Earth System Research Laboratory
Physical Sciences Division

CIRES
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Colorado WATF,
15 April 2015
Denver

Seasonal Outlook for Colorado

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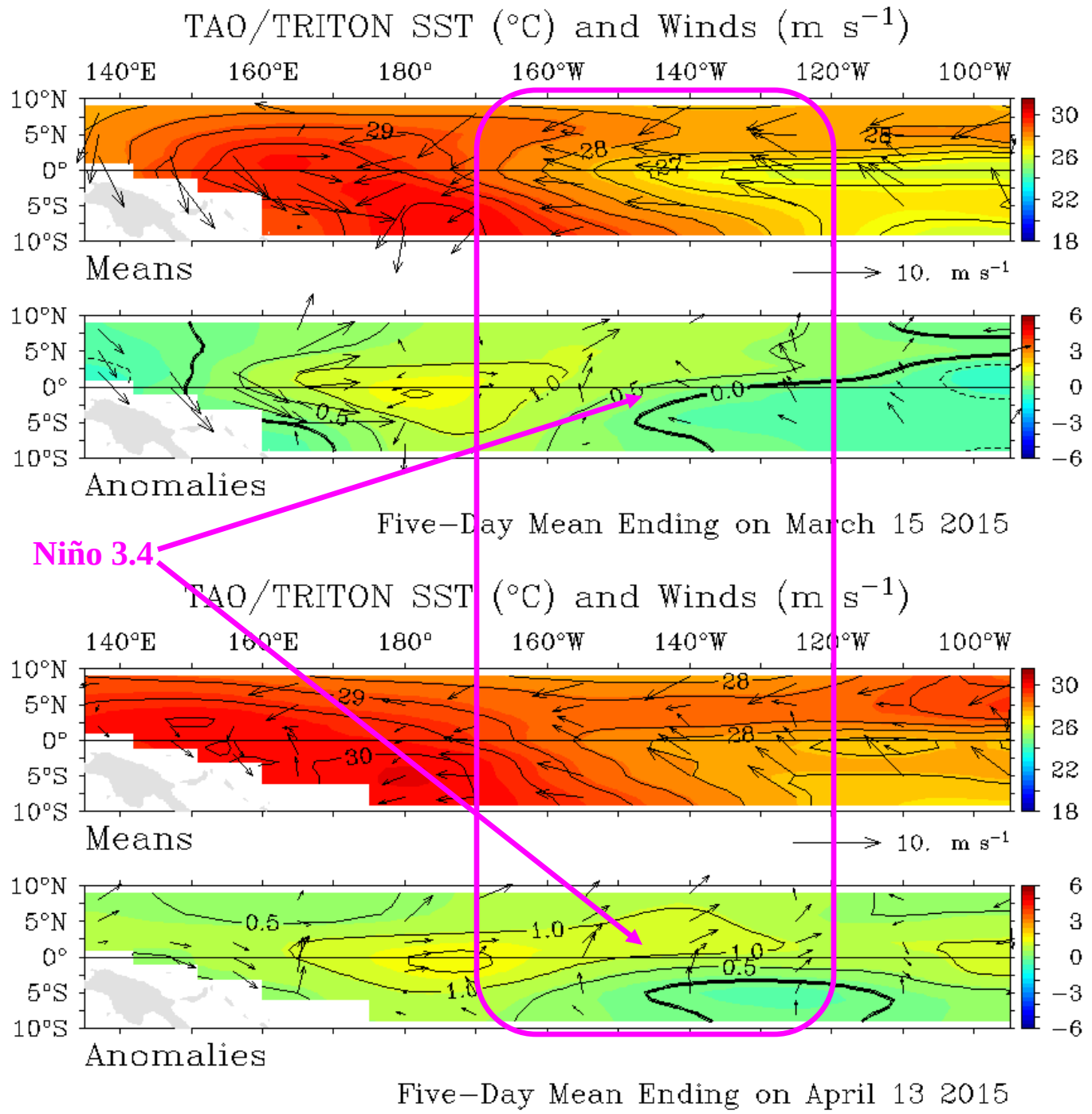
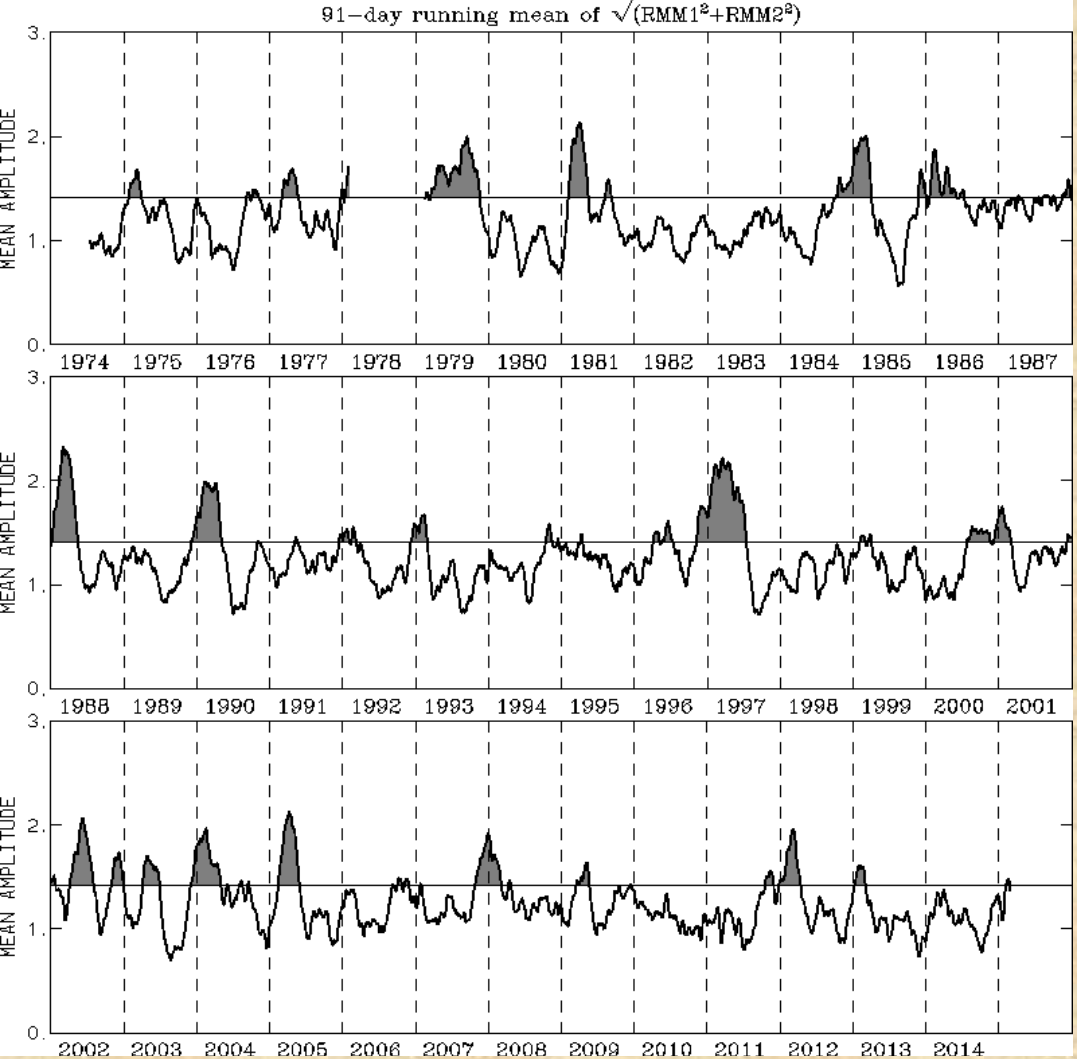
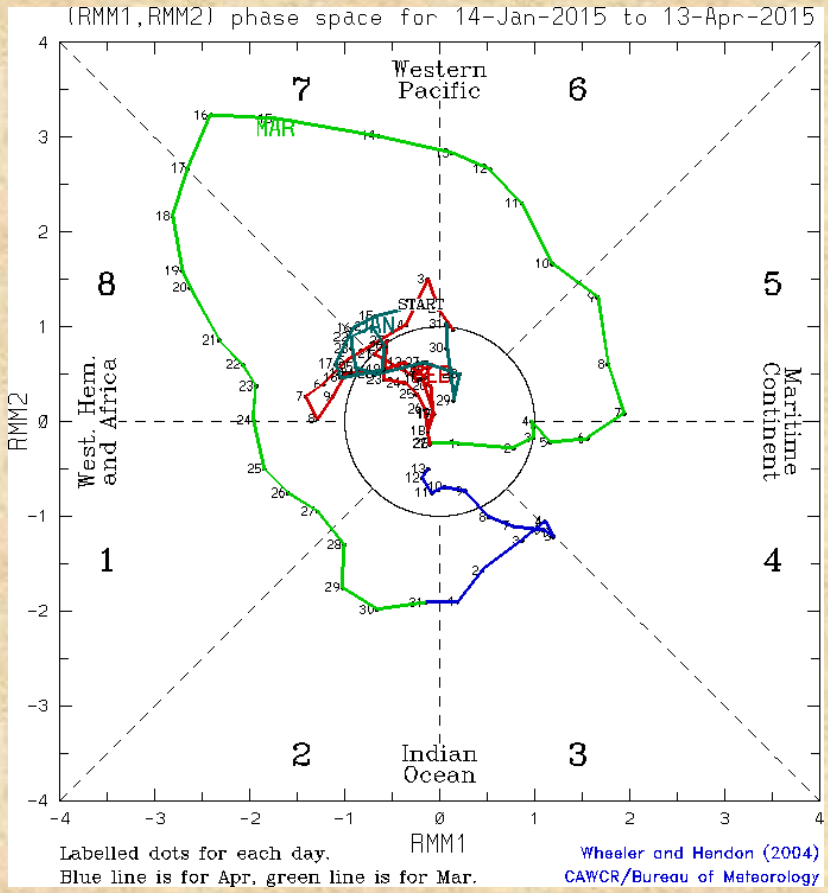
- **What has happened to ENSO(+), what will happen next, and what does that mean for us?**
- **CPC forecasts into summer**
- **Experimental precipitation/SWE guidance**
- **Executive Summary**

