Earth System Research Laboratory
Physical Sciences Division

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NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

Colorado WATF, 6-22-16, Denver

DNR
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Seasonal Outlook for Colorado

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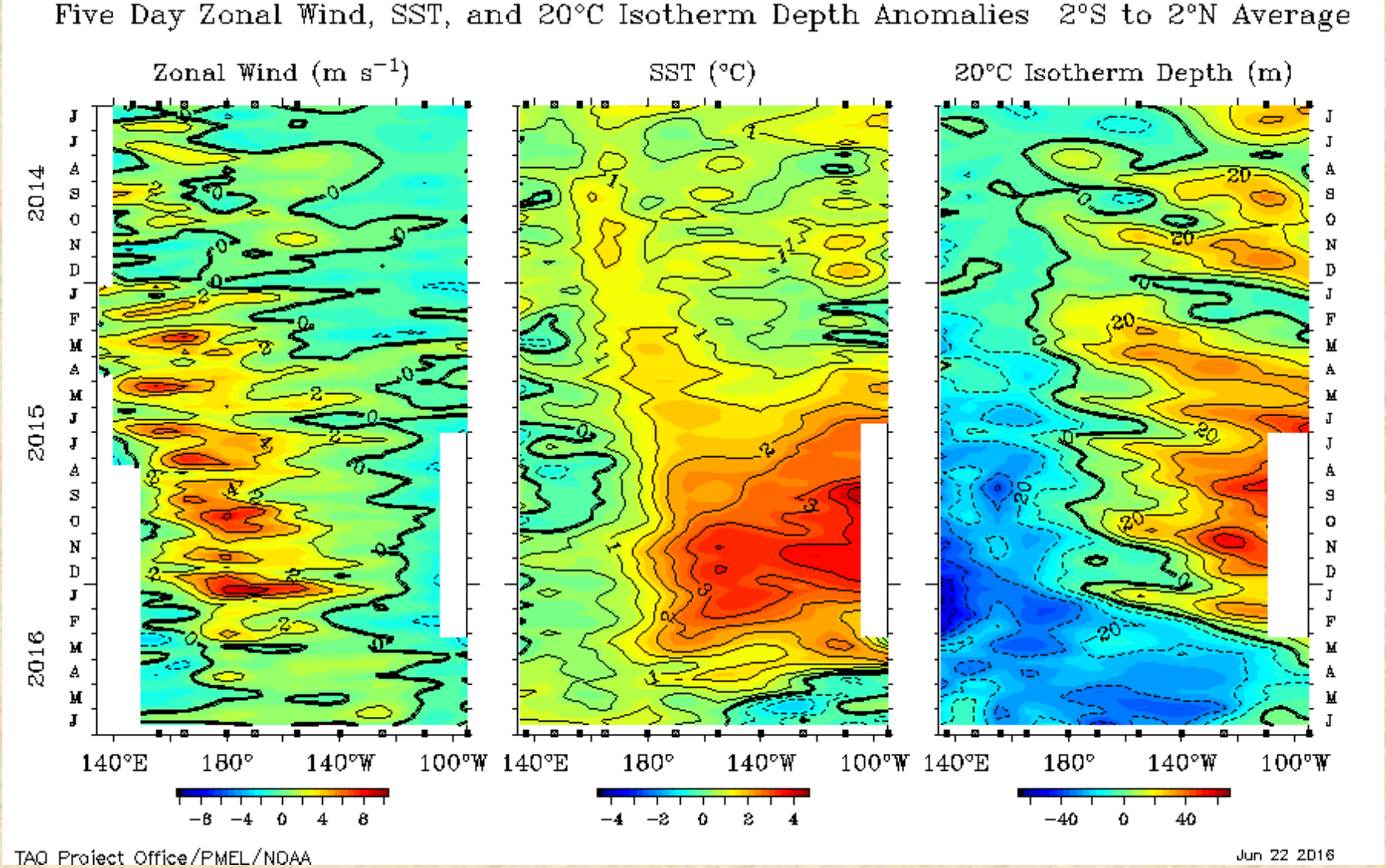
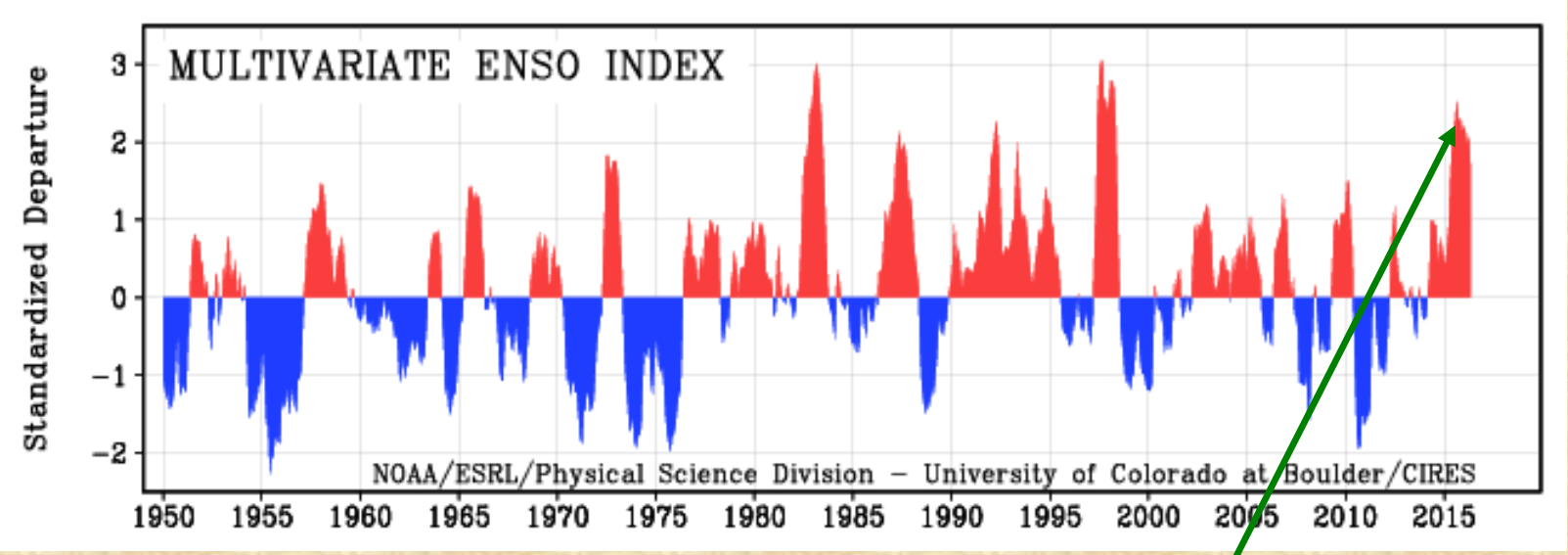
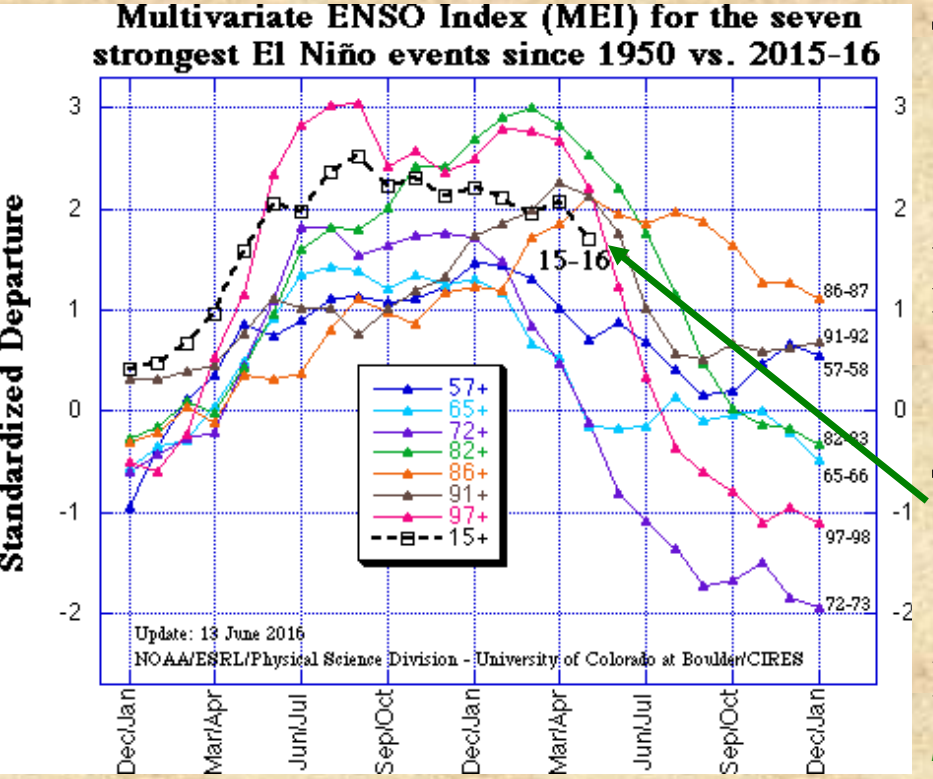
- ***El Ninõ is just about done…***
- ***Postmortem Spring 2016***
- ***CPC forecasts into late summer 2016***
- ***Experimental late summer forecast guidance for precipitation***
- ***Next two weeks***
- ***Executive Summary (22 June)***



