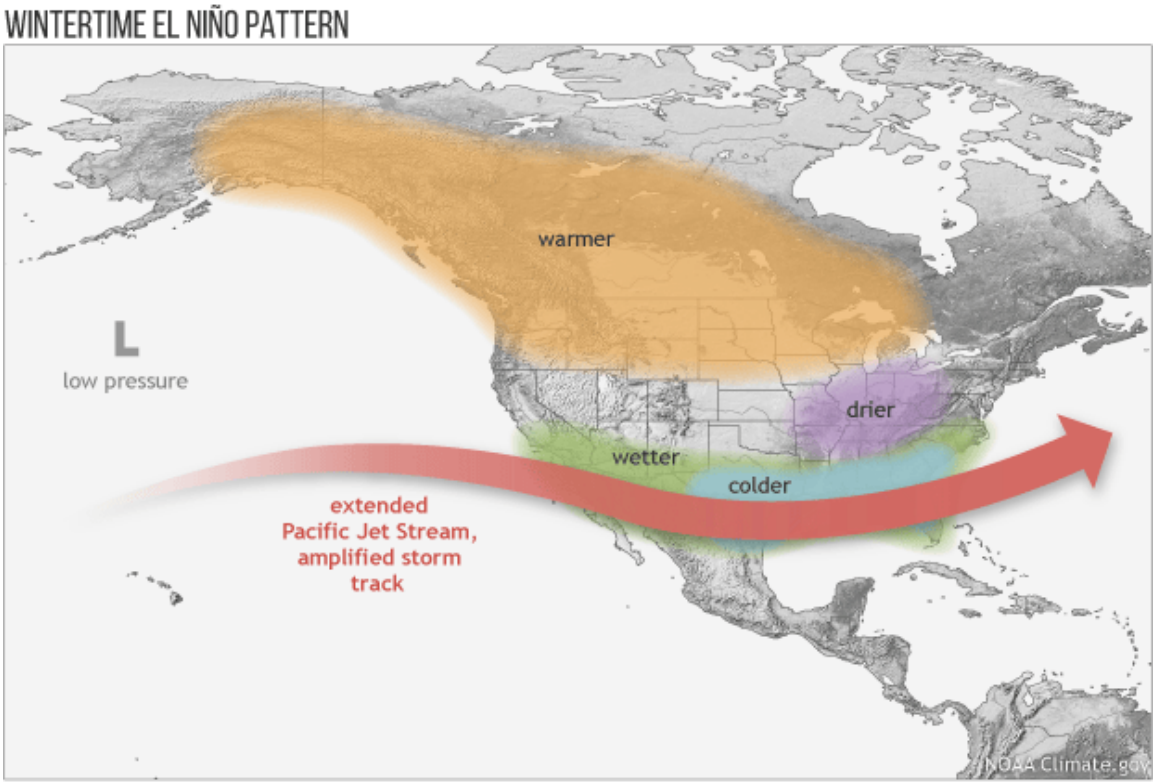
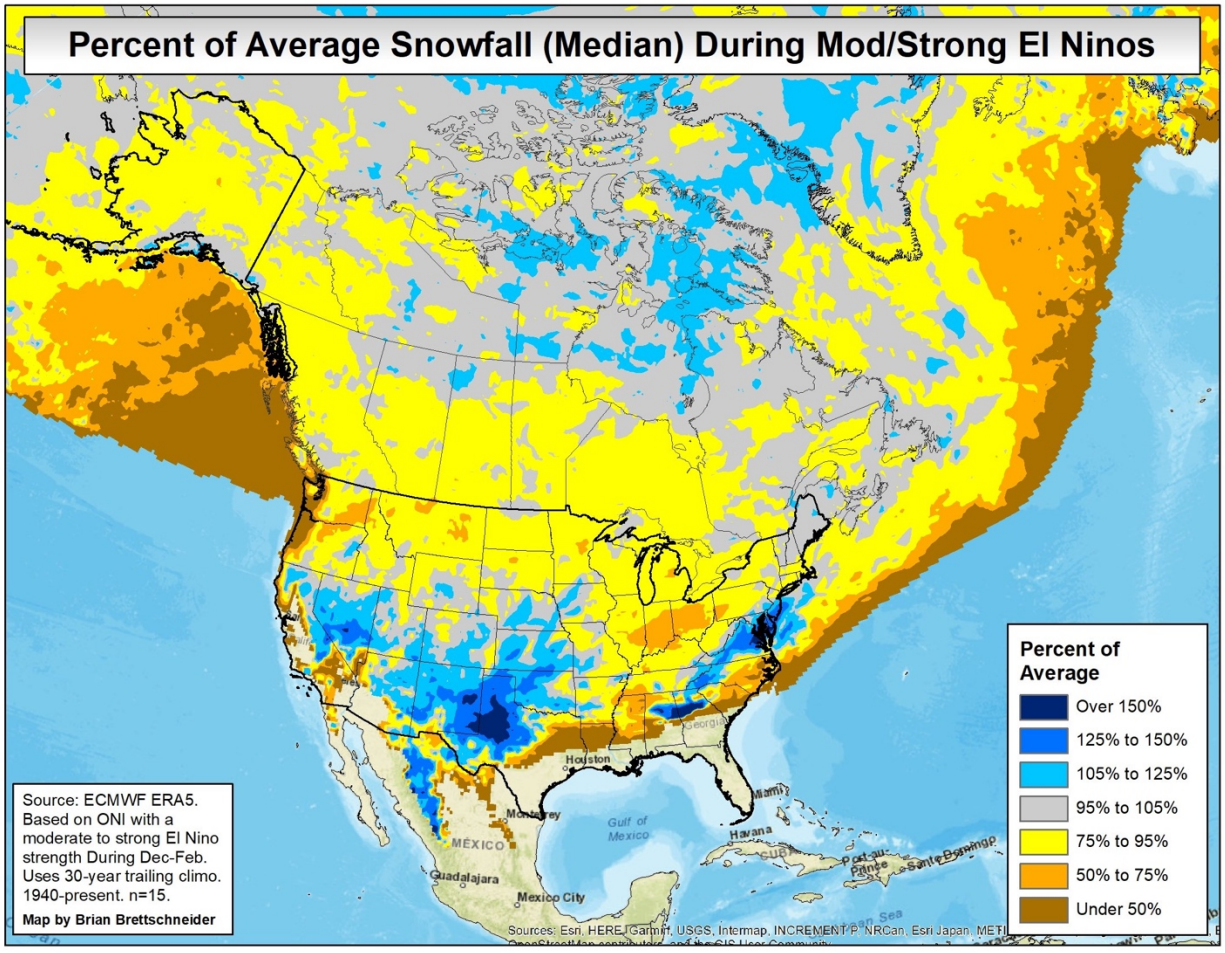
Snowfall Distribution By Month During El Nino Years