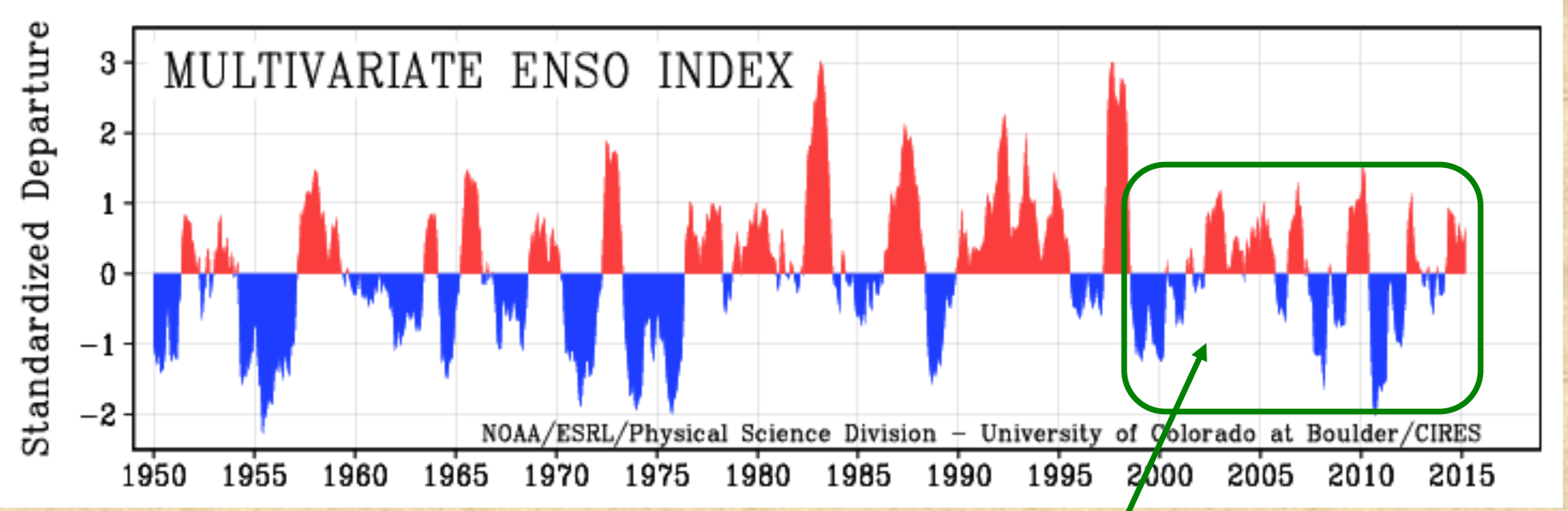
Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to last month (top): Recent SST have come up a bit along the Equator (Niño 3.4 now at +0.7C), while wind anomalies have finally continued from the west, thus promoting further growth.

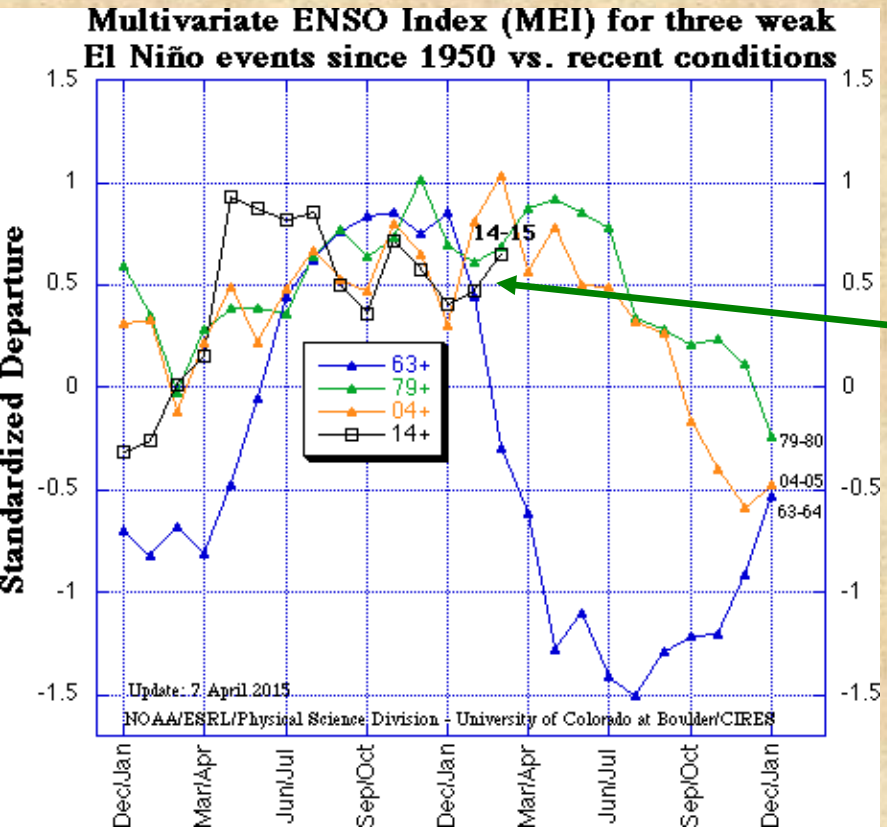






After a few years of being 'AWOL' (left), the MJO had a good run last month (right). ***Maybe I should call it the "Rockies'15 run"?***

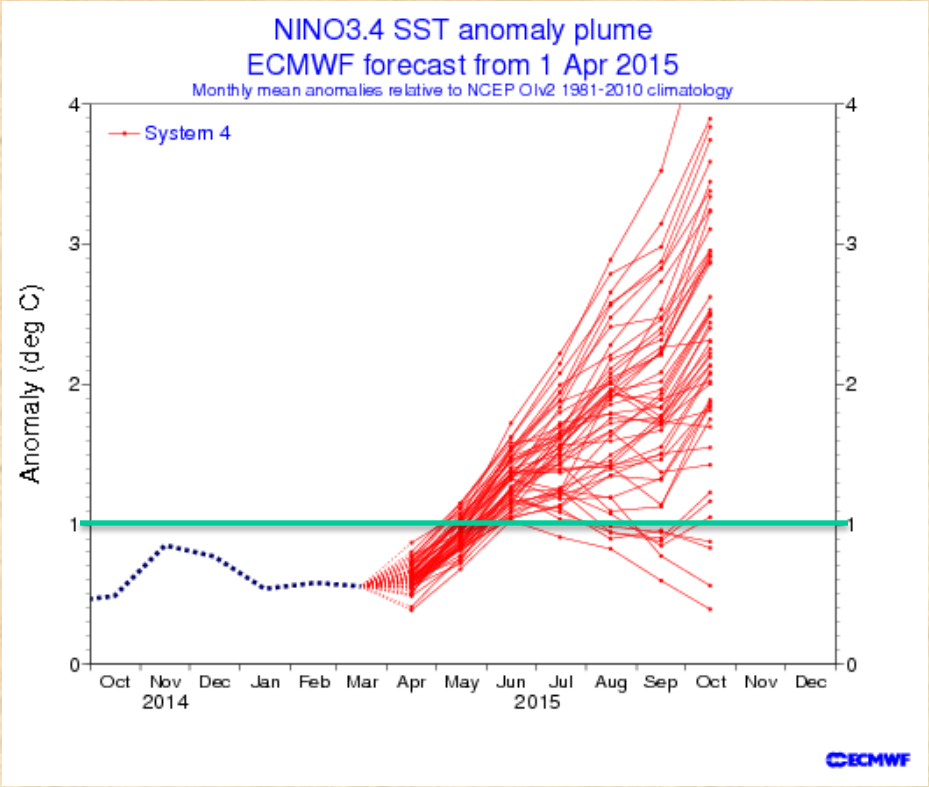




Since late 1998 we have been in a regime that favors La Niña, but does allow for occasional El Niño events, mostly of the weak-to-moderate variety.

Since April-May 2014, the MEI has indicated off-and-on El Niño conditions, similar to the 2004-05 event. While 1979-80 shared this behavior as well, 1963-64 is a good counter-example of a weak El Niño that came out of La Niña and returned back to it as soon as it could.