El Niño is winding down, but winds have not shifted towards easterly anomalies yet (left), SST anomalies have gone from high positive to weakly negative (middle), and the subsurface cold push has sloshed back towards the west (right). Cold water at depth (west of 130W) is 'waiting' for enhanced trade winds…

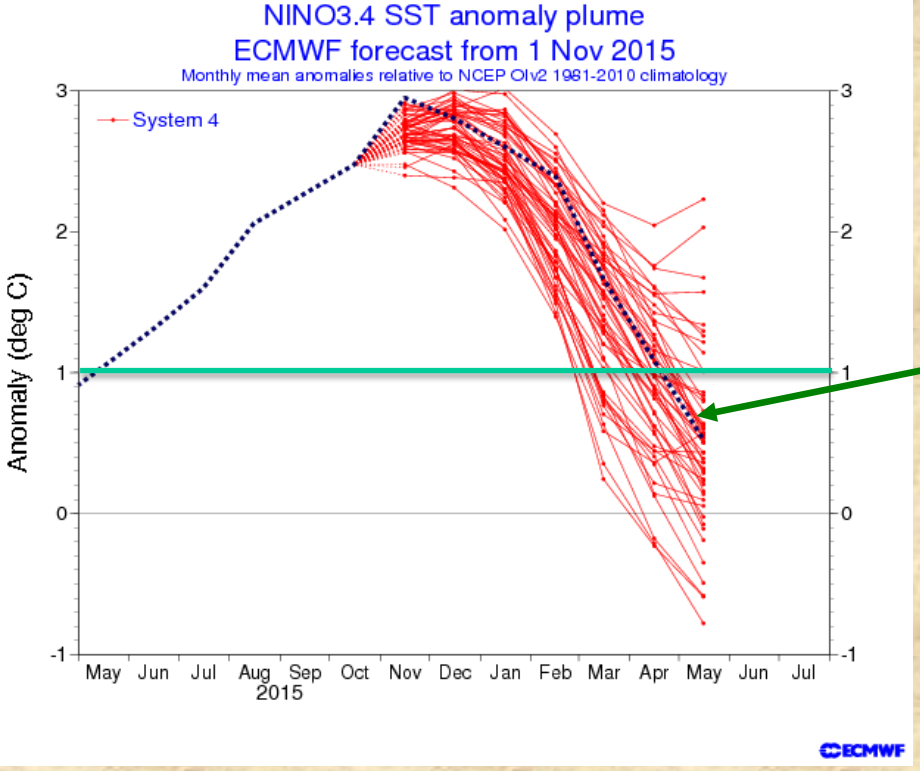
http://www.pmel.noaa.gov/tao/jsdisplay/index.html





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 dropped to 6th rank since 1950, still reflecting El Niño-like conditions over the tropical Pacific in April-May.

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

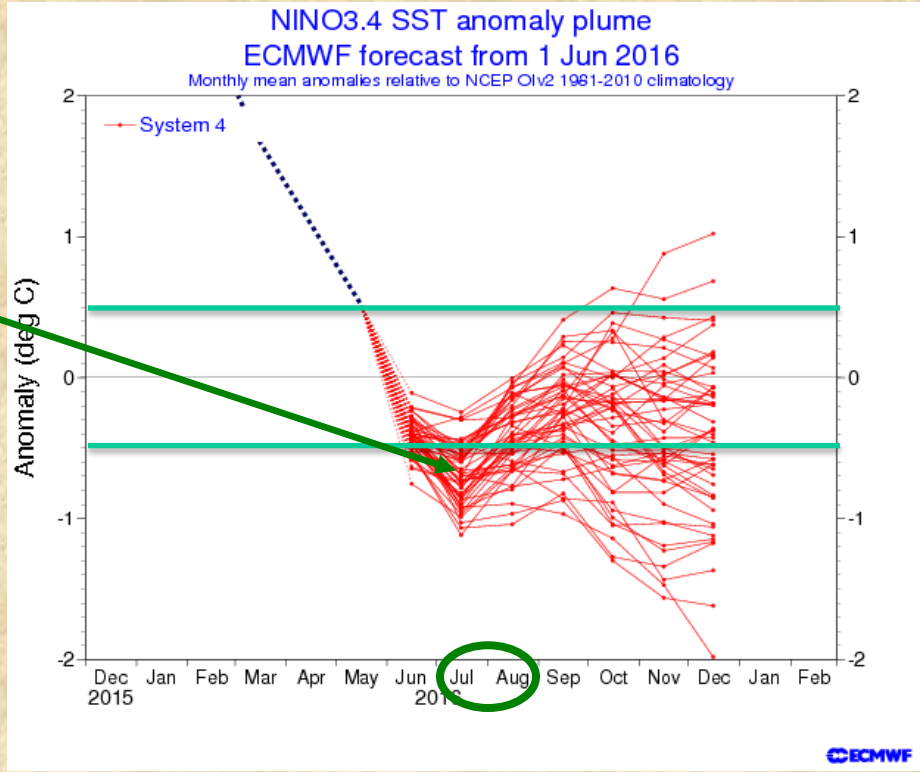


The ECMWF November 2015 forecast (left) showed a fairly compact plume, with a drop below +1C in May that verified nicely. While the observed trace (in stippled blue) was a bit higher than median expectations, this was again a very successful forecast cycle.

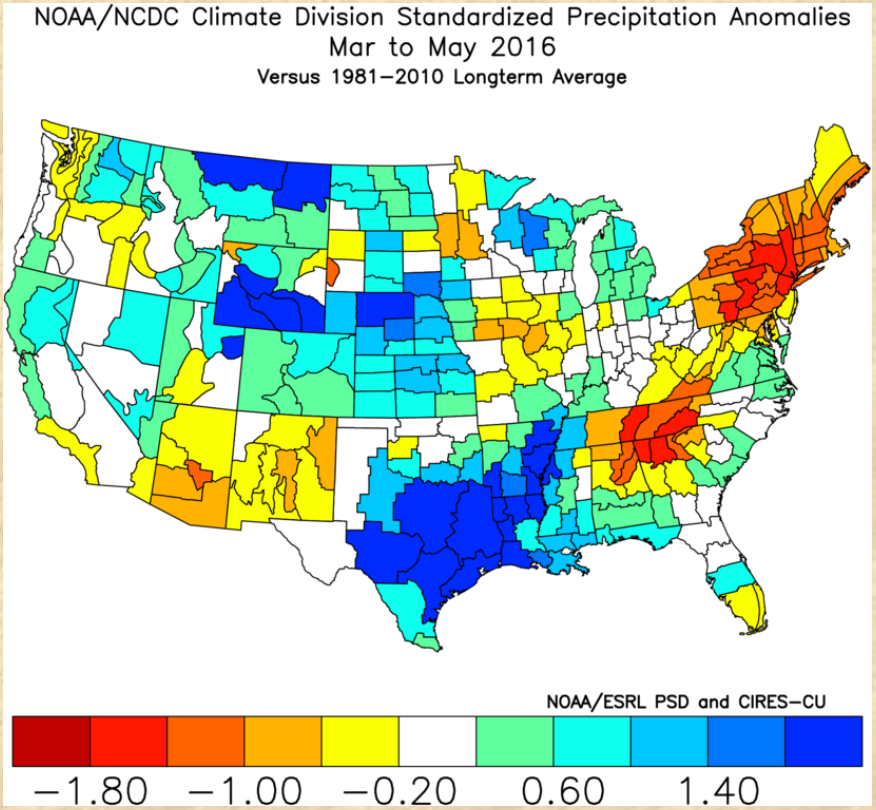
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/

