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Physical Sciences Division

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Colorado WA/FTF, 3-24-16, Denver

DNR
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Seasonal Outlook for Colorado

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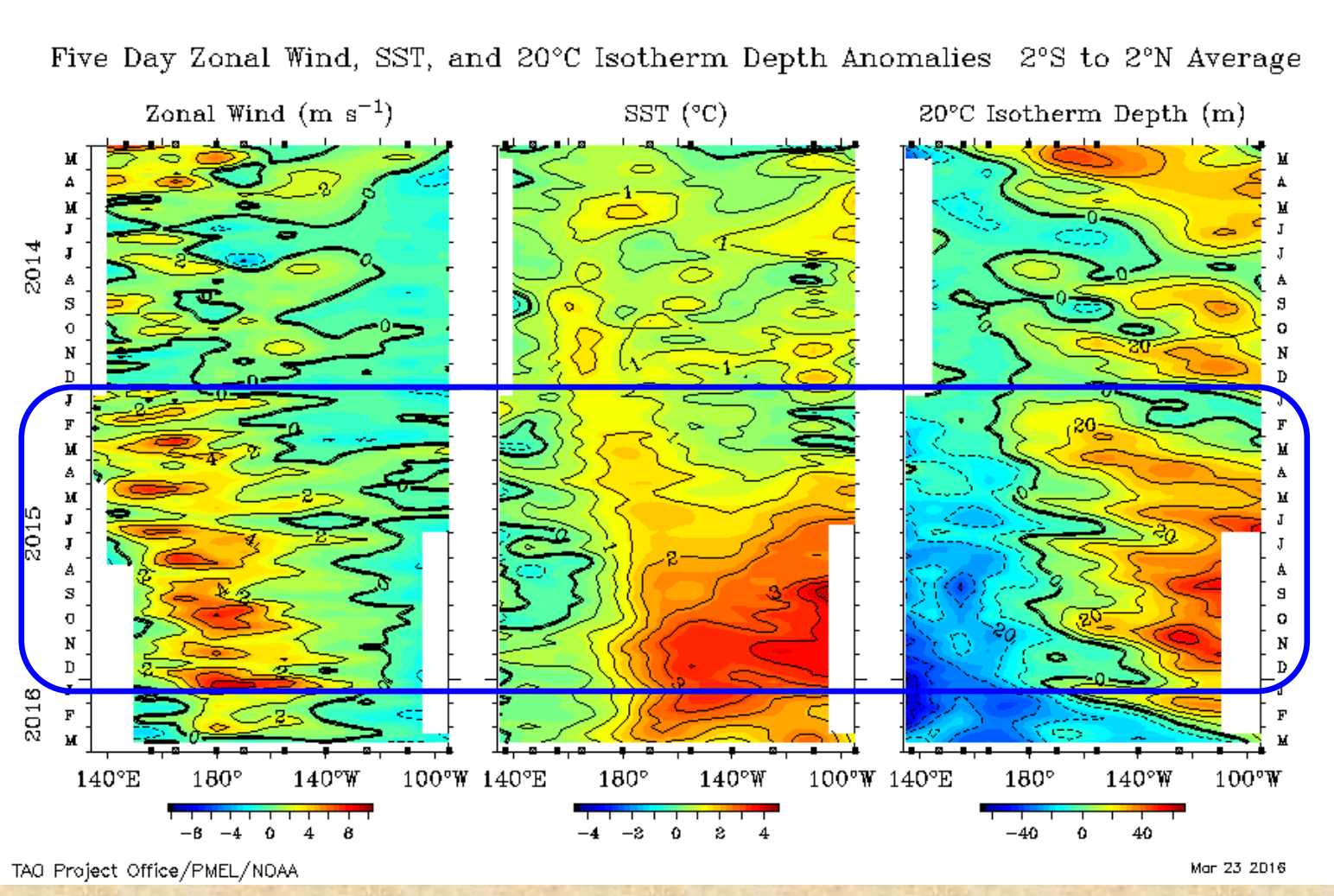
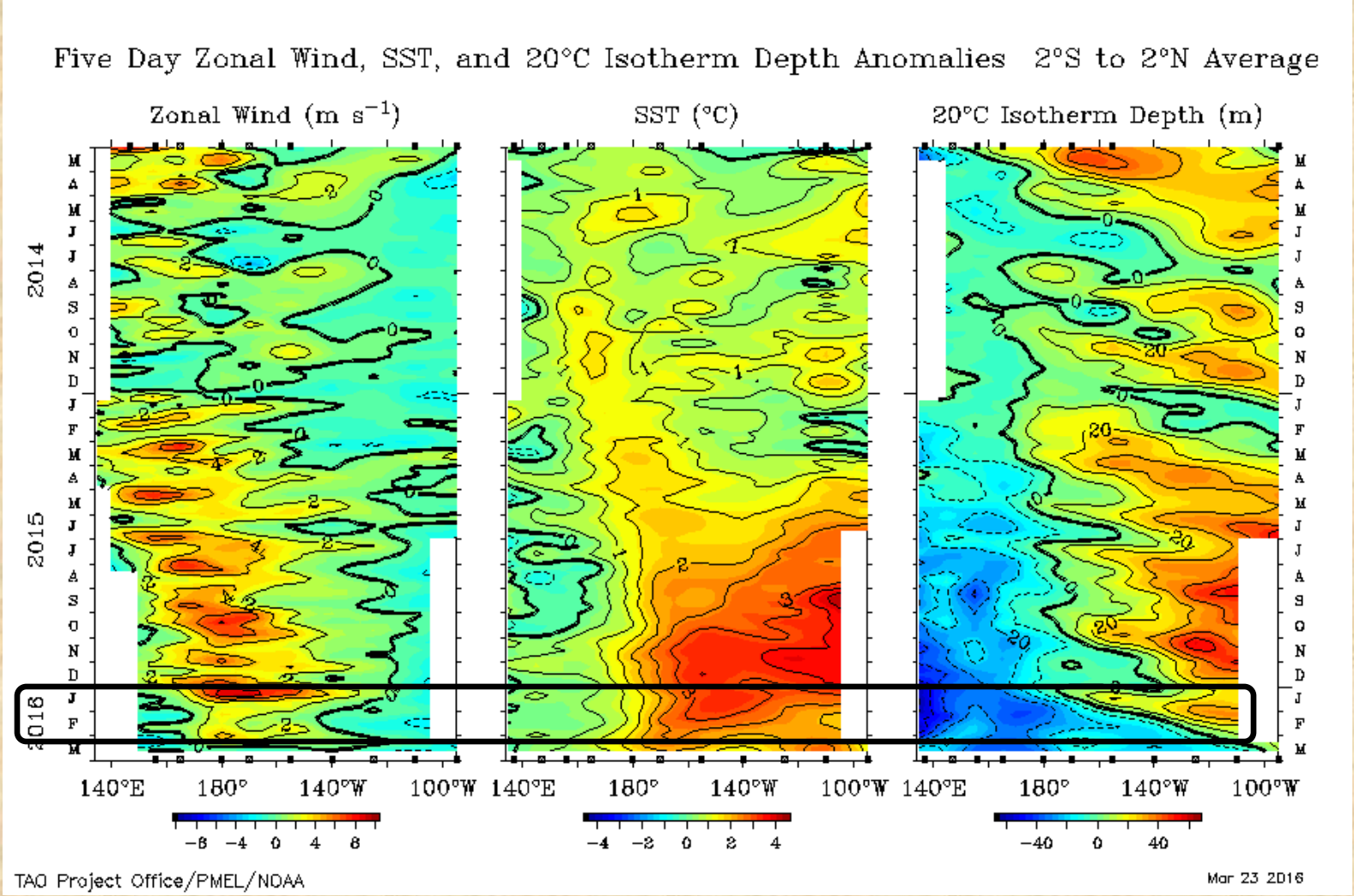
- ***Our Big Boy El Ninõ is winding down***
- ***Impacts so far & expected into mid-2016 (precip & SWE)***
- ***(Last month's) CPC forecasts into late spring 2016***
- ***Seasonal late spring forecast guidance for precipitation***
- ***Next two weeks***
- ***Executive Summary (16 march)***



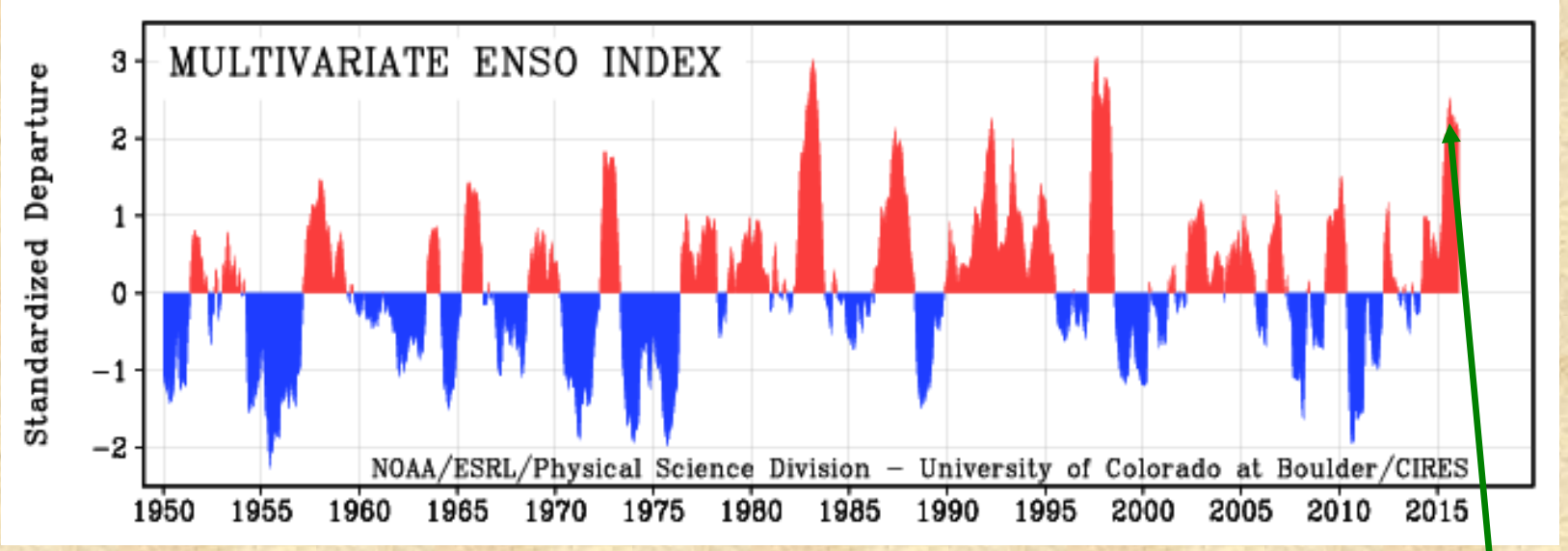
Most of 2015 saw a persistent drumbeat of westerly wind anomalies (left) to give us our recent 'Big Boy' El Niño, reaching widespread SST anomalies above +2C (middle), and positive upper ocean heat content anomalies east of the dateline (right). While SST anomalies in Niño 3.4 (170-120W) reached record levels in November, most other components of the system did not.