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

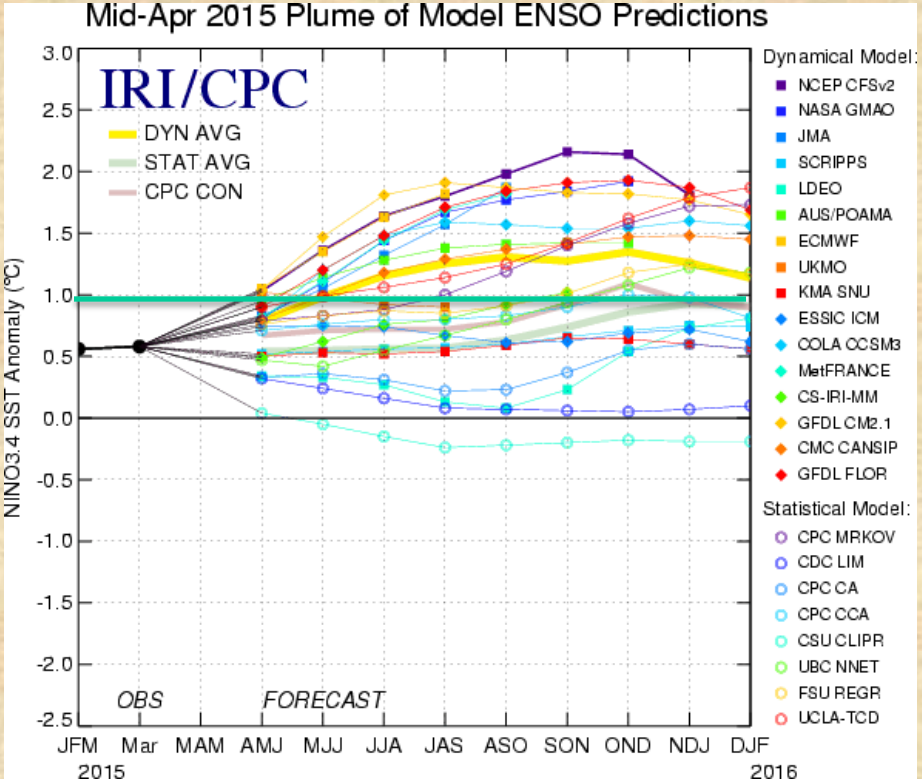


The ECMWF April 2015 forecast (left) remains very bullish, with 100% of the ensemble members hitting at least+1.0° C by June! Sizable fraction of runs even hits new records (3° C+) by October...

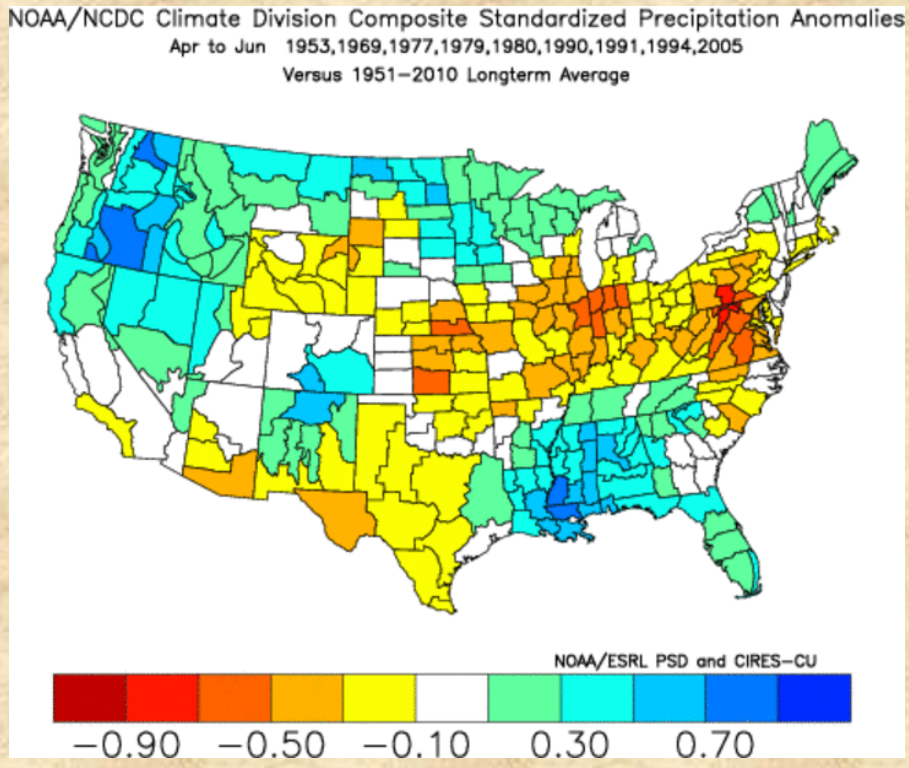
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/

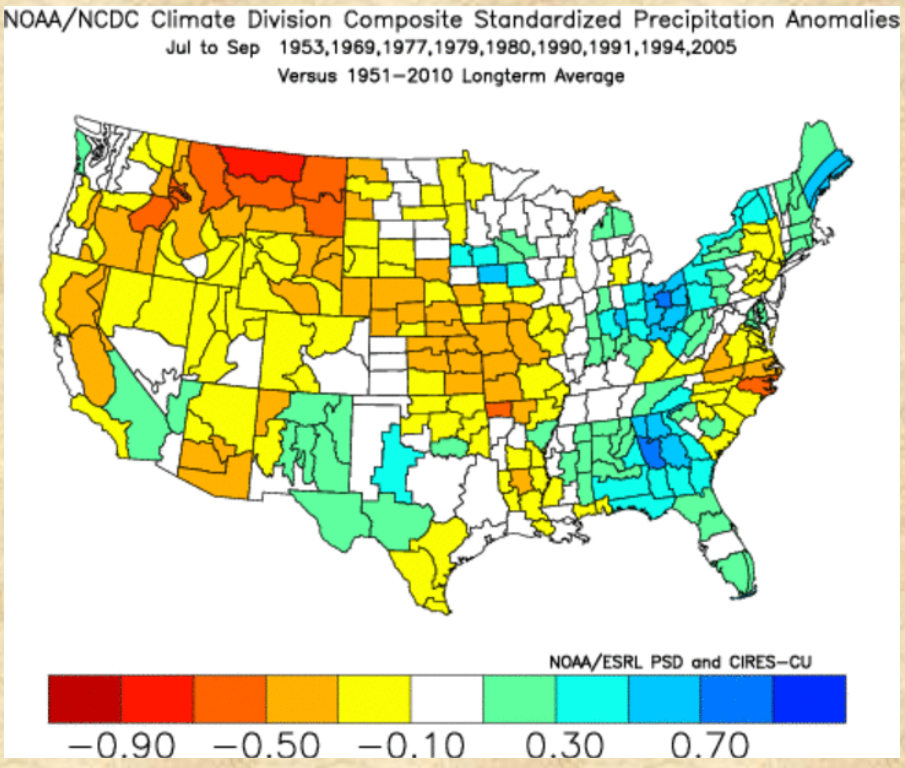
The preliminary IRI plume from all available forecast models (right) shows a more bullish outlook by most models, including finally some statistical ones in addition to the usual (dynamical) suspects.

http://iri.columbia.edu/wp-content/uploads/2015/03/figure4.gif



MEI-based analog cases (last month's version)