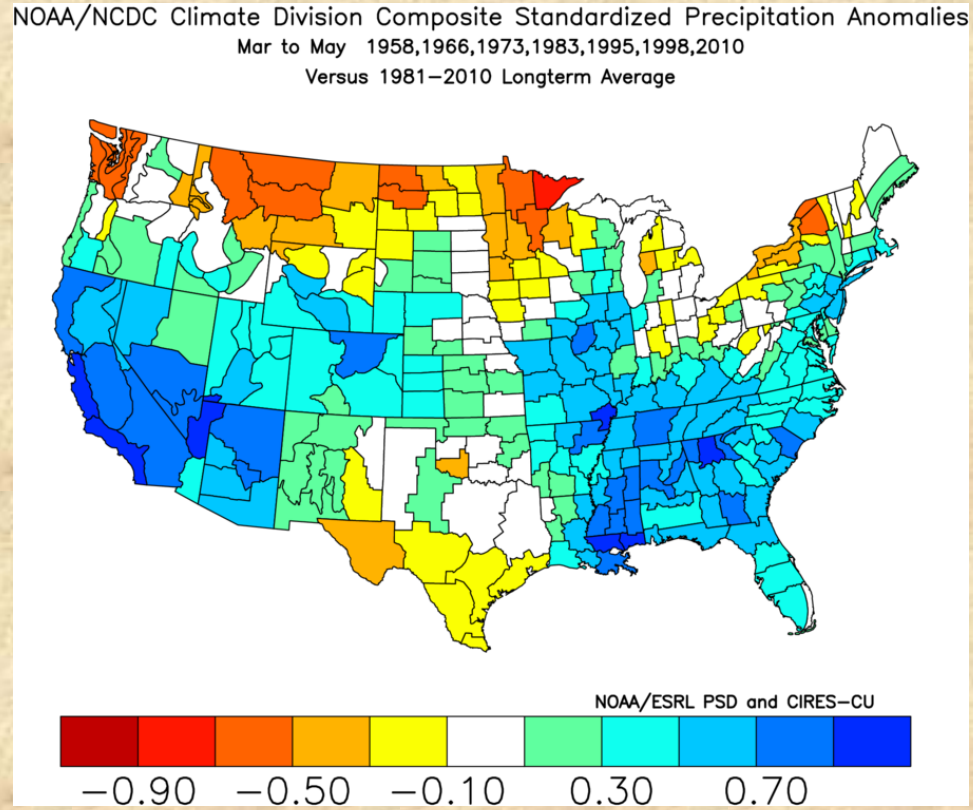
The June '16 ECMWF forecast (right) shows a brief dip into weak La Niña (-0.5C) conditions during the next few months, and a relaxation towards neutral afterwards, with increasing uncertainties. IOW, this could end up being an aborted La Niña (*negative analogue to 2012?!*).

Meanwhile, the PDO hit +2.6 in April and +2.4 in May, both record-highs. Bears watching!



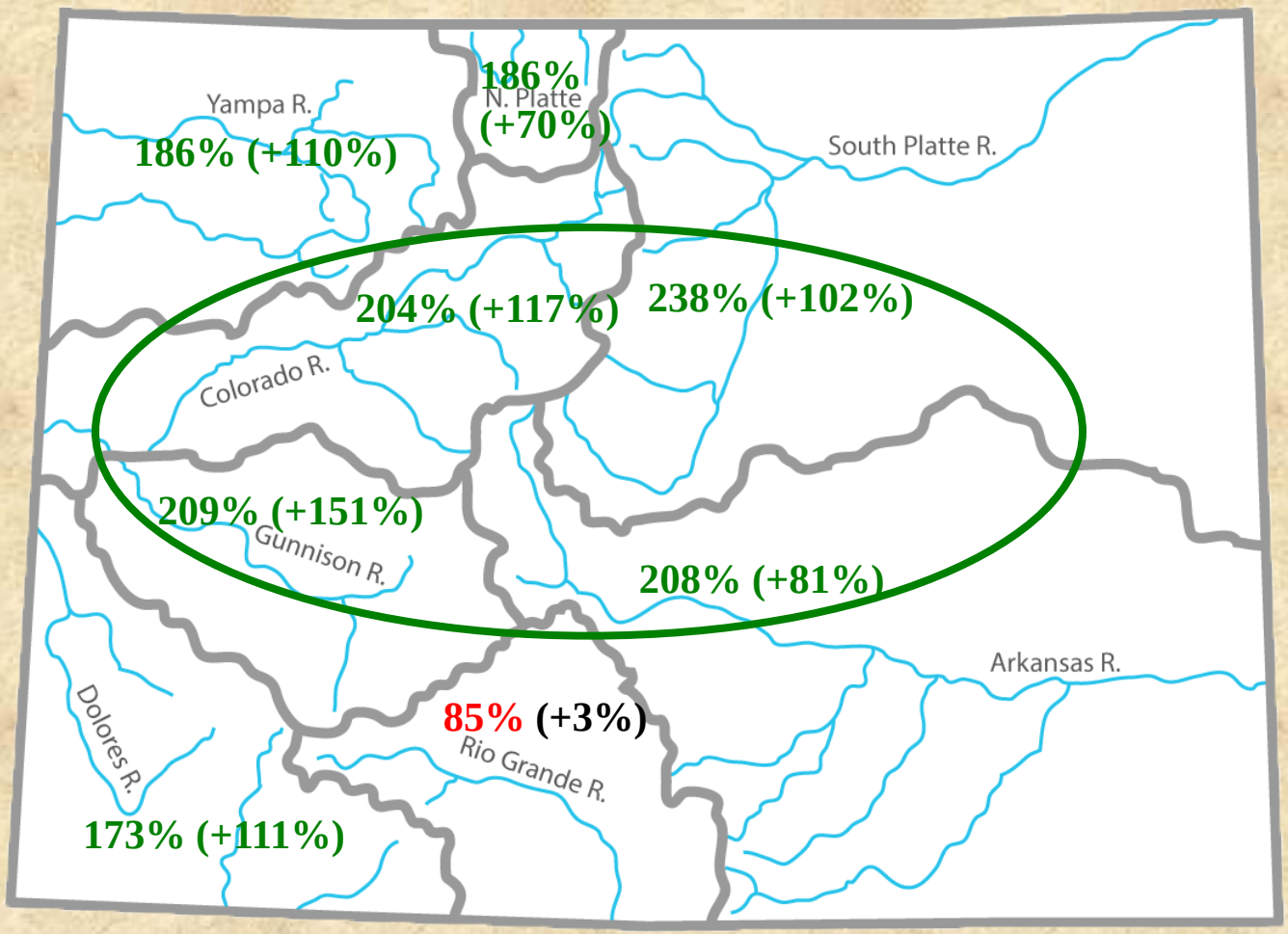
Spring precipitation versus strong El Niño expectations





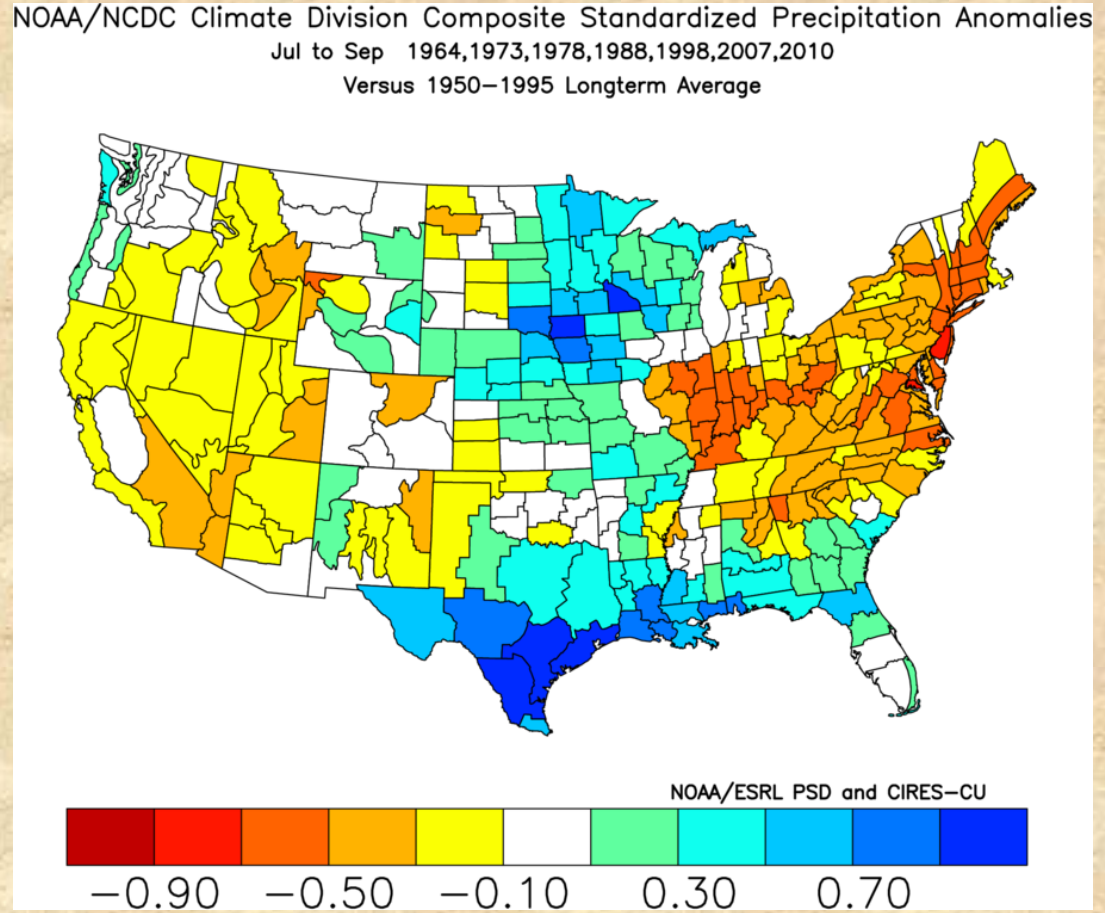
A modestly wet outcome was anticipated for spring (right), and it verified in CO and (left). *Different story for southern CA and AZ, or even UT*. This continues a theme established during the winter where the <u>El Niño footprint appears shifted to the north</u> from our longitudes westward…