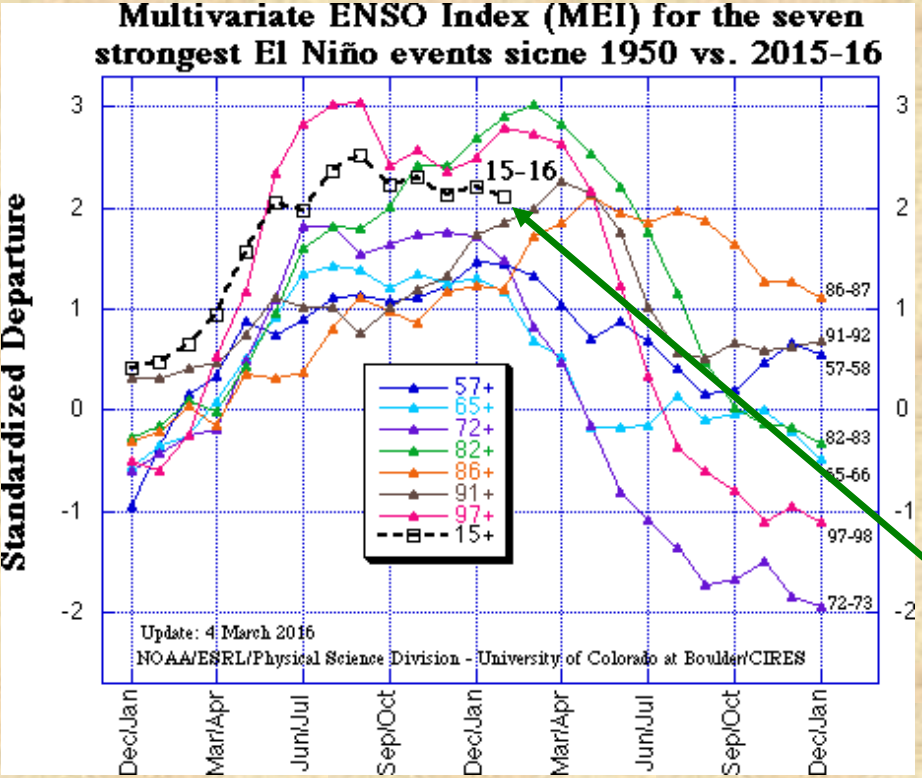
http://www.pmel.noaa.gov/tao/jsdisplay/index.html



All of this almost collapsed once NOAA decided to launch a field campaign ('El Niño Rapid Response' *) in mid-January. Thankfully, that one was over as of March 10 (managed to get the 'Miracle-March' for CA going right at the tail end of this…).

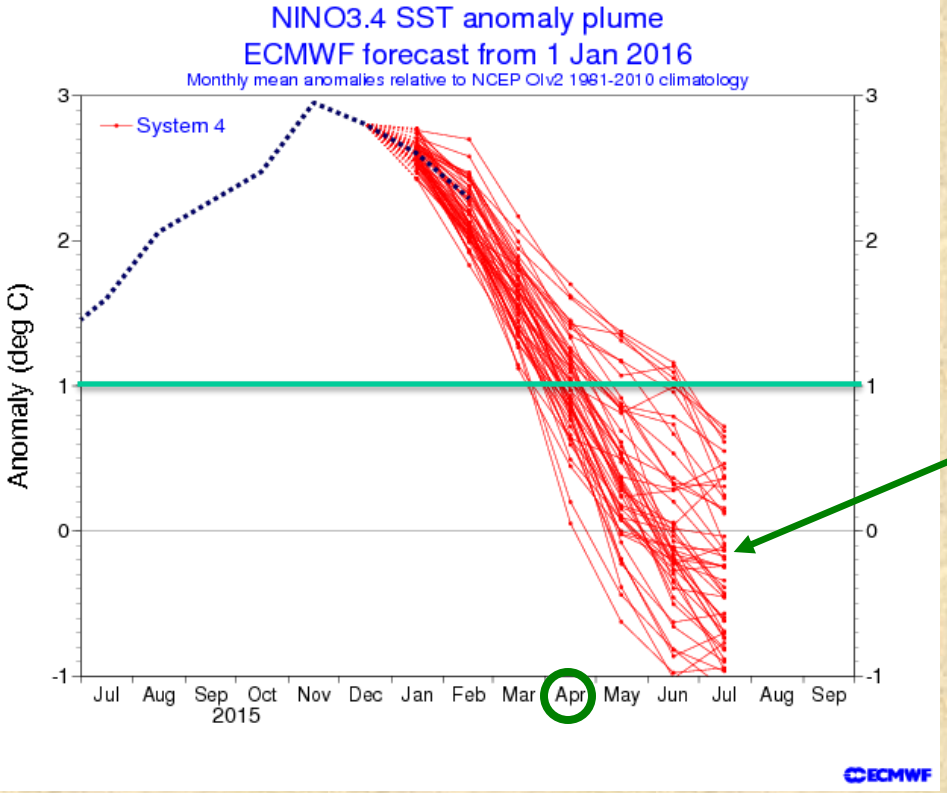
***** ***http://www.esrl.noaa.gov/psd/enso/rapid_response/***





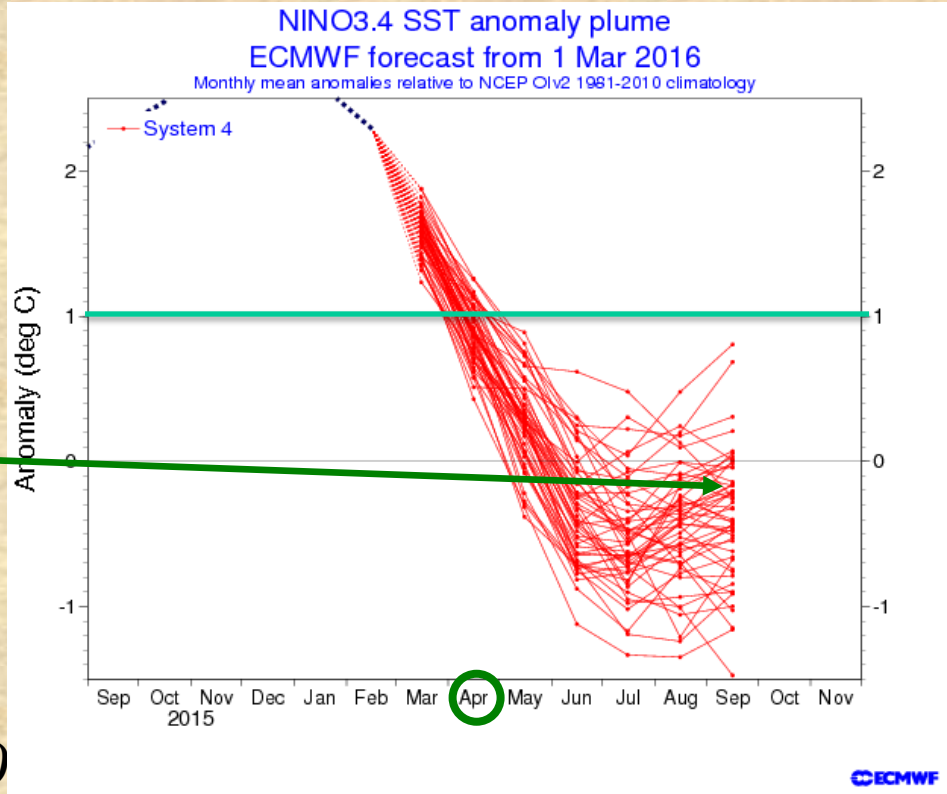
The **MEI** monitors ENSO based on all observed fields over the tropical Pacific (pressure, wind, temperatures, cloudiness). It is the 1st combined Principal Component, normalized with respect to the season. **The current El Niño peaked in Aug/Sep at +2.53, the largest MEI value since 1998**. The latest update has remained 3rd strongest since 1950 for the time of year for four months runinng.

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



The ECMWF January 2016 forecast (left) was correct in anticipating a reduction in SST anomalies going forward. The observed (blue) Niño 3.4 SST ended up in the middle of the plume during the last two months. The most likely transition month to anomalies under +1C is April. By July more than 50% of ensemble members go negative.

