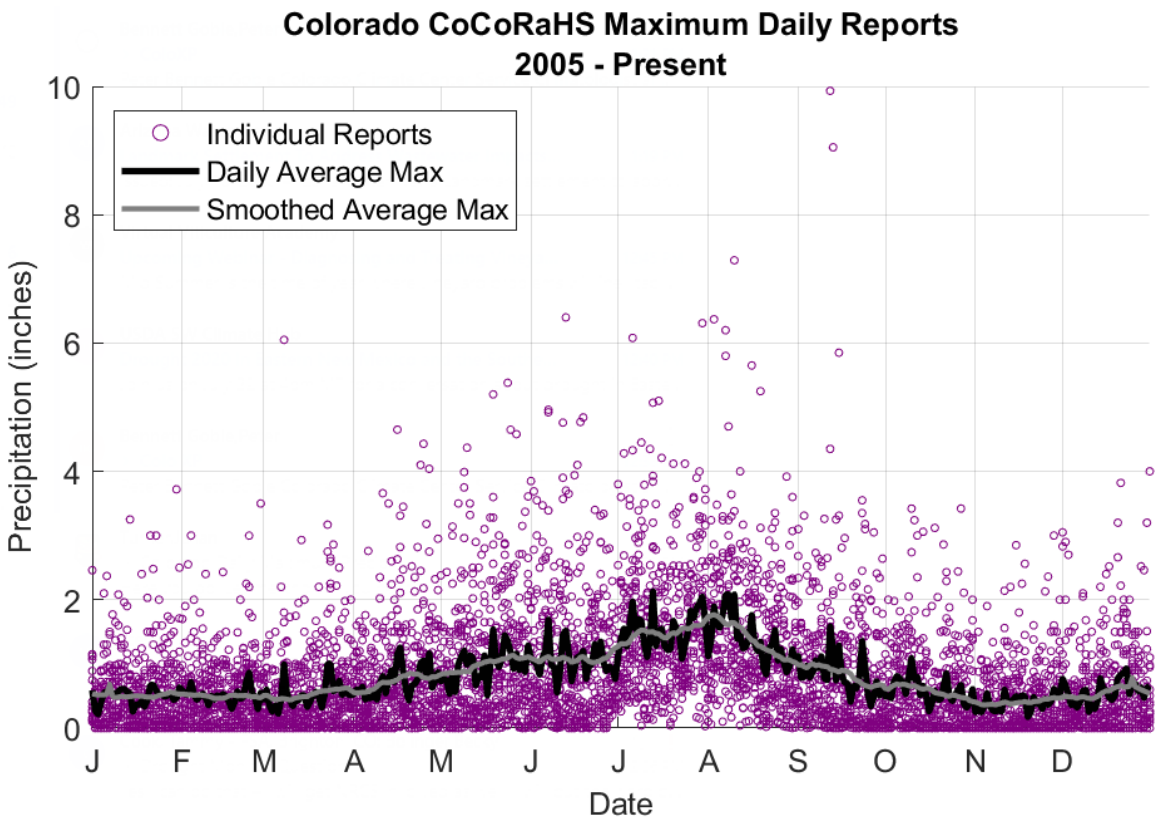

Figure 1: Colorado CoCoRaHS daily precipitation extremes as a function of season.

Daily Precipitation Extremes: Speaking of extremes, here is a fun example from a study our office conducted recently: We looked at the highest daily reports from CoCoRaHS and the Weather Service's Cooperative Observer Network (COOP) for years 2010-2017 (CoCoRaHS has been in all 50 states since December 2009): Figure 2 shows the location and relative magnitude (dot size) of the highest report in the nation for all days in meteorological winter (a), spring (b), summer (c), and fall (d). Figure 3 shows a histogram of all daily extremes broken down by season. Colorado does not make a strong showing on the maps despite our high participation numbers; it's too darn dry here! Even on days where high rainfall (or snowfall) does grace Colorado, there is usually something higher on the West Coast, or across the Central Plains. Big snow days in the Colorado Rockies often coincide with bigger snow days in the Sierra Nevadas. Big thunderstorm days in eastern Colorado often coincide with bigger thunderstorm days in Nebraska and Kansas. However, if you look at panel d of figure 2, you'll see a few dots stand out across the Front Range from the month of September. Many of you can probably guess the year =)