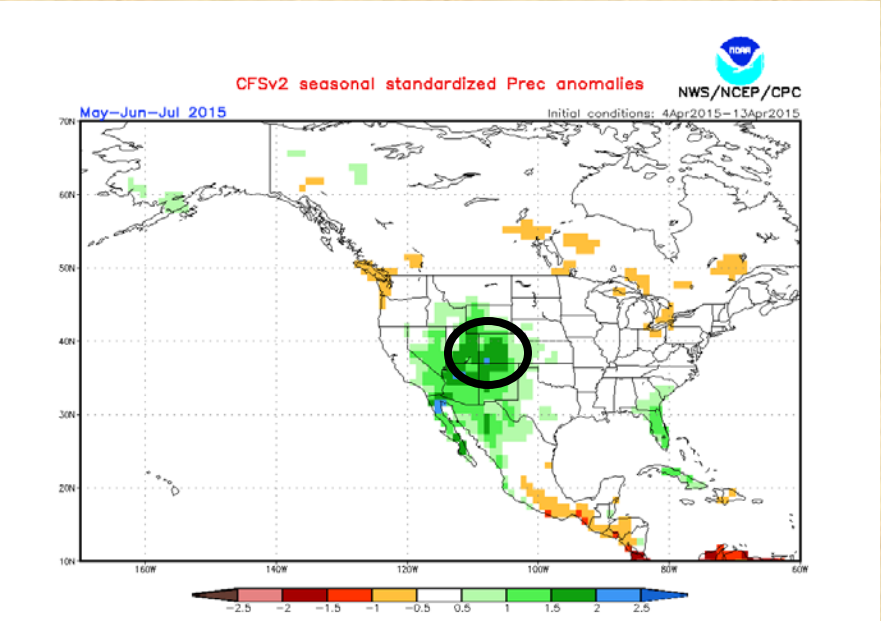


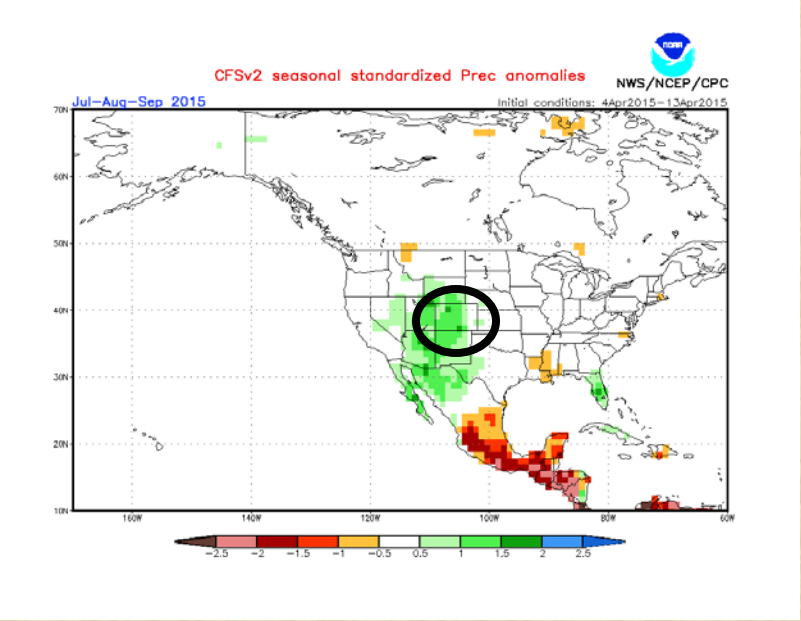


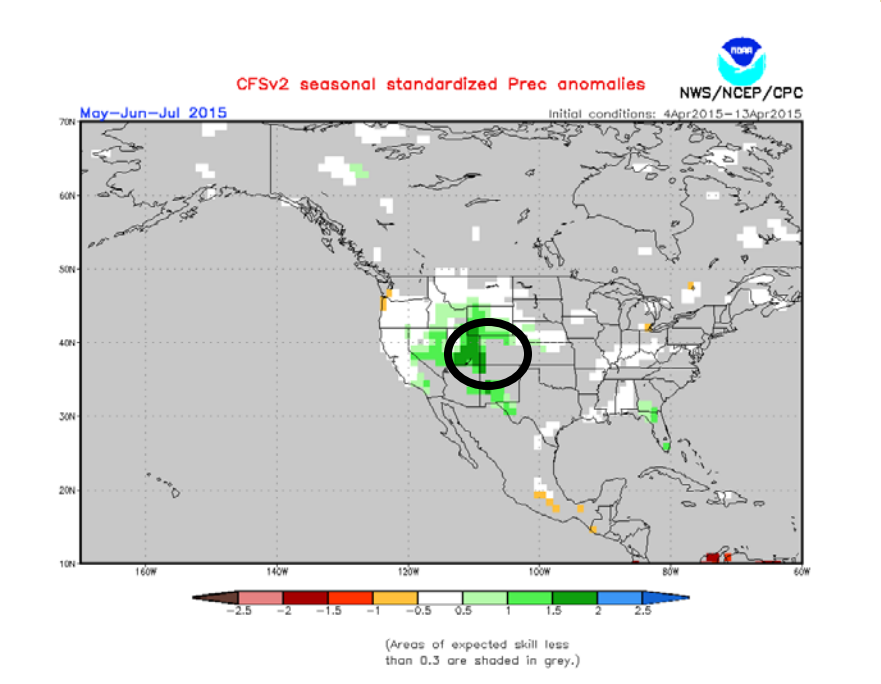
Weak El Niño composites for April-June (left) and July-September (right) favor wet spring in SE Colorado, neutral odds elsewhere. ***Keep this in mind when we look at my independent statistical forecast.*** **Meanwhile, a first peek at the summer is 'vanilla-lemon' flavored'...**

Heads-up: incoming storm could give us the seasonal outcome within a week...

CPC Coupled Forecast System Version 2



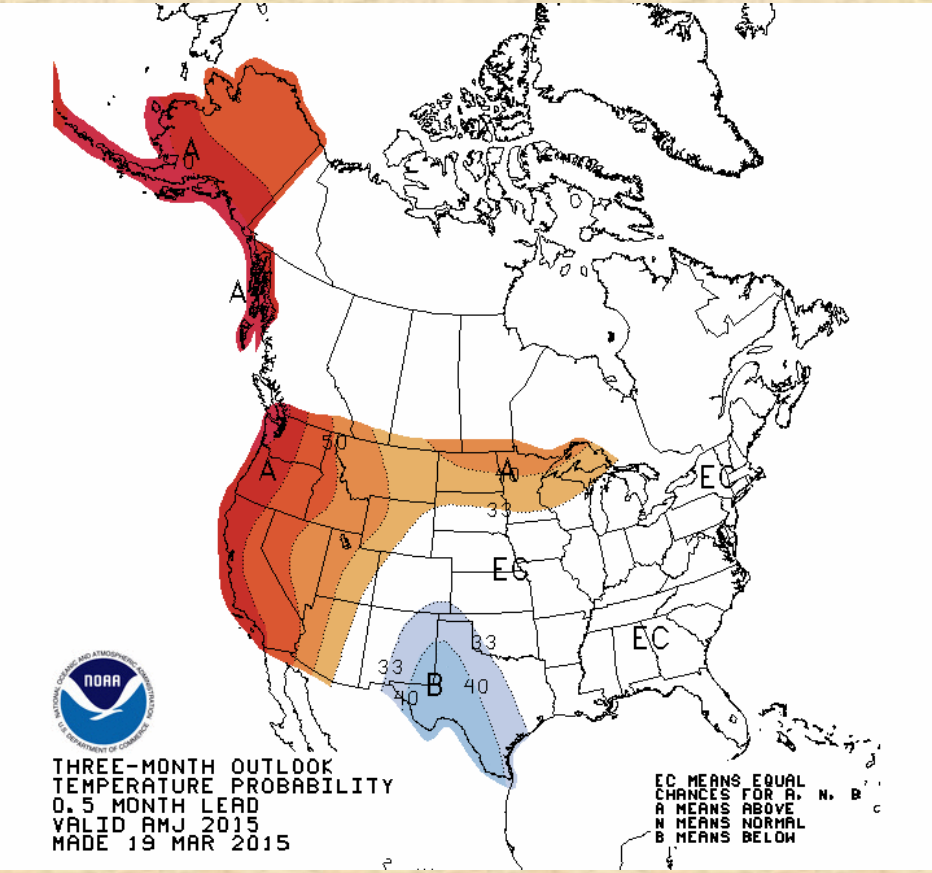


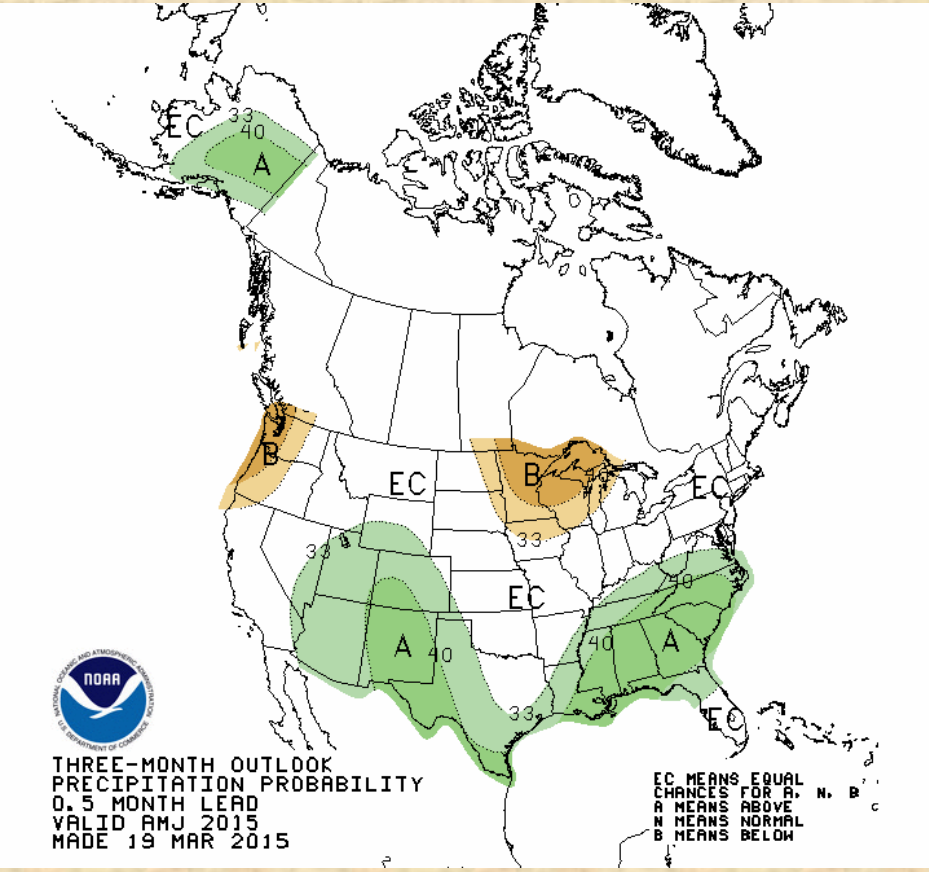


CFS forecasts for May-July (left) and July-September (right; top = standardized anomalies/bottom = same with skill mask) favor wet late spring and summer conditions, unfortunately with only little skill (better for 1st season than summer). After last year's success, this model 'rules'...

