Earth System Research Laboratory
Physical Sciences Division

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Colorado WATF,
23 January 2013
Denver

Seasonal Outlook for early 2013

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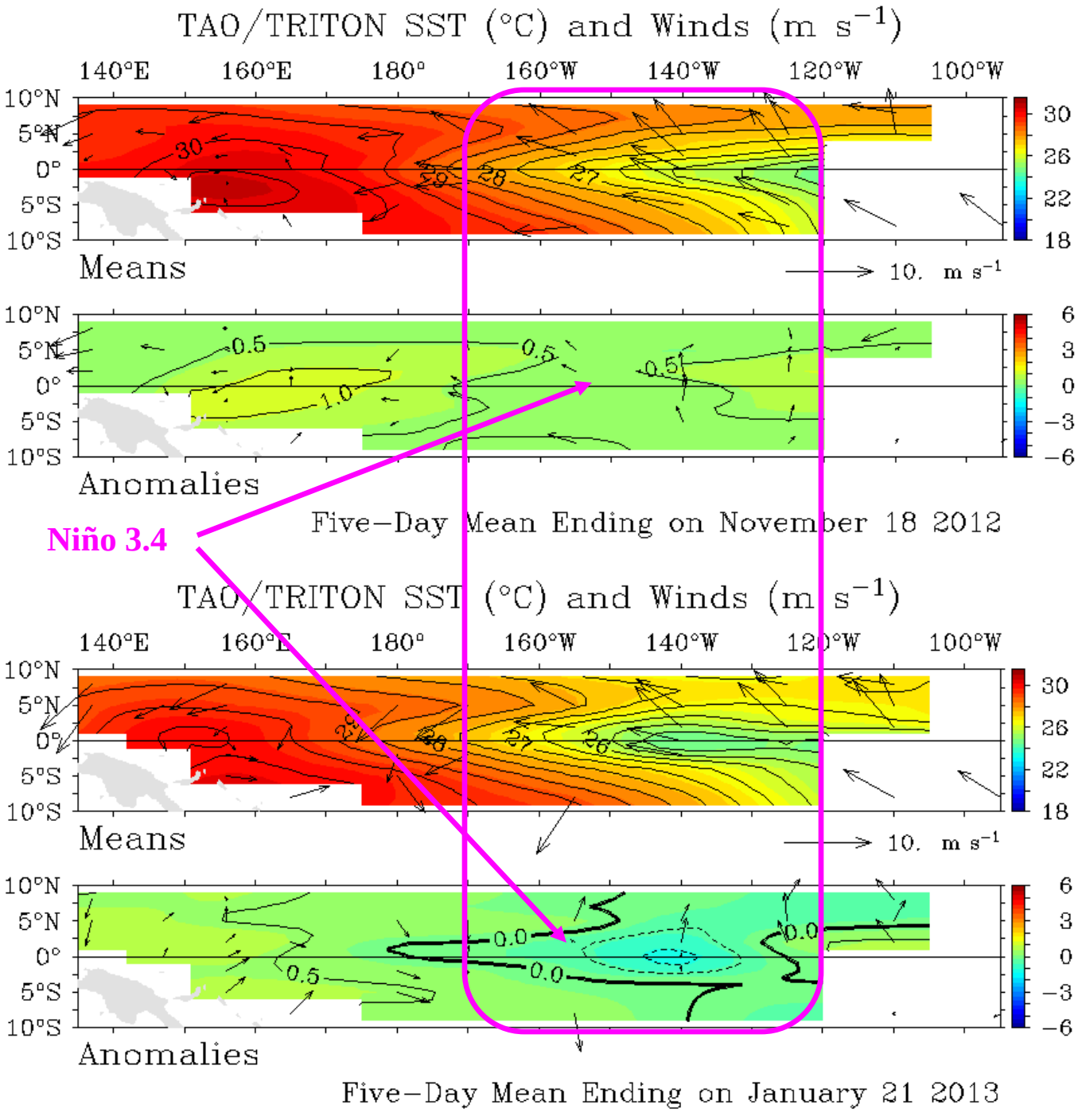
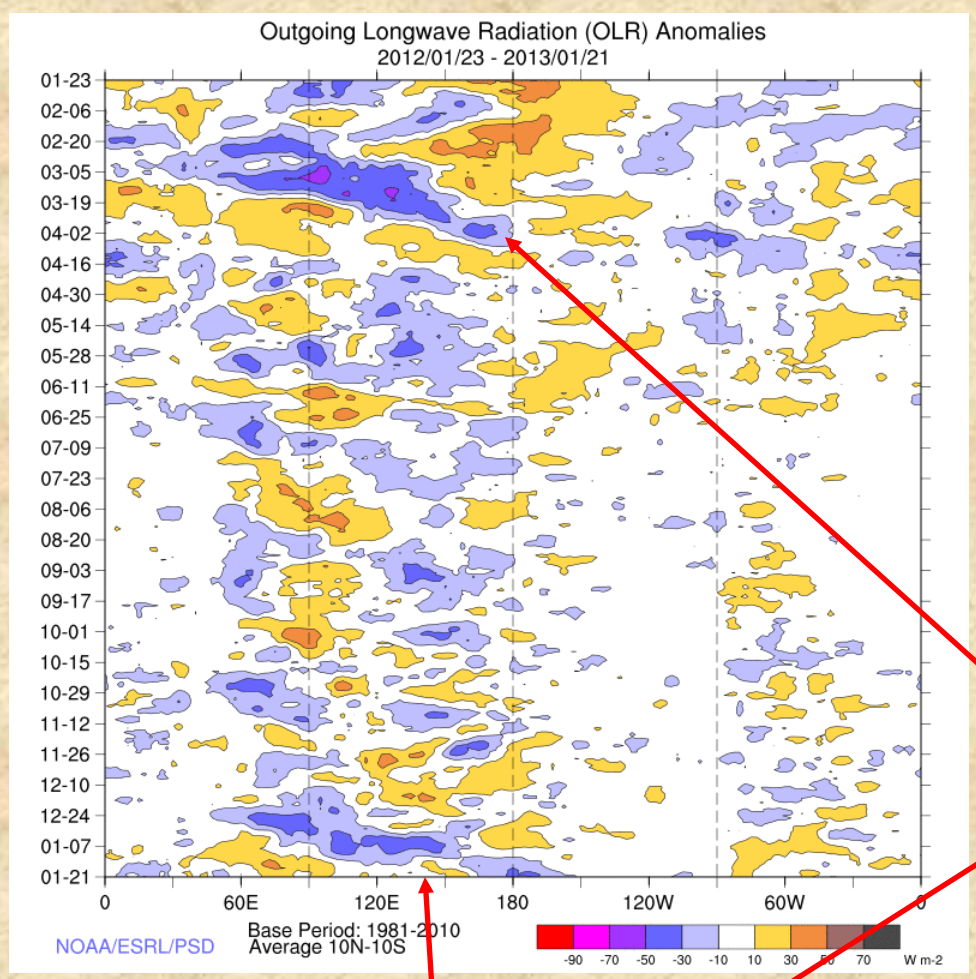
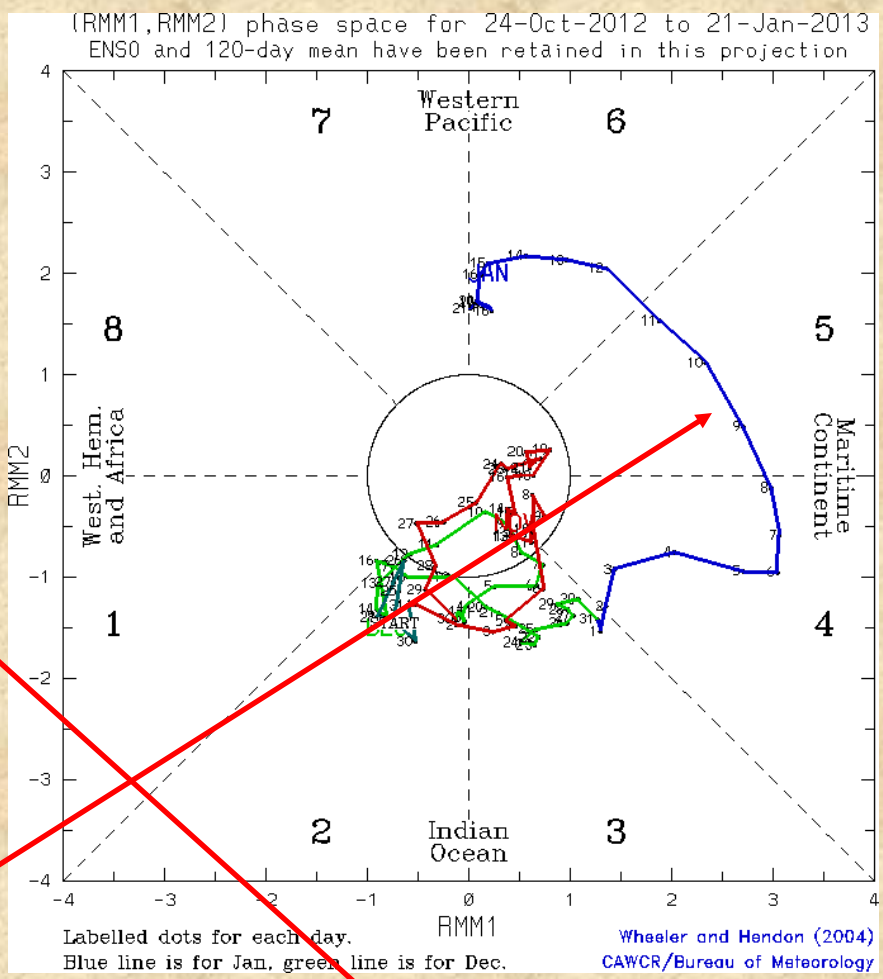
- **First ENSO-neutral winter in nine years**
- **Expectations for the next two weeks**
- **CPC forecasts for February through May 2013**
- **Experimental Seasonal Forecast Guidance**
- **Executive Summary**

Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to last time (top): Tropical Pacific wind anomalies are weak; SST anomalies have remained positive west of the dateline where they COULD help to reignite an El Niño event, IF the right westerly wind burst (MJO) were to come along, while negative SST anomalies have come back to Niño 3.4.