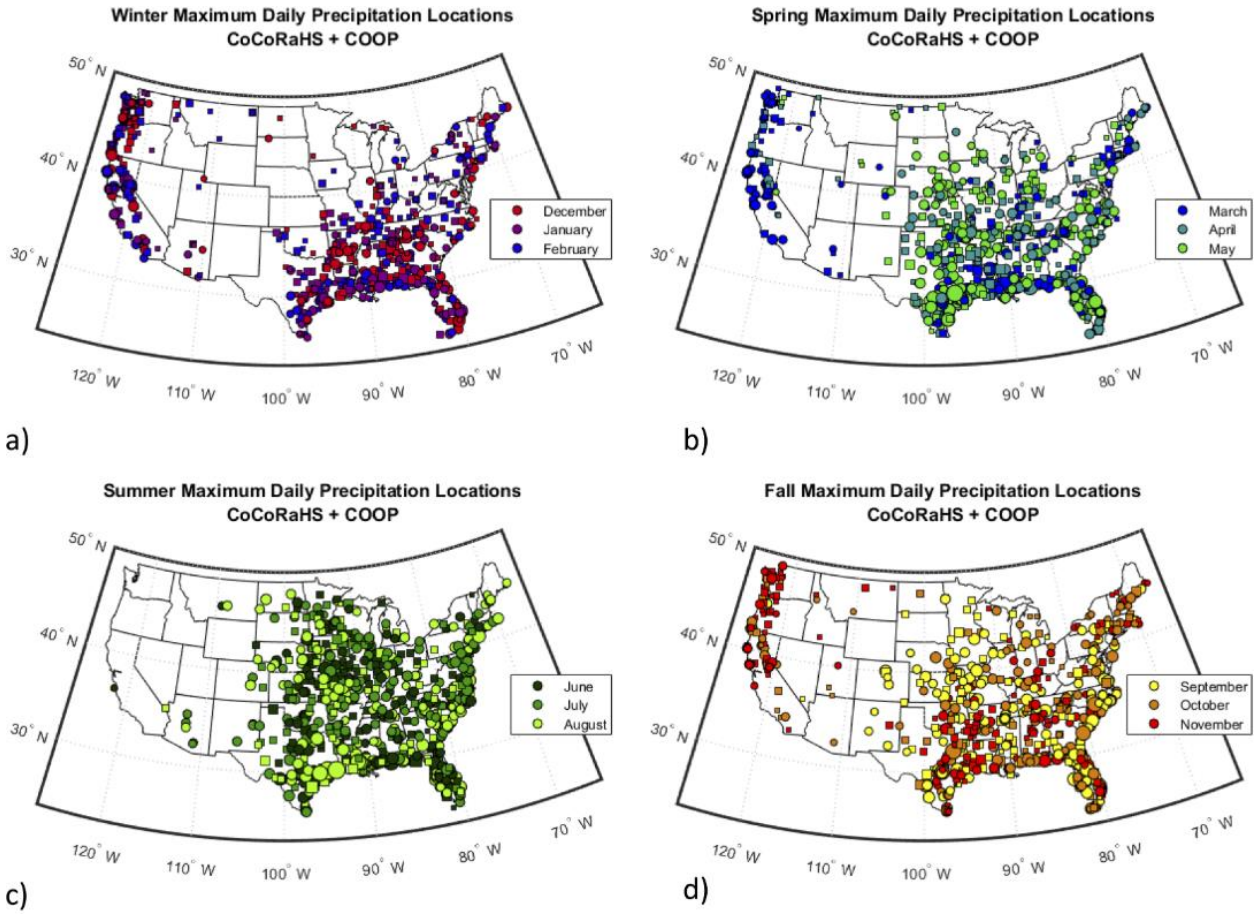

Figure 2: Precipitation extremes for (a) winter (DJF), (b) spring (MAM), (c) summer (JJA), and (d) fall (SON). Dot size is scaled by precipitation amount. Shape is based on network (circle = CoCoRaHS, square = COOP). Additional color coding is by month.