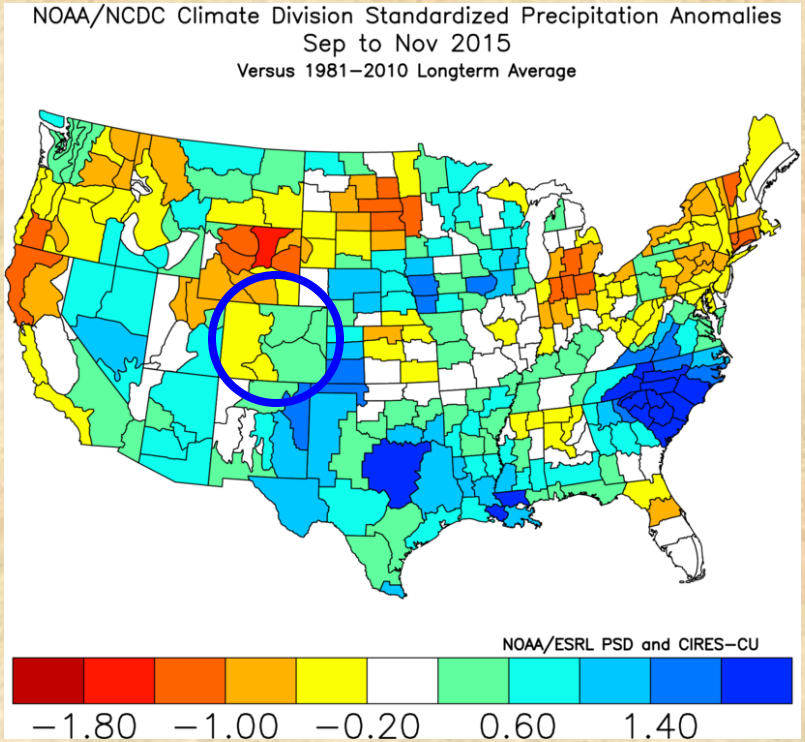
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/

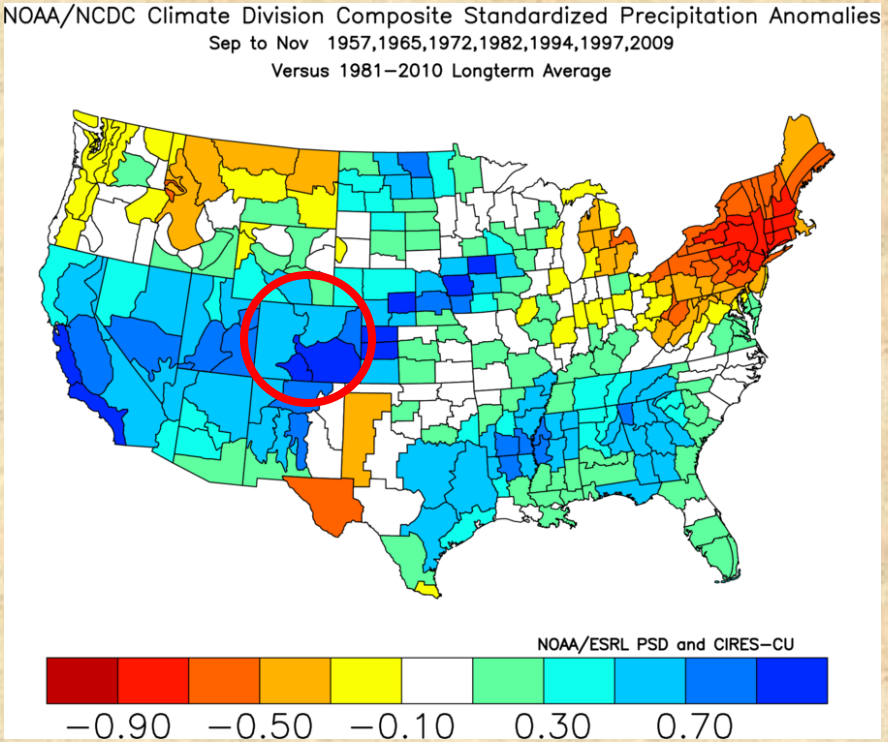


The updated ECMWF forecast (right) shows a reduced range of possible outcomes, perhaps moving a bit faster out of El Niño conditions than before. By July, the average outcome is weak La Niña (-0.5C), but it may just relax back towards neutral afterwards.

In IRI plume (not shown), the majority of statistical models show La Niña by fall, but dynamical models are much less decisive (CFS2)

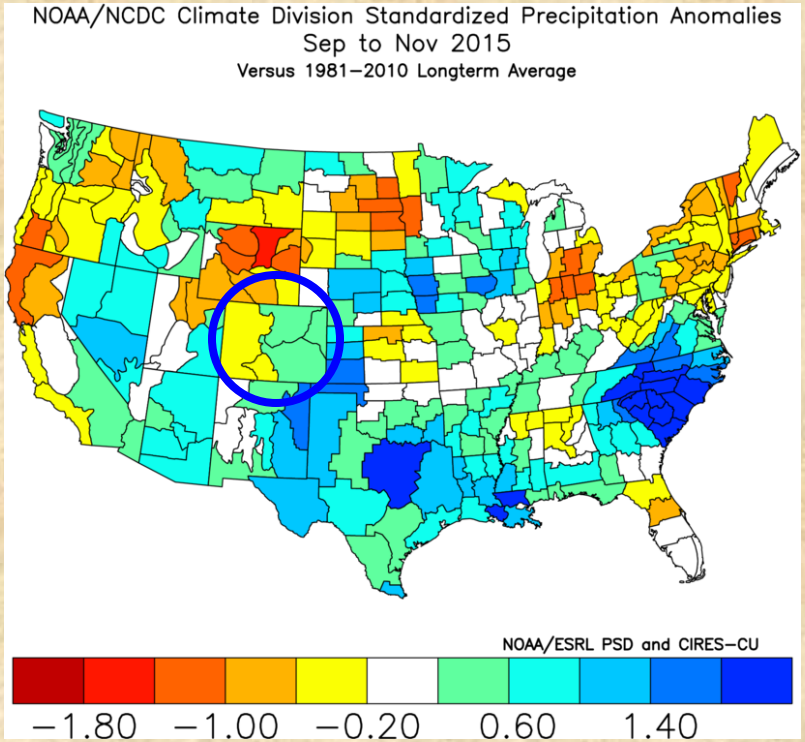
Fall precipitation versus expectations

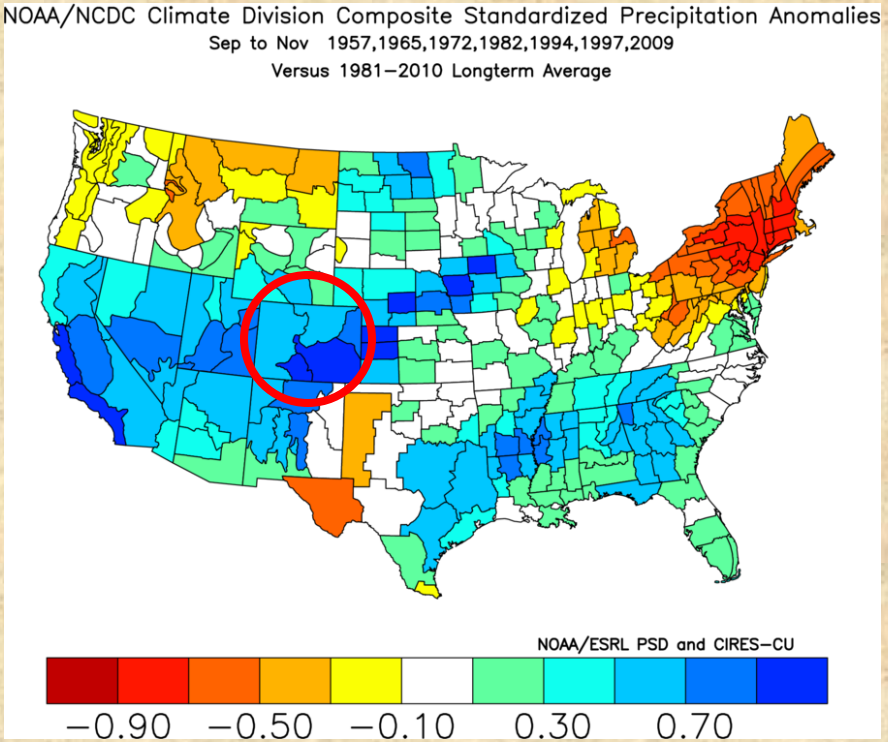




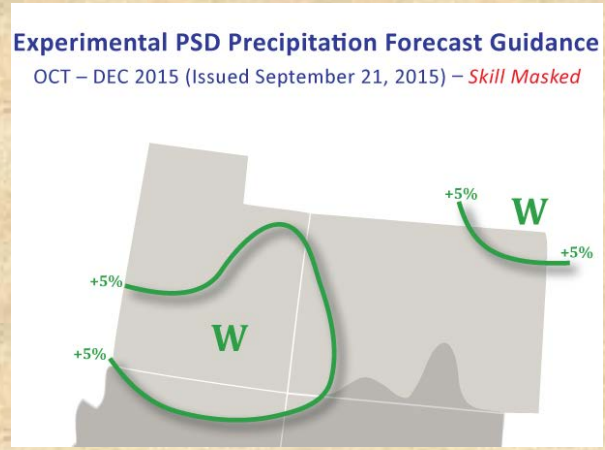
The fall season got CO off on the wrong foot (left) compared to expectations (right), especially west of the divide. This was mainly due to a record(?)-dry September.