Observed 1june SWE compared to my prediction two months earlier



Apparently, April and May were snowy and cold enough to overcome initial snowpack numbers on the low side (except for the Upper Rio Grande). This is consistent with typical El Niño spring behavior. *Highest percentages in central and east basins...*

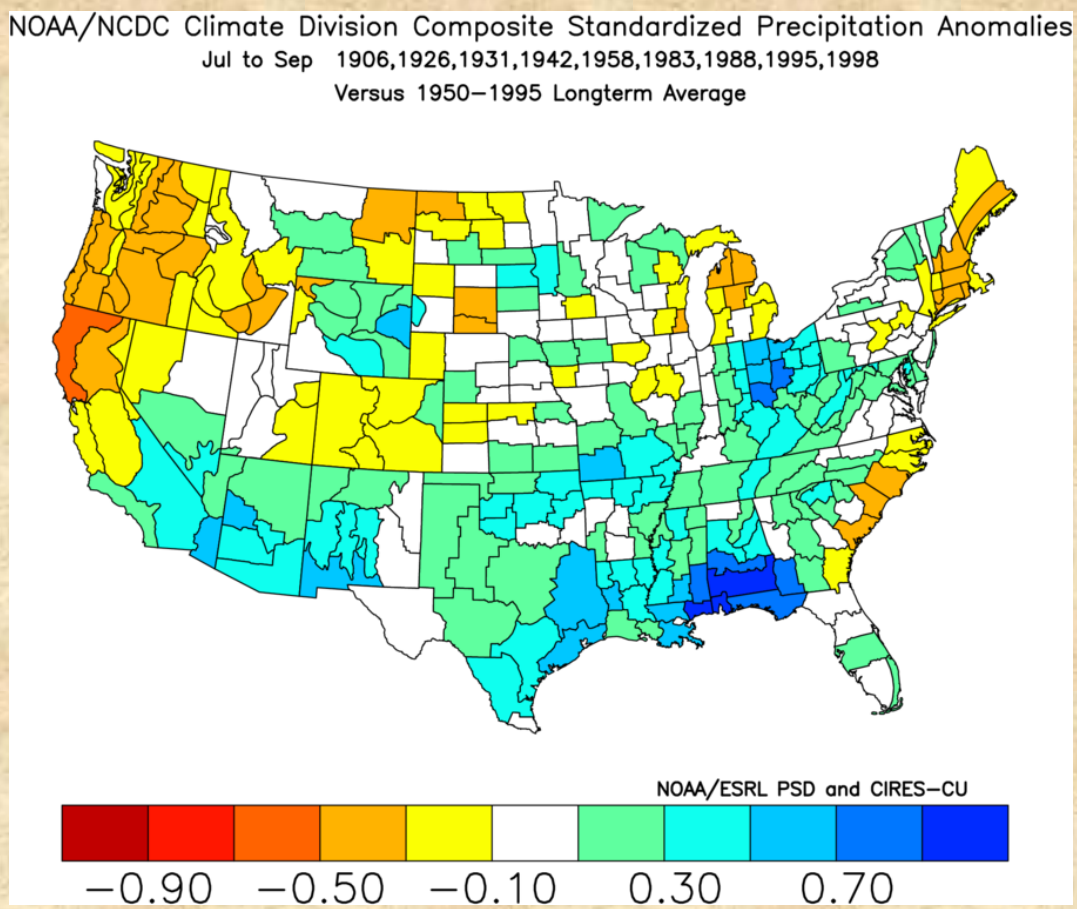
Typical late summer precipitation during at least weak La Niña AFTER El Niño winter (encore)



If we were to experience a transition to La Niña this summer, historical analogues don't give much preference for wet or dry conditions (none of these color shadings are statistically significant over CO/UT/NM/AZ).

Showed this in April.

Typical late summer precipitation after high PDO values in spring, and past-peak Niños…

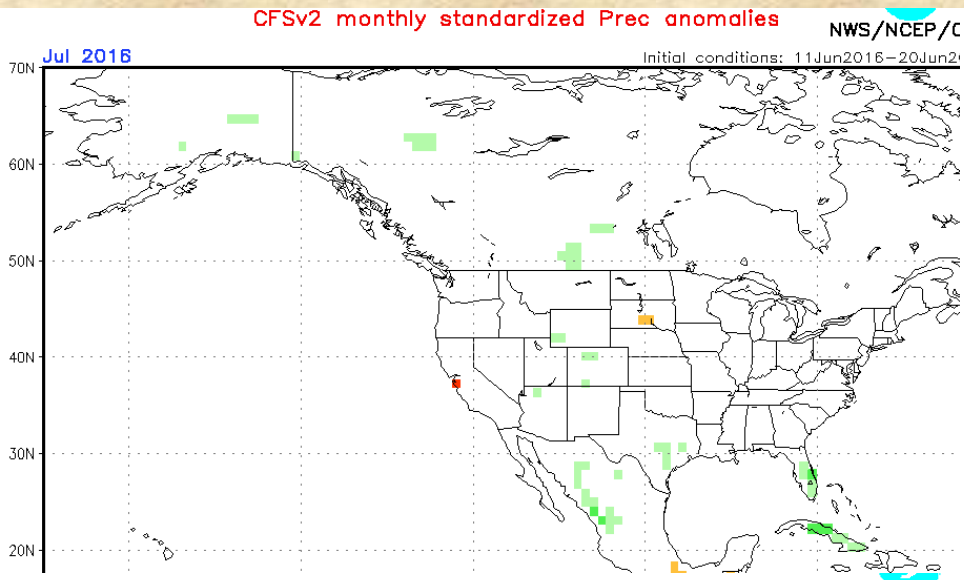


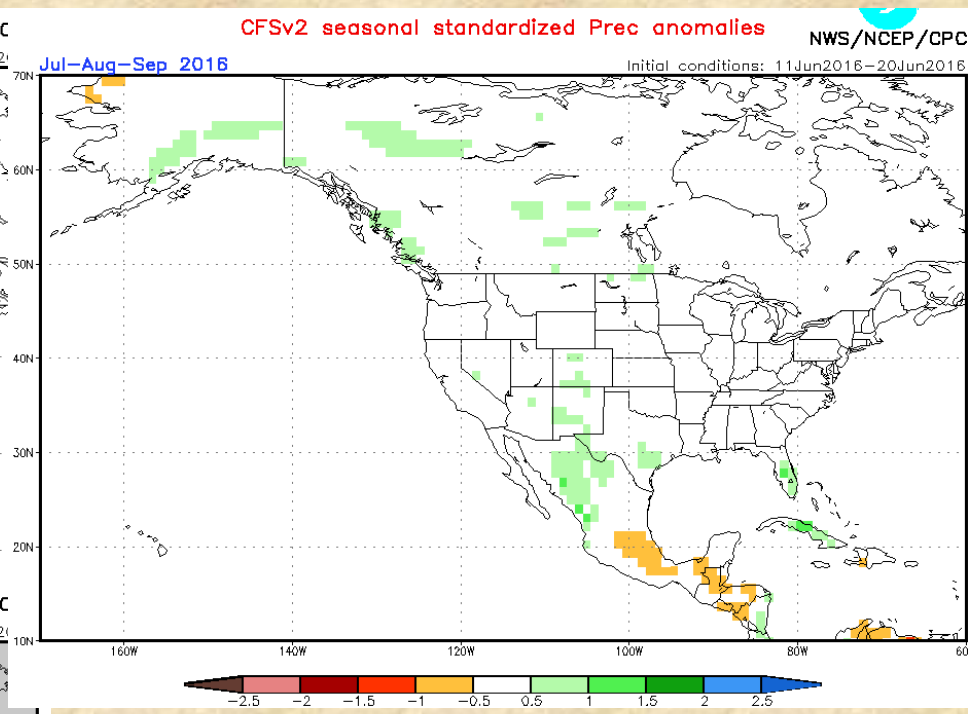
Very weak signal around here, enhanced monsoon towards Mexico.

