Earth System Research Laboratory
Physical Sciences Division

CIRES
Cooperative Institute for Research in Environmental Sciences

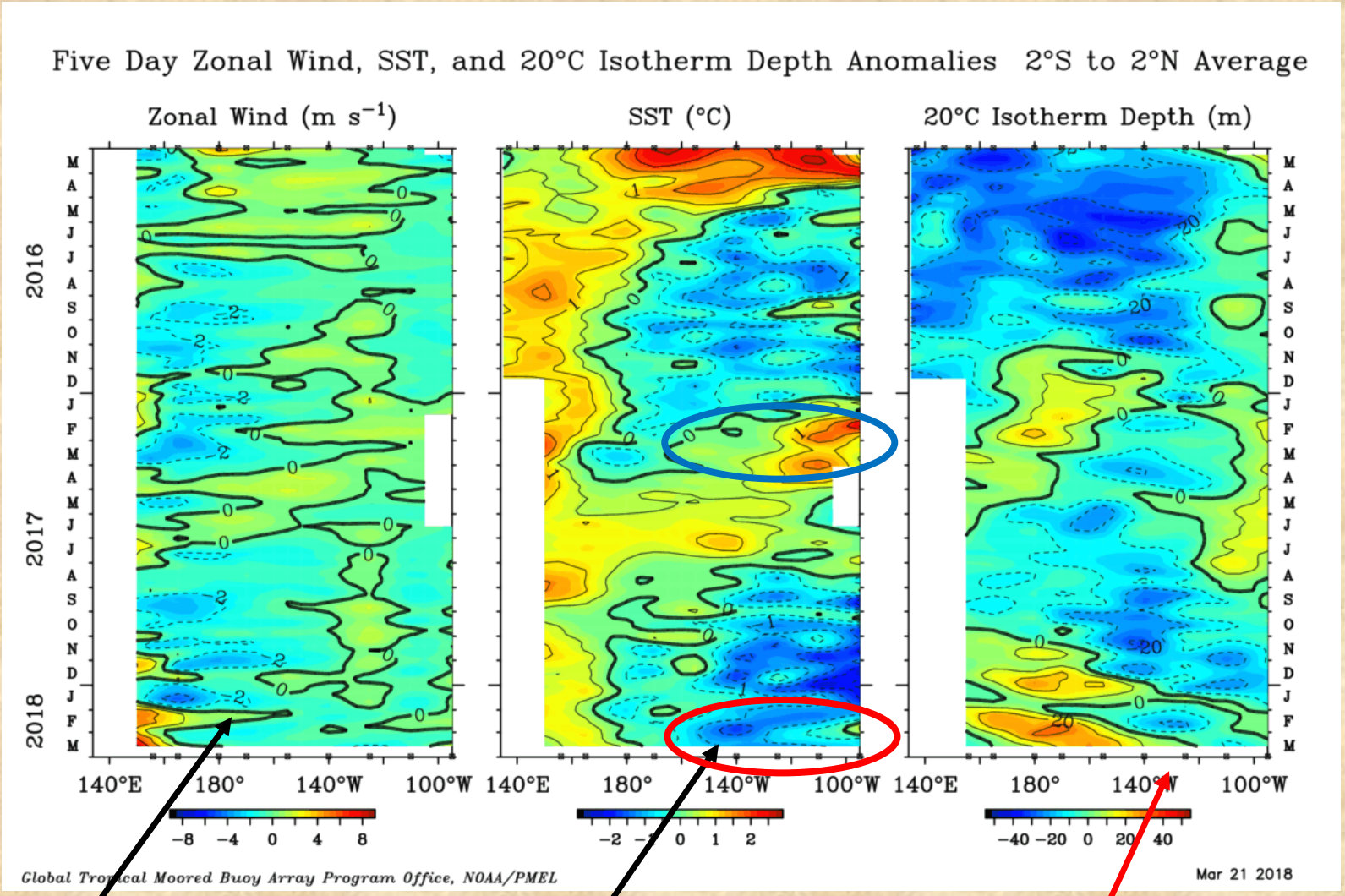
Colorado WATF,
23mar18, Denver

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Seasonal Outlook for Colorado

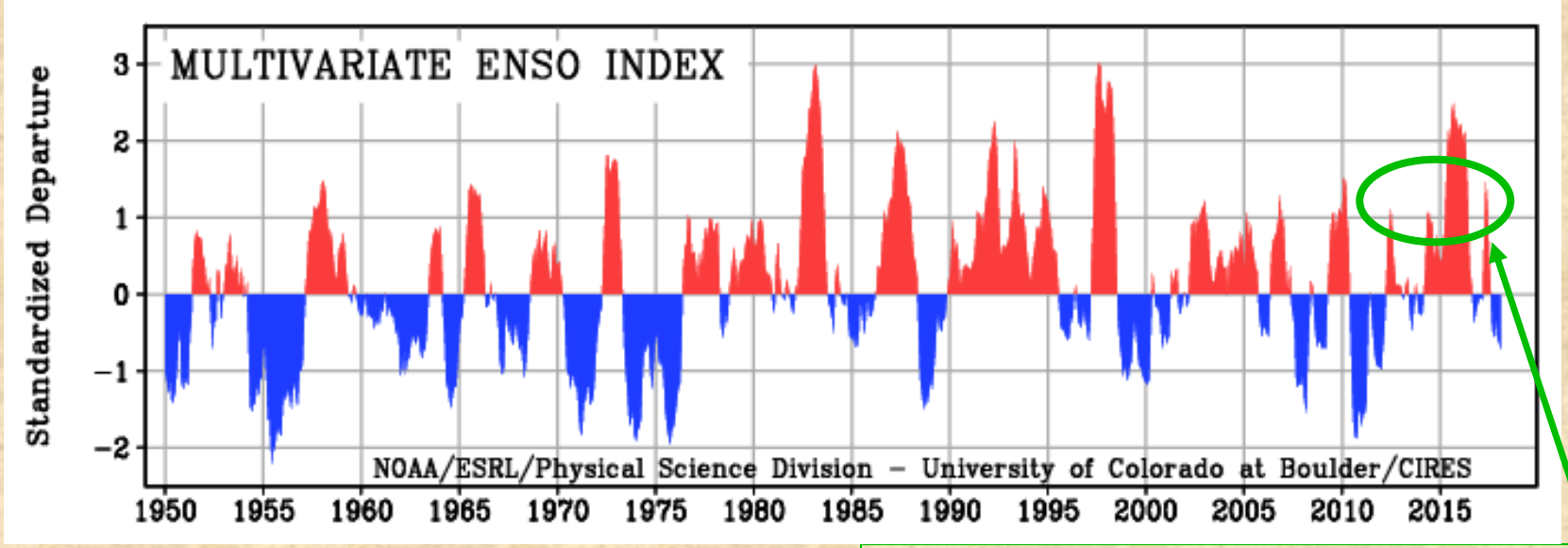
Klaus Wolter
University of Colorado, CIRES & NOAA-ESRL Phyiscal Science Division
klaus.wolter@noaa.gov

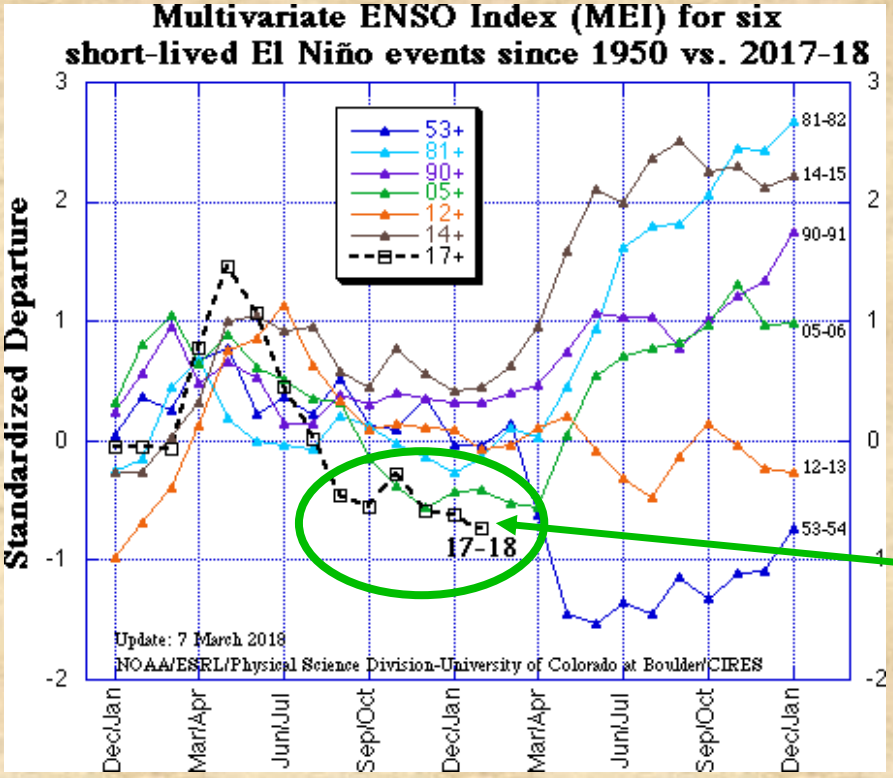
- *La Niña of 2017-18: 'The Fat Lady has not sung yet'!*
- *CPC/CFSv2 Forecasts thru September 2018*
- *Experimental Forecast Discussion*
- *Year-2 La Niña 'Analogue' versus latest MEI analogues*
- *Weather Forecasts into early April*
- *Executive Summary*



Wind anomalies (left) near the dateline have gone easterly (blue) again after a brief westerly surge in February, cold SST anomalies (middle) continue in stark contrast to last year, while negative upper ocean heat content anomalies (right) are almost gone. In other words, this La Niña is 'running on empty'.