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

Climate Prediction Center Forecasts

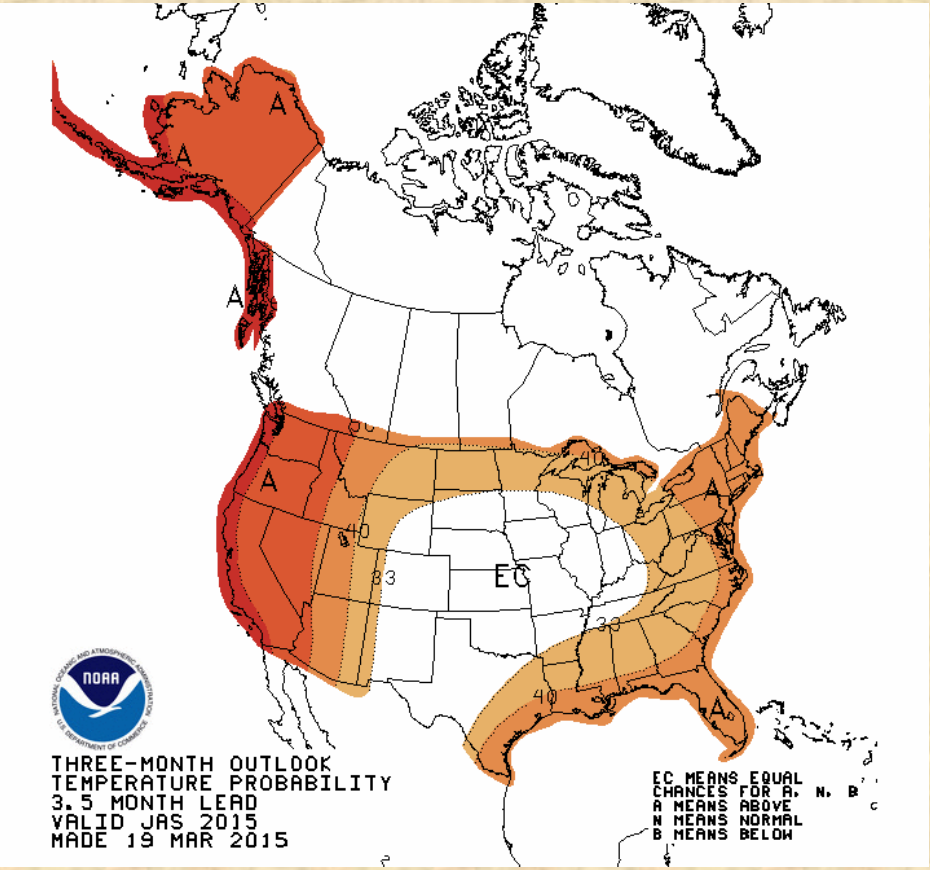


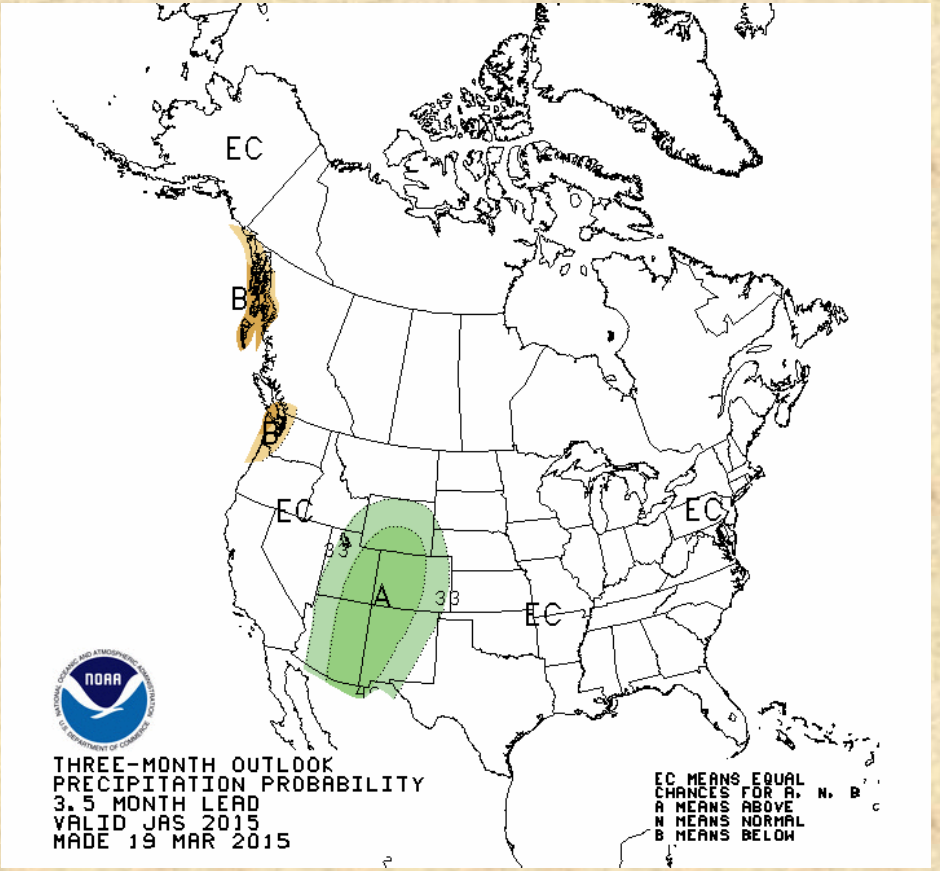


The spring temperature forecast by CPC (left) keeps Colorado undecided ('EC'), with warmth to the west (nothing new there). Their moisture forecast (right) continued surprisingly bullish (related to El Niño).

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

Climate Prediction Center Forecasts

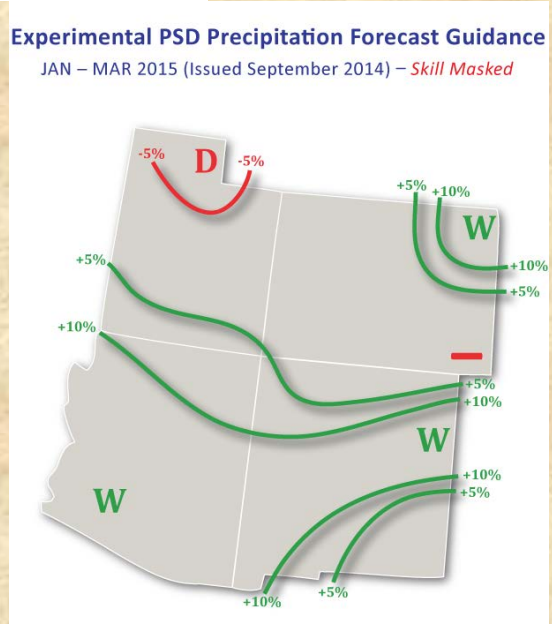


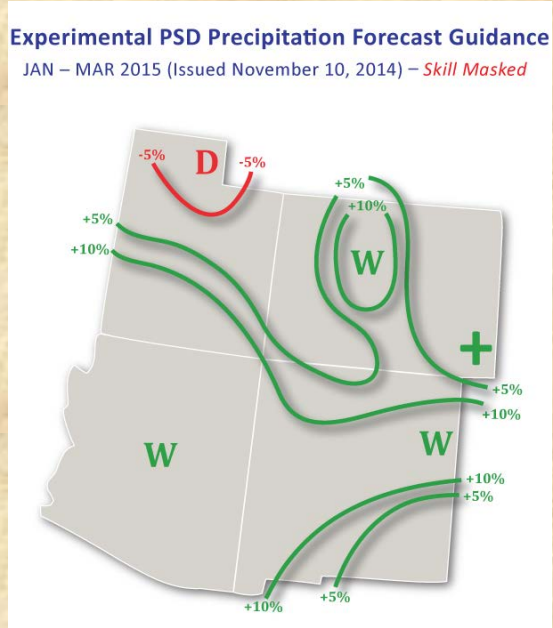


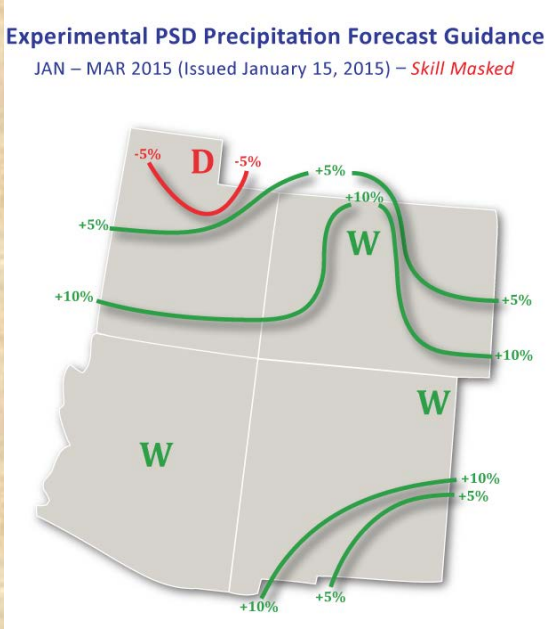
The summer temperature forecast by CPC (left) puts Colorado on the edge of warmth to our west, as has been the case for quite a few seasons. Their moisture forecast (right) commits to an active monsoon... The updated forecast will come out tomorrow…

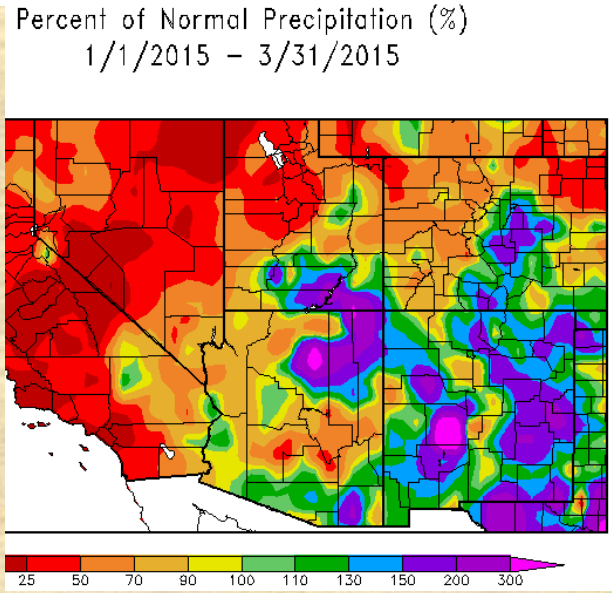
Source: ***http://www.cpc.ncep.noaa.gov/products/predictions/***