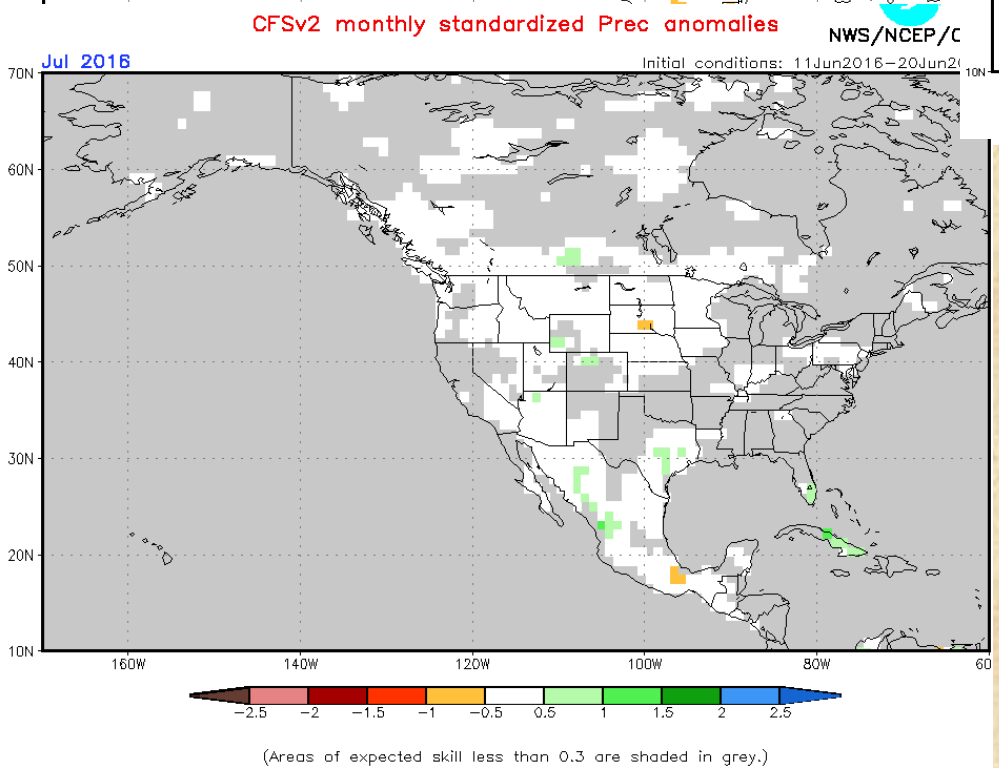
Some of these summers were followed by wet winters, especially higher up (1983-84, '95-96), but not all of them –

Stay tuned!

CFSv2 forecasts for July and July-September2016



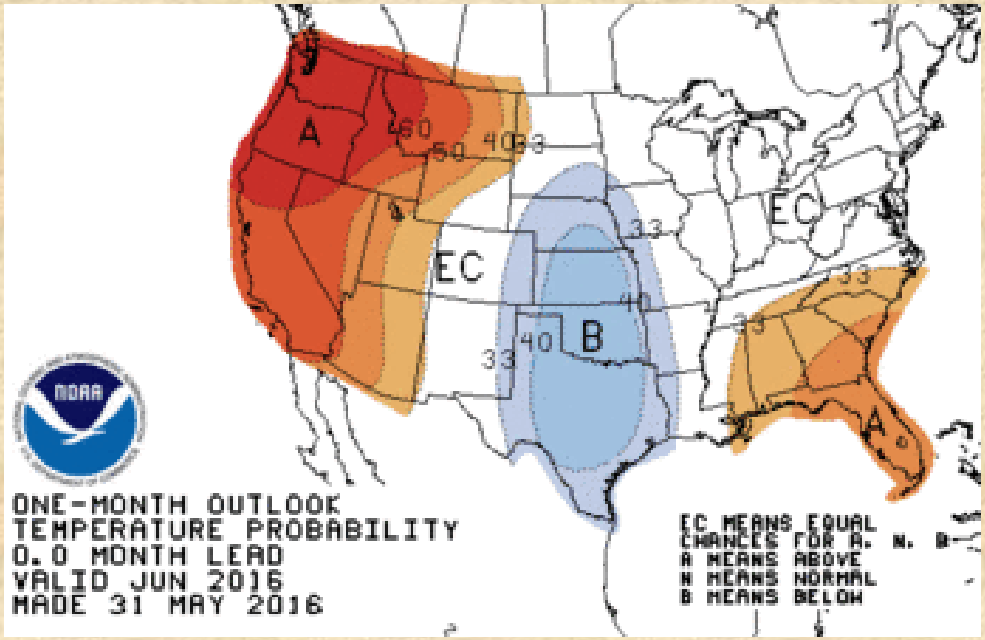




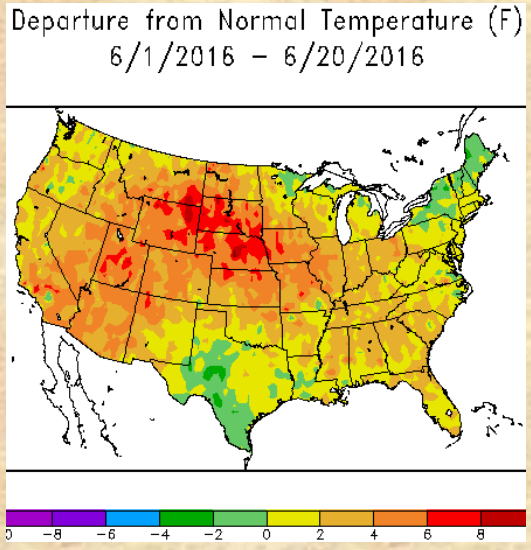
July (top left) and July-September (top right) look near-normal to isolated wet in CFSv2. This is only partially supported by skill for July (left) and does not make it thru the skill mask at all for JAS (not shown). ***All in all a weak signal!***

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

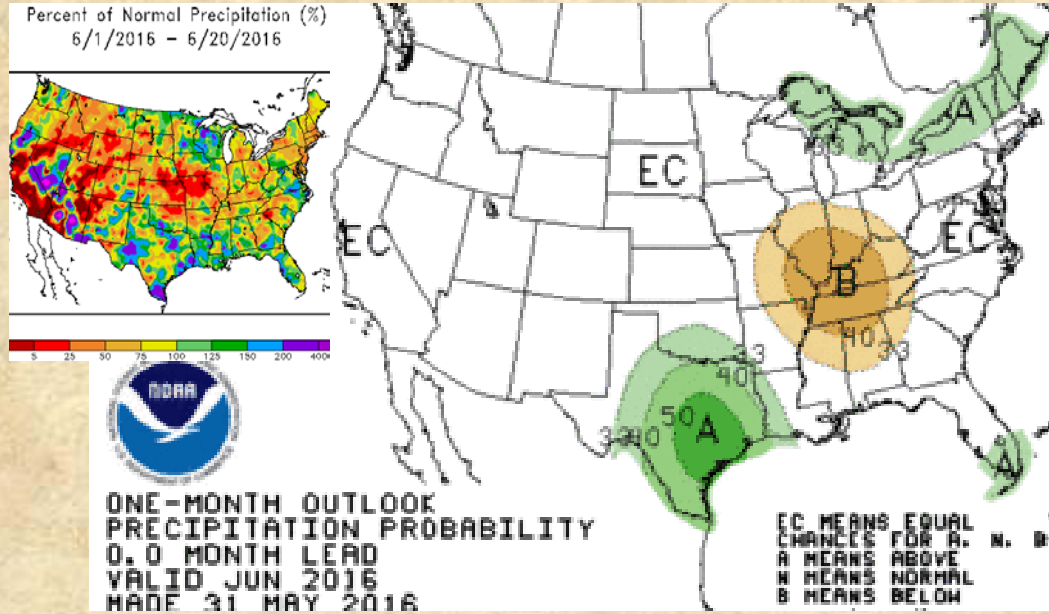
Climate Prediction Center Forecasts: June