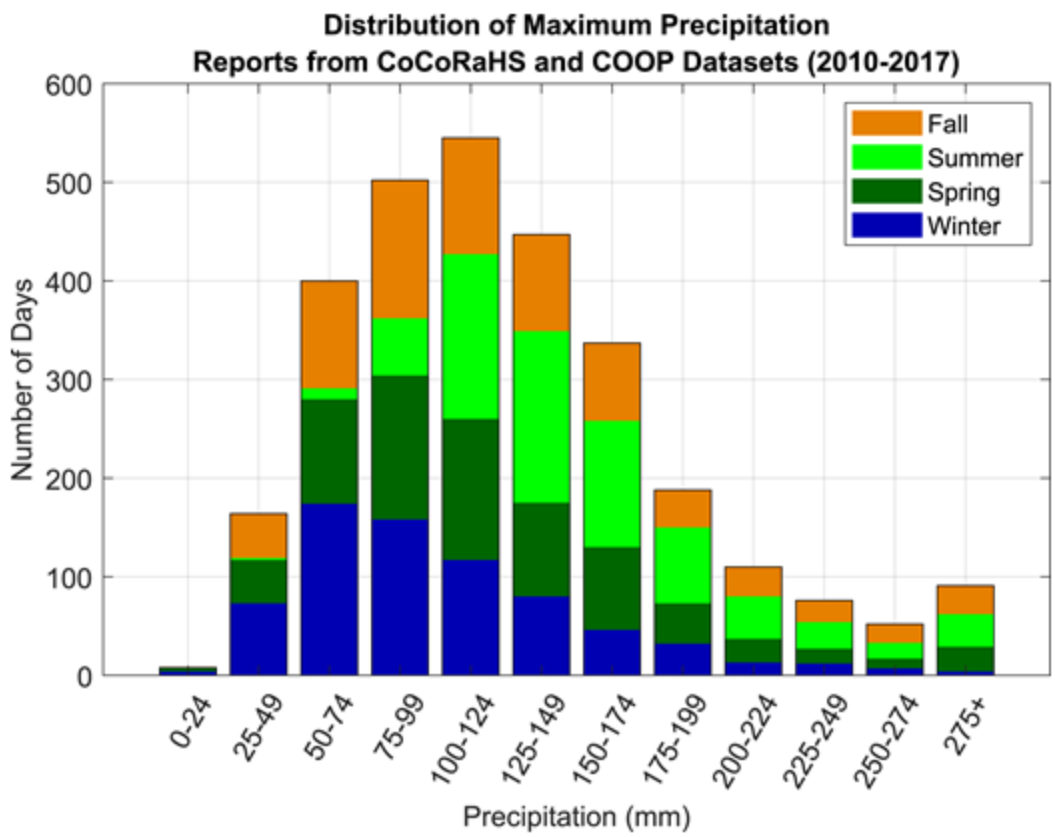

Figure 3: Histogram of CoCoRaHS + COOP Contiguous US maximum daily precipitation reports color-coded by season.

Derecho: It's been a strange severe weather season so far for Colorado. We haven't seen as many tornadoes as normal on the eastern plains. We have had devastating severe winds nonetheless. We set a state record on June 6th for the most severe wind reports in one day. The winds were produced by one single line of thunderstorms stretching from Colorado Springs to Cheyenne. You may have added the word "derecho" to your vocabulary in the process. The definition of a derecho is "A widespread convectively induced straight-line windstorm." – American Meteorological Society Glossary.