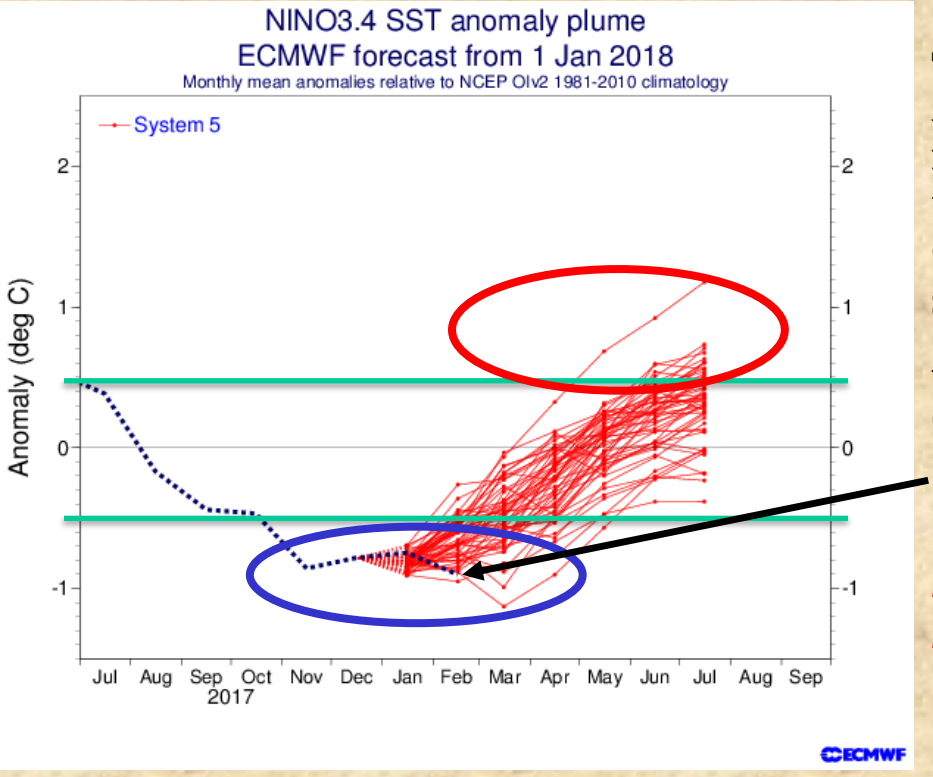
http://www.pmel.noaa.gov/tao/jsdisplay/index.html





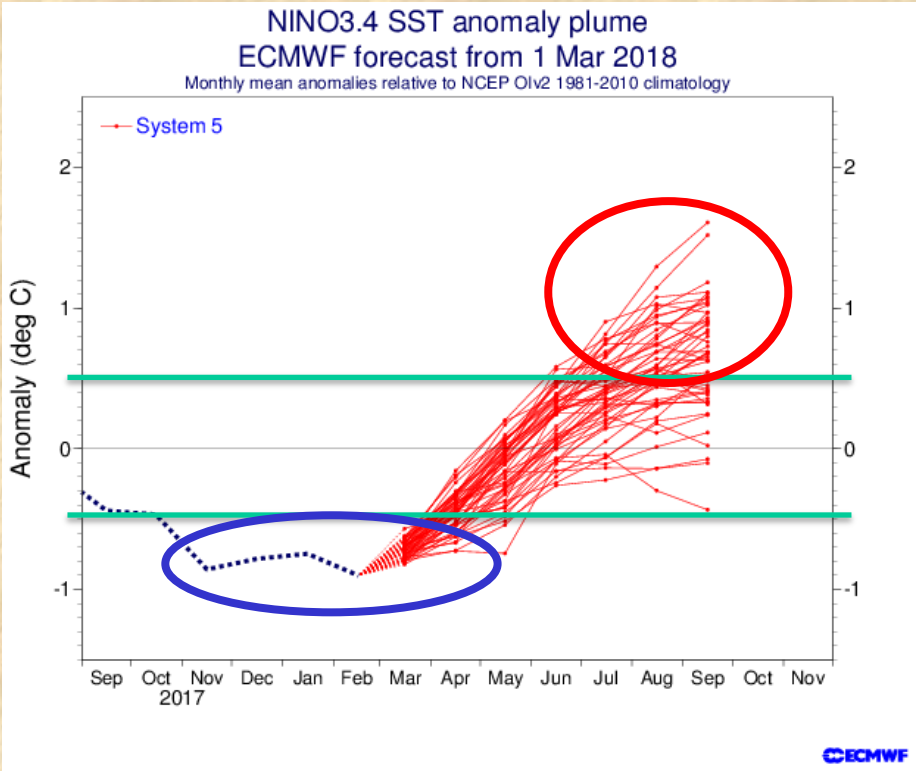
The MEI monitors ENSO based on six observed variables over the tropical Pacific (SLP, surface wind components, air- and sea surface temperatures, cloudiness). In 2017, we witnessed a 3rd aborted El Niño in six years (others in 2012 and 2014). We saw a very unusual transition to La Niña by early fall that actually deepened to near-moderate conditions in Jan-Feb 2018.

http://www.esrl.noaa.gov/psd/enso/mei



The ECMWF January 2018 forecast (left) promised a fairly rapid end to the current La Niña, with the majority of members climbing above 0C by June. While most forecast models shared this outlook, a few of them (like the American CFSv2) continued La Niña conditions through 2018. ***The last 2 months (blue stippled line) have verified on the cold side.***

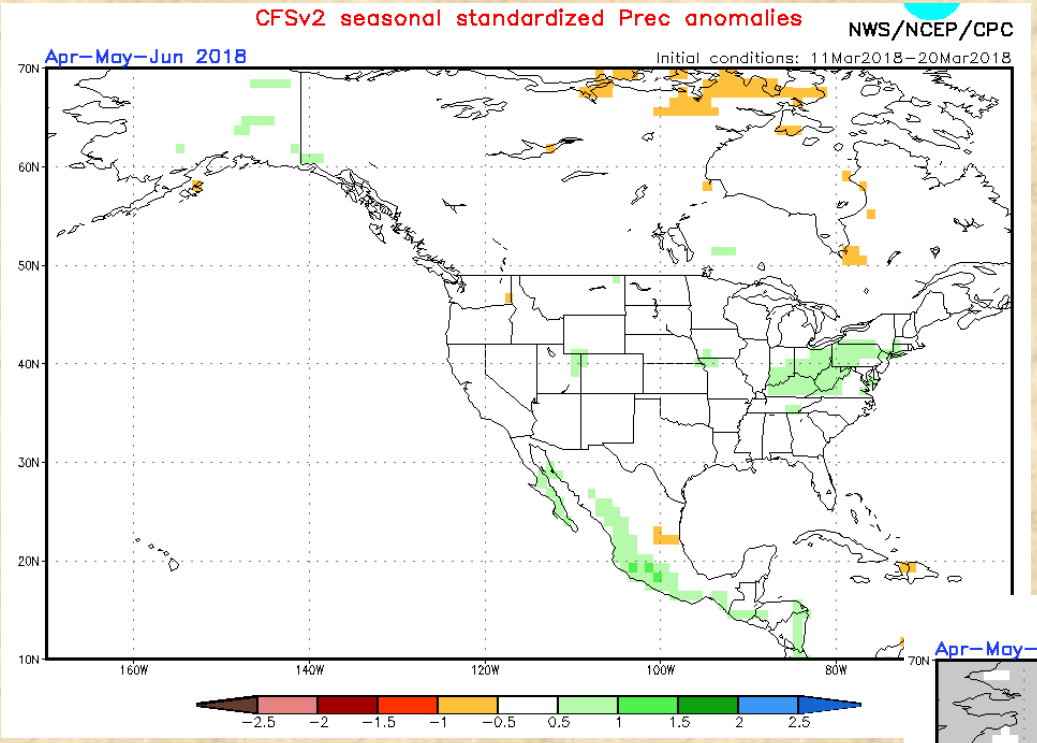
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/



The March 2018 ECMWF forecast (right) continues to show a rapid transition to ENSO-neutral conditions by May-June, with a hint of El Niño conditions by August-September, virtually excluding continued La Niña conditions by June. ***The US CFSv2 model remains the only holdout for that scenario (not shown in this talk, but can be accessed here):***