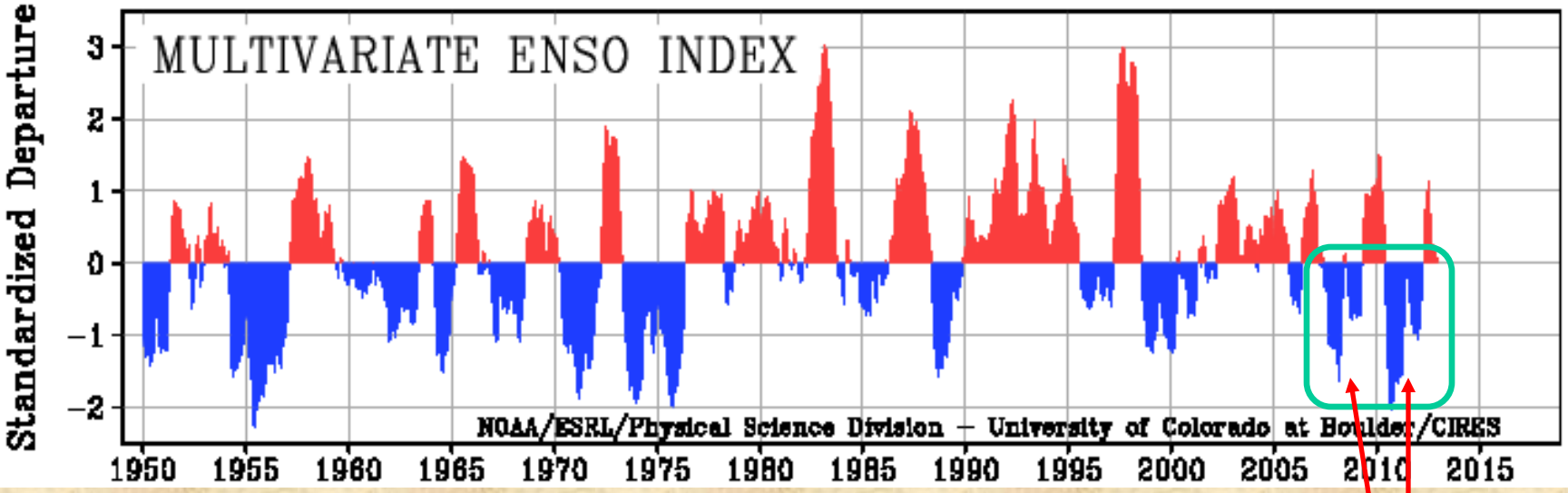


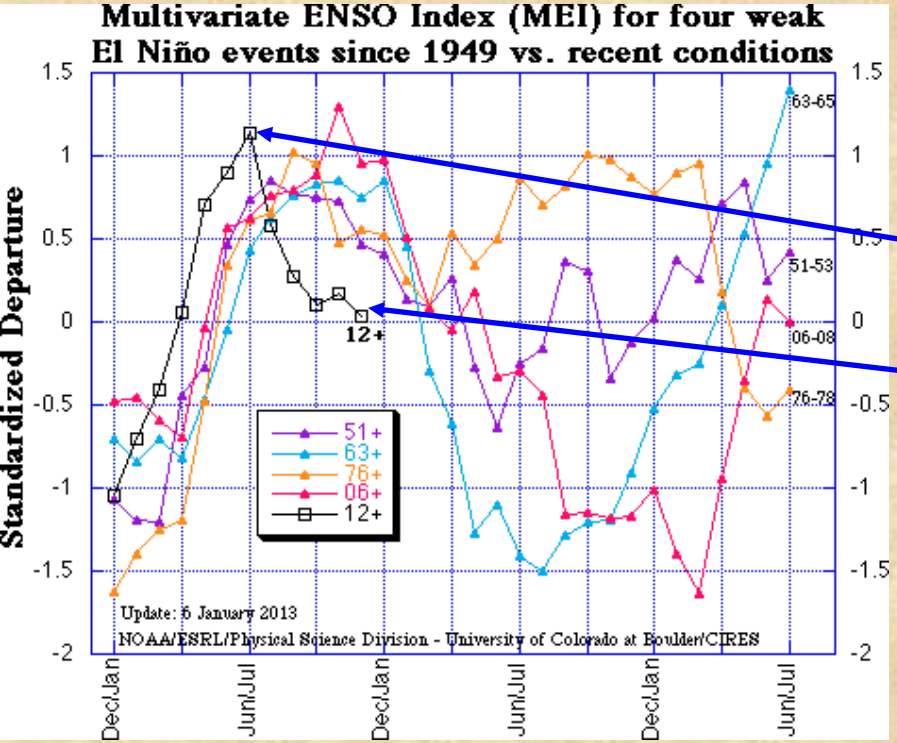
“Herman Cain” MJO run is sputtering?





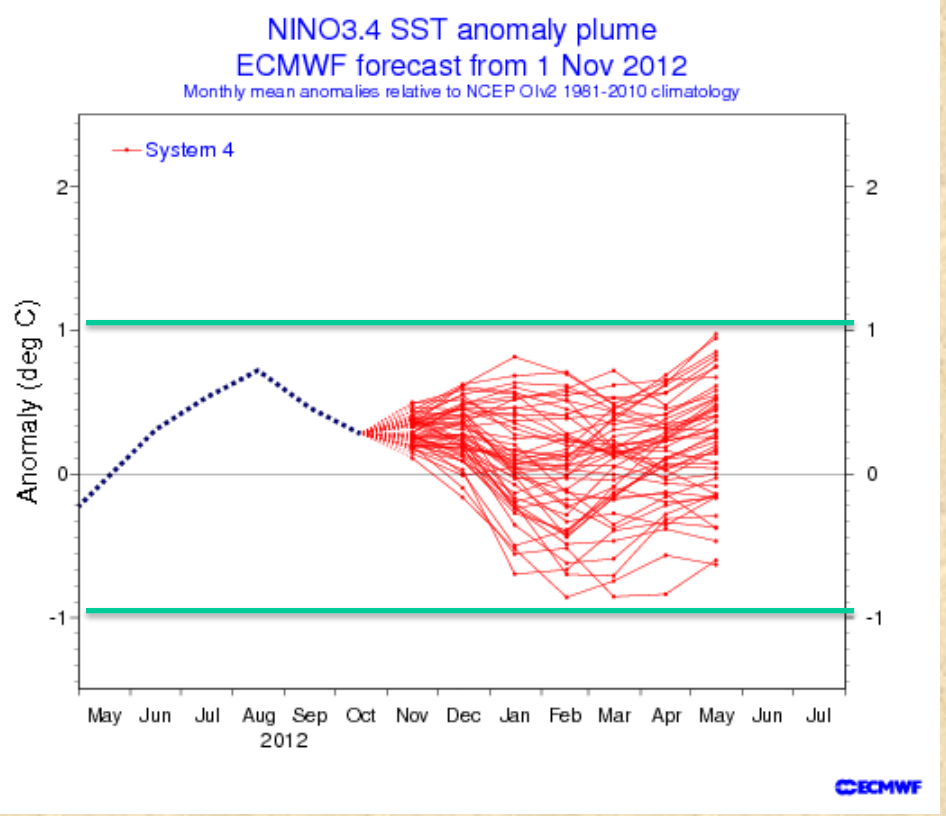
This one did not last nearly as long as last year’s “Rick Perry” event!