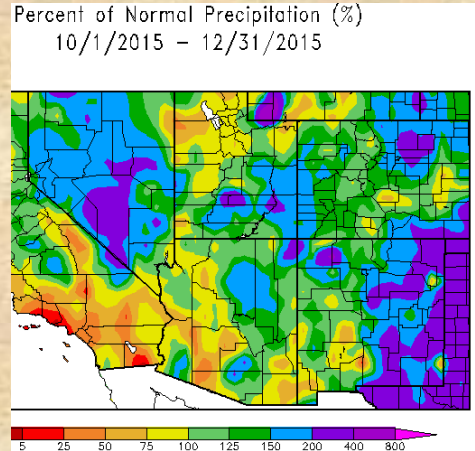
Fall precipitation versus expectations



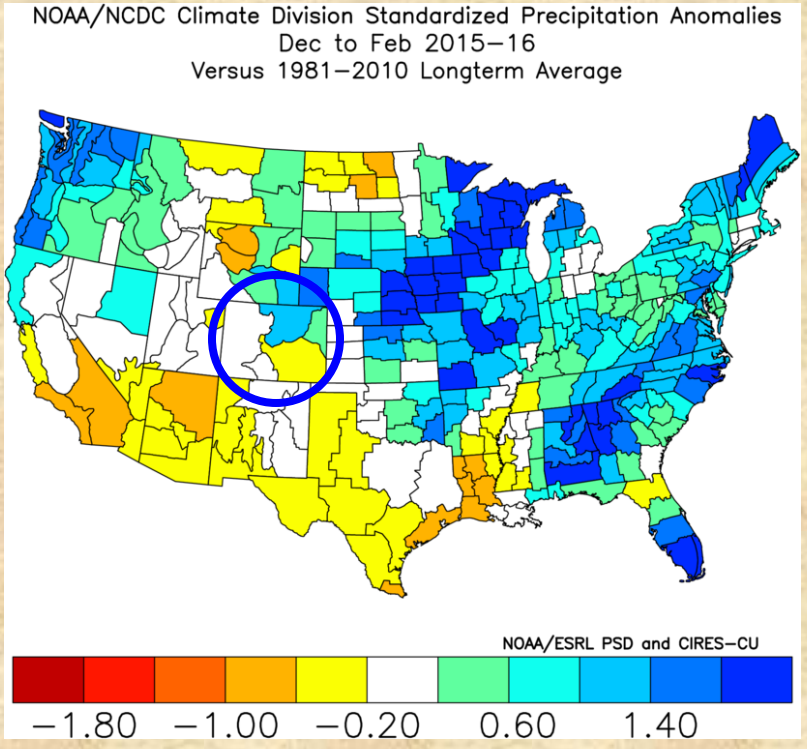


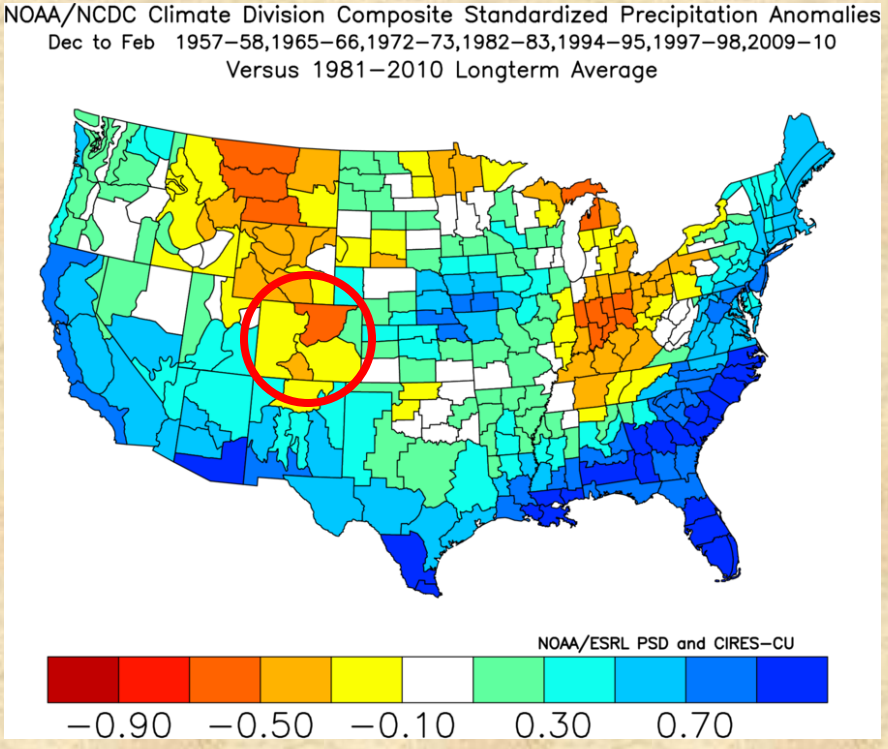
The fall season got CO off on the wrong foot (left) compared to expectations (right), especially west of the divide. This was mainly due to a record(?)-dry September. My wet OND'15 forecast verified nicely:





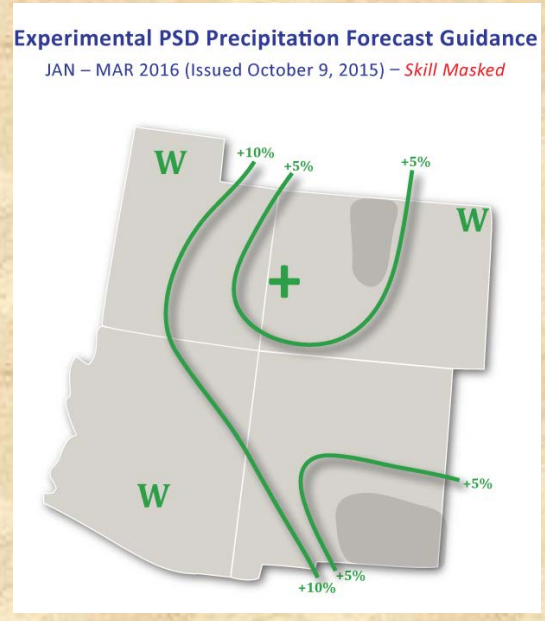
Winter precipitation versus expectations

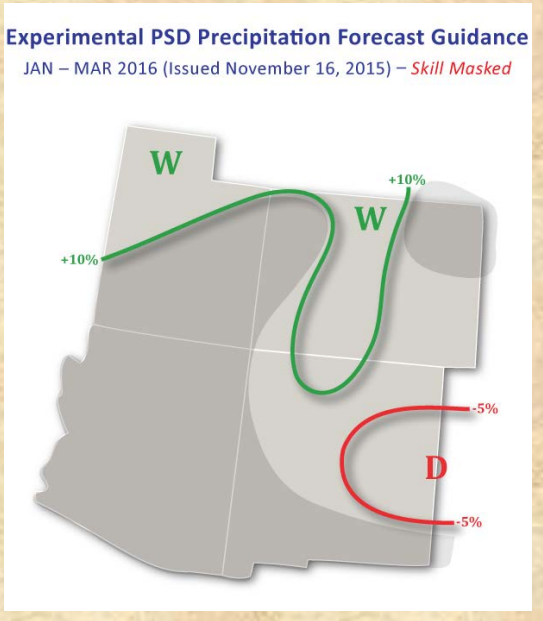


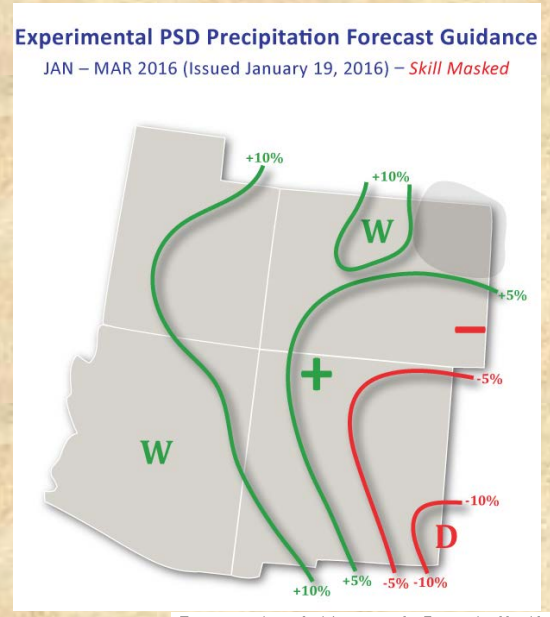


The winter season 2015-16 (left) benefitted from a wet December on both sides of the divide and a wet February east of the divide, thus exceeding expectations (right), and making up for lost ground in the fall season.