‘Postmortem’ January-March 2015





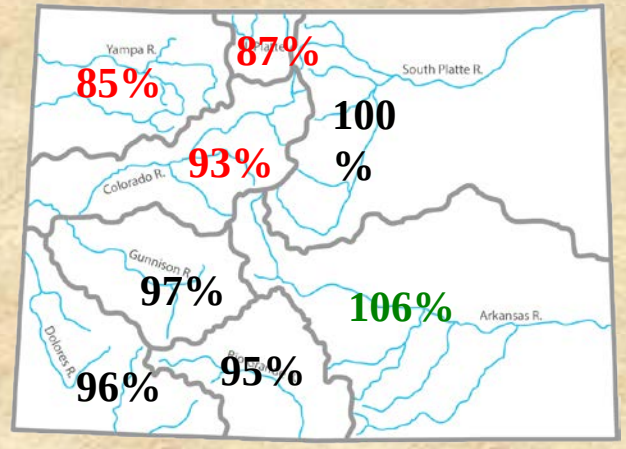


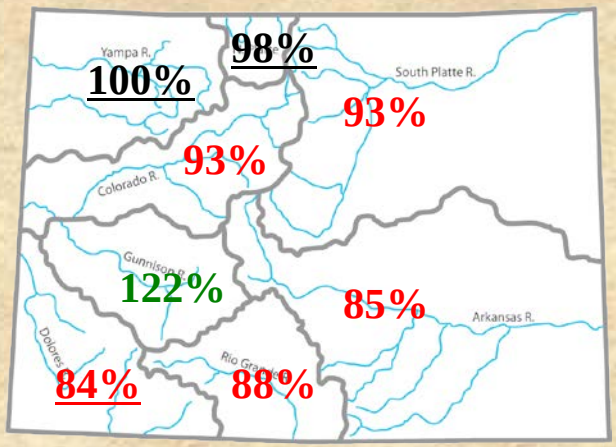


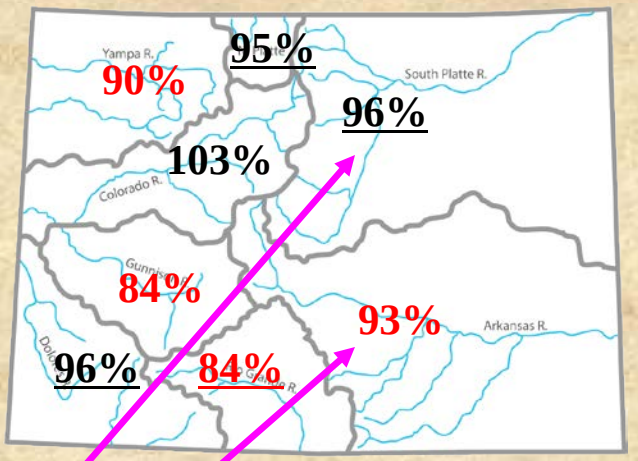
The skill-masked winter forecasts (latest on the right) showed a wet tilt for most of CO. The only CO region not covered by skillful forecasts in last two updates was in the northeast corner.

From a broader perspective, note the persistent tilt towards drought conditions in northern Utah. Unfortunately, the latter ended up extending all the way into NW Colorado. But the overall skill score for the map ended up positive, thanks to February (alas, not March)...

Median Forecast 1apr SWE
ENSO (left), 1oct (middle), and 1jan (right) vs observed (bottom right)

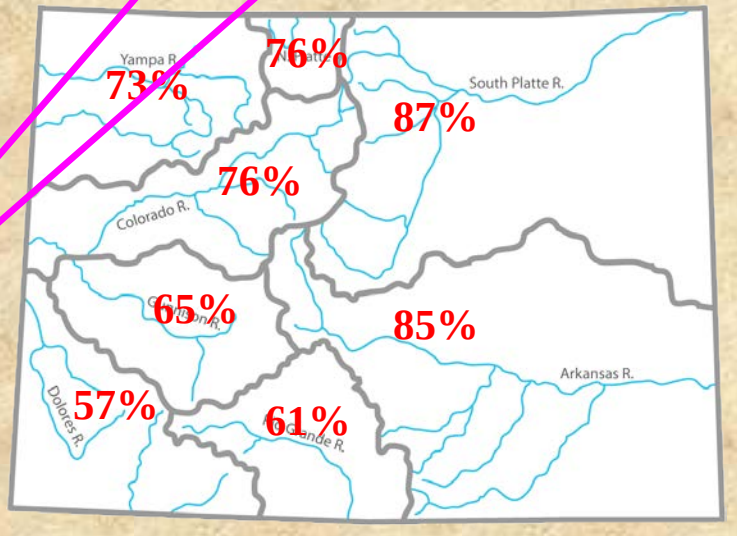




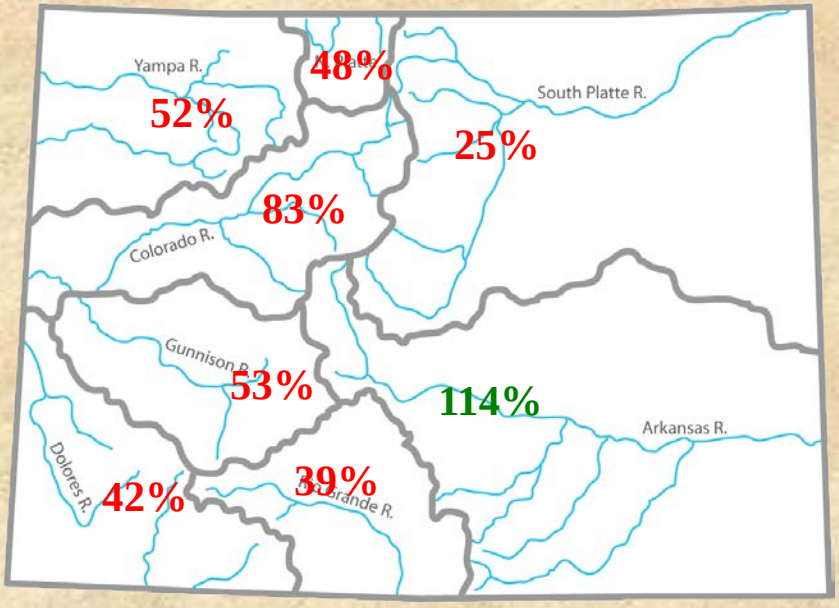


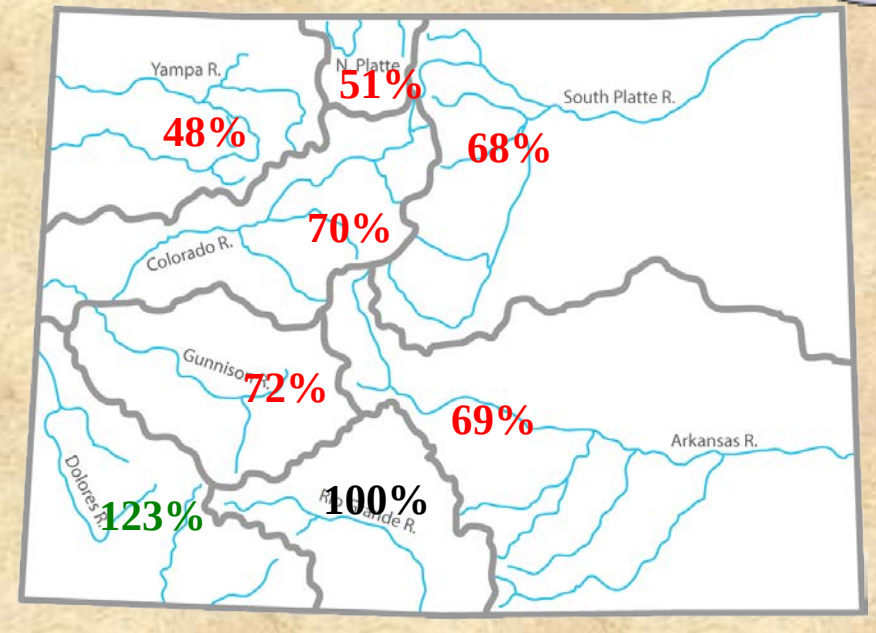
Median outcome for set of weak-to-moderate Los Niños (left; defined in fall season: ‘86, ‘91, ‘93, ’02, ‘06, ‘09). Forecasts issued 6 (middle) and 3 months ago (right) were pessimistic (6/7 times under 100%), but underestimated the severity of the snow drought, especially for the San Juans.