Updated forecasts from May 31, 2016 & observations so far this month

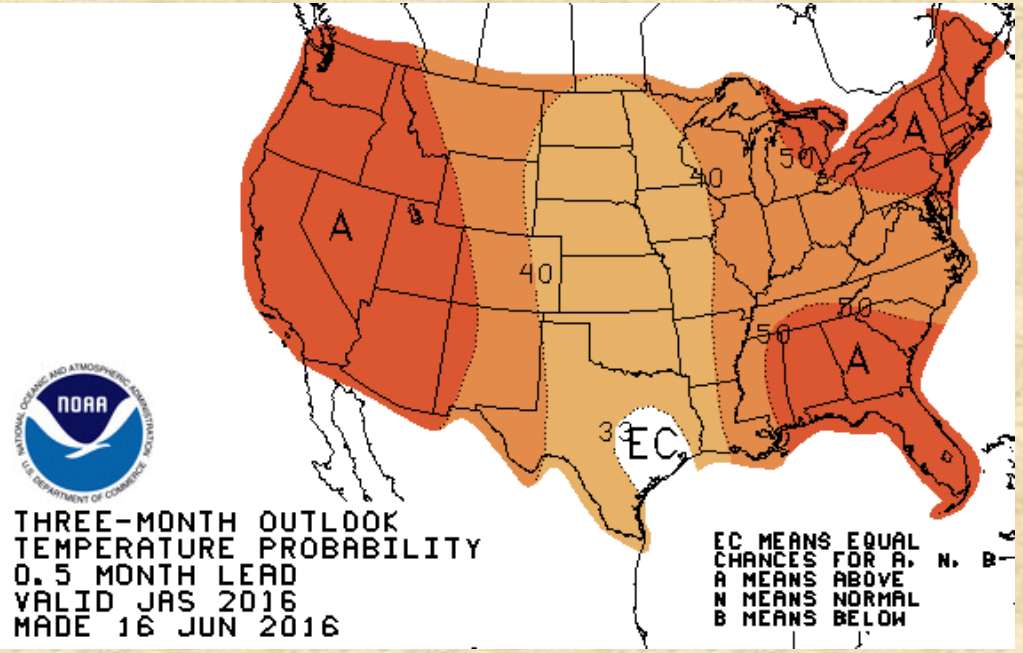


The CPC June temperature forecast (top left) was cooler over the south-central US than observed so far (top right), while the June precipitation forecast (right) did not anticipated the mostly dry conditions around here (insert)…



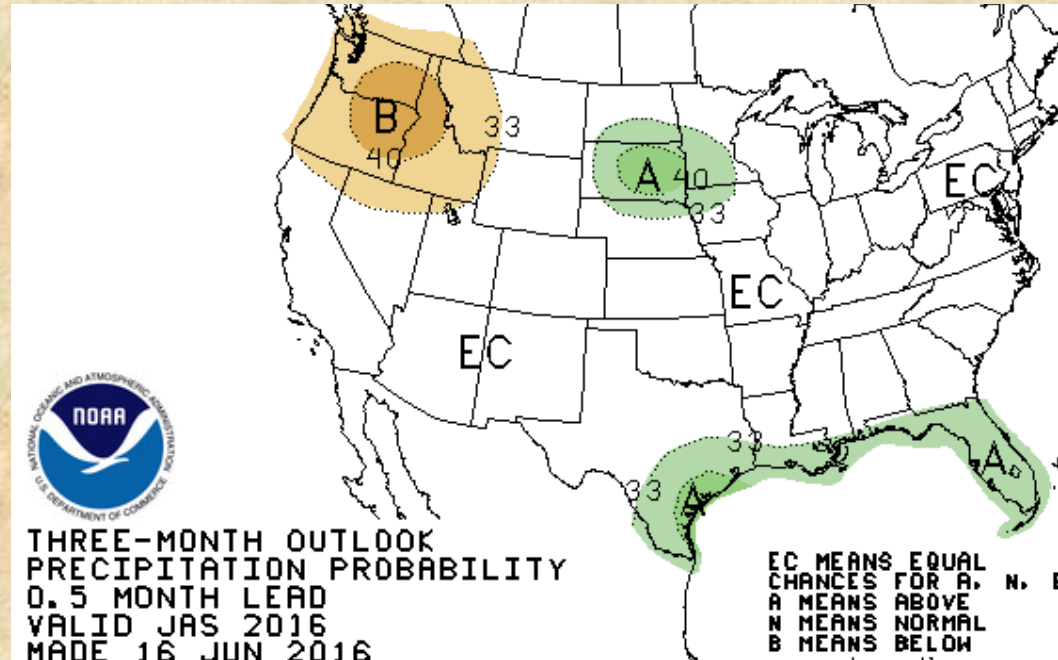
http://www.cpc.ncep.noaa.gov/products/predictions/

Climate Prediction Center Forecasts: JAS



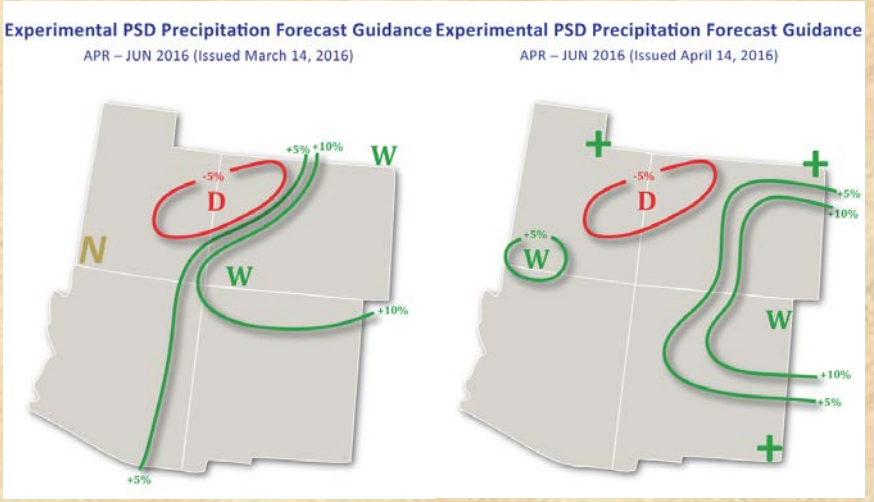
The latest CPC late summer temperature forecast (top left) is warmer than normal for all of the West. The precipitation forecast is 'EC' around here (right) – *consistent with the CFS2 output (& various composites) shown before.*