It's been shown through historical analogs that El Nino's tend to facilitate better winters in terms of snowfall for certain regions of the country. This is especially true for the regions in the Mid-Atlantic, parts of the Northeast, southern Plains, and across the Ohio River Valley toward the northern tier of the Southeast. The reason mainly has to do with the active subtropical jet stream that funnels in waves of moisture and energy across the southern portions of the U.S. At certain times during the winter season, there is enough cold air dislodged from the polar jet that times it just right to get snow events from the Plains to the East Coast.

Our current El Nino quantifies as a moderate to strong event, with the latest Oceanic Nino Index (ONI) registering at 1.5*C from the three-month period of August to October in Nino region 3.4. We're likely going to have this El Nino event "peak" over the coming two months. With this upcoming winter, many winter forecasts and outlooks have taken this into account. Of course, there can be unforeseen external forcings that come into play that aren't predictable in the short term, but we use this knowledge as a "base" to help predict what the seasonal temperatures and snowfall will be across the various regions. Below is a map created from expert climatologist Brian Brettschneider that displays the percentage of average snowfall across the U.S. during moderate to strong El Nino's. This reveals areas whose December-February snowfall average is influenced by the way the polar and subtropical jet streams interact during the course of the winter.

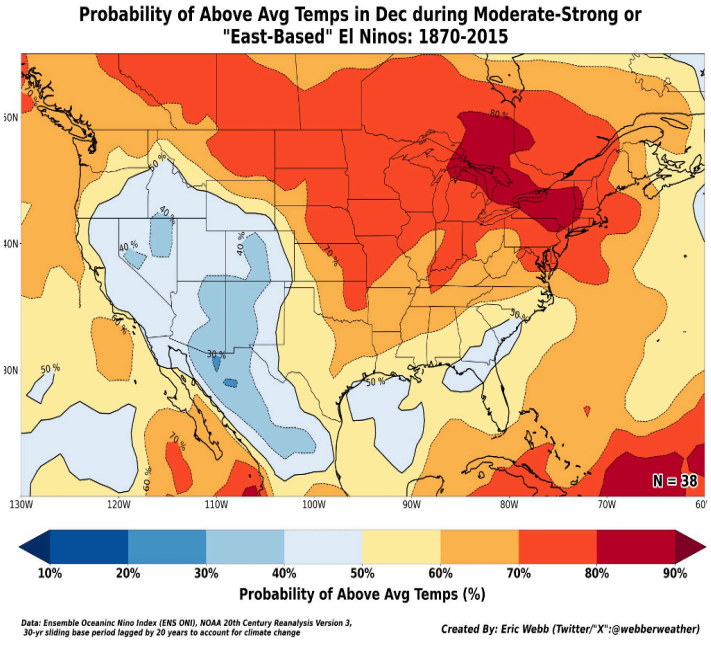


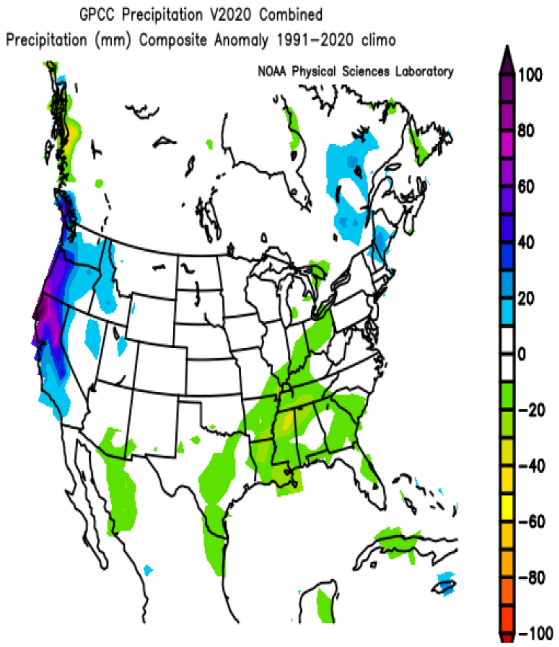
As aforementioned, the greater snow potential exists further south due to the active subtropical jet that spans mainly the southern third of the U.S. Of course, this isn't "black and white" due to the limited amount of case studies (i.e., years)

and whether these El Nino events were either east or central based; however, there is a stronger correlation for these regions in terms of more snowfall observed during El Nino's.

Now, below its broken down each month from December to March to see how precipitation and temperatures vary. Prior to proceeding, we collected superb temperature composites created by expert meteorologist Eric Webb that takes into account temperature probabilities during moderate-strong El Nino's (or east based), and using NCEP/NCAR reanalysis data from NOAA.