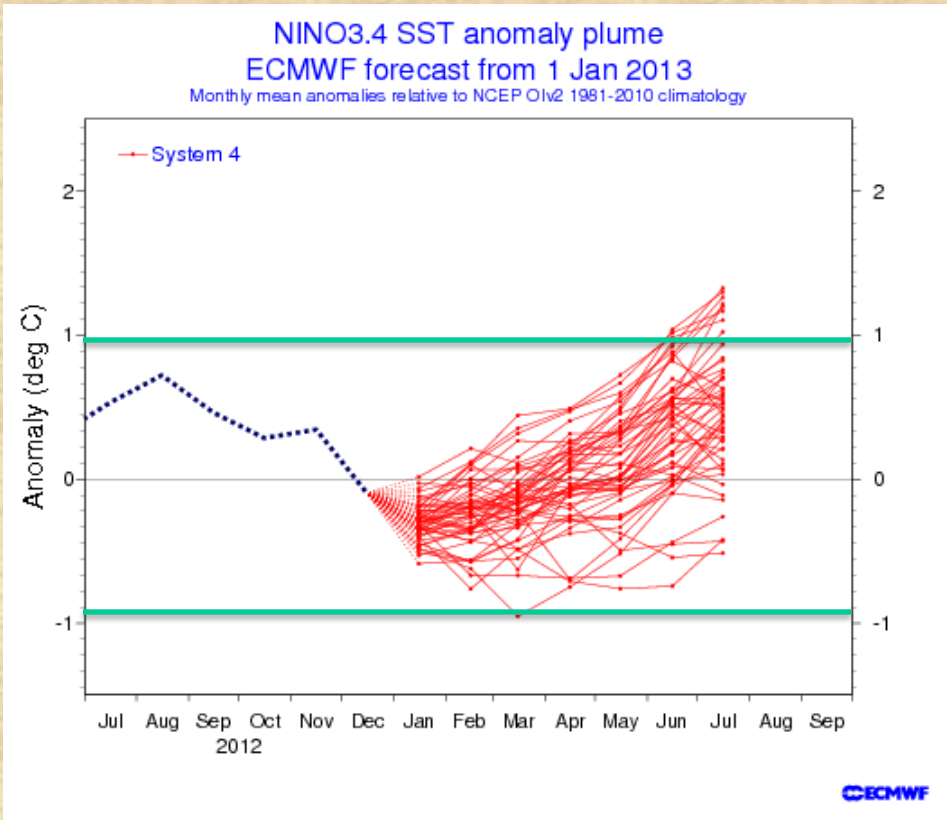
Last six years have seen two 'double-dip' Las Niñas in a row, followed by a brief excursion to what looked like an El Niño event in mid-2012, and a return to ENSO-neutral conditions in late 2012 – highly unusual behavior, but not completely unprecedented (1953 featured a similar aborted El Niño event).

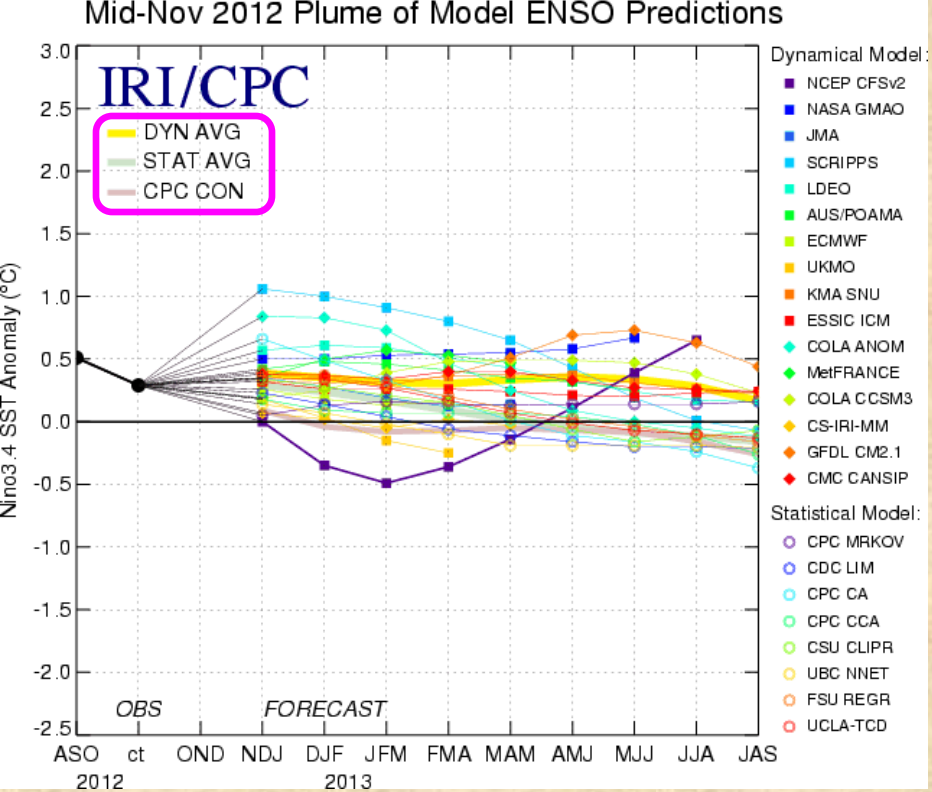
http://www.esrl.noaa.gov/psd/enso/mei



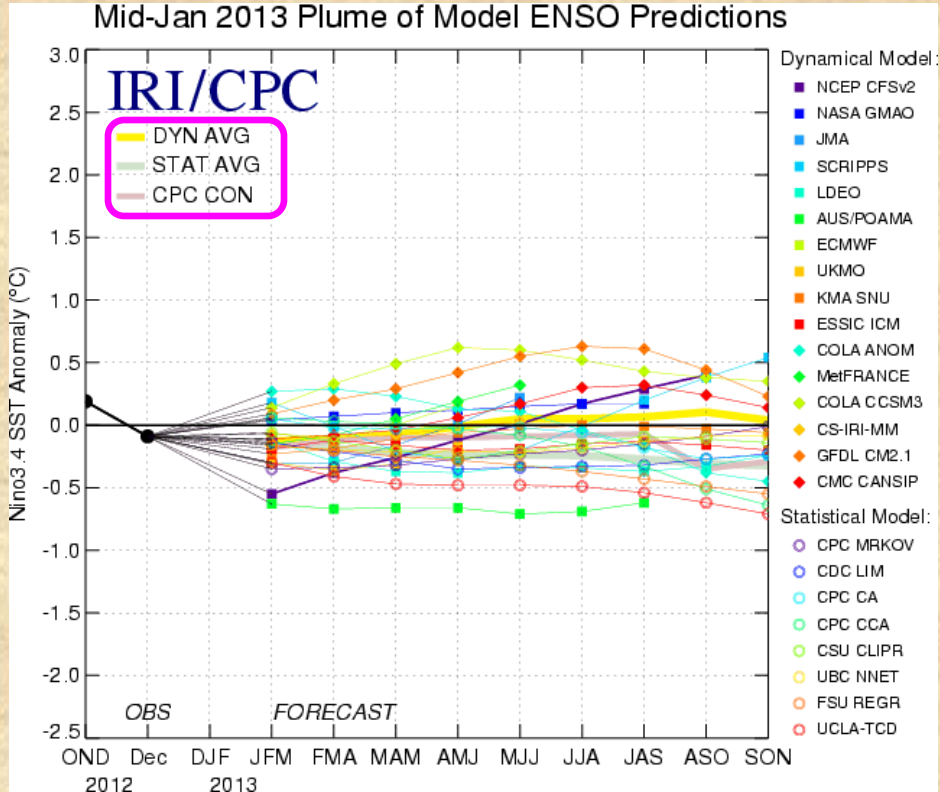
The ECMWF November 2012 forecast (left) settled on an ENSO-neutral outlook for this winter, with no ensemble member outside the +/-1°C range. *There was a small hint of drifting towards El Niño again next spring.*

The ECMWF January 2013 forecast (right) shows a drift from weakly-negative / neutral conditions towards El Niño by mid-2013. However, there are still a few ensemble members that show weak La Niña conditions to persist into the summer.





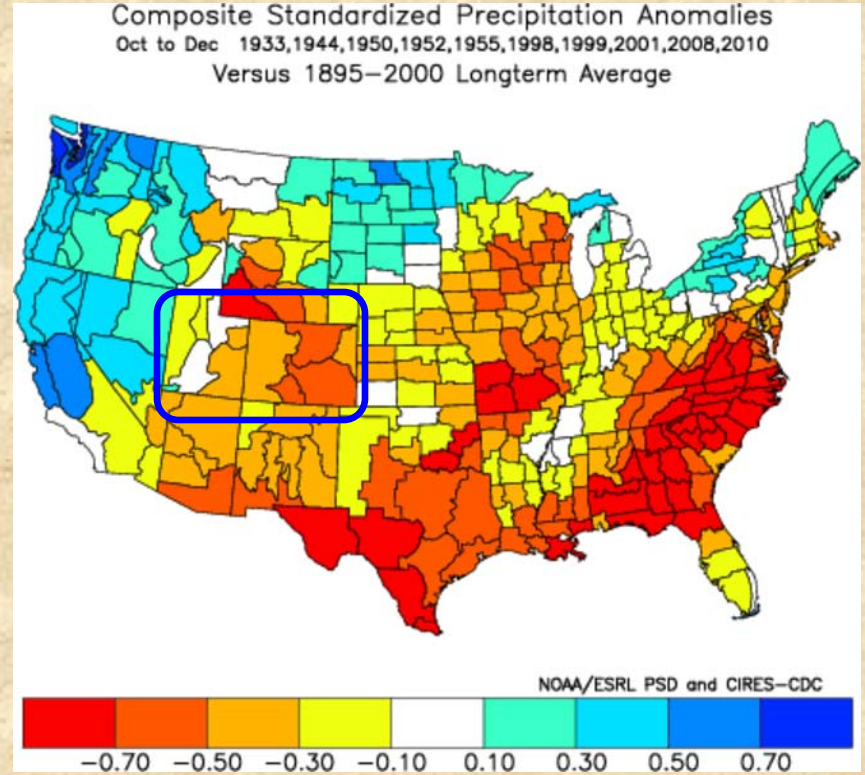
ENSO forecasts from 16 dynamical & 8 statistical forecast models in November 2012 (left): Dynamical models showed pretty much the same ENSO-neutral outlook as statistical models. The most interesting model output was the drop into weak La Niña territory by the CFS2 (CPC).