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

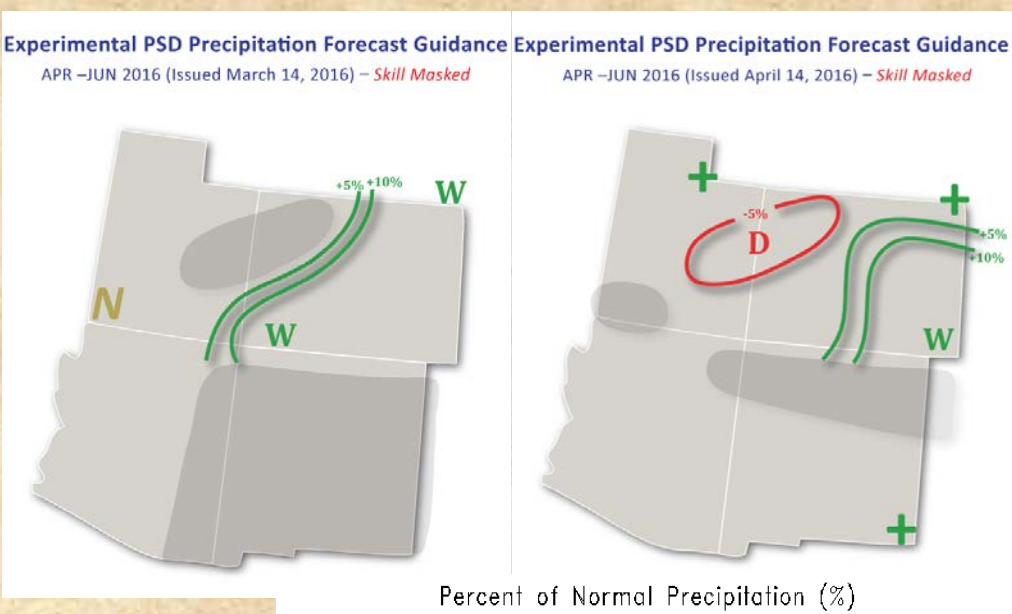


Forecasts for April-June 2016

Colorado Water Conservation Board
Department of Natural Resources



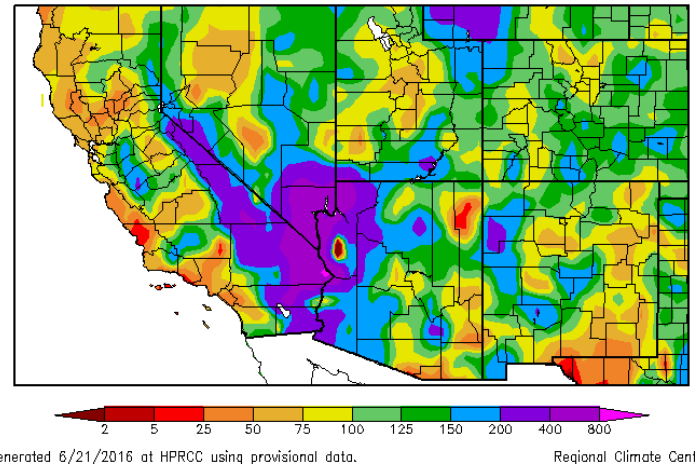
Skill-masked maps



The late spring precipitation forecasts were bullish for eastern CO, but not over northwestern CO (left). ***The latter was not supported by any operational skill in the March initialization (2nd from right), but made it thru the skill mask in April (top right).***

Looks like the wet forecast in eastern CO is on track, while the dry forecast west of the Divide was too pessimistic.

Percent of Normal Precipitation (%)
4/1/2016 – 6/20/2016



Forecasts for Jul-Sep 2016

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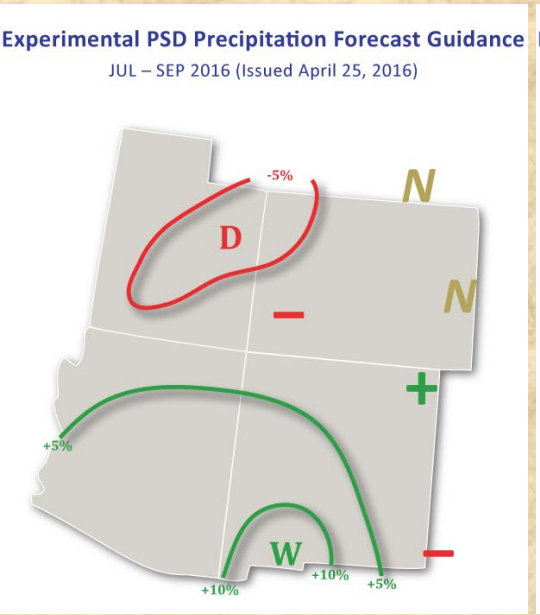
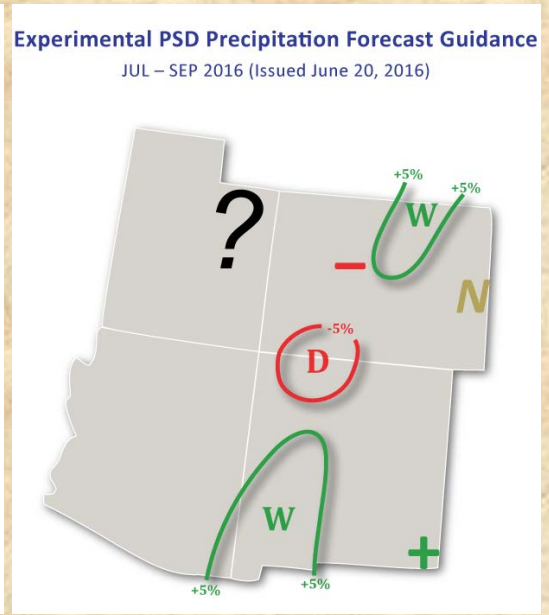
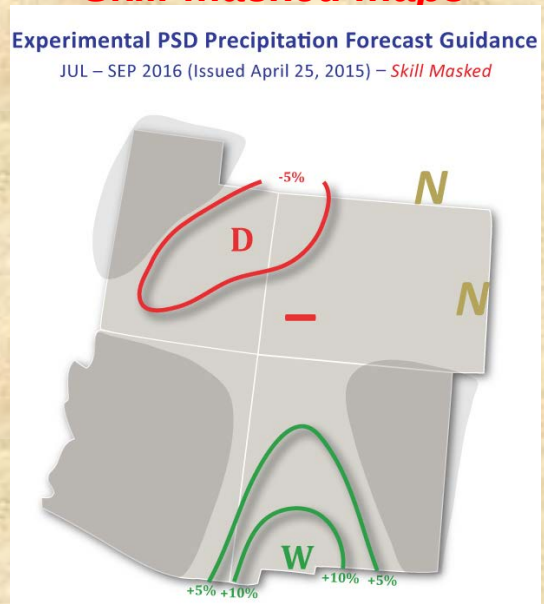
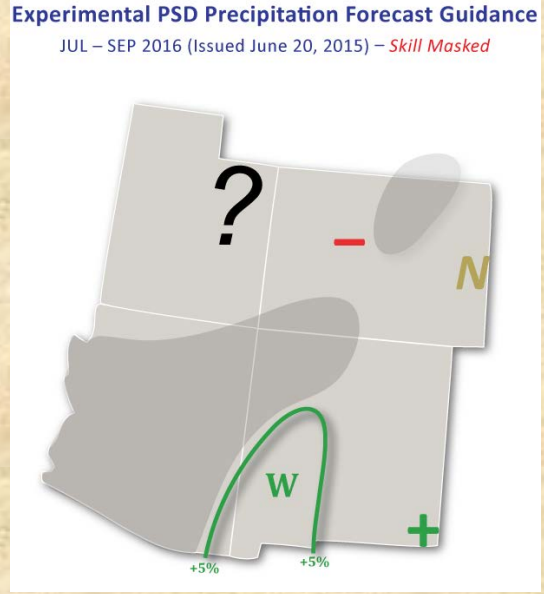