DECEMBER

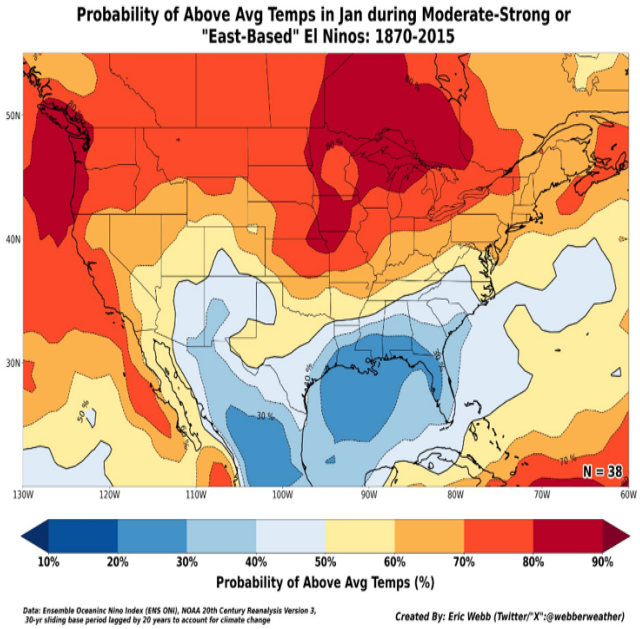


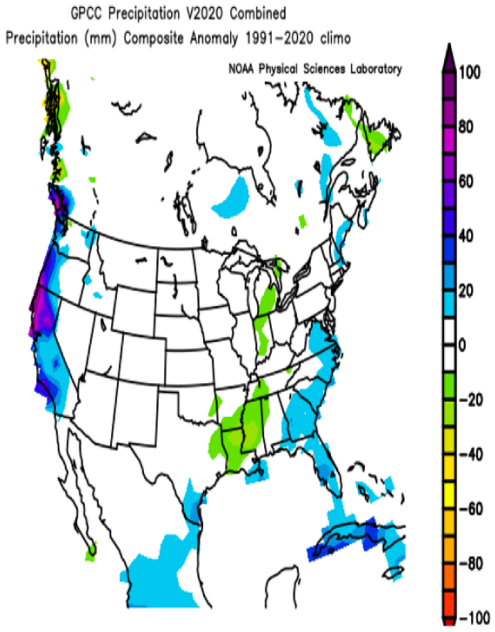


In December, the height pattern across the U.S. displays more ridging across the northern and eastern 2/3rds. This engenders average to above average temperatures from the northern Plains to the deep South, and to the entire East Coast. Unsurprisingly, the temperature probability composite reveals a higher likelihood for above average for those regions. A trough is typically observed across the West Coast to the Southwest. This is where you're going to see below average temperatures. The Pacific jet begins to "ramp" up, though oriented zonally which is why you see more warmth flooding the CONUS; however, this brings above average precipitation to the West Coast (blue). Elsewhere, it's

typically more “mundane” and not as active due to the persistent ridging east of the Rockies, which is why there’s less snowfall and precipitation (green) seen.