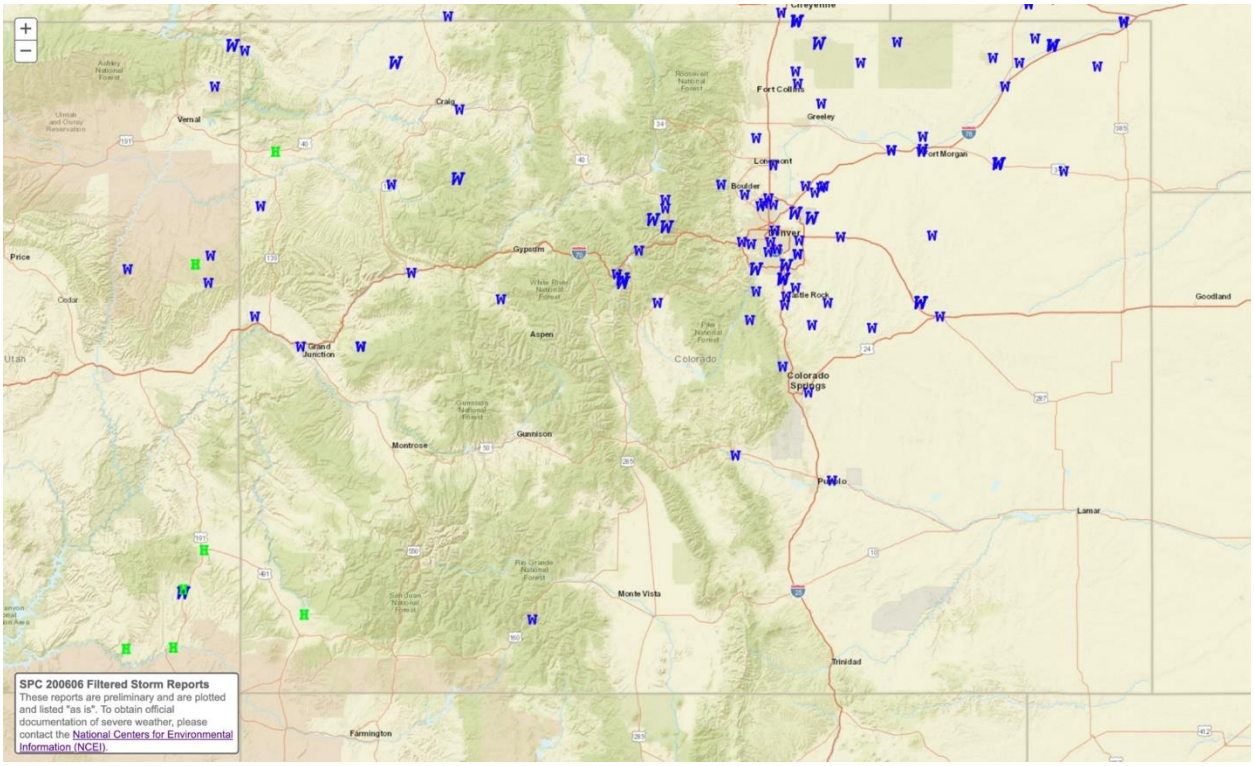

Figure 4: Severe weather reports in Colorado 6/6/2020. "W" = severe wind.

What causes a derecho? Why are they so rare in Colorado? In Colorado, thunderstorms are usually generated over high elevation terrain when sun shining on mountain peaks creates pockets of buoyant air. When sufficient atmospheric moisture is present, these thunderstorms will grow in intensity and spatial extent as they blow over the eastern plains. Damaging winds are most likely to occur when upper atmosphere winds are fast because the air keeps its momentum as it descends.