Skill-masked maps

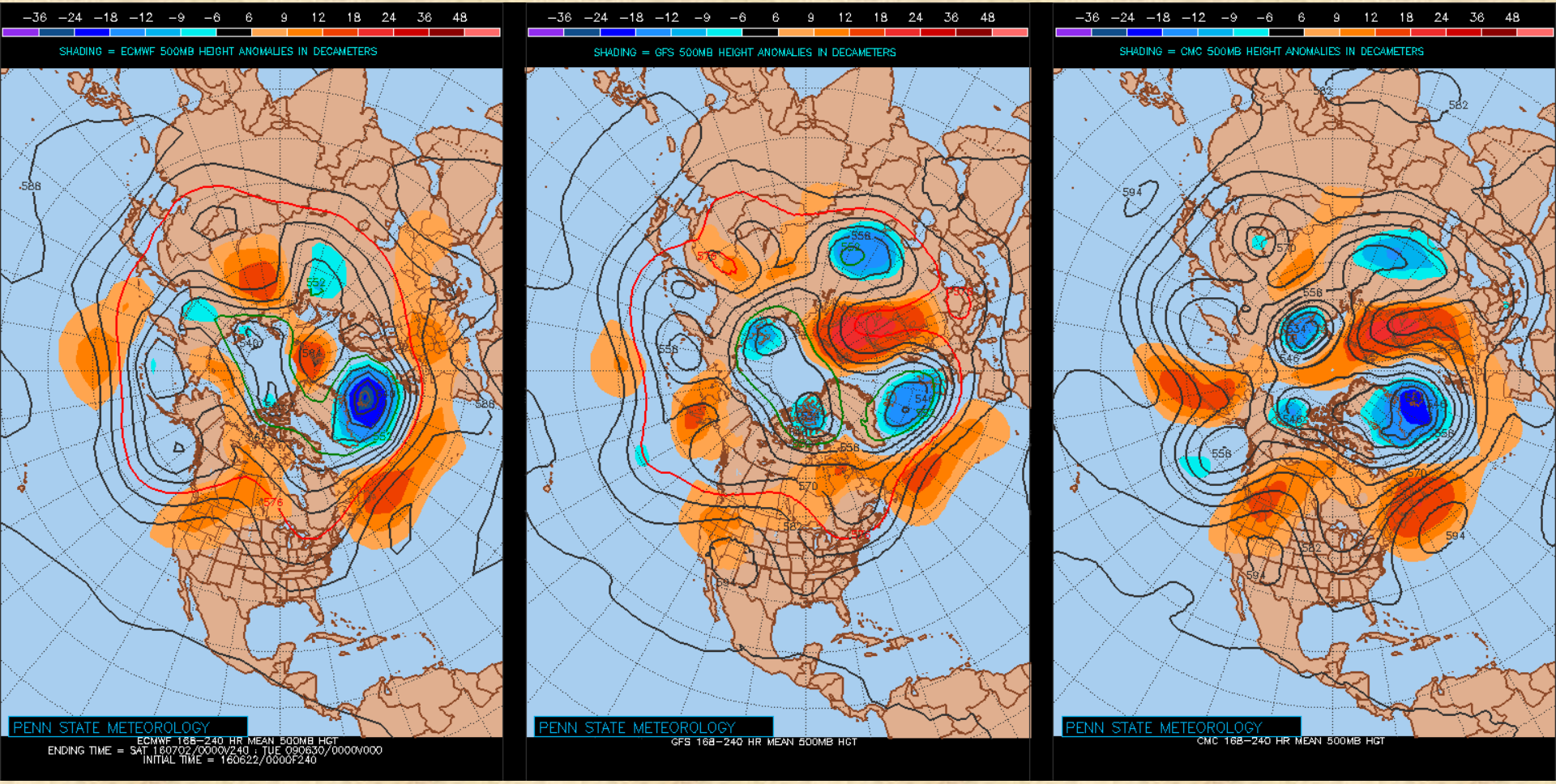




The late summer precipitation forecasts were initially favoring near-normal for eastern CO, and dry over western CO (top left). The updated forecast (left middle) is a bit more optimistic around here, but continued leaning dry over western CO.

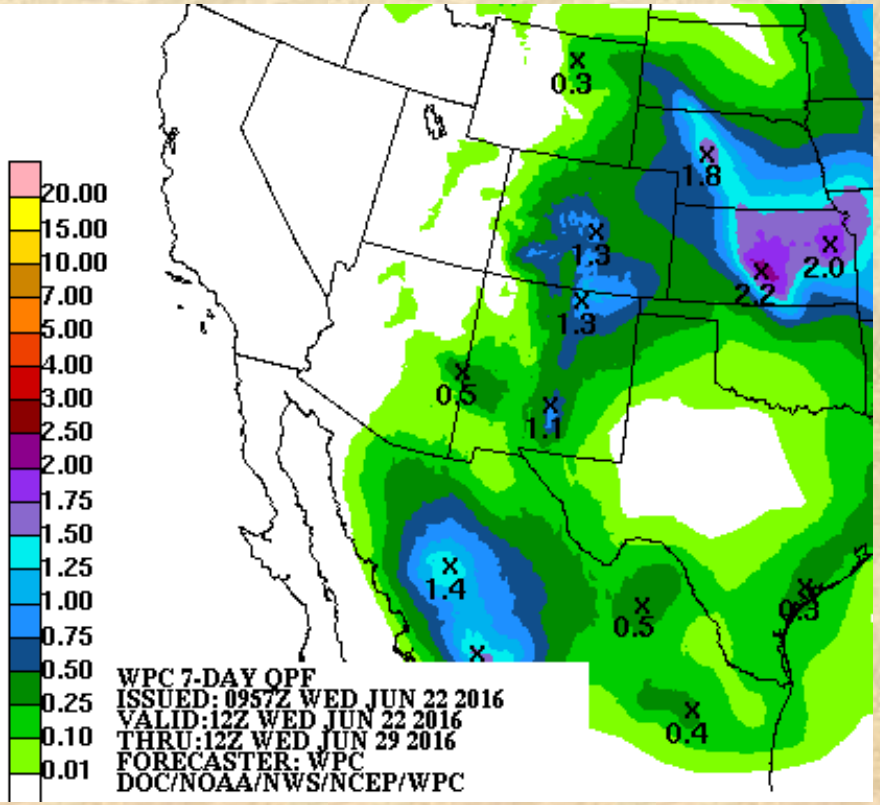
Skill-masked forecasts did not change the original forecast for CO (top right), but took out both the wettest (Front Range) and driest (San Juans) forecasts in update (bottom right). All in all, the most 'vanilla-flavored' monsoon forecast in my memory, not unlike CPC/CFSv2/composites.

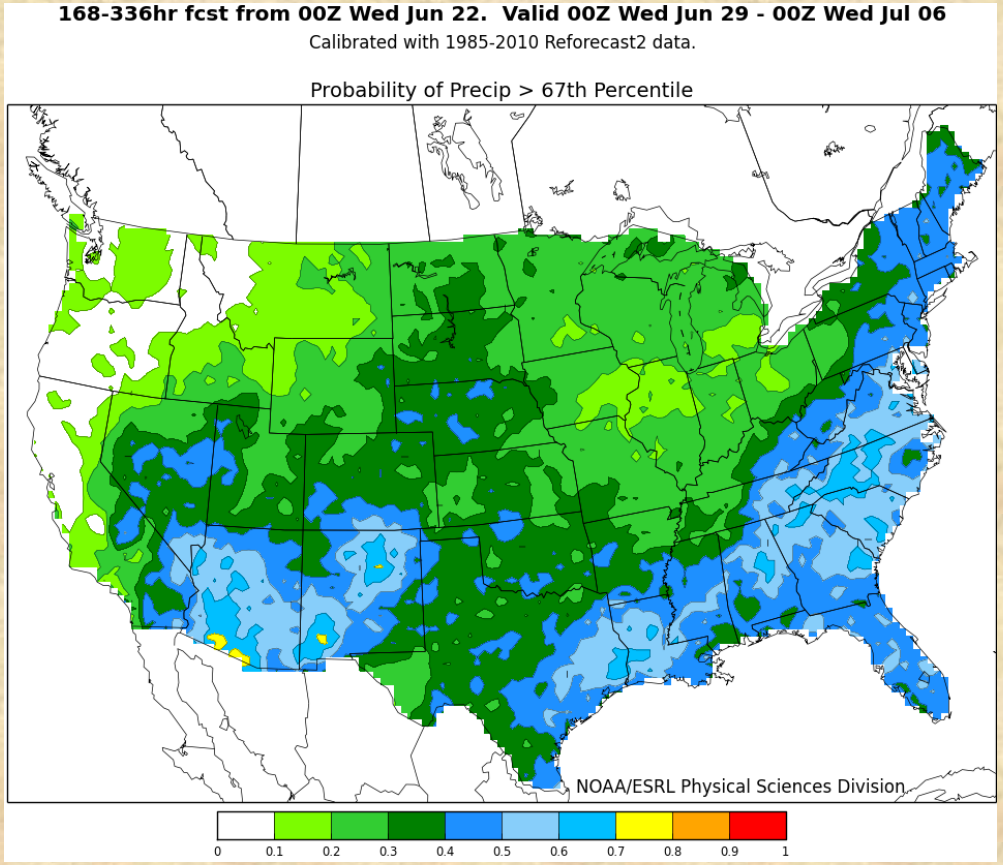
What can we expect next week?



ECMWF (left), GFS (middle,) and CMC (right) show continued ridging to our northwest, especially in Canadian model (right). This should keep the hottest weather to our west, and allow for occasional incursions of cooler air from the north…

What can we expect for next two weeks?





WPC forecast for the 1st week (left) shows decent moisture totals for the mountain, but only 1/4" or so at lower elevations (mostly in 1st 3 days, crossing fingers on that), while the extended reforecast for Week 2 (right) hints at the onset of the monsoon in AZNM by early July…

We often get late June heat&dryness before the North American monsoon gets established – here is hoping that those forest fires to our south do not interfere too much!

Executive Summary (22 June 2016)

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- **El Niño is winding down, fastest in terms of the Niño 3.4 index. In my book, this has been the 3rd strongest event of the last century. It remains unclear whether La Niña will get a firm foothold this summer.**

- **All in all, Colorado did quite well (wet) with this El Niño, especially during spring, and in comparison to other states to our south and west that ended up drier than expected.**

- **In rare unanimity, none of the forecasts for our monsoon season are showing any strong tilts towards wet or dry. This is true for CPC products as well as my own composites and experimental forecast guidance.**

- **The next two weeks promise continued hot weather over the Western US, with a gradual transition towards a monsoon onset in AZNM by early July.**

- **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.** ***Given the record-high PDO this spring, a La Niña would have to overcome the influence of the former. Examples for weak La Niña conditions with positive PDO conditions going into the following winter include 1983-84 and 1995-96 – we should be so lucky!***