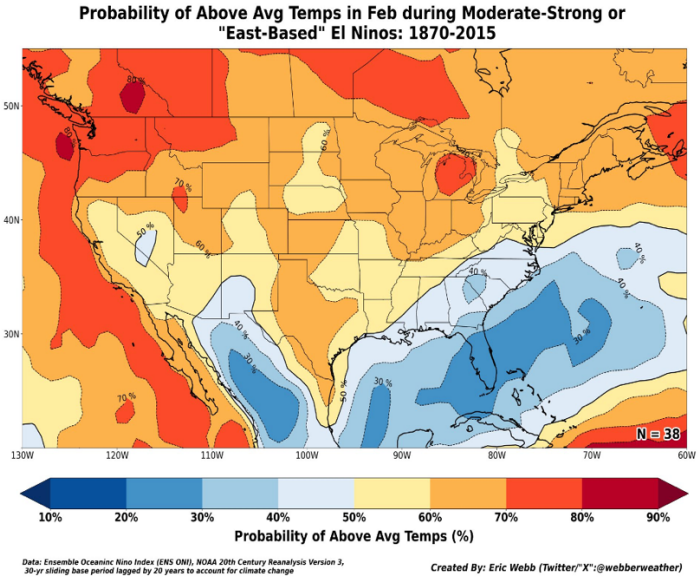
JANURARY

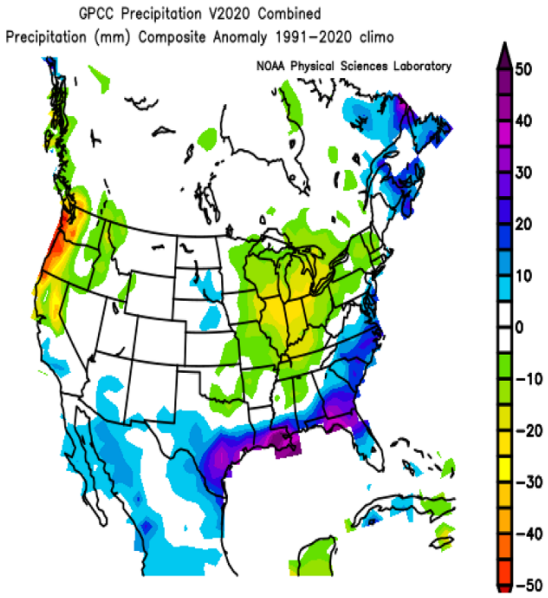




January usually can be thought of as the “interface” part between the relatively quiet winter weather and the more active snowy weather. It likely is referenced as “the wildcard” since this month tends to feature more favorable external forcings (i.e., polar vortex disruptions, MJO events, etc.,). Overall, we begin to see positive heights (ridging) build across the northern Plains, Northwest, and southern Canada. Any Alaskan low (which is a hallmark for widespread U.S. warmth) pulls back toward the Aleutian Islands. This results in more troughiness across the South, Southeast, and into the Mid-Atlantic. The subtropical jet remains active, however, and begins to shift northward. While there may still be prominent above average temperatures, we tend to see those below average departures expand eastward compared to December. Furthermore, note the above average precipitation begin to blossom northward from the Southeast up the East Coast. With the better opportunities for colder air masses via the polar jet to bleed southward, this is where we’ve seen some of the larger snowstorms like Miller A and B’s.

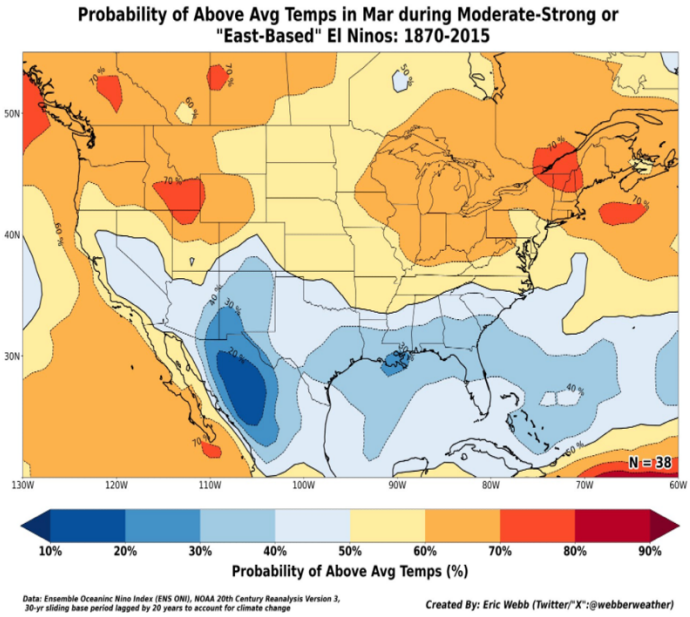
FEBURARY

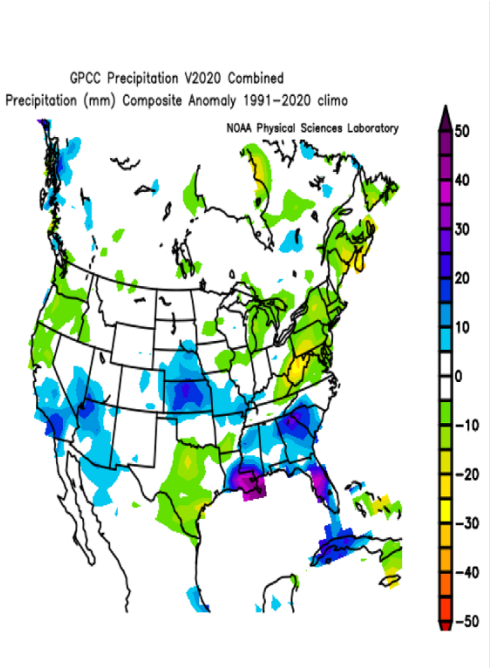




February is undoubtedly notorious for producing the most snowfall and biggest snow events during El Nino's. It's also why you'll see at times the word "backloaded" associated with El Nino events, since most winter weather happens in the back end of the winter season. By February, we see a much better orientation of a tenacious trough east of the Rockies. This coincides with a higher probability of below average temperatures mainly eastward of the Mississippi River Valley. Elsewhere, upper-level ridging is seen mainly across the central and western portions of Canada and down into the Northwest. In conjunction, we tend to see more favorable teleconnections conducive for winter weather such as a -NAO, -AO, and +PNA combo. This results in average to above average precipitation (and snowfall) from the deep South to the Southeast and up toward the Northeast. Elsewhere, we see lesser in the way of precipitation due to the polar jet (cold air = dry) dislodged well south relative to the previous months.