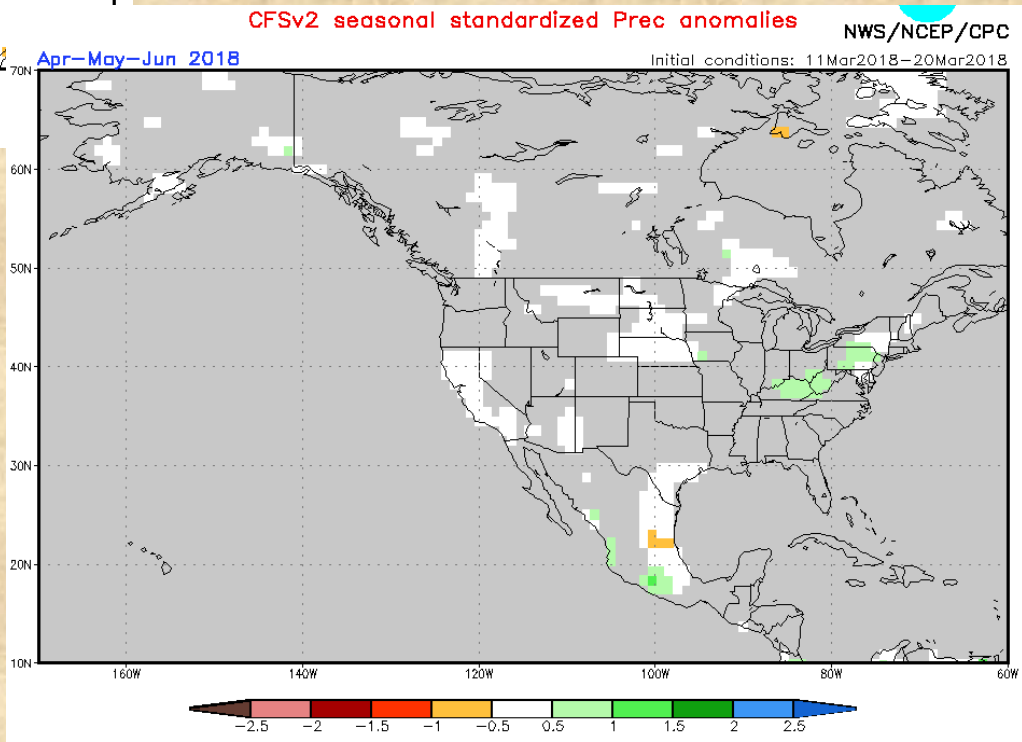
https://iri.columbia.edu/wp-content/uploads/2018/03/ figure4-2.png

CFSv2 forecasts for April-June 2018

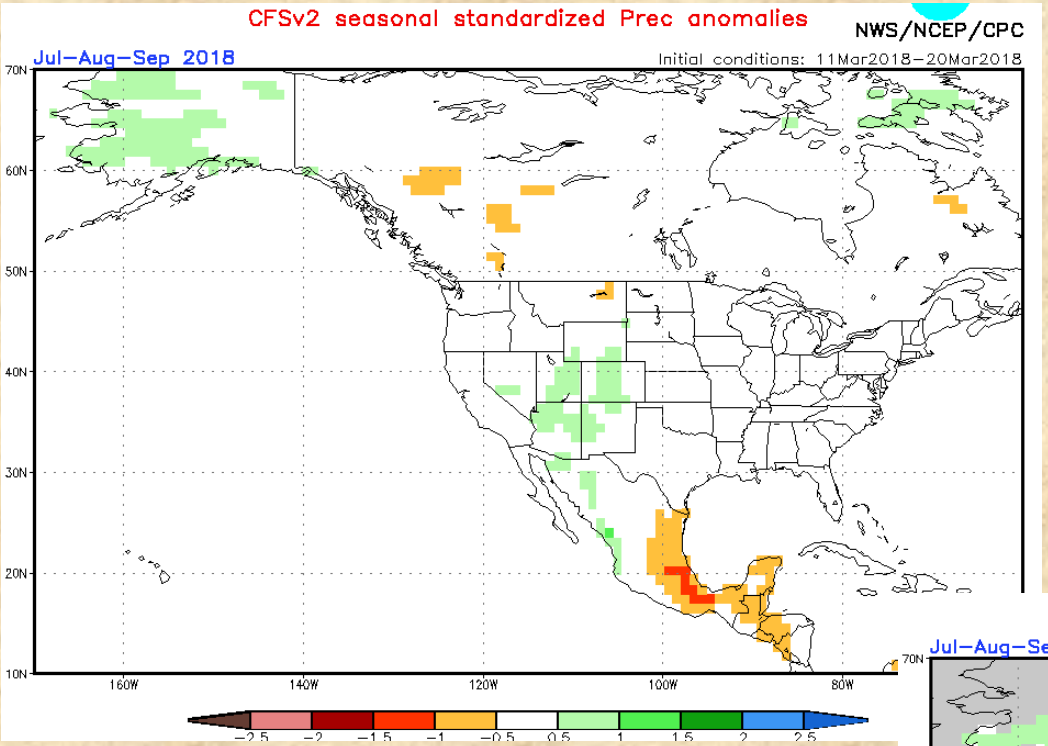


http://www.cpc.ncep.noaa.gov/products/predictions/90day/tools/briefing/

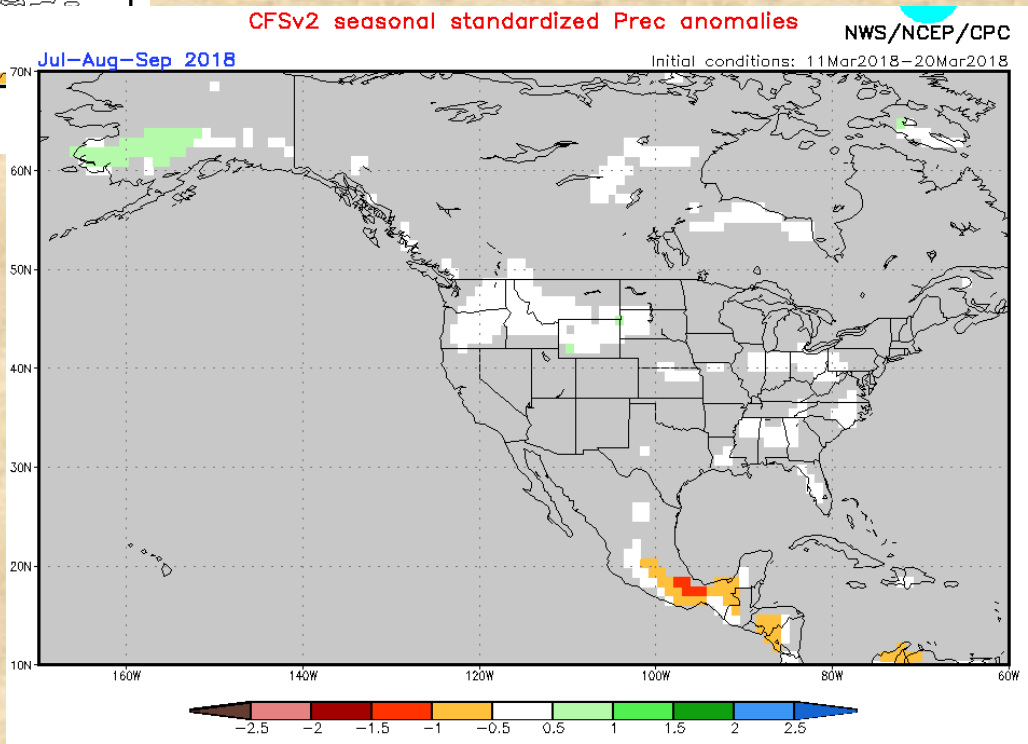
AMJ 2018 (top) shows no tilts to speak of over CO. Not that any of that would have survived the skill mask application (right). On the other hand, there is no sign of drought either – surprisingly, since this model keeps La Niña going.