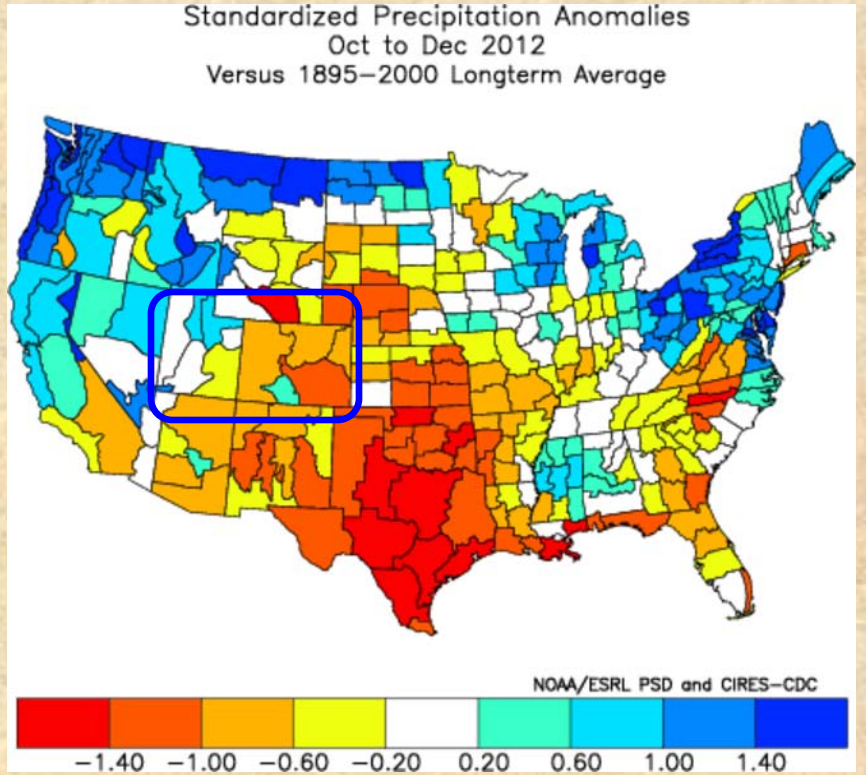


In its latest update (right), the difference between statistical and dynamical models is growing again – the former are slightly more positive (El Niño-ish) than the statistical models (which are all negative by JJA)...

My own forecast drifts from ENSO-neutral in mid-'13 to weak La Niña in late '13.

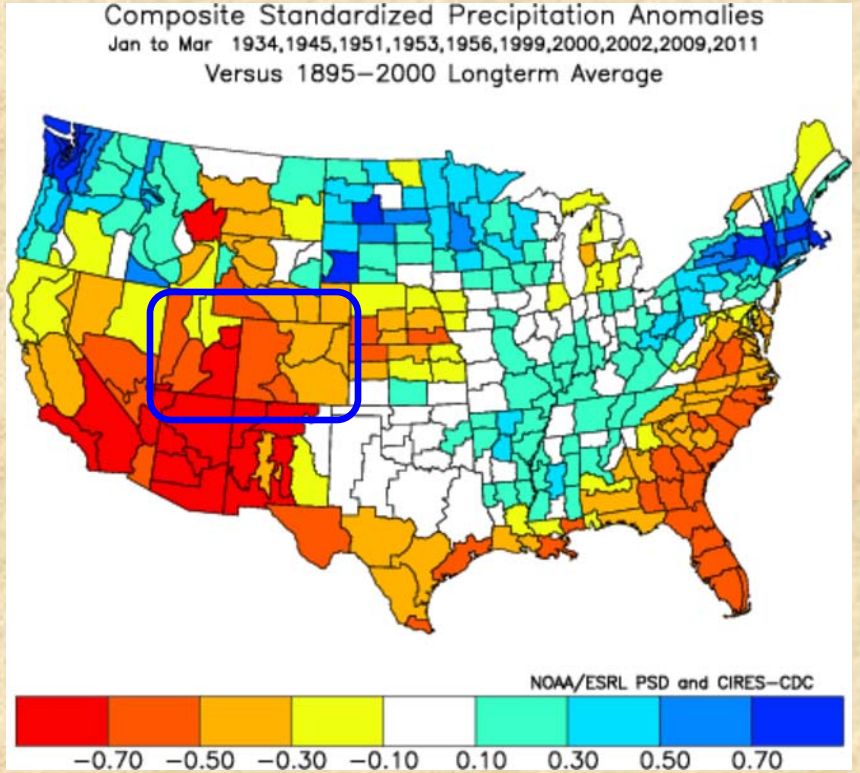
How did the low <PDO-AMO> composite work out in late 2012?

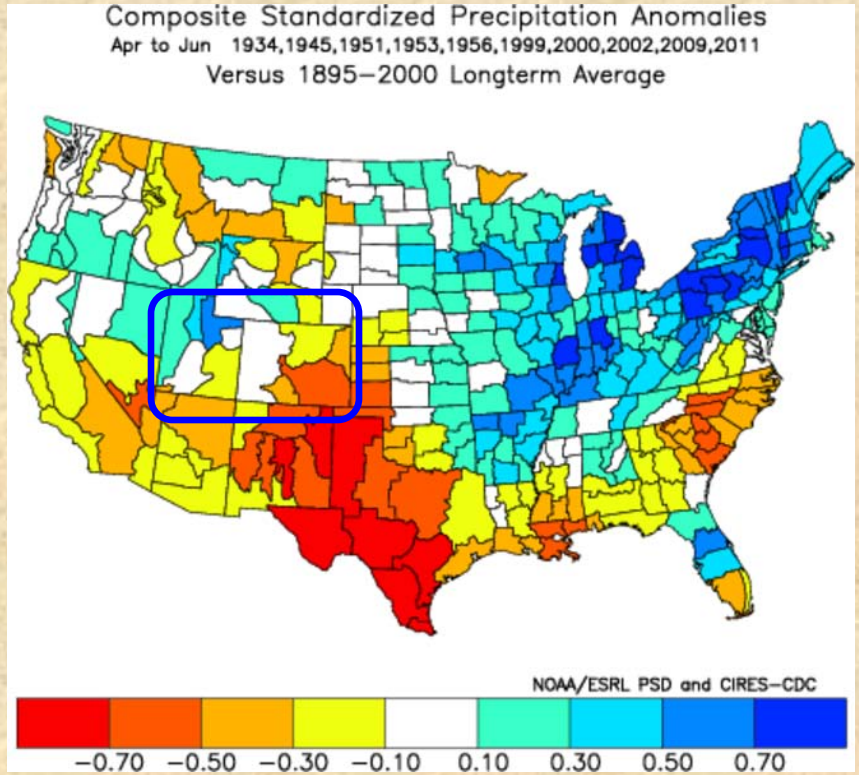




After being consistently low for much of the last decade, the difference in normalized anomalies between PDO and AMO reached its lowest value on record last summer. In the wake of that, late fall precipitation (left) tends towards the dry side in all of Colorado. In 2012, dry conditions prevailed as expected not just in Colorado, but also AZ&NM, from TX into MO, and from FL north to VA, while the greater Pacific Northwest wound up wet, as expected...

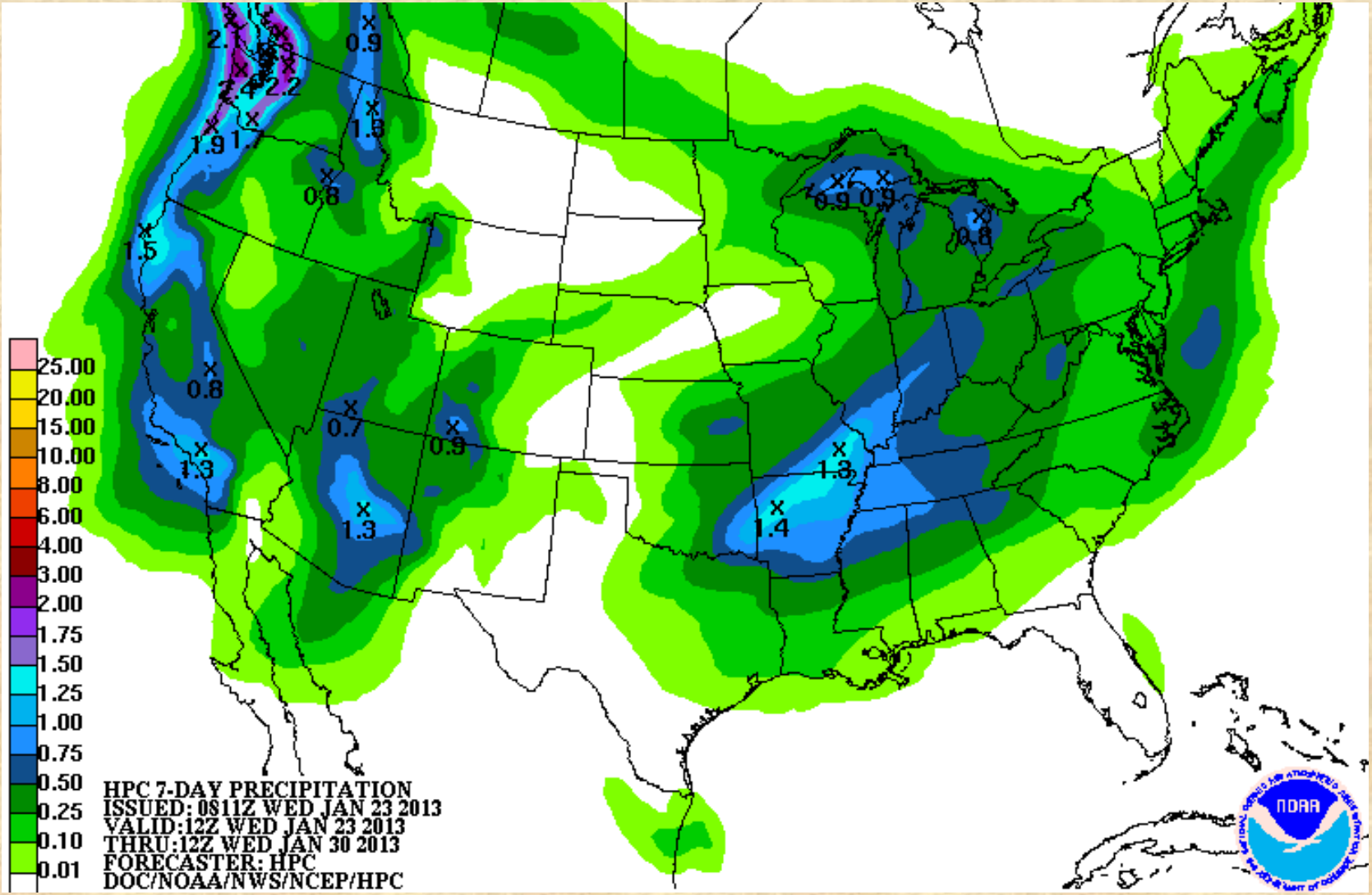
What can we expect in next half year with low summer <PDO-AMO>