Best overall verification along the Front Range



Forecast 1junSWE
Median (left) and ENSO composite (right)

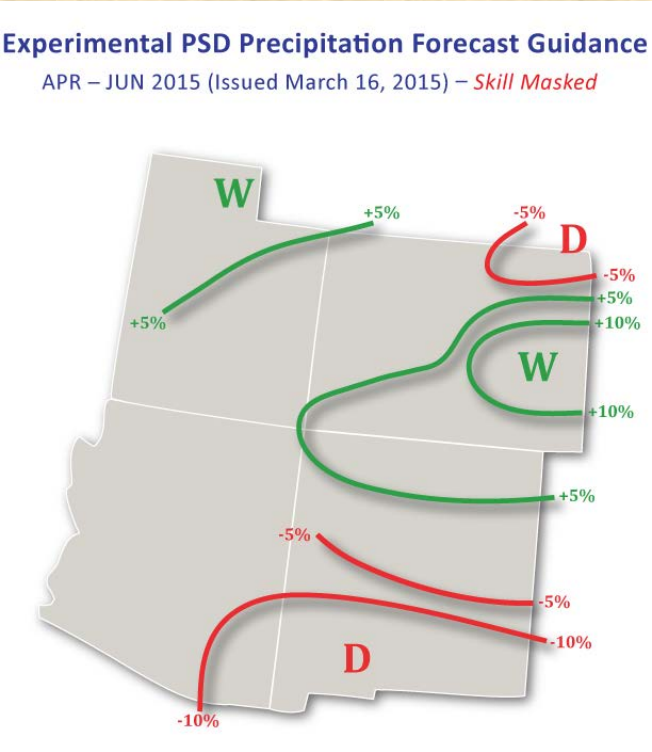


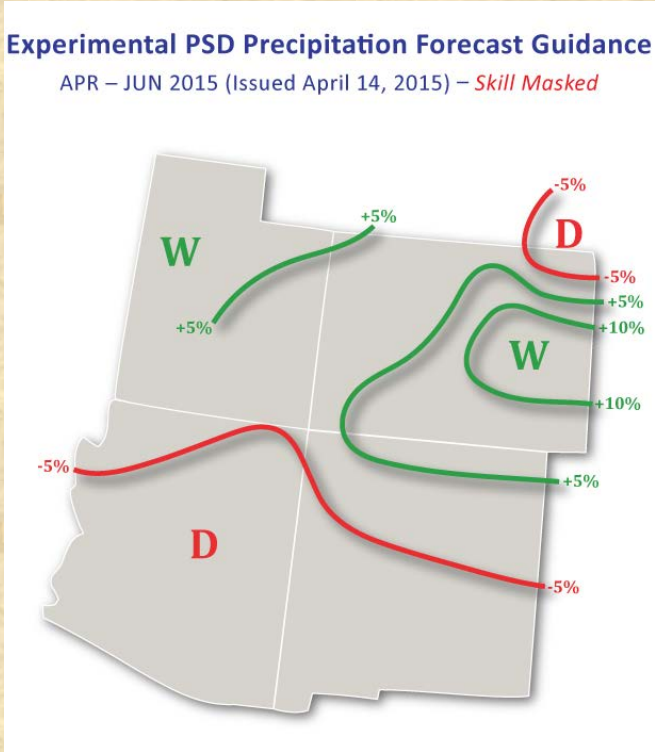


Forecast (left) is strongly influenced by 1apr conditions, thus the San Juans are a lost cause, while the contrast of the South Platte versus Arkansas is a bit surprising. ***Average forecast for the state: 57%, sorry to say.***

Composite outcome for set of weak-to-moderate Los Niños since 1980 (defined during fall season: '86, '91, '93, '02, '06, '09) was also on dry side, except for San Juans (biggest difference compared to 2015). ***Average outcome for the state: 75%, the deck was stacked against us from the beginning!***

Statistical Forecast for April-June 2015

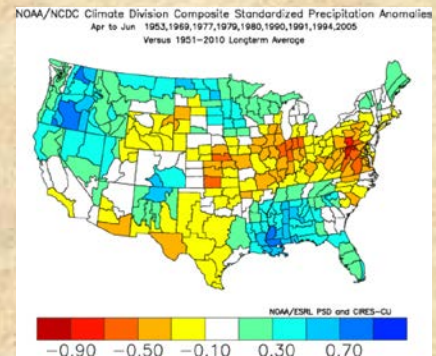




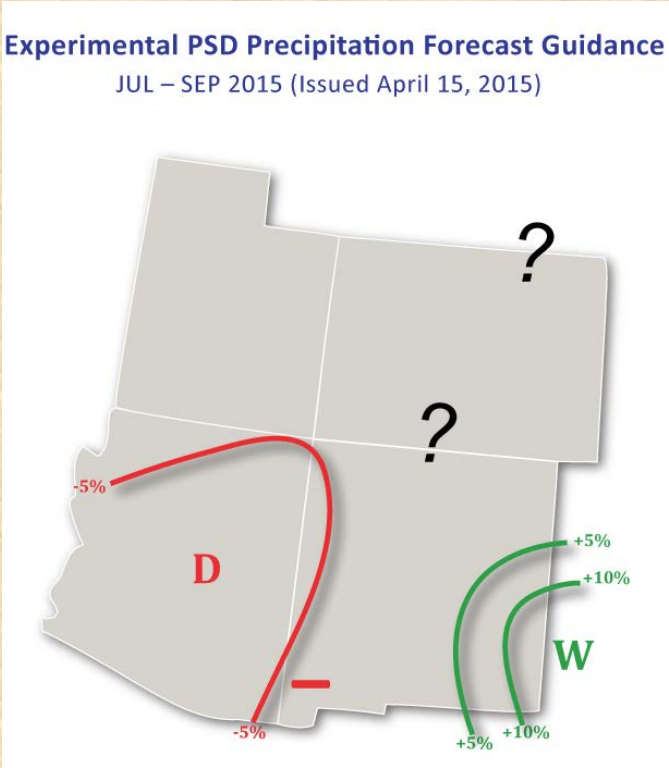
Experimental spring forecast remains wet for southeastern half of CO and northwestern UT, with little skill (or tilt in the odds) in between. The lower basin (AZ/NM) looks dry, but is going through its driest time of year anyway.

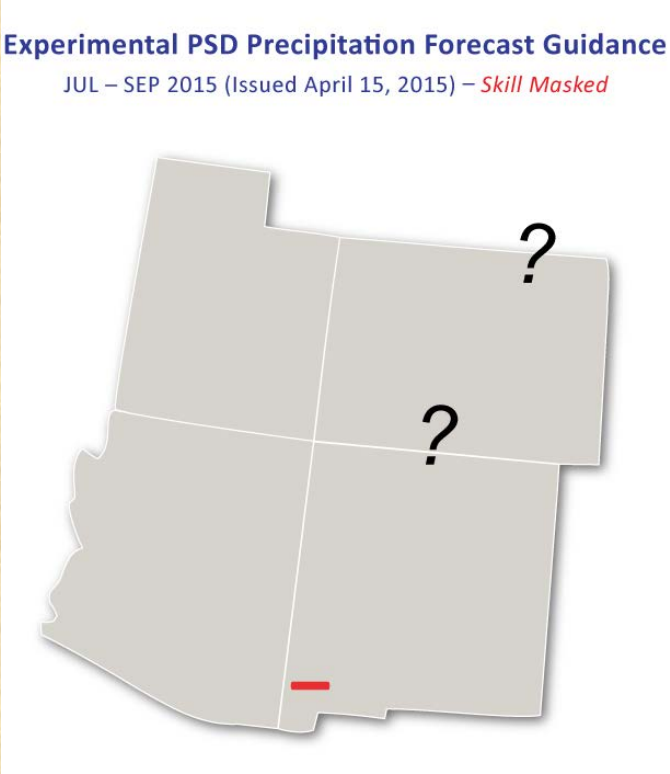
Flashback to weak El Niño composite:

√



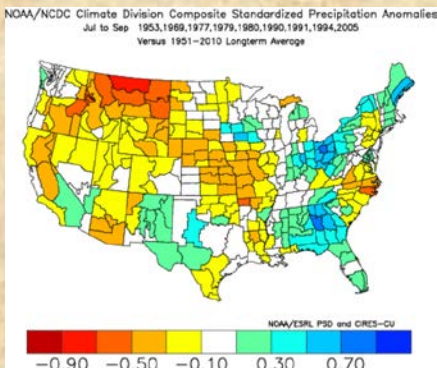
Statistical Forecast for July-September 2015