CFSv2 forecasts for July-September 2018

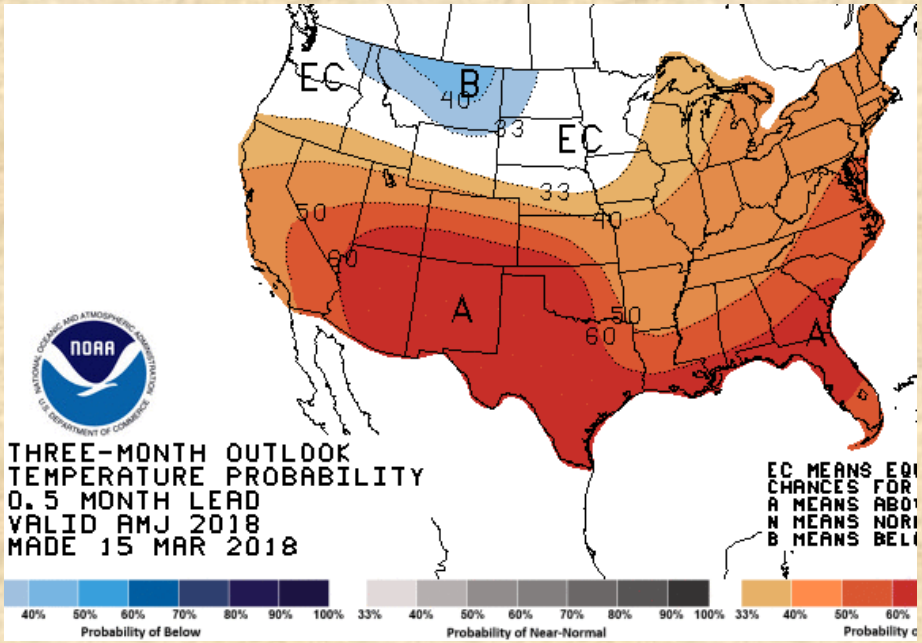


http://www.cpc.ncep.noaa.gov/products/predictions/90day/tools/briefing/



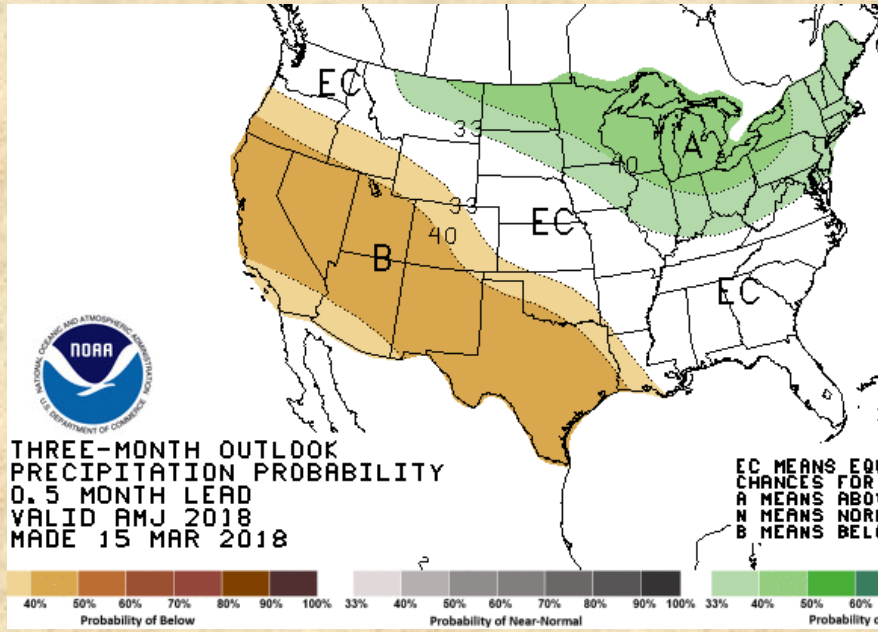
JAS 2018 (top) or the upcoming summer monsoon is fairly wet in CFSv2. None of that would have survived the skill mask application (right). My impression is that this model "likes" to be wet around here during the summer (in observational record, the only state with a wet La Niña monsoon signal is AZ).

Climate Prediction Center Forecasts (AMJ'18)

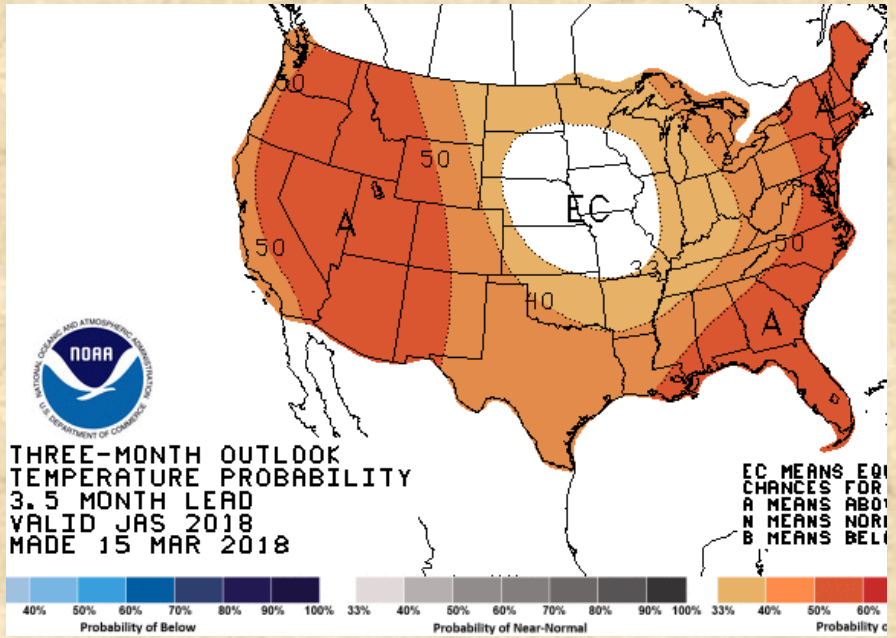


http://www.cpc.ncep.noaa.gov/products/predictions/

The latest CPC late spring temperature forecast (top left) shows continued warmth for us *(with lingering cold to the north)*, while the precipitation forecast (right) is dry. While La Niña itself is expected to be on its way out by then, lingering effects would be typical for this time of year.

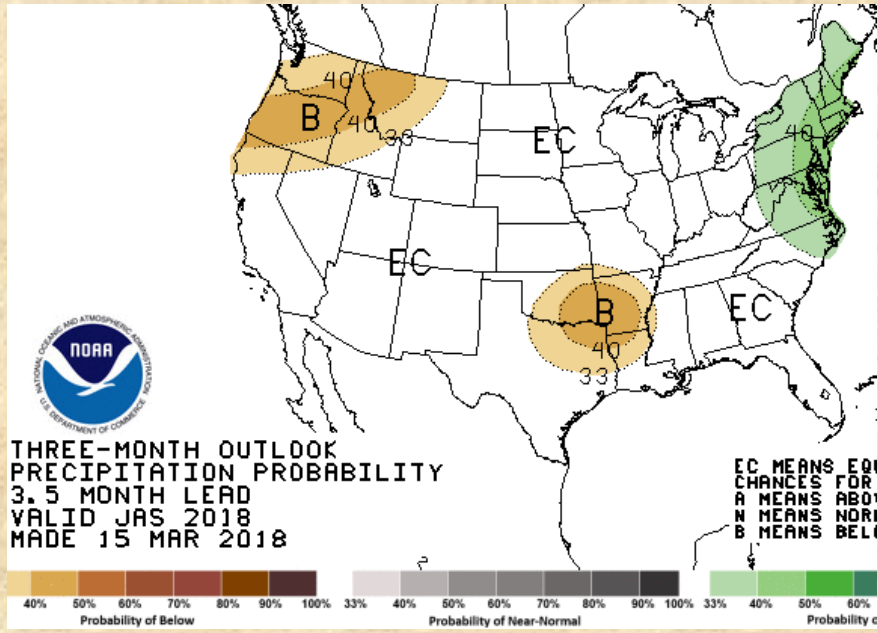


Climate Prediction Center Forecasts (JAS'18)

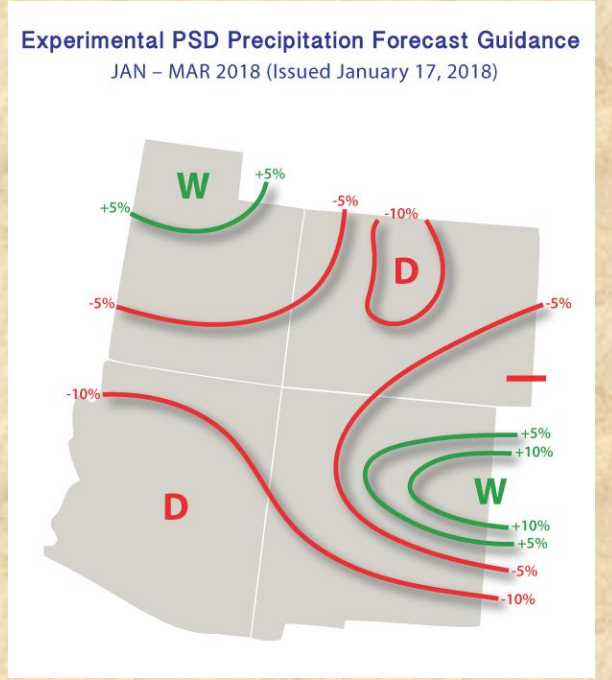


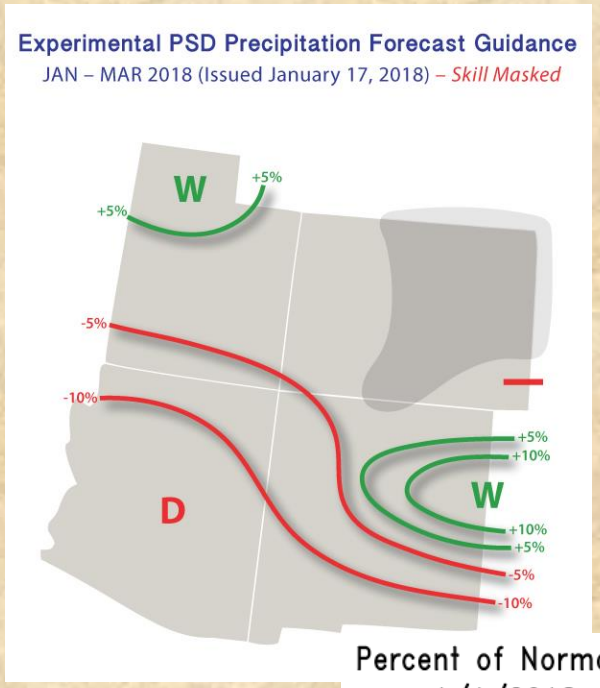
http://www.cpc.ncep.noaa.gov/products/predictions/

The CPC late summer temperature forecast (top left) shows yet another warm summer forecast for us, while the precipitation forecast (right) is 'EC', despite the wet monsoon in the CFSv2 *(I may have played a role in cautioning against its use this far out)*. Neutral ENSO conditions are expected, thus not tilting the odds one way or the other.