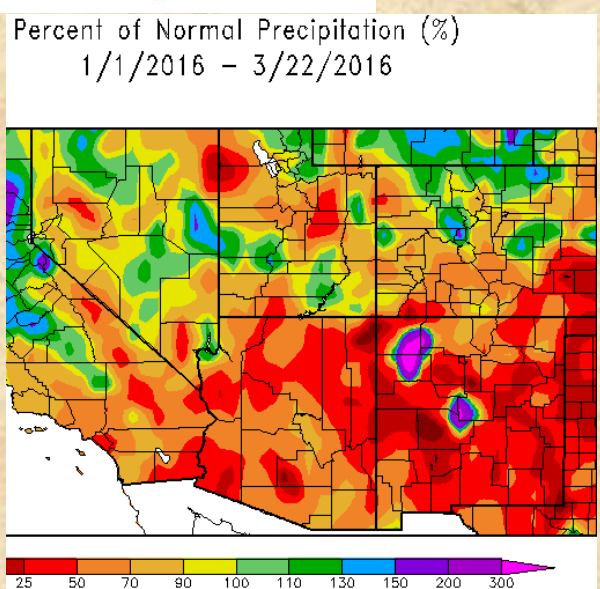
Postmortem for Jan-March 2016 so far



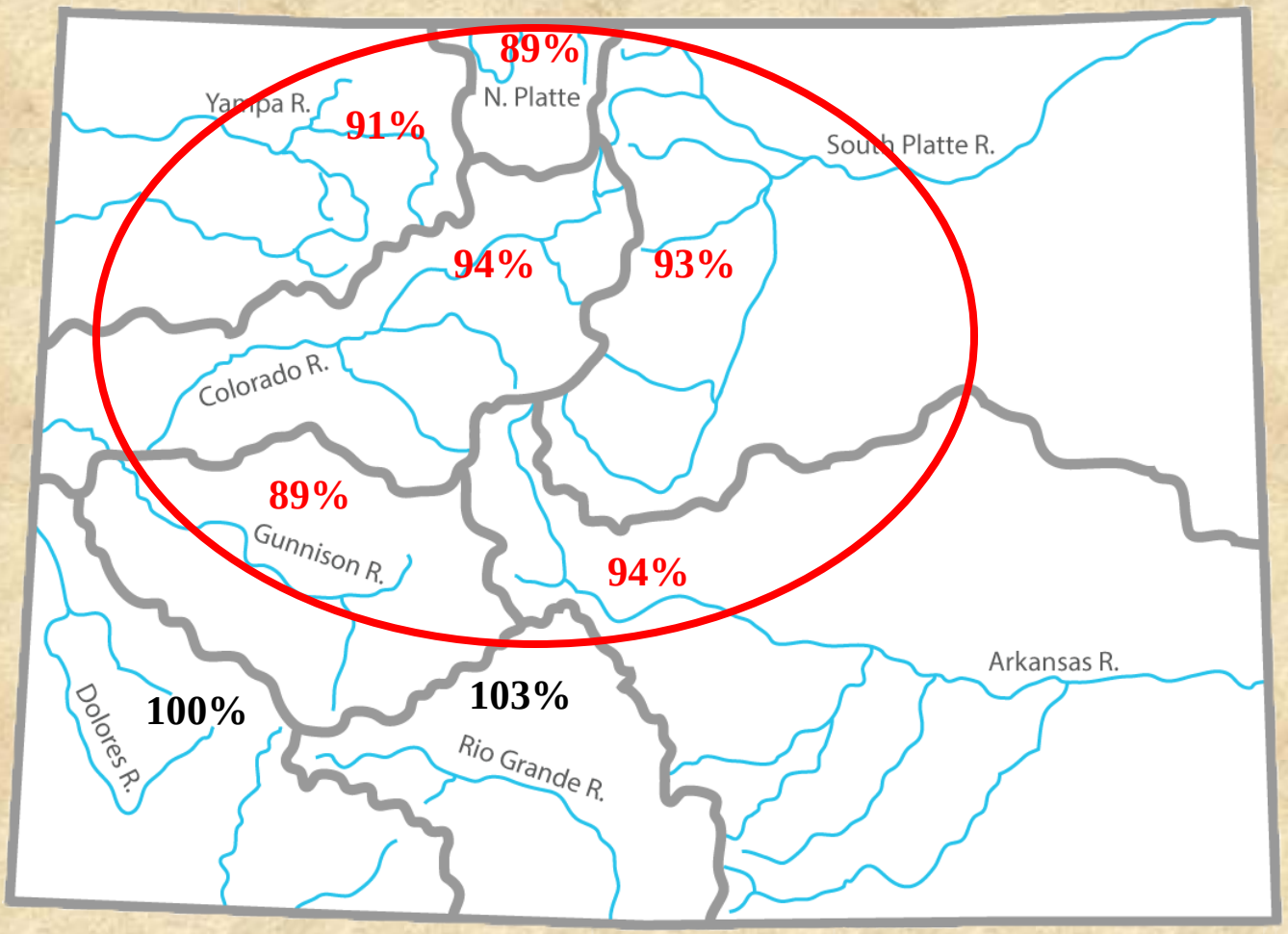




My late winter forecasts were fairly bullish for most of Colorado since September. Not counting our most recent storm, the dryer portions of the forecast maps (NM into SE Colorado) have a better chance of verifying than the wetter ones… ***Least likely recovery overall in Arizona…***



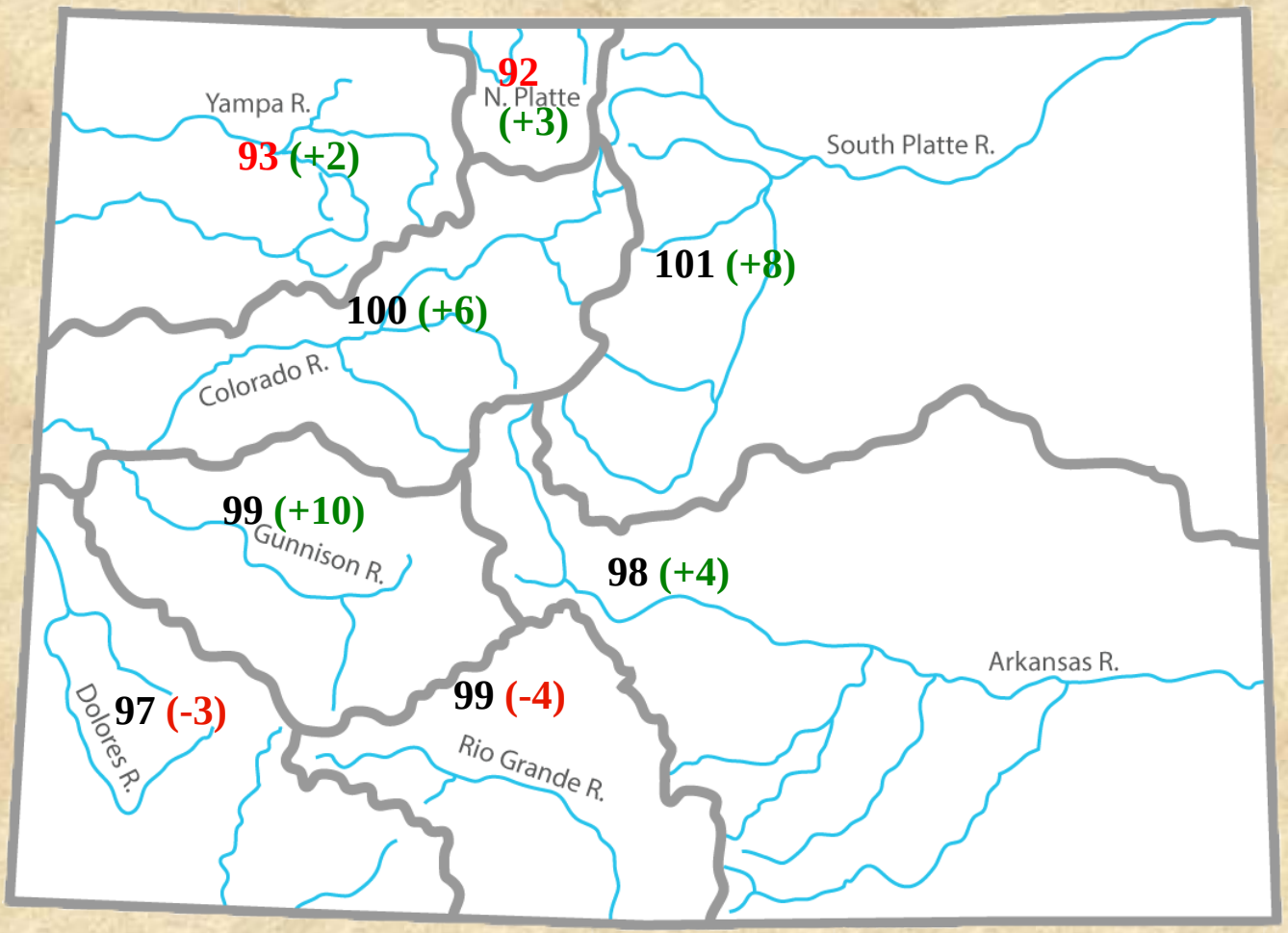
Based on Fall El Niño composites for 1marSWE



Median outcome for strong Los Niños since 1968
(after fall seasons: ‘72, ’82, ’87, ’94, ’97)

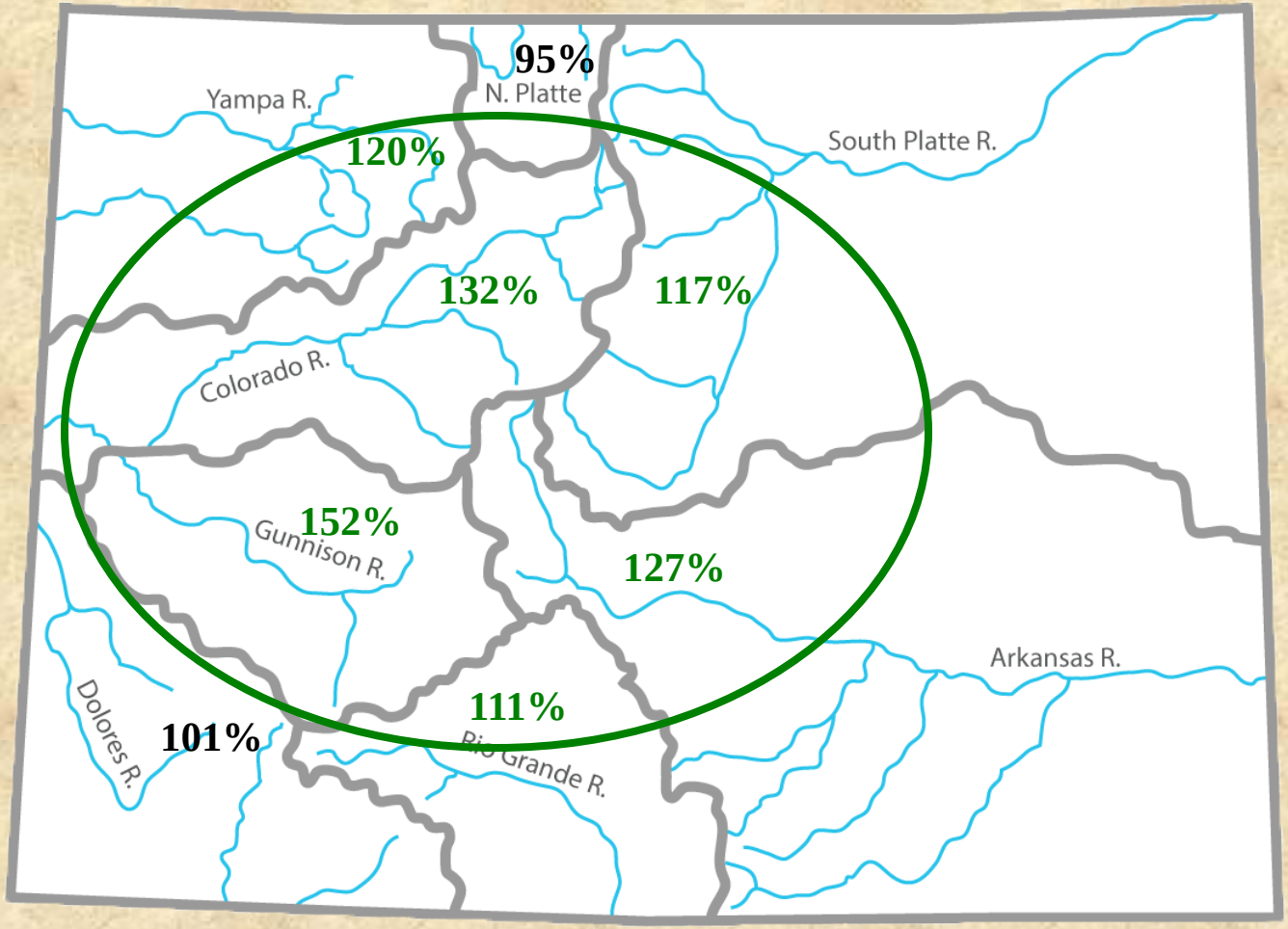
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/?cid=nrcs144p2_063324

1marSWE 2016 versus Niño composites (in % of median)



2016 left slightly more snow on the ground than expected in the northern and central basins, while the San Juans ended up a bit dryer.