The line of thunderstorms (derecho) we saw on June 6th was not generated over the high elevations. It was formed much further west, and careened over the mountains like a dirt bike over a rock. We can see in the radar image provided in figure 5 that severe thunderstorm warnings were in place all across the high terrain of North Park and South Park. The ingredients that allowed a strong, organized line of thunderstorms to develop so far west of the Rockies were anomalously high moisture content across the west slopes, and a passing cold front with very strong upper level winds. As a result, the National Weather Service in Boulder drew larger single severe thunderstorm polygons than for any other storm. The whole urban corridor from Colorado Springs to Cheyenne experienced severe winds at nearly the same time.

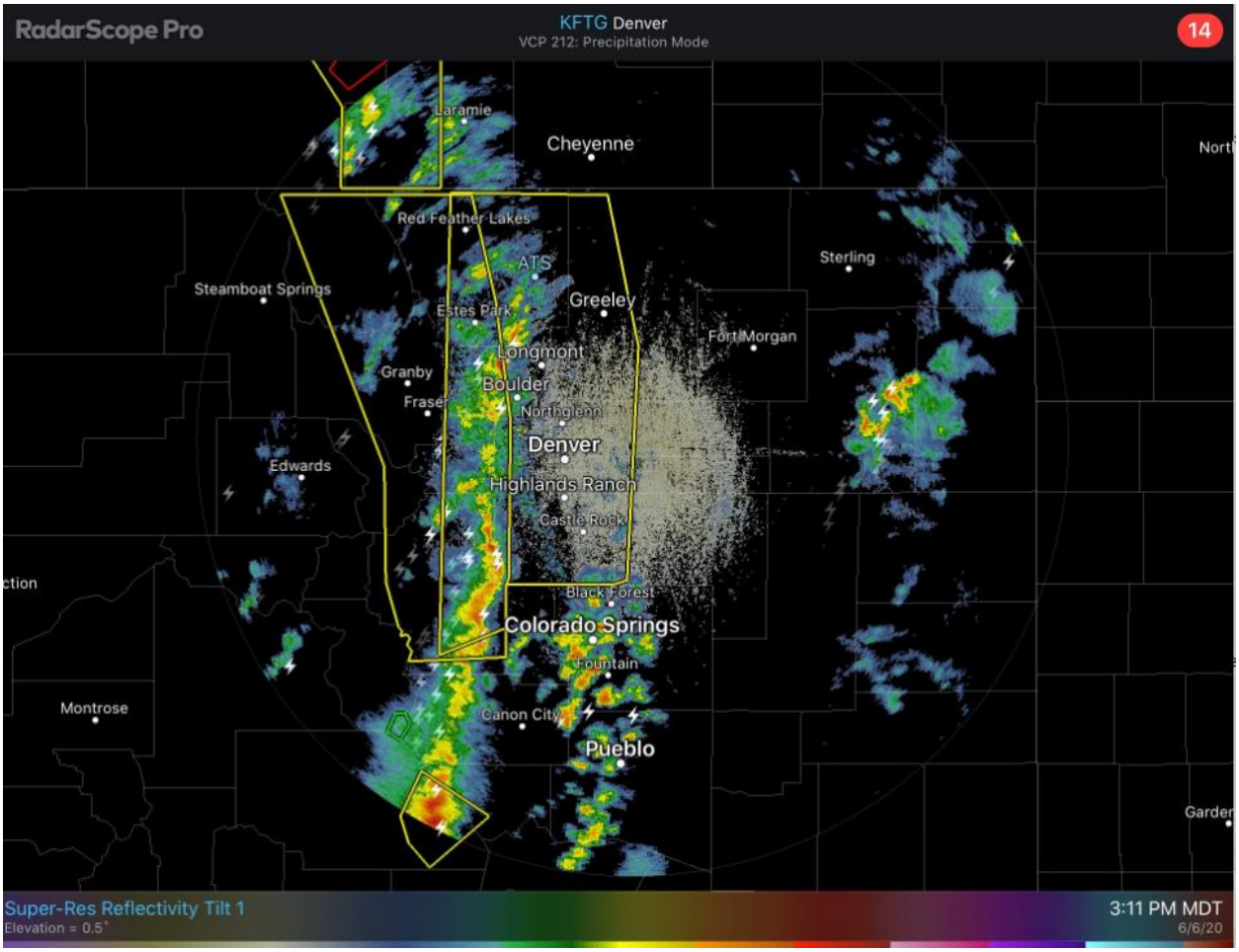

Figure 5: Radar screenshot 6/6/2020 at 3:11 PM MDT. Color contouring shows storm intensity. Yellow boxes indicate severe thunderstorm warnings. Red boxes indicate tornado warnings.