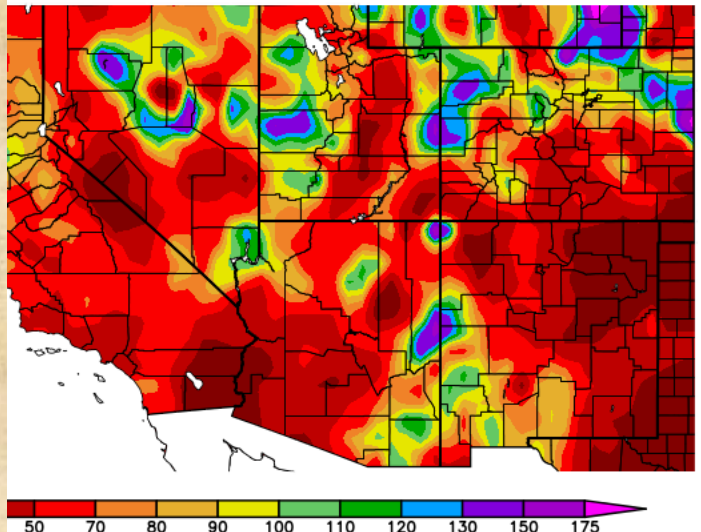


Postmortem January-March 2018 (prelim.)



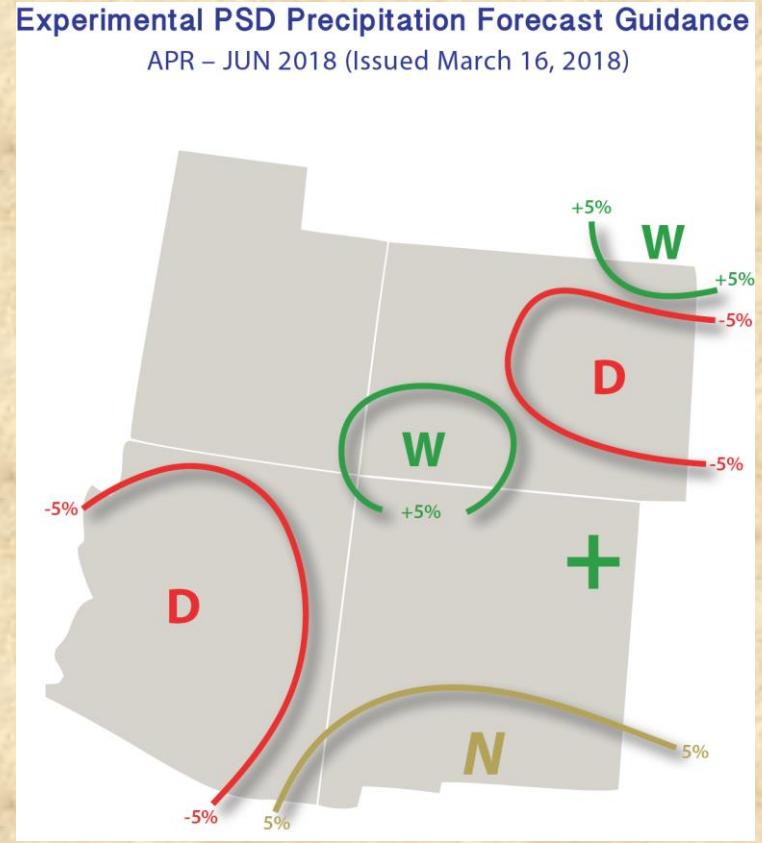


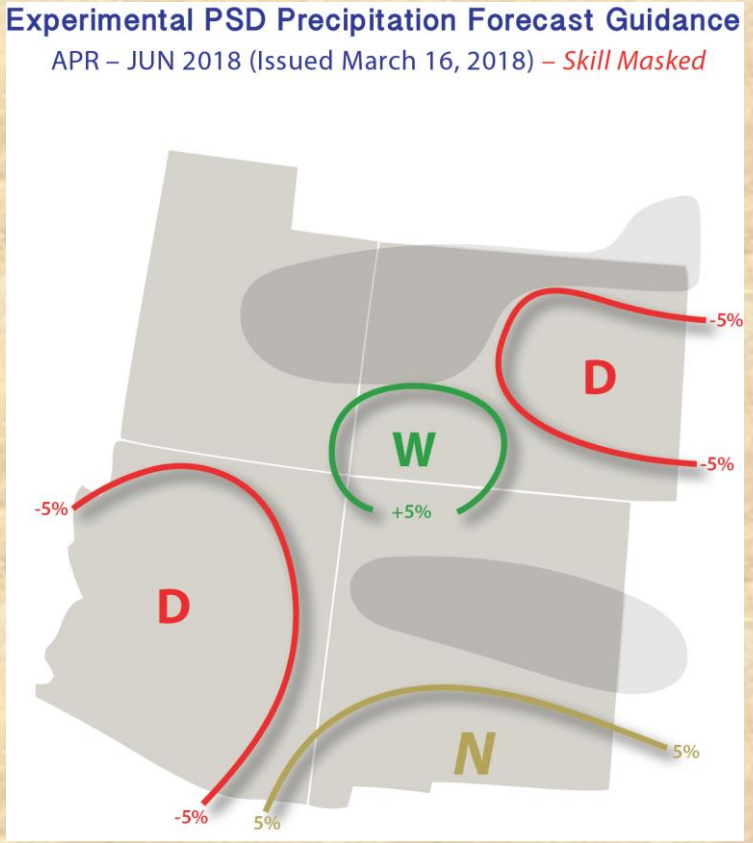
Percent of Normal Precipitation (%)
1/1/2018 – 3/20/2018



Two months ago, my experimental forecast (above left) was dry across Colorado, with the skill mask removing much of that from the map (top right). Unless it gets extremely wet in next eight days, the dry outlook was justified (right) for our state, with only the northwest and northeast corners coming in somewhat wetter than expected…

April-June 2018





Not as bad as I had originally expected, surprisingly wet near San Juans, but dry on the eastern plains (both of which survive the skill mask filter). If we were to see a wet spring in SW Colorado, that would be welcome news, but it would come at a time of year when this region gets little moisture on average, so the drought would probably continue. *Nevertheless, this is a good sign.*

Two choices for La Niña analogues

(1) Ten 2nd year La Niña events over last century (from 1906-2008); these were originally picked in 2011 in preparation for the 2011-12 2nd year La Niña:

1909-10, '17-18, '22-23, '50-51, '55-56, '62-63, '71-72, '74-75, 1999-2000, '08-09

I could have added for instance: 1984-85, '96-97, and 2011-12, but decided to keep the original choices. The maps would not have looked much different. ***They all show a northward expansion of dry conditions compared to a Year-1 La Niña.***