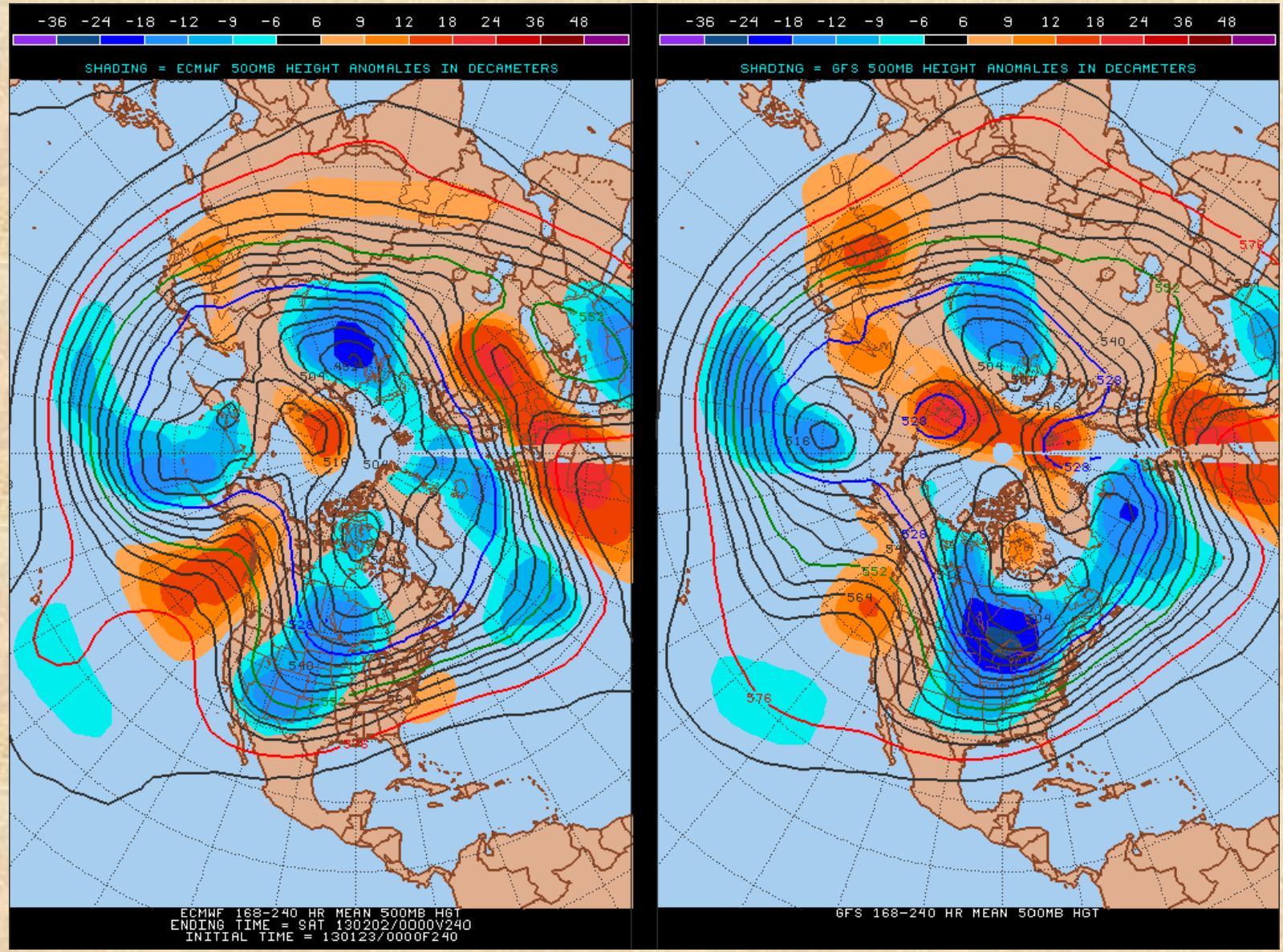
After being consistently low for much of the last decade, the difference in normalized anomalies between PDO and AMO reached its lowest value on record last summer. In the wake of that initial condition, late winter (left) precipitation tends towards the dry side in all of Colorado, especially west of the divide. Late Spring (right) is neutral for the West slope, but still dry for the eastern plains, especially in the Arkansas Valley.

What can we expect in the upcoming week?



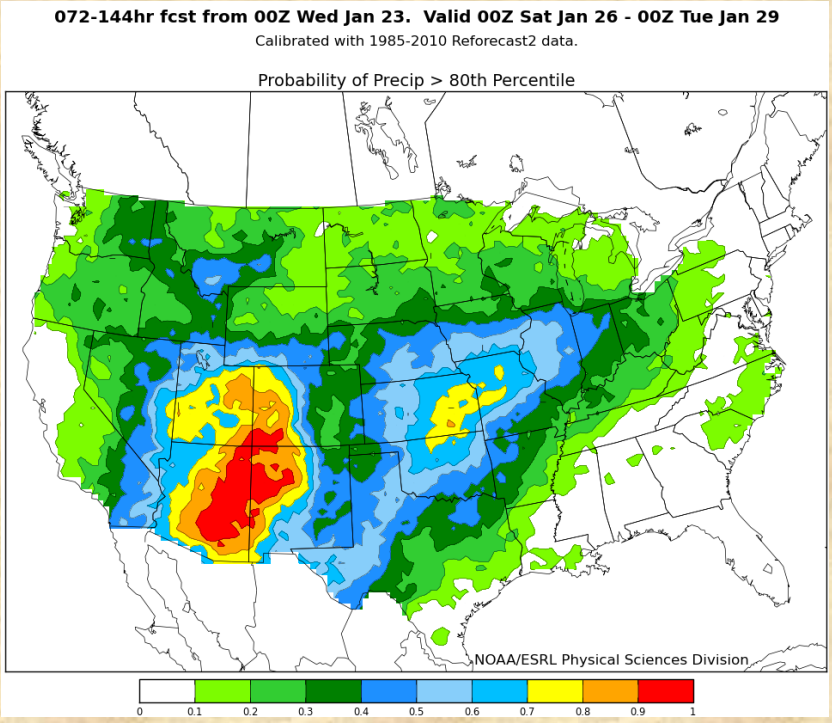
Expected total precipitation thru Wednesday morning, according to the Hydrological Prediction Center (HPC): ***0.1-0.9" on the West Slope, maybe a few 1/100" around here...***

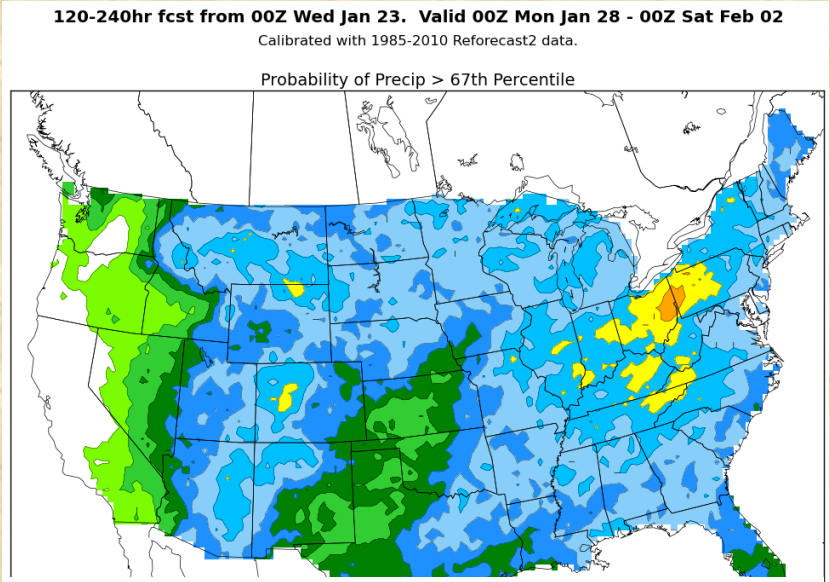
What can we expect in 7-10 days?