June 6th was not the only severe wind event. The cover photo of this newsletter depicts damage from a downburst in a severe thunderstorm on June 9th in Akron.

Drought/Aridification: Most of Colorado is back in drought… again. Our last major drought was just two years ago. We have seen hot, dry conditions across the southern and eastern portions of the state. Snowpack was decent this year, but the combination of a horrible 2019 monsoon season, and a hot, dry spring has been sufficient for leaving Colorado short on moisture once again. Mesa Verde National Park experienced its driest July-October in 2019 (98 years of record). That has been followed by Mesa Verde's fourth driest April-June in 2020.

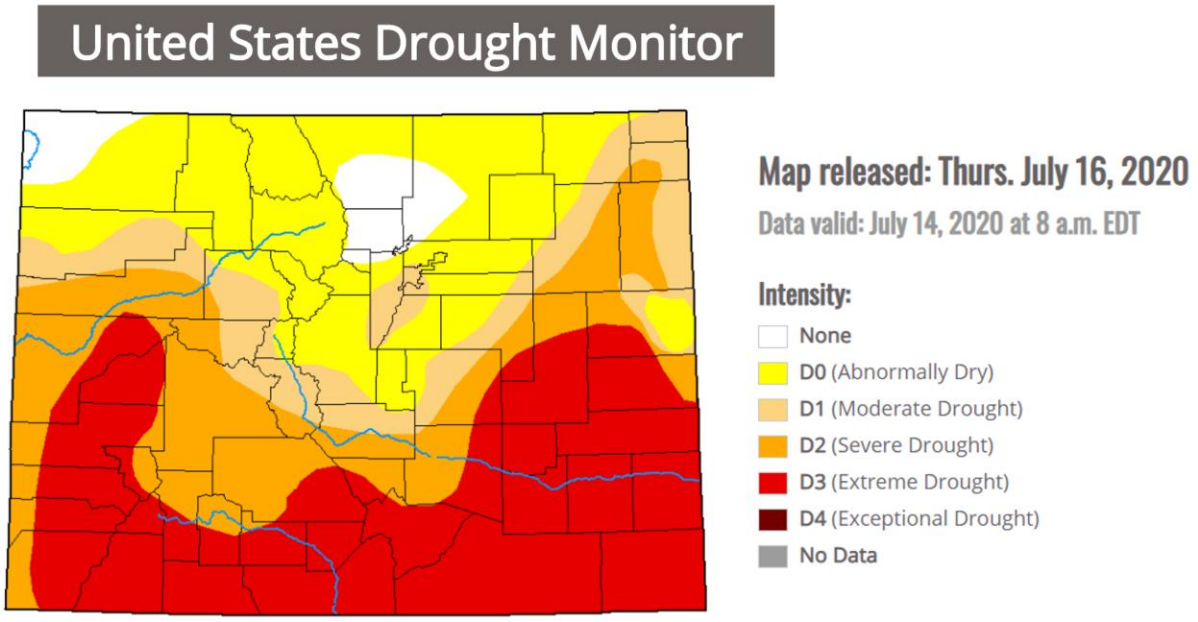

Figure 6: US Drought Monitor map produced July 16, 2020.

I get tired of talking about drought. It feels like we are never rid of it in Colorado. Moreover, it feels like the deck is stacked against us. Colorado is warming. Our warming trend is most convincing in summer and early fall. Warmer air in summer means trees, native grasses, and crops must use water more quickly to survive. Dry years hurt more under these conditions.