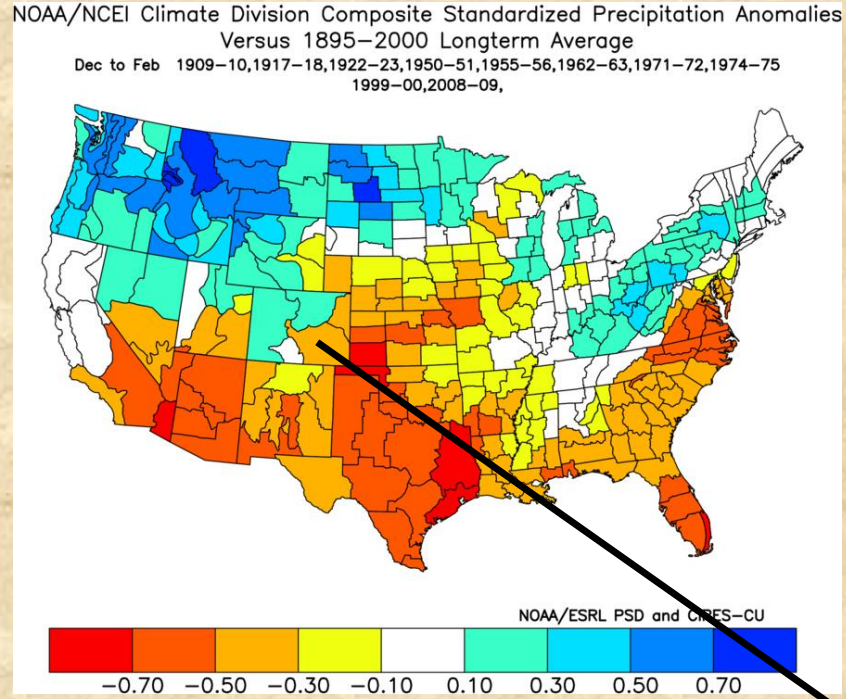
(2) My 2nd set of La Niña cases were based on the most recent ranking of the MEI (15th lowest in 69 years, close to the 20%ile) and a recent deepening, or at least not weakening of La Niña conditions in that index. Looking at the 12 nearest-ranked neighbors and excluding two that were rising over last few months, I get the following 10 analogues (since 1949-50):

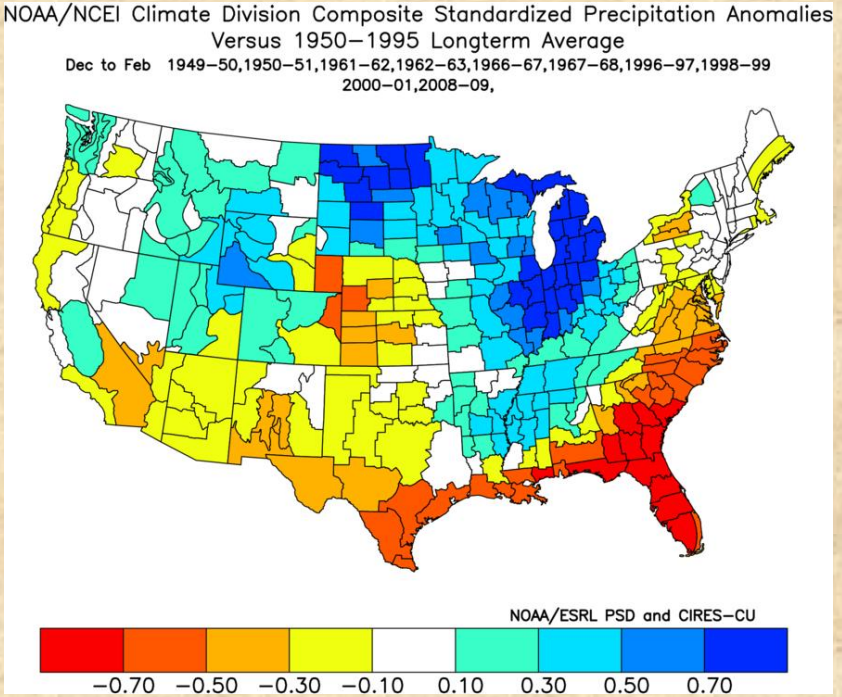
1949-50, '50-51, '61-62, '62-63, '66-67, '67-68, '96-97, '98-99, 2000-01, '08-09

There is only a small overlap ('50-51, '62-63, and '08-09), but this 2nd round of cases is not concerned about picking 1st or 2nd year Niñas (in fact, one could argue that 2000-01 is a 3rd year La Niña).

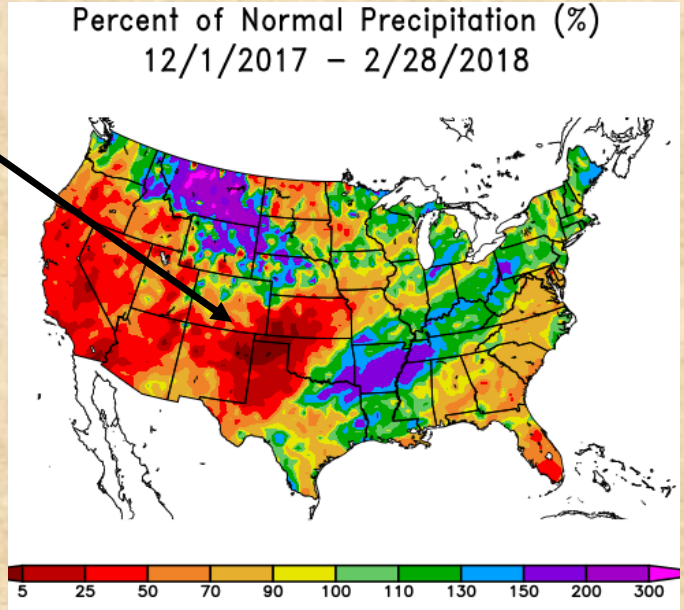
www.esrl.noaa.gov/psd/enso/mei

2nd year La Niña vs most current analogues vs DJF 2017-18

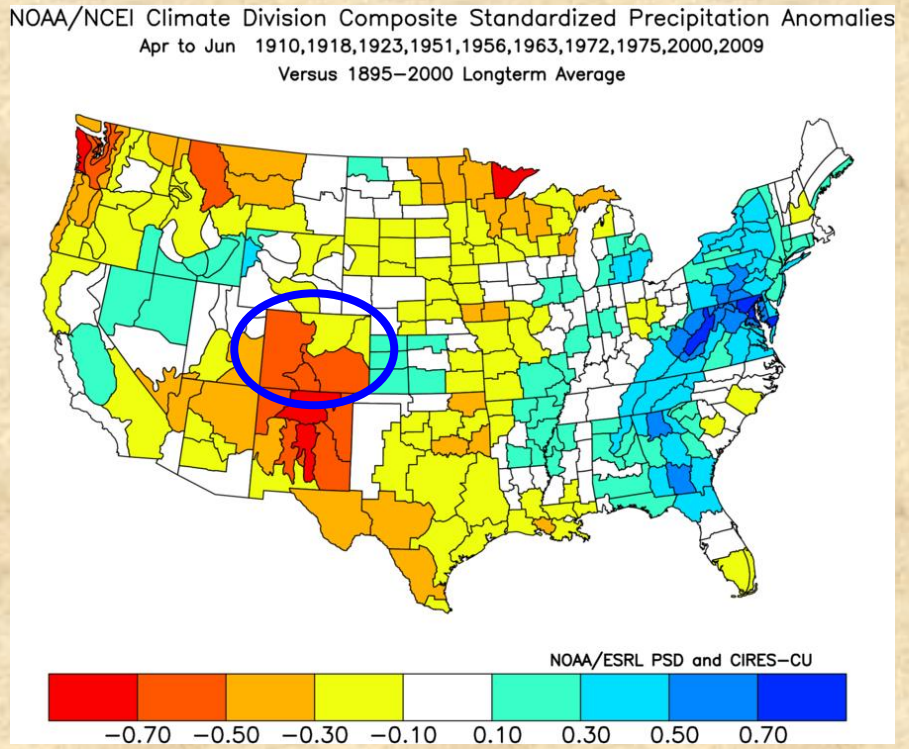


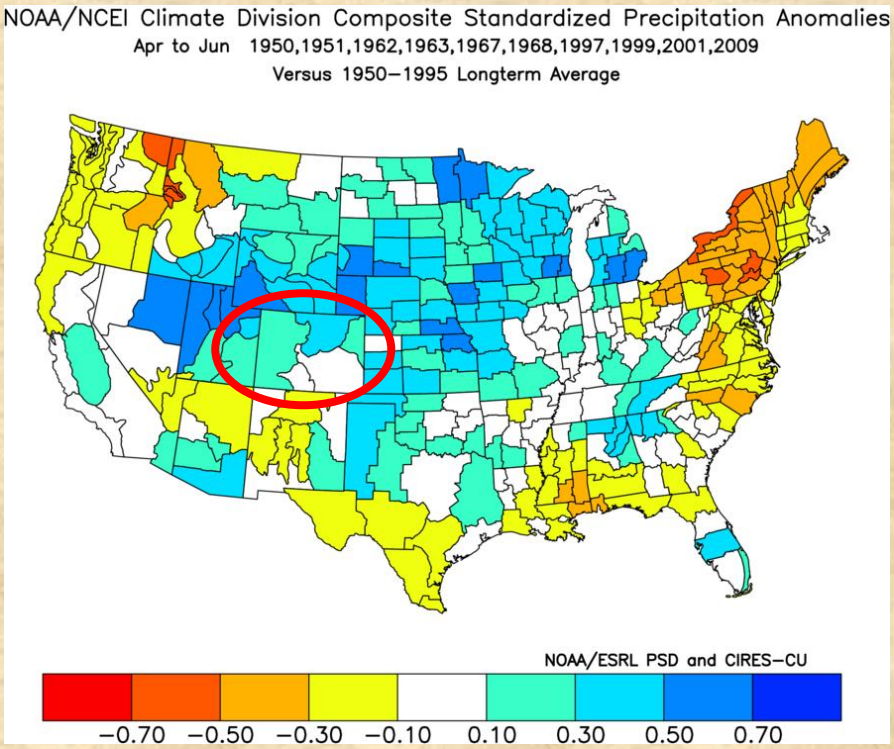


A comparison between the 2nd year La Niña (top left) versus new analogue La Niña (top right) versus observed precipitation for the last season (DJF) fits better for the 2nd year La Niña analogue (right). There are some key regions outside CO (PNW, AK+) where the new composite would have provided for better guidance, but around here the original composite worked better.