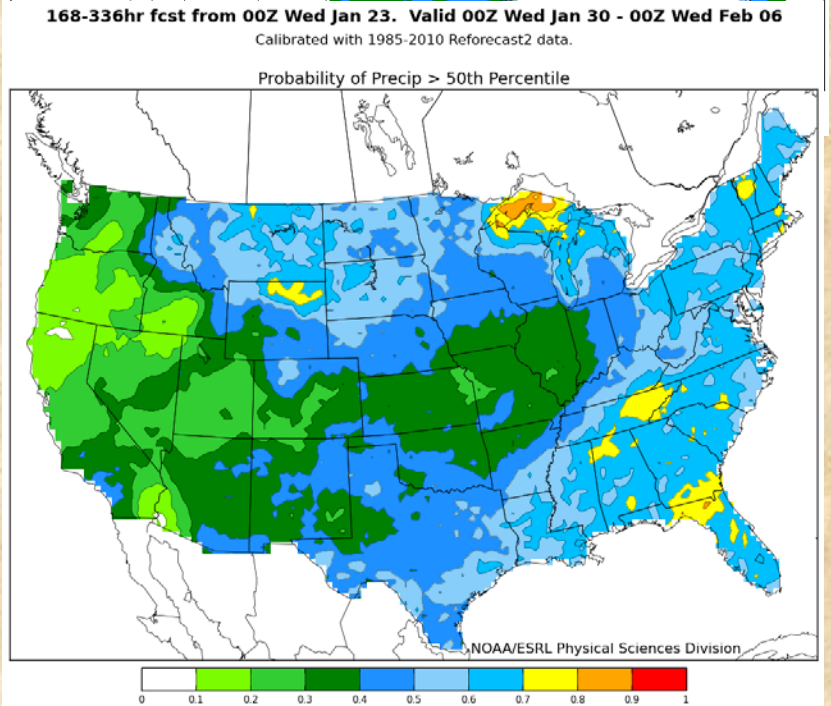


ECMWF and GFS show anomalous troughing over the mid-continent – the ECMWF is more favorable than GFS for us. At least it will feel like winter again...

What can we expect in the upcoming two weeks?

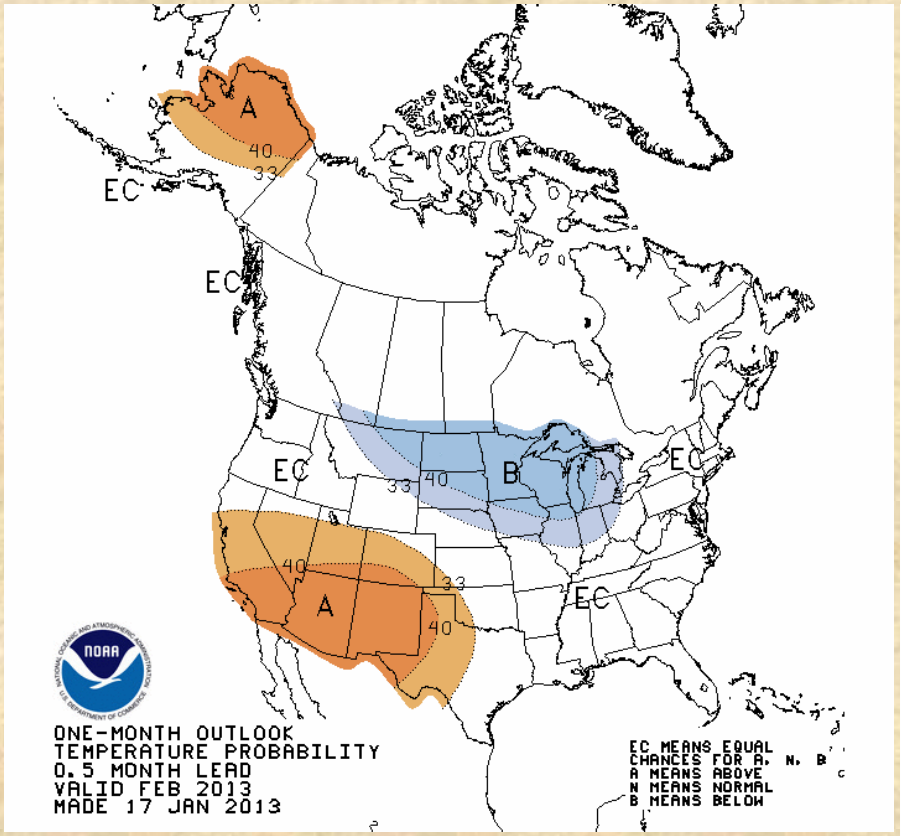


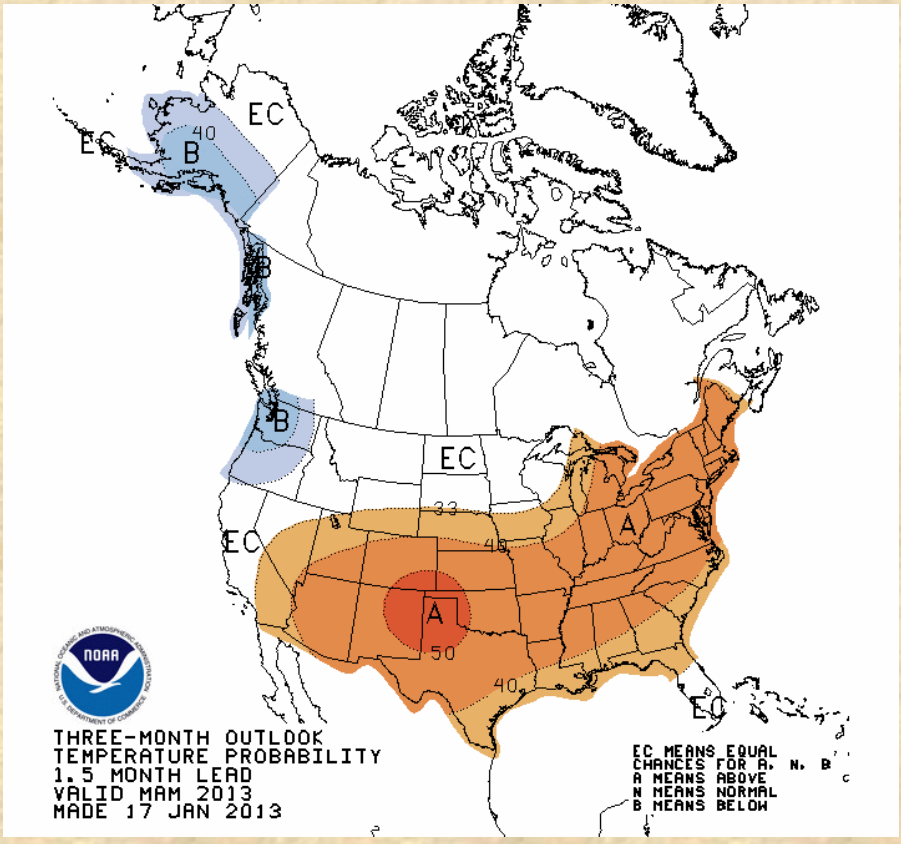




Reforecast amounts for days 3-6 (left), 6-10 (top right), and 8-14 (bottom right). Note that the odds are shown for the upper quintile in the 1st slide, upper tercile in 2nd, and only the median for Week 2. All in all, not exactly cause for celebration, but clearly an improvement over the last three weeks...