Our warming trend is not most convincing in summer because it is the time of year that has warmed most, but rather because natural variability is the lowest. Summertime low temperatures in particular don't wiggle as much from day-to-day and year-to-year as other types of weather. Figure seven shows the average amount of warming observed across the state of Colorado in orange. The blue line shows how big a difference there is between seasons with temperatures two standard deviations apart. It is a representation of how much temperatures vary naturally from year-to-year. What we see is that temperatures across Colorado are most variable in winter and early spring, and least variable in summer and early fall. Our warming trend, however, is consistent across seasons. It's easier for us to have a notably cool winters than summers.

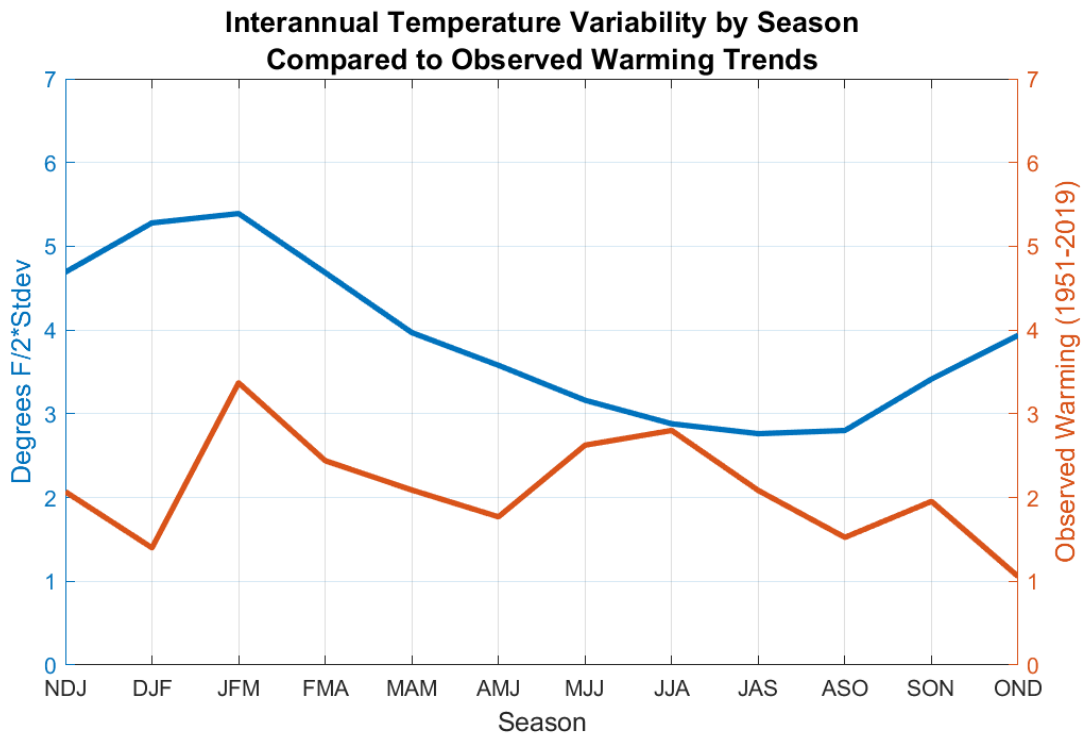

Figure 7: Colorado statewide temperature trend (orange), and variability (blue) as a function of season.

Condition Monitoring: Is drought bad in your area? Are you noticing local impacts that you feel warrant concern? Please give CoCoRaHS condition monitoring a try! https://www.cocorahs.org/Content.aspx?page=condition It's fast, it's easy, and you don't have to do it every day. The "Condition Monitoring" form is located on the left-hand side of the page in the "enter my new reports" section when you are logged in. These reports provide a quick and easy means of explaining how things are looking for your location relative to normal. You're also able to elaborate on the sectors being affected by dry or wet conditions. If you live in an agricultural area, you may want to elaborate on how winter wheat harvests went. If you live in the mountains, you may want to elaborate on how a nearby creek or stream is running compared to normal, or about the beetle kill impacting nearby trees. These reports area valuable supplement to measured data for describing the duration, severity, and nature of a drought.