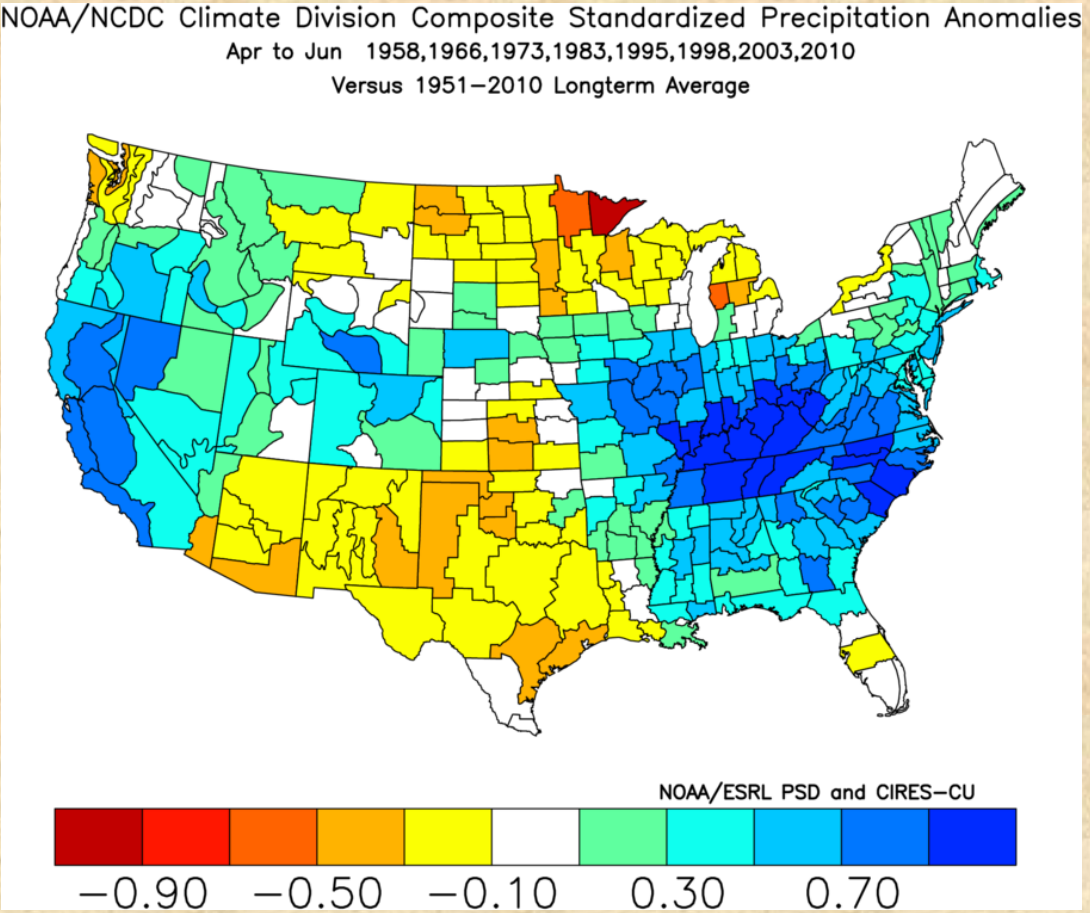
Based on Fall El Niño composites for 1may SWE



Median outcome for strong Los Niños since 1968 – not a slam-dunk, but only 1 in 5 cases 'failed' (1988)

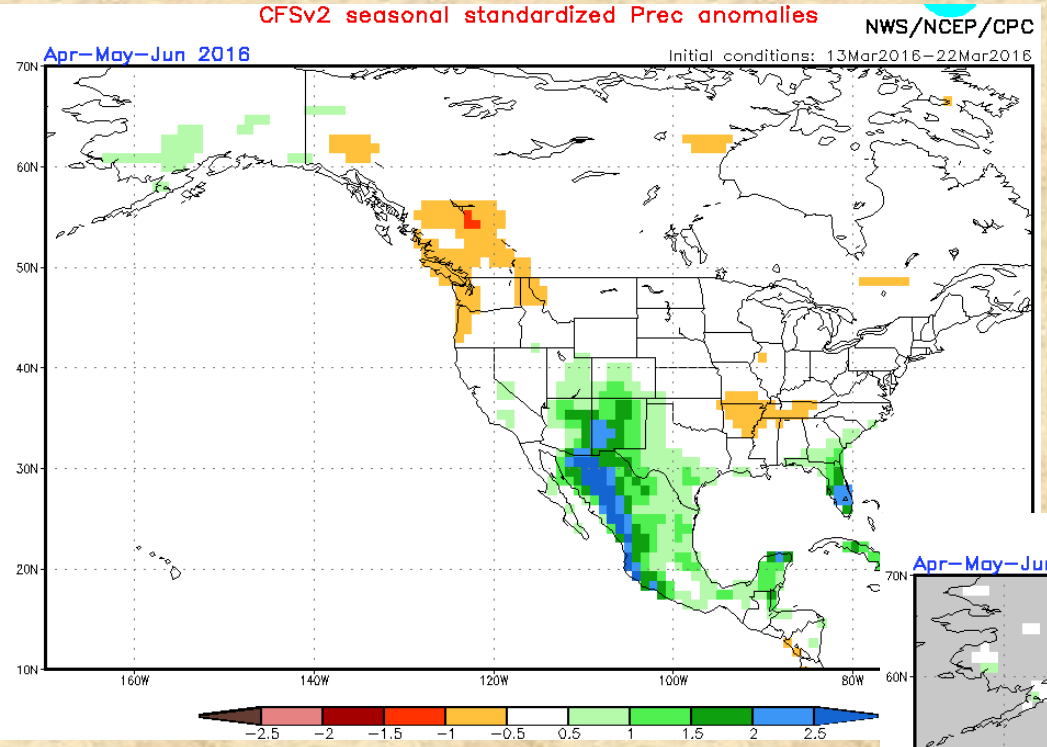
(after fall seasons: '72, '82, '87, '94, '97)

Typical late spring precipitation AFTER strong El Niño during winter (that is not growing during spring)



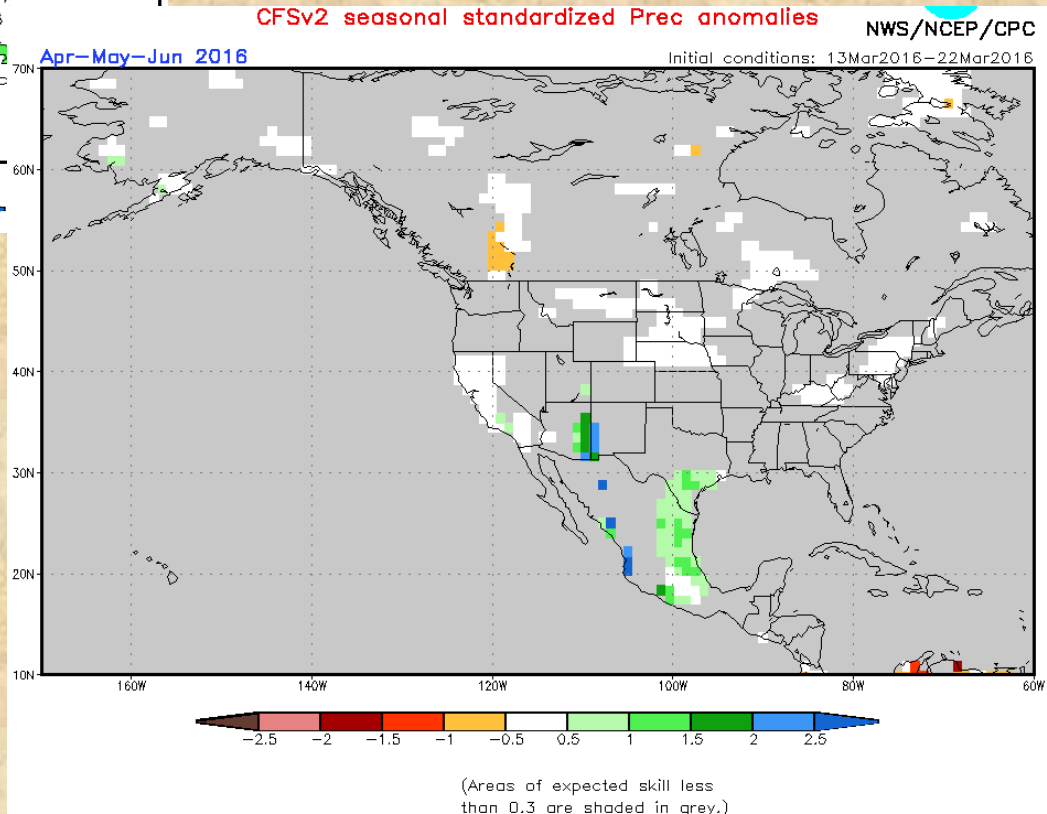
Most strong winter Niños were followed by a near-normal or wet spring for our state, with the South Platte Basin being the most favored, and the Arkansas as well as Upper Rio Grande being the least favored.