2nd year La Niña vs most current analogues for April-June

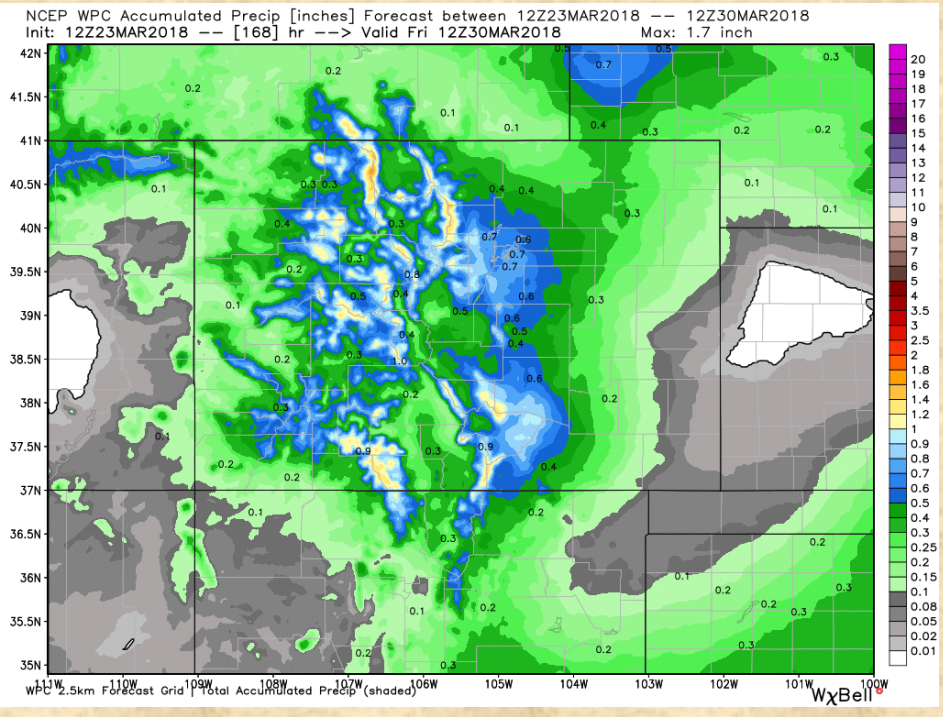


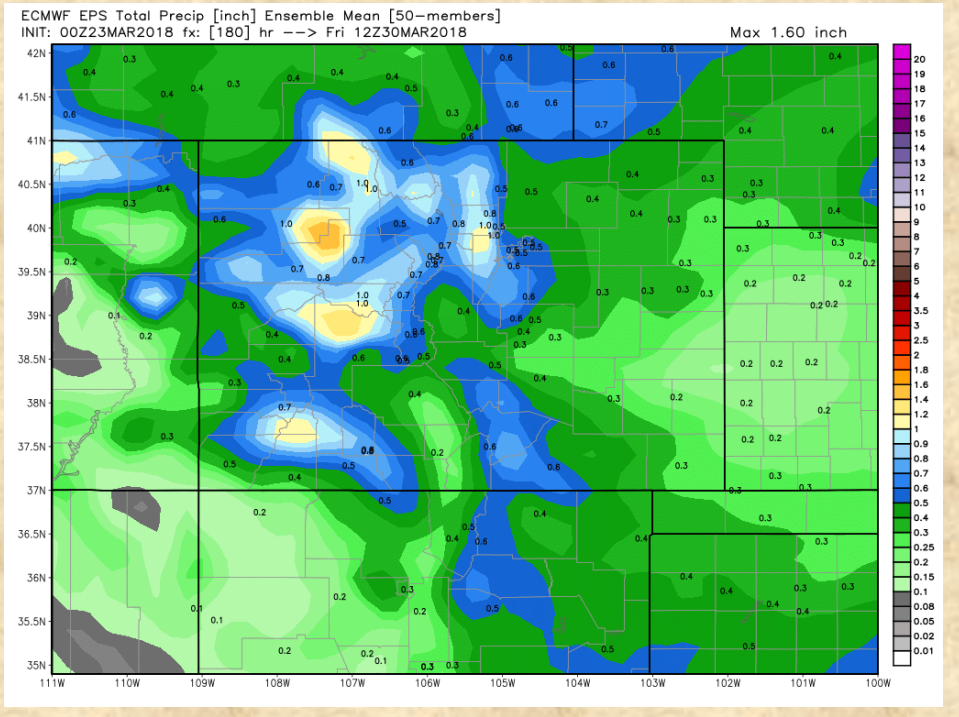


A comparison between the 2nd year La Niña (left) versus new analogue La Niña (right) shows huge differences over our state: serious drought conditions in 1st scenario (left) versus close to and even wetter than normal in 2nd scenario (right).

Let's call that 'EC'. ***(and crossing fingers here that the new analogues match!)***

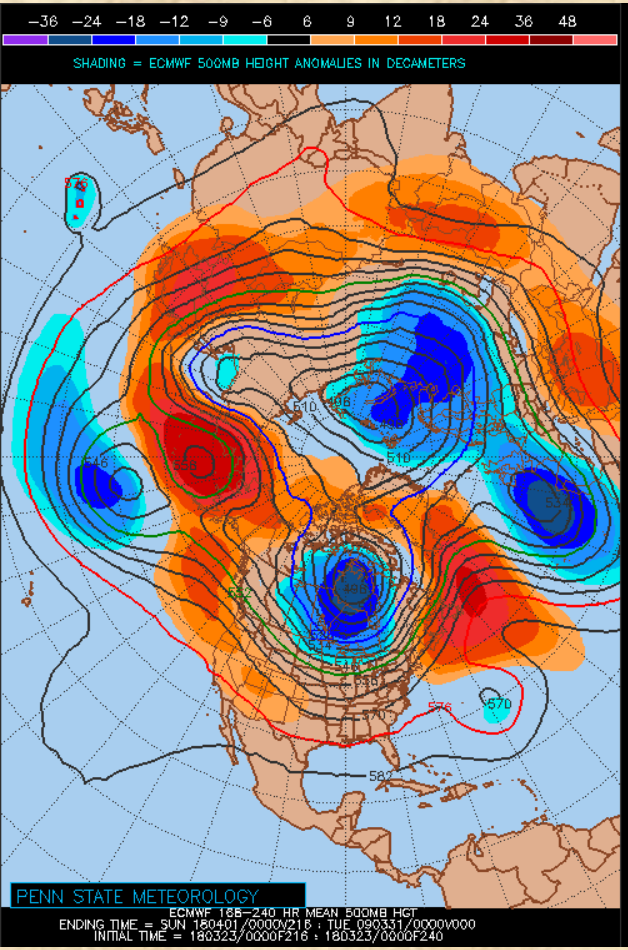
What can we expect in next seven days?