Colorado Condition Monitoring Map: July 16, 2020

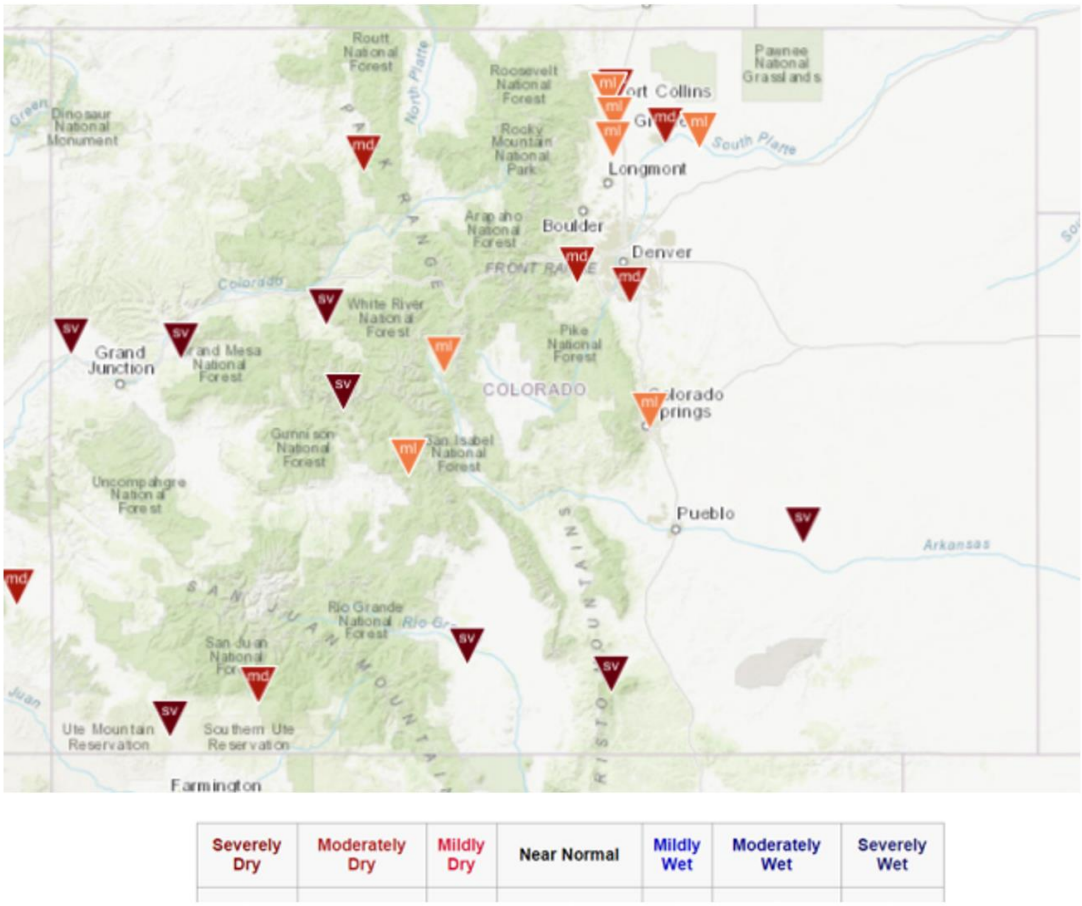

Figure 8: Colorado condition monitoring map and scale bar from July 16, 2020.

If you have any questions about submitting a condition monitoring report you're always welcome to get in touch with either me or your local coordinator. We would be more than happy to hear from you. I get lonely working from home; please talk to me.

That's all for now. Have a great rest of your summer!

Sincerely,

Peter