CFSv2 forecasts for April-June 2016

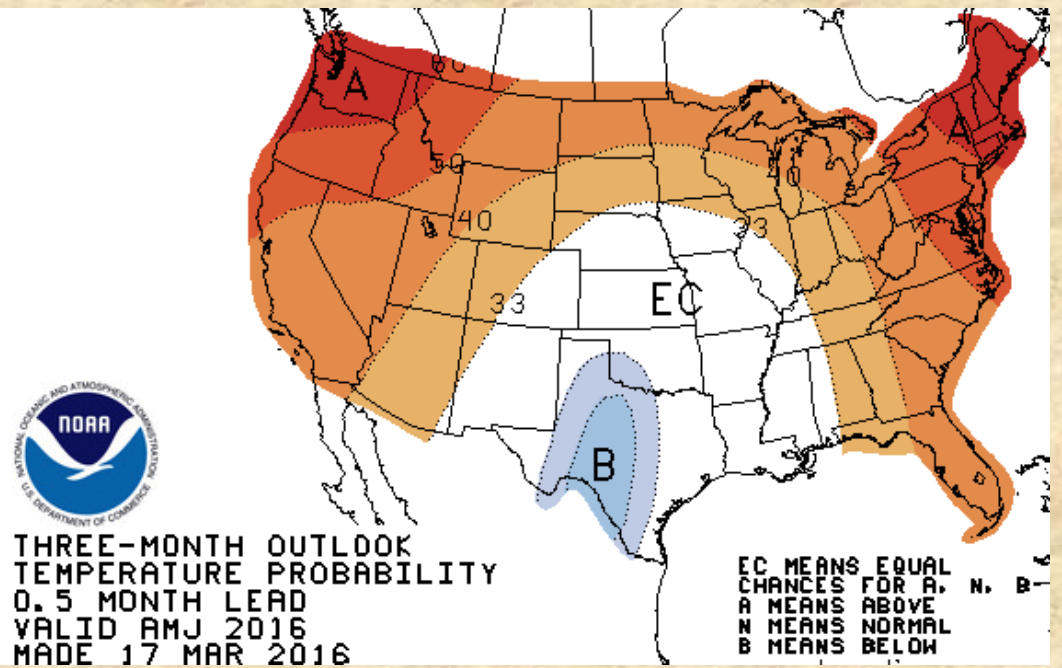


http://www.cpc.ncep.noaa.gov/products/predictions/90day/tools/briefing/

Spring (top) shows modest chances for a wet outcome in the CFSv2. Unfortunately, this is not supported by high skill (right).

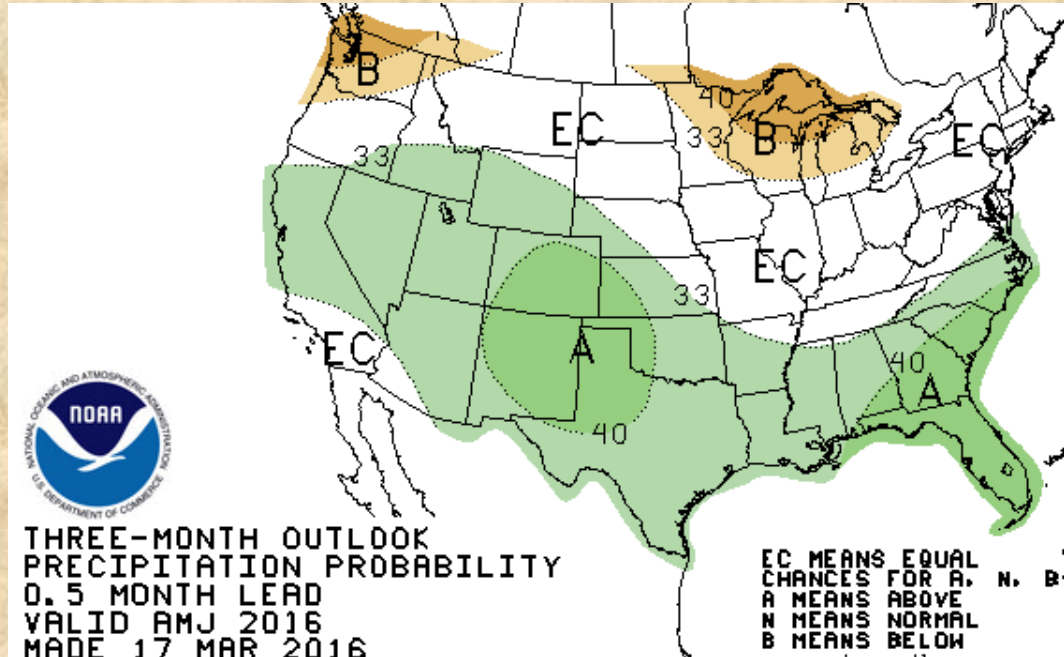


Climate Prediction Center Forecasts

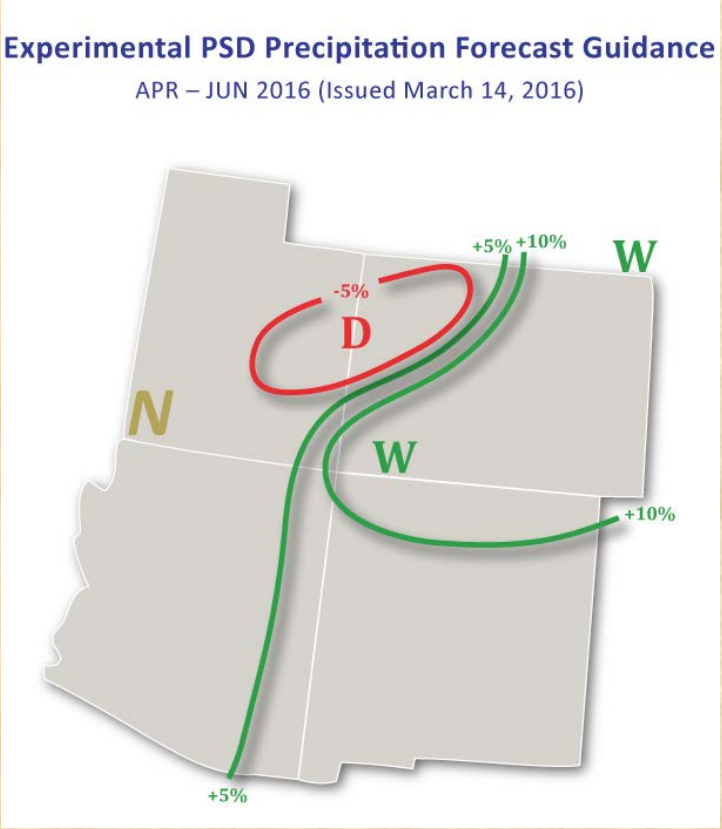


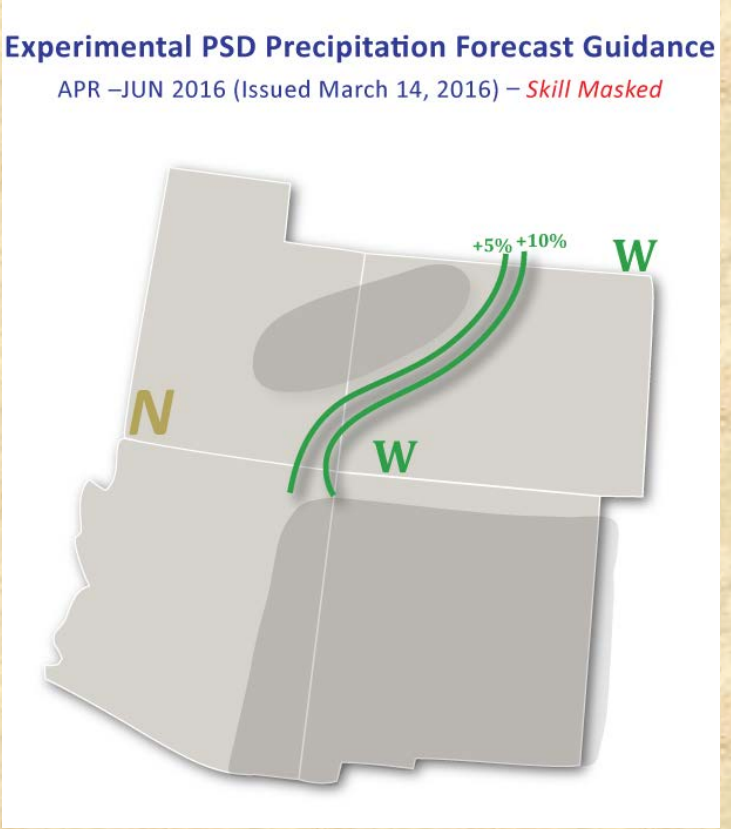
The CPC late spring temperature forecast (top left) is undecided for eastern CO, and warmish on the west slope, while the precipitation forecast continues wet (right) – *this is more or less the last season where El Niño is expected to play a major role for us.*