Climate Prediction Center Temperature Forecasts

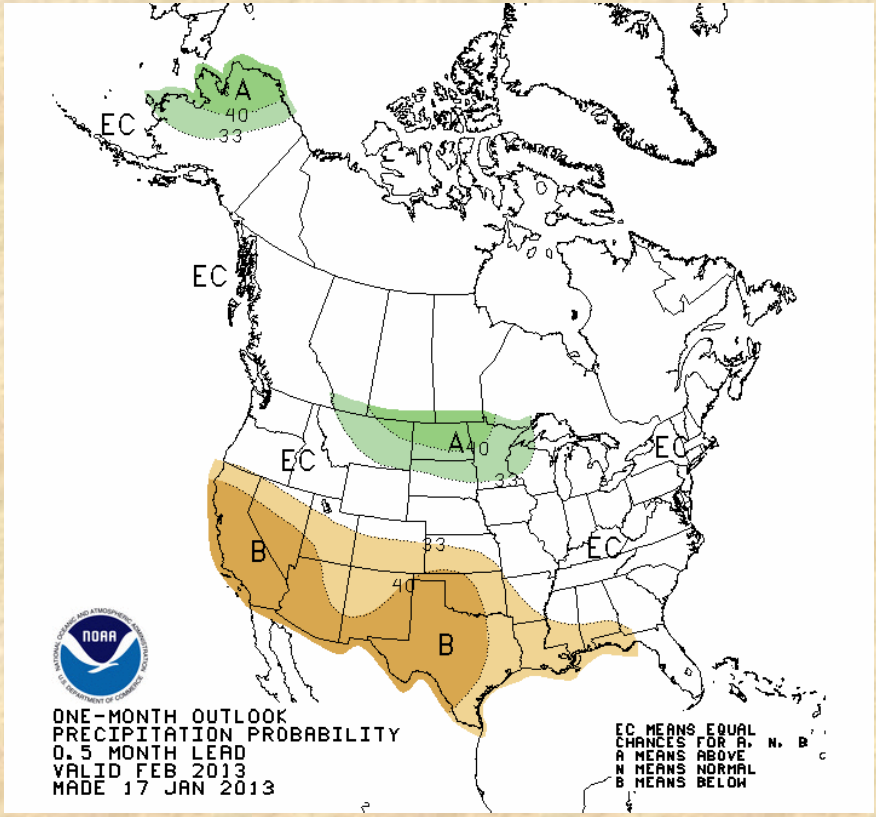


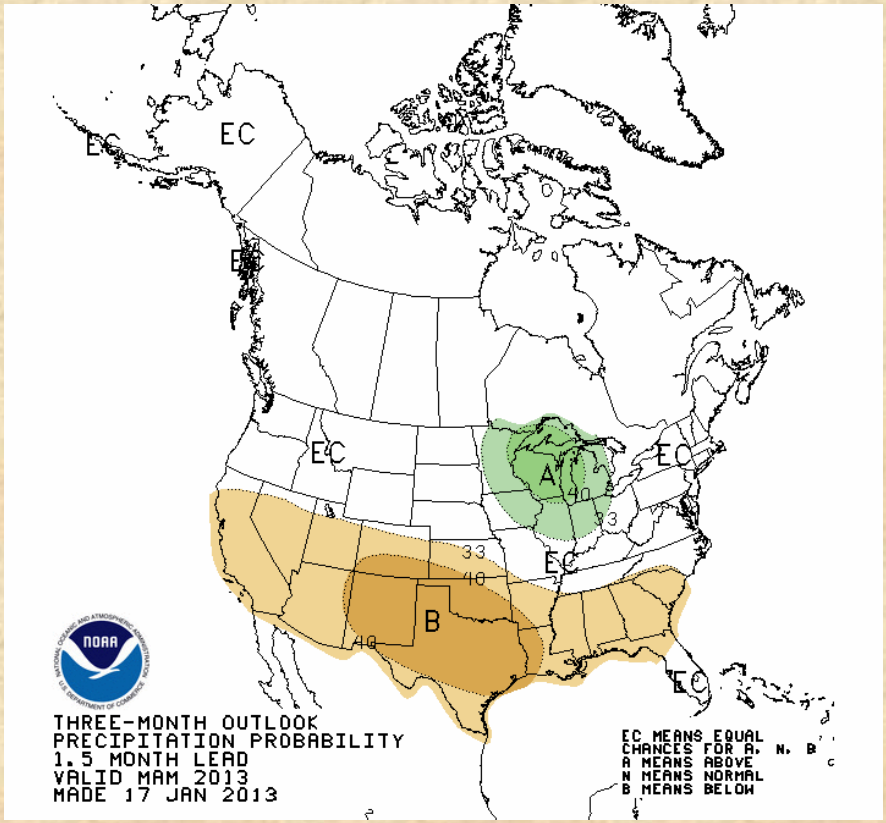


CPC's temperature forecasts for February (left) and March-May (right) reflect recent warming trends plus the combination of negative PDO and ENSO-neutral conditions. Colorado is expected to be *warmish* for the remainder of this winter (mostly trend). While the recent cold on the west slope was not anticipated, it could very well extend into February.

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

Climate Prediction Center Precipitation Forecasts

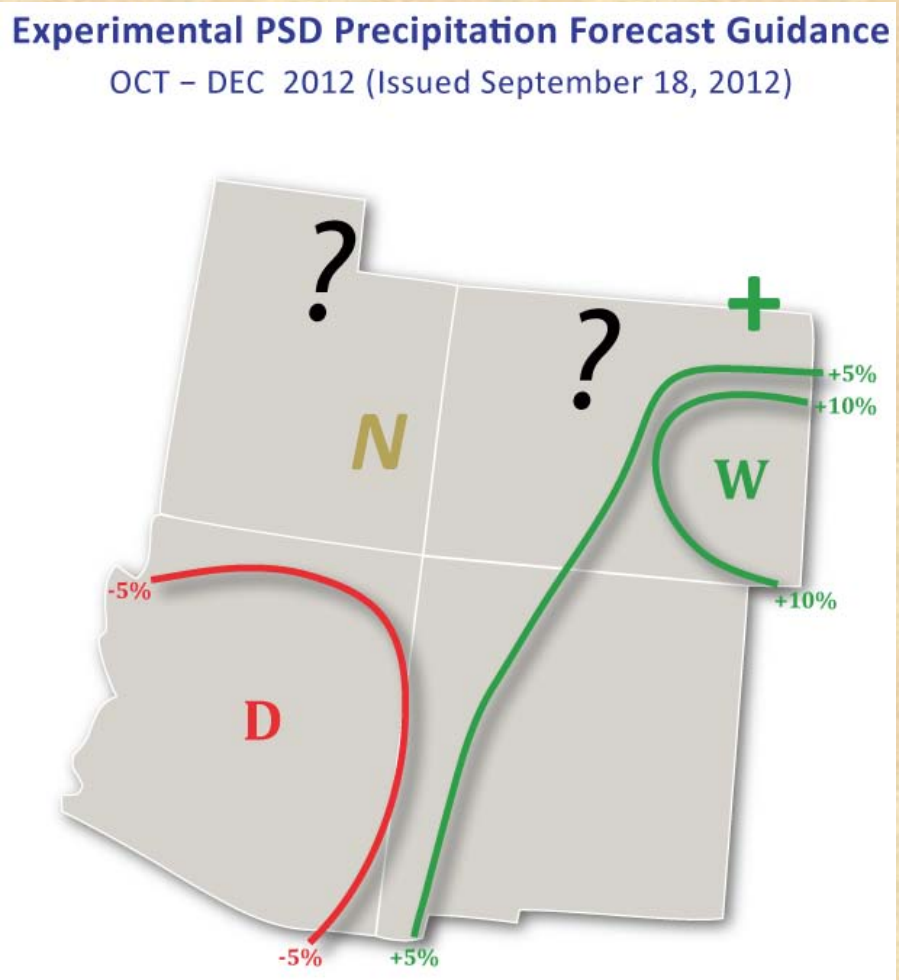




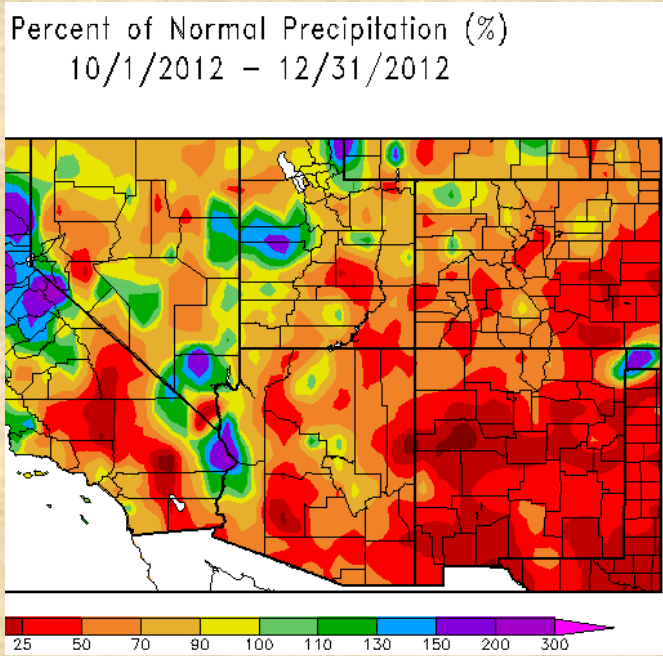
CPC's precipitation forecasts for February (left) and March-May (right) reflect recent warming trends plus the combination of negative PDO and ENSO-neutral conditions. Continued low soil moisture is expected to exacerbate drought conditions in the southern U.S. *Things are not looking 'good'...*

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

Statistical Forecast for OND'12 – Verification



Back in September, I wrote: "Fall (left) remains the hardest season to predict for this region. In particular, "??" over the mountains of northern UT and CO denote an uncertain outcome. ***A closer look at the performance of similar forecasts in the past shows a preference for dry outcomes over north-central CO.*** **Eastern CO has a tilt towards wetness where** ***operational forecasts have been most reliable since 1999."***

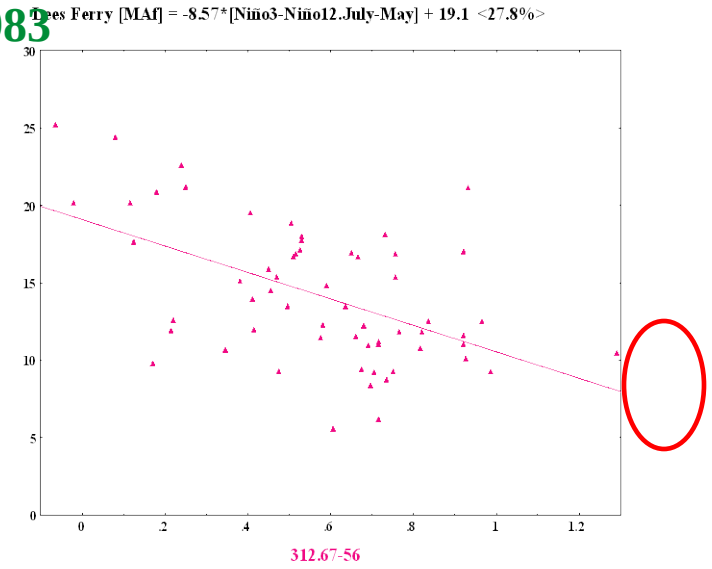


Observed H_2O (right) verified well for dry forecast regions (AZ), o.k. for UT (closer to normal than in CO), and poorly for eastern CO and NM. ***PDO-AMO was hard to beat!***