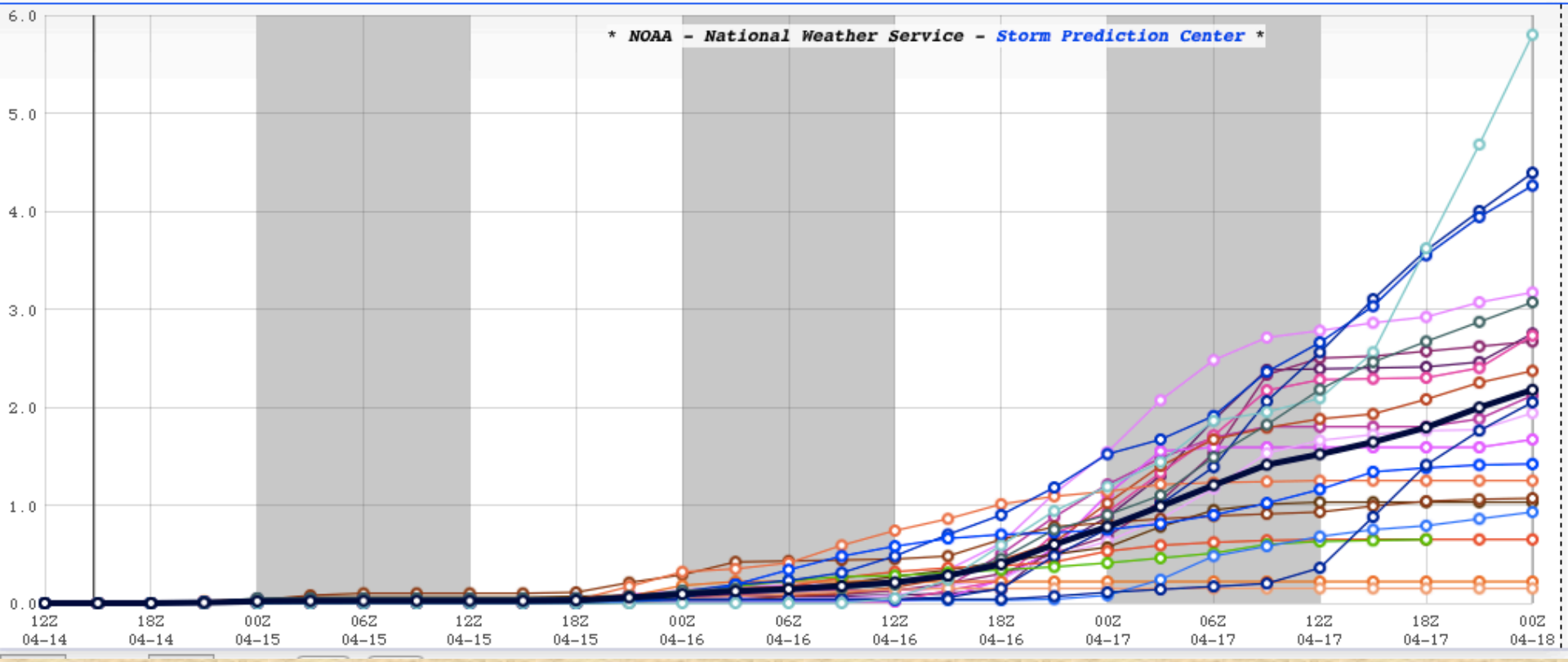


Experimental summer forecast is handicapped by lack of skill this far out, and/or lack of decisive predictive influences (a lot of weak tilts that don't even show up on the map). This *should* change by the next update.

Flashback to weak El Niño composite:

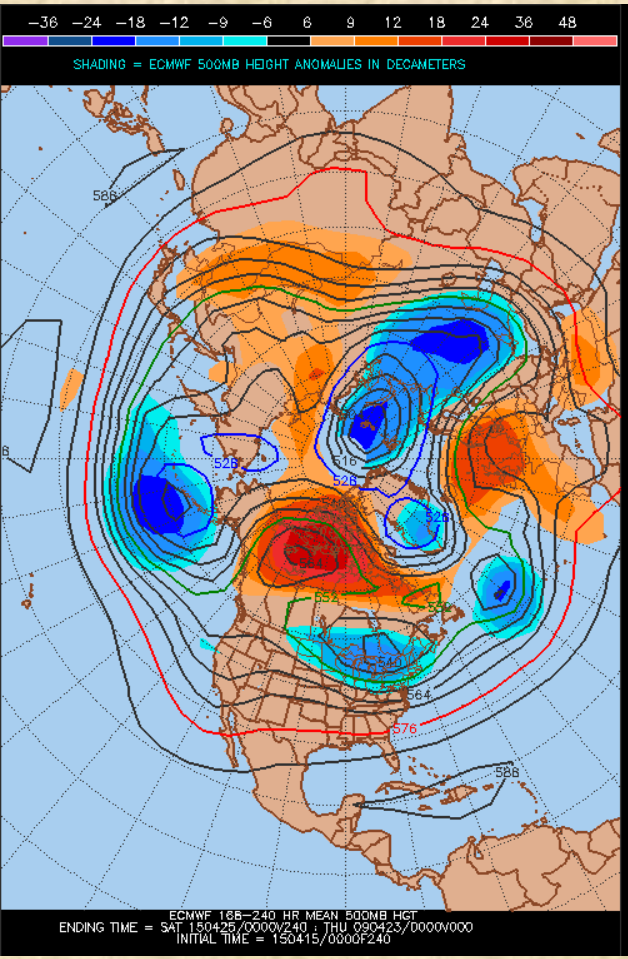


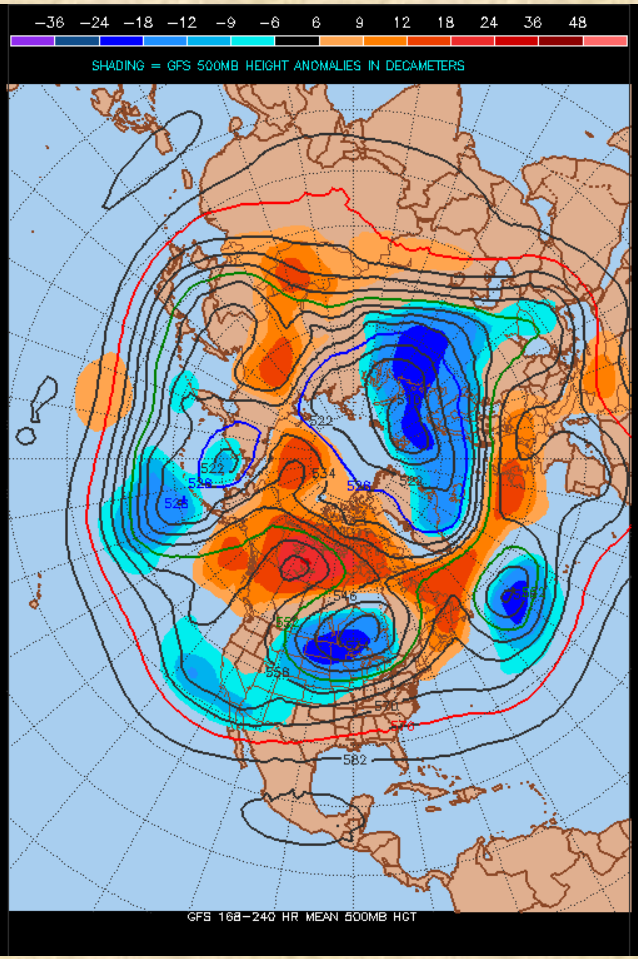
What can we expect in the next seven days?

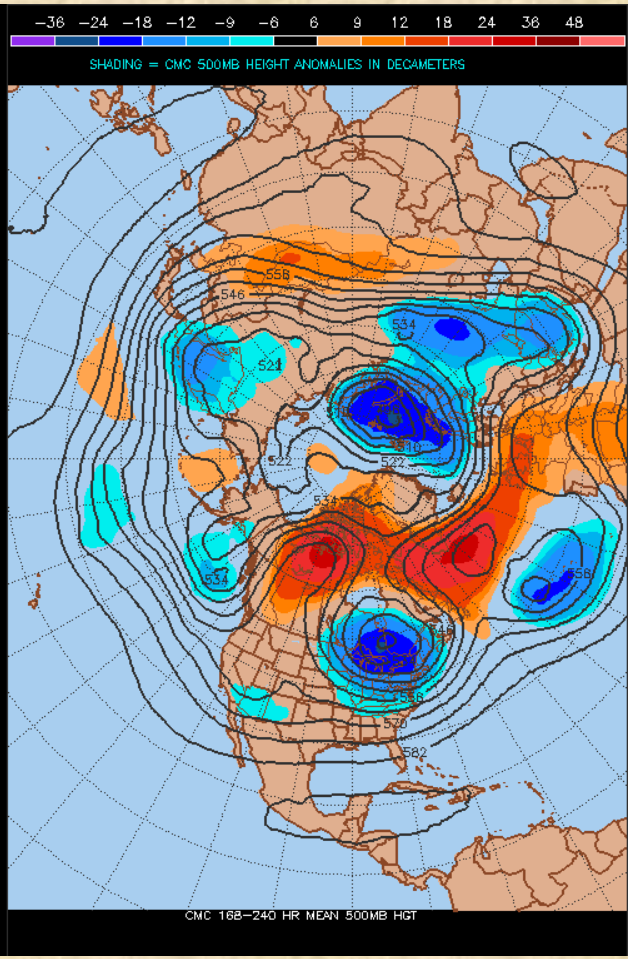


Huge uncertainties even as of yesterday regarding our incoming storm - the Short Range Ensemble Forecast (SREF) plot from last morning for Jeffco Airport showed almost unprecedented range of possible outcomes, from basically a trace to over 5" (the last time I saw a range this big was in September 2013). As of this morning, this range has reduced to a slightly less outrageous 0.4-3.2"...

What can we expect for Days 7-10?







European & U.S. models show near-normal or even below-normal height anomalies over us, with incoming storms undercutting a ridge over Western Canada. This looks promising!

Executive Summary (15apr15)

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- **A weak El Niño appears to be gaining strength right now, and may become bigger than last year's 'incomplete event' over the next few months. Meanwhile, positive PDO conditions are helping to support El Niño expectations.**
- **CPC's forecasts favor a *wet* spring (April-June) for the Upper Colorado basin, with warm temperatures anchored to our west for occasional visits, as seen repeatedly over the last few months.**
- **Experimental precipitation forecasts are supportive of a wet forecast in SE CO during the next three months, also consistent with weak El Niño composites. The monsoon forecast is still fraught with a lot of uncertainties, thus not tilting the odds one way or the other, as of now.**
- **Uncertainty abounds with an incoming storm this week. It could help out tremendously over eastern Colorado, although the original focus on the Arkansas Valley has shifted northwards (yes, a PSA is in the works). It should definitely reduce our fire danger, and it might bring in a prolonged period of unsettled conditions for the whole region (AKA "typical" April weather).**
- **Bottomline: Upcoming growing season should benefit from evolving El Niño conditions, especially along the Front Range. If it holds together for the summer, the monsoon should be on the wet side for our state, especially east of the divide.**