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



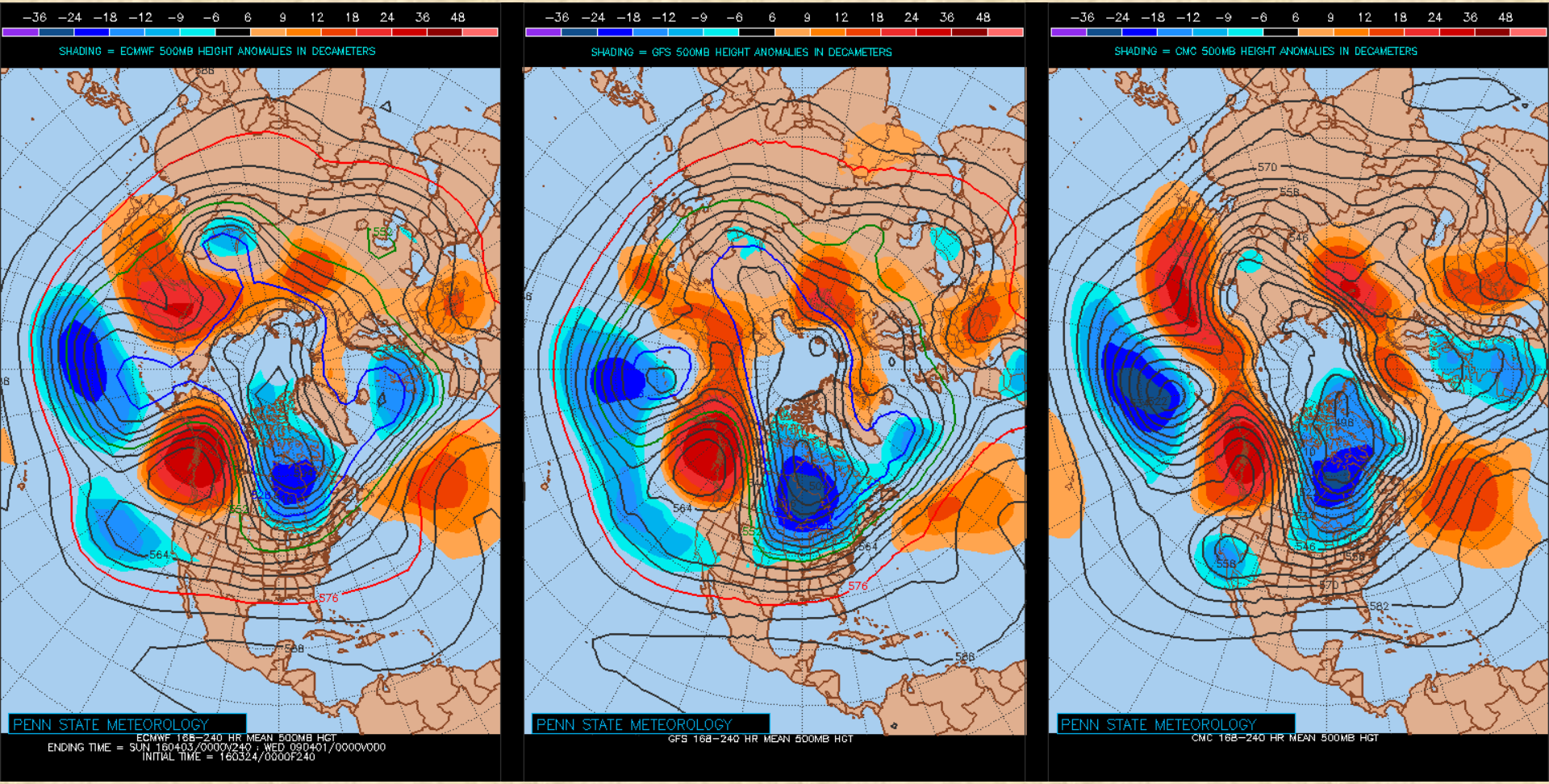
Forecasts for April-June 2016





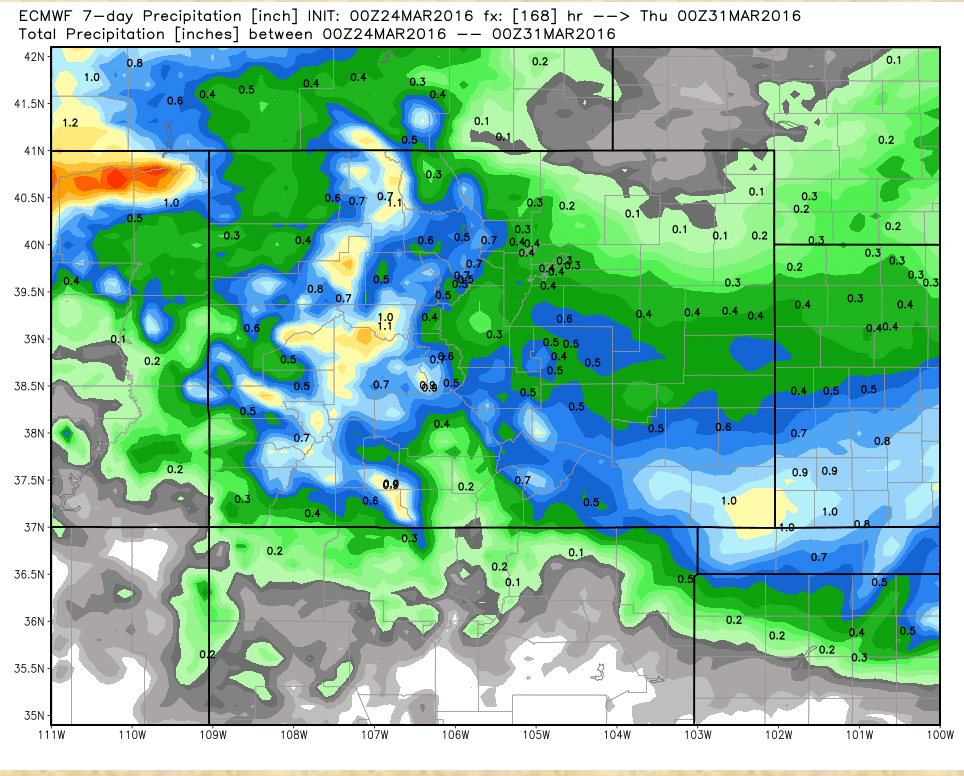
The late spring precipitation forecast is bullish for eastern CO, less so over northwestern CO which happens to be a region of poor verified skill over last 16 years. ***This forecast is somewhat similar to last year's which ended up verifying wet everywhere.***

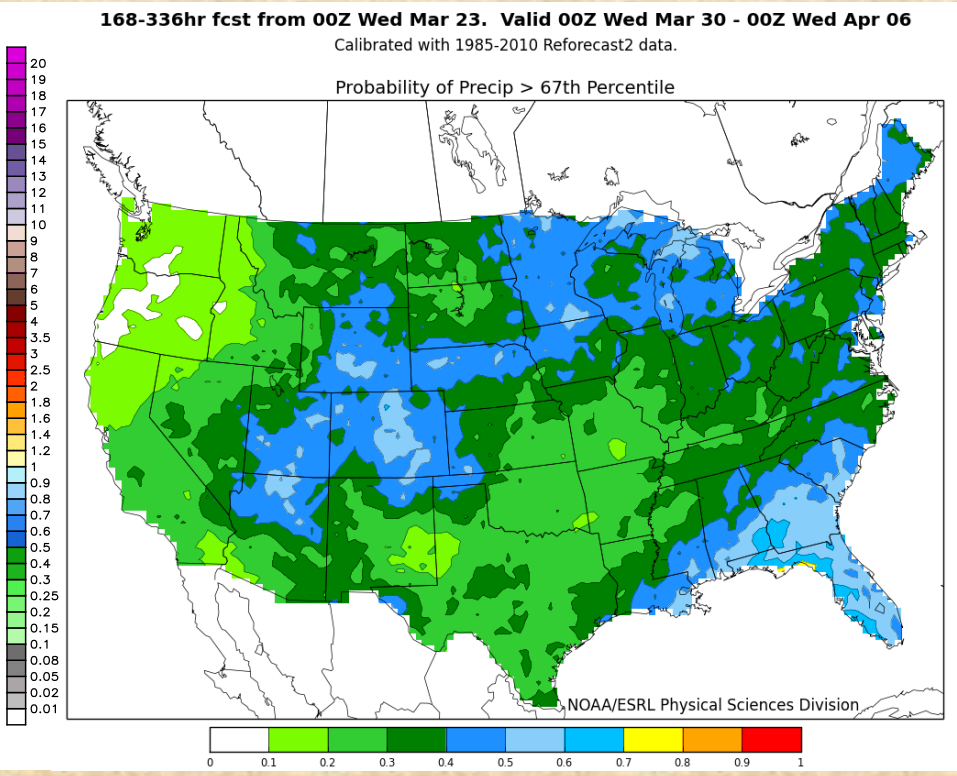
What can we expect towards the end of next week?



ECMWF (left), GFS (middle,) and CMC (right) show a ridge from the Pacific Northwest into Alaska, with undercutting westerlies to the south, and a deep polar low over Hudson's Bay. CO sits in between these features, with the potential for continued cold weather most pronounced in GFS, and storms possible both from the north(west) and southwest.

What can we expect for next two weeks?





European High-Resolution forecast for the 1st week (left; courtesy of 'Weather Bell') shows decent moisture totals for the mountains and in southeastern plains, while the extended reforecast for Week 2 (right) gives central and eastern CO better-than-normal chances for another storm by early April (a day old since our virtual map room was closed this morning)

Executive Summary (24 March 2016)

klaus.wolter@noaa.gov

- **El Niño is still here, it is still very strong, and should impact the U.S at least thru spring. In my book, this has been the 3rd strongest event of the last century.**

- **The expected mid-winter El Niño dryness came a bit later for our mountains, such that snowpack numbers for the 1st of March were actually slightly ahead of previous El Niño winters (overall close to normal). I still expect to see a statewide increase in snowpack by the 1st of May.**

- **CPC's forecasts favor our state during spring, consistent with my own expectations. However, my experimental forecast guidance for April through June gives better odds for the eastern half of our state than the western half, backed up by better real-world skill since 2000.**

- **As best as I can tell, dust storms have been less active than in other years so far this season, leaving the snowpack 'cleaner' than we have seen in previous years. Together with expected enhanced storm activity into May, I don't foresee an early melt-out. This sets up a more intense runoff season than average, although I don't believe it will be as intense as in 1995 or '83. On the other hand, the odds for summer thunderstorm activity with flash-flood potential are *not* enhanced.**

- **While it is not guaranteed that we will transition into La Niña this year, its return would not necessarily foretell re-emerging drought conditions right away. *Most recently, 2010-11 was an exceptionally wet year in this region despite being a very strong La Niña after a strong El Niño event.***