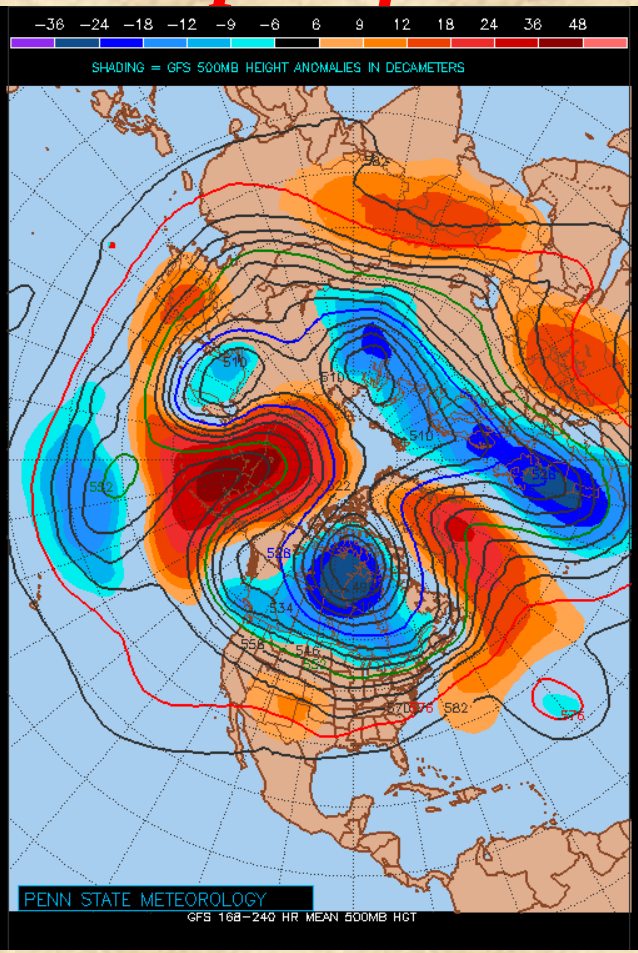


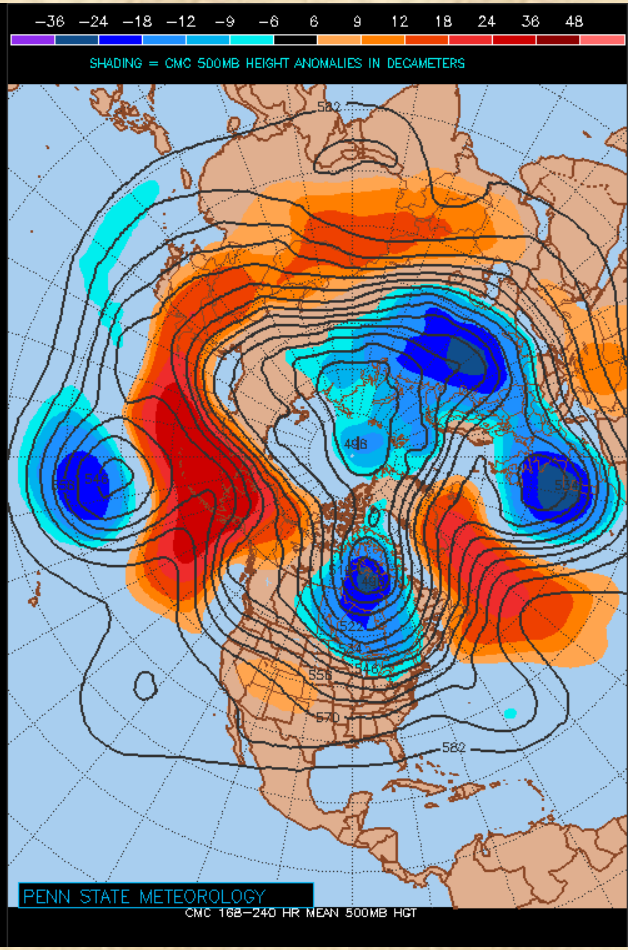


While the next seven days look reasonably stormy (especially early next week), precipitation totals around 0.5-1" for most of the mountains are only close to normal, not above-normal. I hate to sound like a broken record, but in contrast to last winter, "wet" periods since November have been quite anemic, close to normal at best.

What can we expect for next weekend

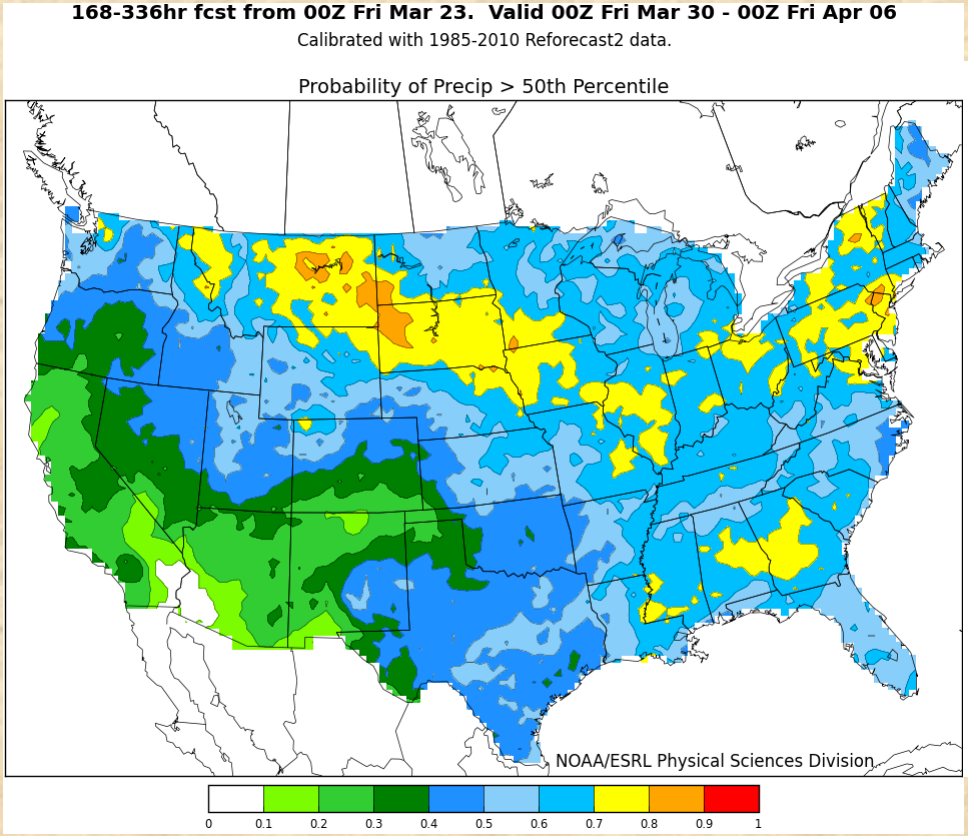


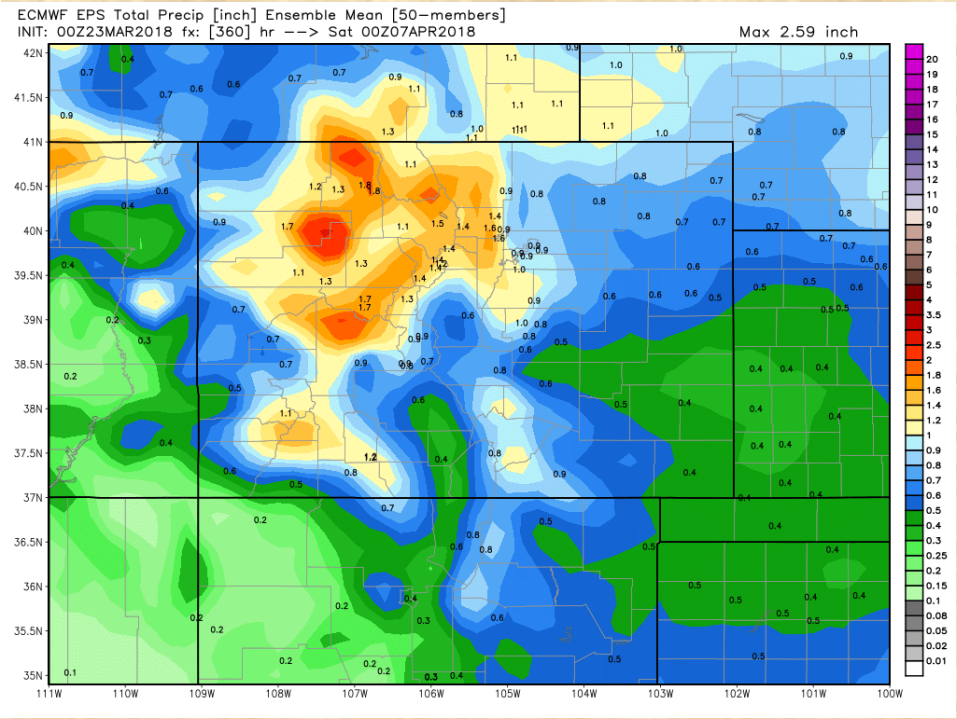




Bottomline: Remarkable agreement among models that we should see dry-ish conditions, with cold air parked over Canada (as all winter) and our region warming up but still close to seasonal rather than 'hot'.

What can we expect during Week 2?





Near-normal odds at best for Week 2 in reforecasts (left), while the full 15 day ECMWF ensemble run drops 1-2" of moisture on our mountains, again, only close to normal for the 15 day period.

Executive Summary (23 March 2018)

klaus.wolter@noaa.gov

- **La Niña re-established itself this fall and is leaving a drought footprint consistent with historic Year-2 La Niña analogues. While it might come to a quick end later this spring, this does not bode well for us. *There is potential for El Niño conditions later this year, but we are way behind last year in terms of transitioning towards that.***
- **Experimental forecast guidance for late winter was much drier than back in September and appears to be verifying well (sorry!). We are still looking at a low runoff year as I discussed back in January.**
- **Forecasts from CPC are dry during spring and 'EC' in the summer. Coupled model forecasts are actually more optimistic (close to normal in spring, wet for summer), but have a poor track record this time of year.**
- **The next two weeks should deliver near-normal amounts of moisture in our state, include a potentially big storm ("PSA-worthy"?) early next week. Temperatures are on track to stay closer to normal than in some drought years, so good news on that front.**
- **BOTTOMLINE: Not as 'gloom-and-doom' as two months ago, but still on track for a poor runoff year. My concern for spring has shifted from SW to SE Colorado.**

I hope not too many of you feel like the guy on the right!