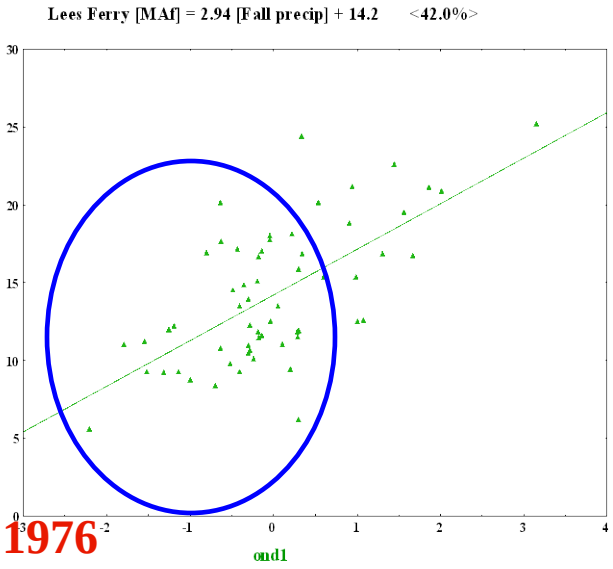
Lees Ferry Naturalized Runoff in Water Year 2013 - Key predictors:

Onset behavior of ENSO (left) + <Oct-Dec>precip (right)

1983

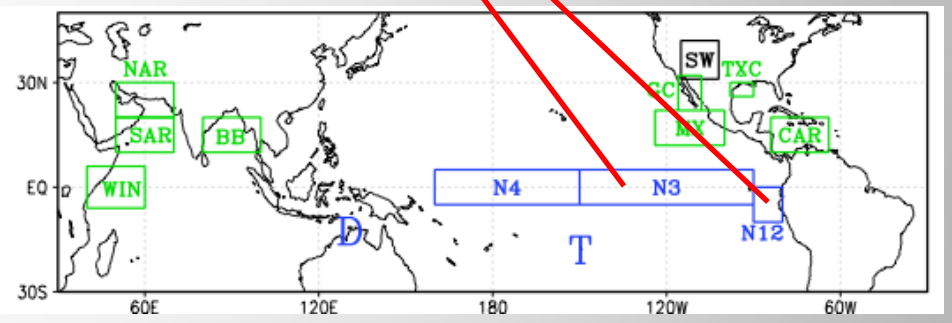


2002

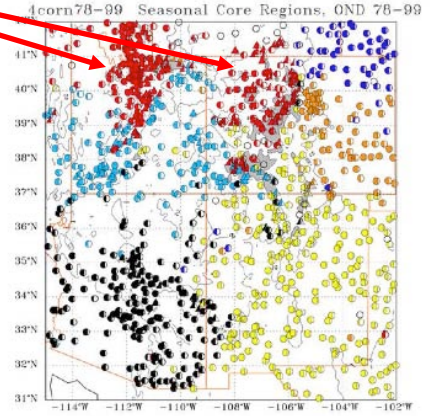


1983

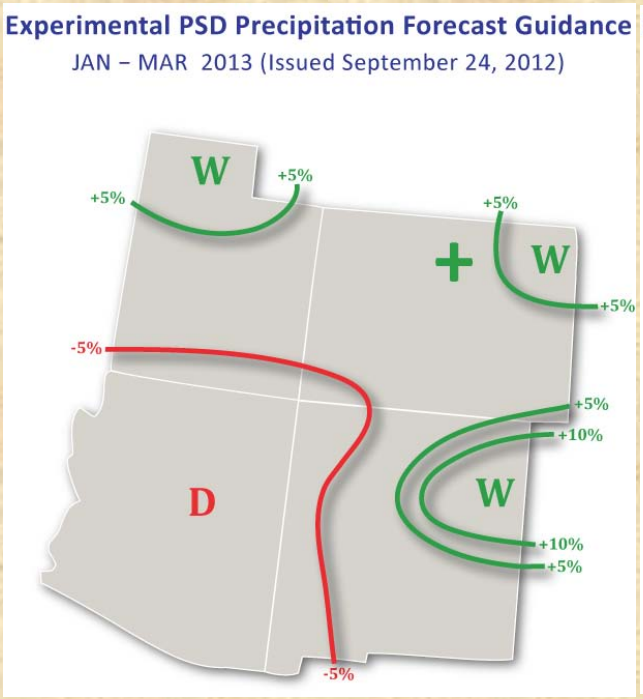
1976

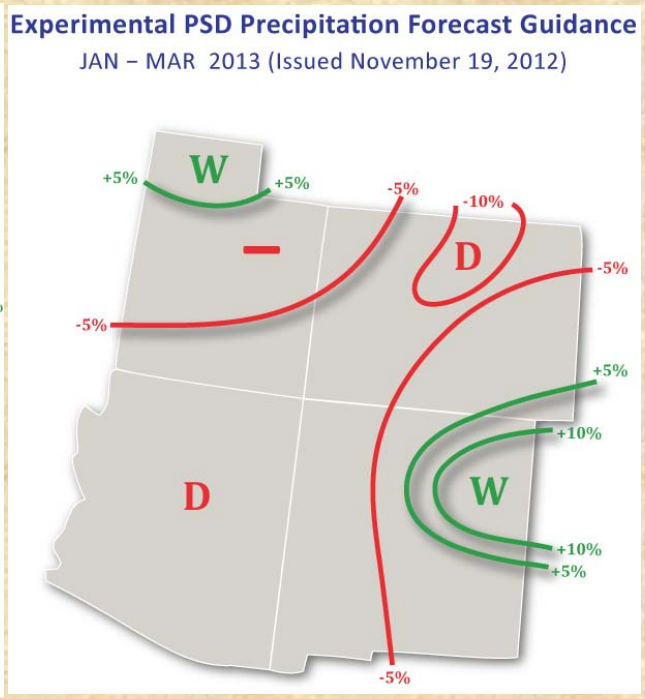


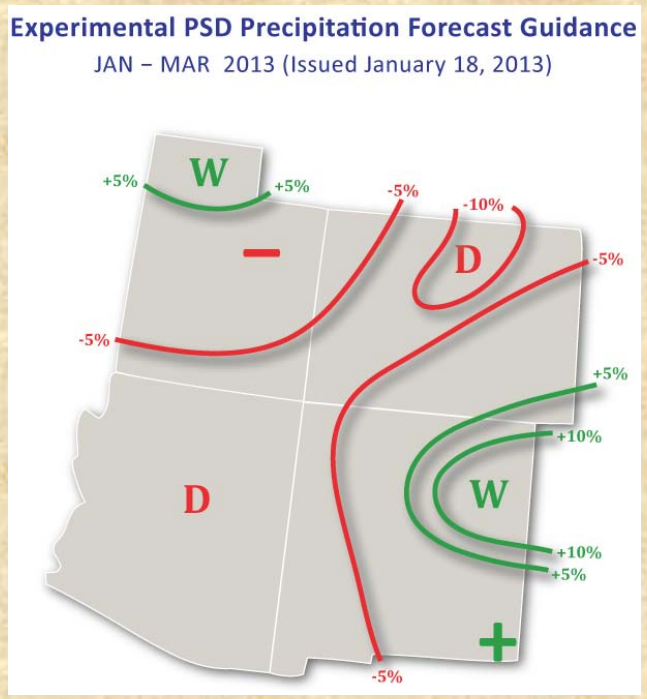
ENSO flavor favors low runoff (left), while fall precip in Upper Colorado Basin does the same unless we get a big turnaround in December (right). This would result in another low runoff year.



Statistical Forecast for JFM'13







For much of this domain (not N CO), winter moisture can be predicted with some skill in September (left). This year's forecast was modestly optimistic over UT, CO, and most of NM. The updated forecast in November (center) was much more tilted towards dryness in our state, covering all but the southeast corner with 'dry' odds. The final update (right) confirms this dire outlook for CO.

Skill is lowest in northern and northeastern Colorado, so the dry forecast is not 'reliable'.

Executive Summary (23 Jan 2013)

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- **For the first time in nine years, ENSO-neutral conditions have been the backdrop to this winter, and are expected to continue into early spring. Positive AMO and negative PDO values go a long way towards explaining our dry fall and early winter.**

- **Snowfall has been unusually anemic for a 2nd winter in a row. This does not bode well for our runoff season (*42% variance of CO River runoff is related to fall moisture*). The next two weeks show above-average chances for moisture in northern CO in particular, but not nearly enough to make up for lost ground.**

- **My forecast for late winter (January-March) shows below-normal odds for moisture in much of CO, still consistent with a cold North Pacific (PDO) in conjunction with a warm North Atlantic (AMO).**

- ***While a strong intraseasonal event could help with a transition back to El Niño by spring, it could also bring us additional moisture before then. There is currently no capability to predict such an event more than a week or two in advance (there is nothing on the horizon for now, despite one brief flicker of hope earlier this month).***

- **Bottomline: After 10 'double-dip' Las Niñas observed in the last century, Year 3 ended up on the wet side on three occasions, while five were clearly dry in the Upper Colorado basin. Given the continuing PDO-AMO setup for drought, pessimism remains justified for at least the next few months.**