MARCH

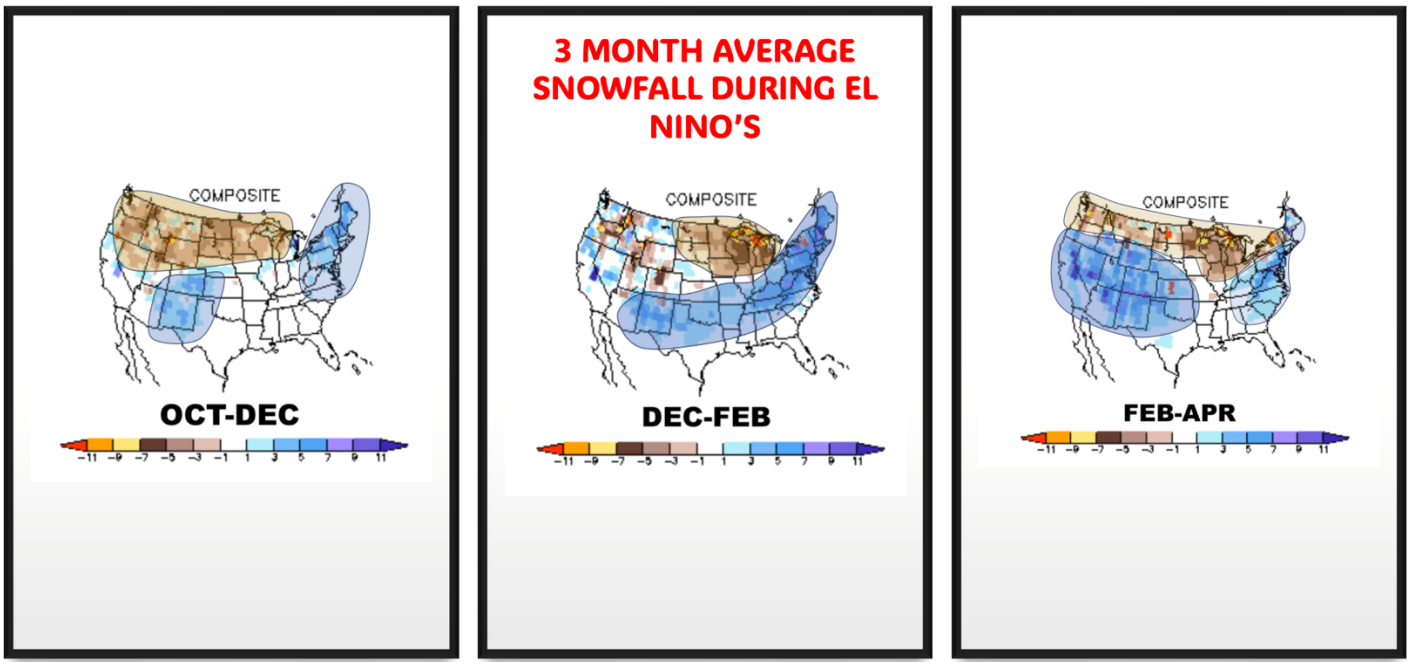




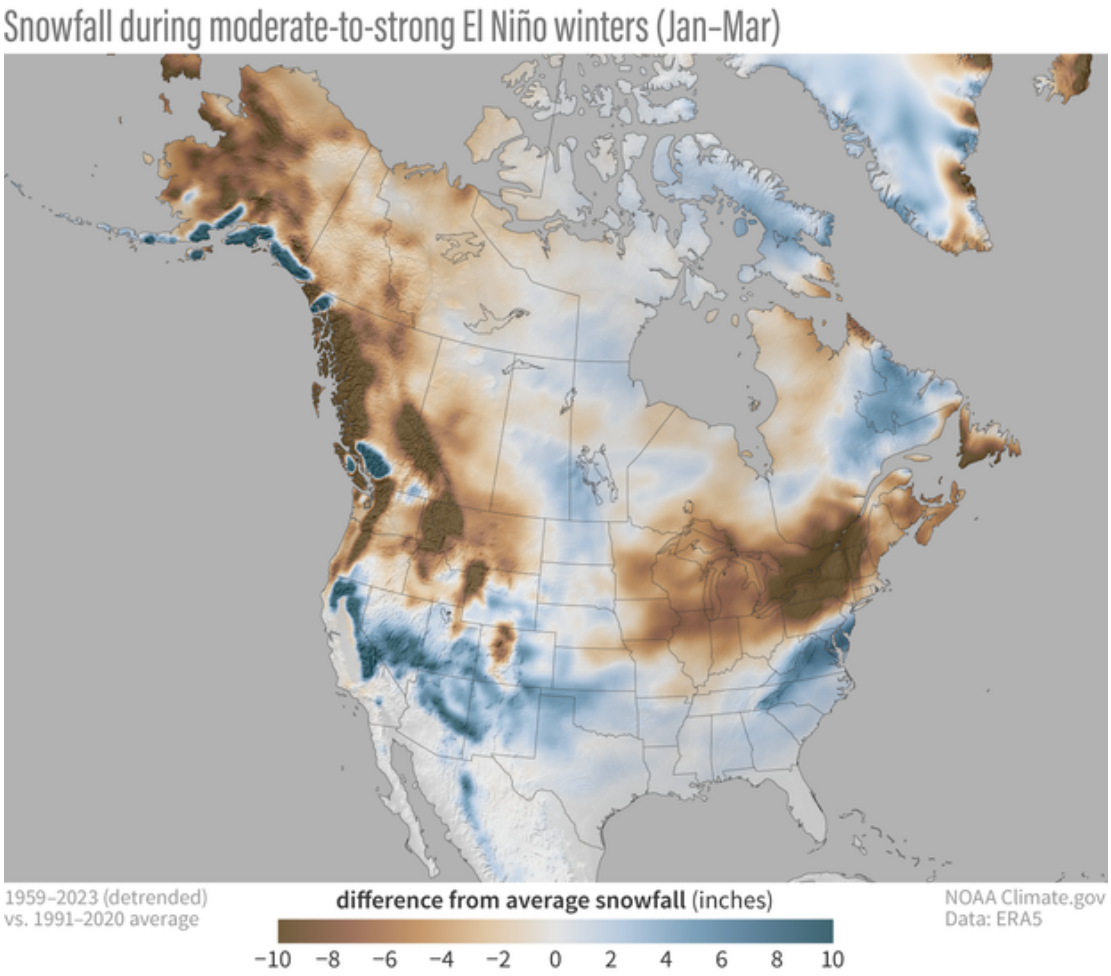
The month of march can usually also be a “wildcard” since high latitude blocking (i.e. -NAO/-AO) can persist into the early Spring. Upper ridging remains somewhat stubborn across Canada and across Alaska, which still renders polar air masses to filter in. Below average heights prevail from the Southwest, across the deep South, and into the Southeast. Accordingly, this is where below average temperatures with average to above average precipitation is observed. Elsewhere, it’s more average to slightly below. March is tricky and can either be very active in terms of snowfall or rather uneventful depending upon the progression throughout the winter season from other variables. However, some large snow events have transpired in March during El Nino years.

As you trek further into the winter months during El Nino’s, let’s look below at a three-month running average that begins in October and extends through April. Below from the Climate Prediction Center (CPC), they’ve collected a

sample size of all El Nino events since 1950 regarding specifically snowfall. From the discussion above, it's not surprising to see snowfall gradually increase toward the backend of the winter season. The brown color represents more below average while the blue is above average. Notice the northern tier of the U.S. leans on the lower side in terms of snowfall while more snow is observed as you decrease in latitude. We really see it ramp up from the Plains to the Northeast by the "heart" of winter and again in the latter half.



Lastly, since we're witnessing a moderate to strong El Nino this for the 2023-24 season, it's acc analyze below what areas stand out the most in terms of net positive and negative snowfall departures. Data collected from climate.gov, a visually appealing graphic reveals what regions either benefit from more snowfall or see less. The brown color shows those areas that tend to not do so well with snowfall, while the blue shows those who end up finishing better with tallied up inches.



It should be emphasized and stressed that no two El Nino's are alike. While they certainly can be similar, each event comes with various complex global factors that either work in tandem, or can oppose each other that ultimately dictate sensible weather patterns across the middle latitudes. The data above appears to all align accordingly, so we have a pretty good idea of what regions across the country will do better than others in terms of snowfall. With another moderate to strong El Nino on deck, it does appear we're headed in the direction that the composites above show. However, the atmosphere is completely chaotic and challenging, but the anticipation is great to see where this year ends up in analog data set.