Earth System Research Laboratory
Physical Sciences Division

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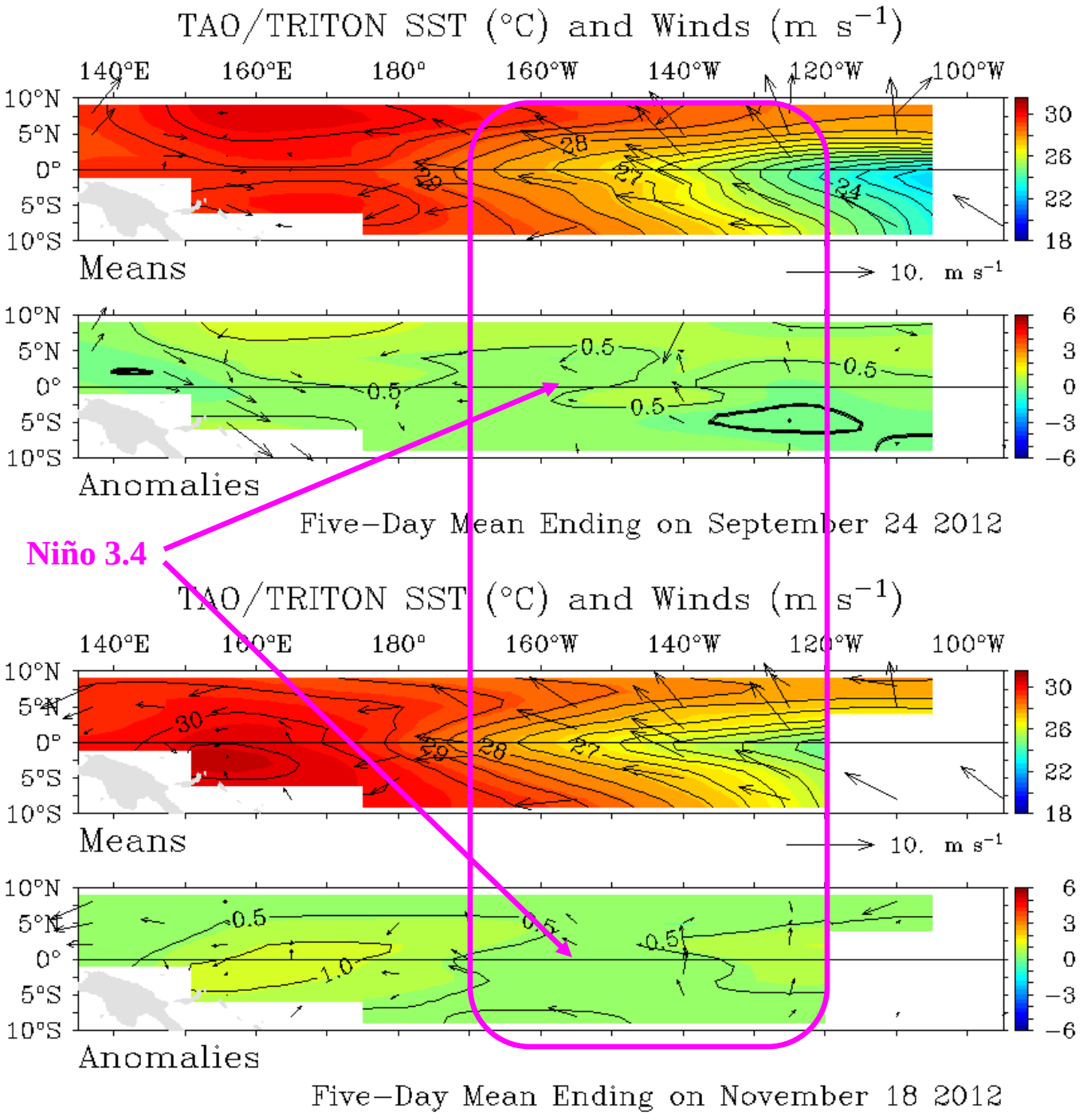
Colorado WATF,
20 November 2012
Denver

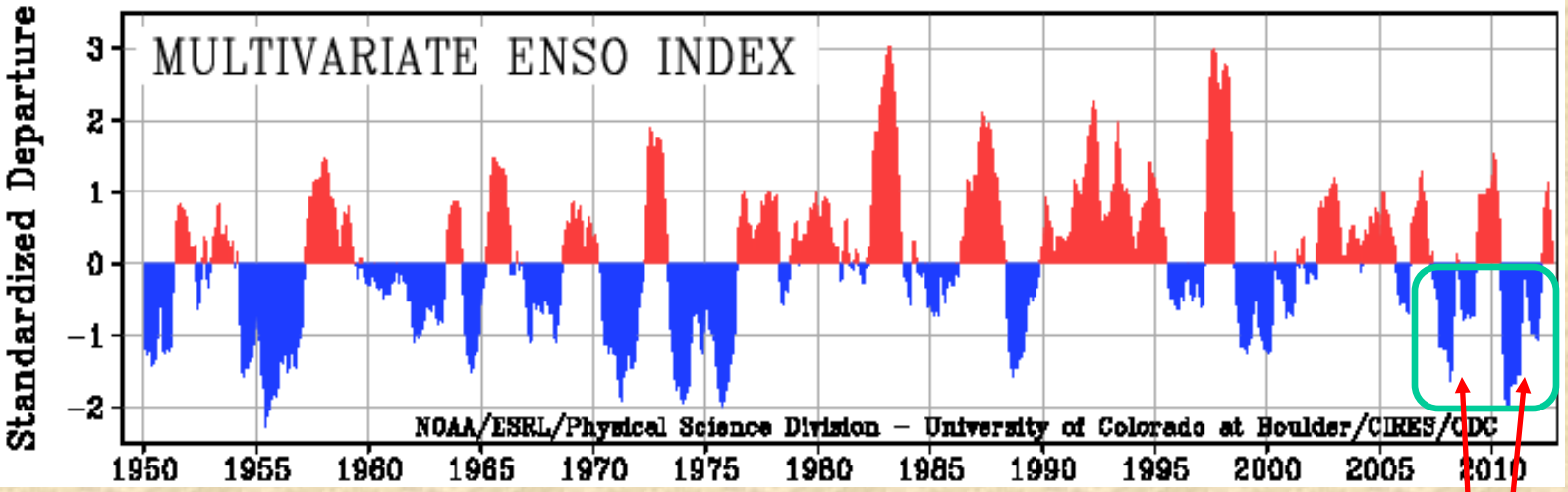
Seasonal Outlook into early 2013

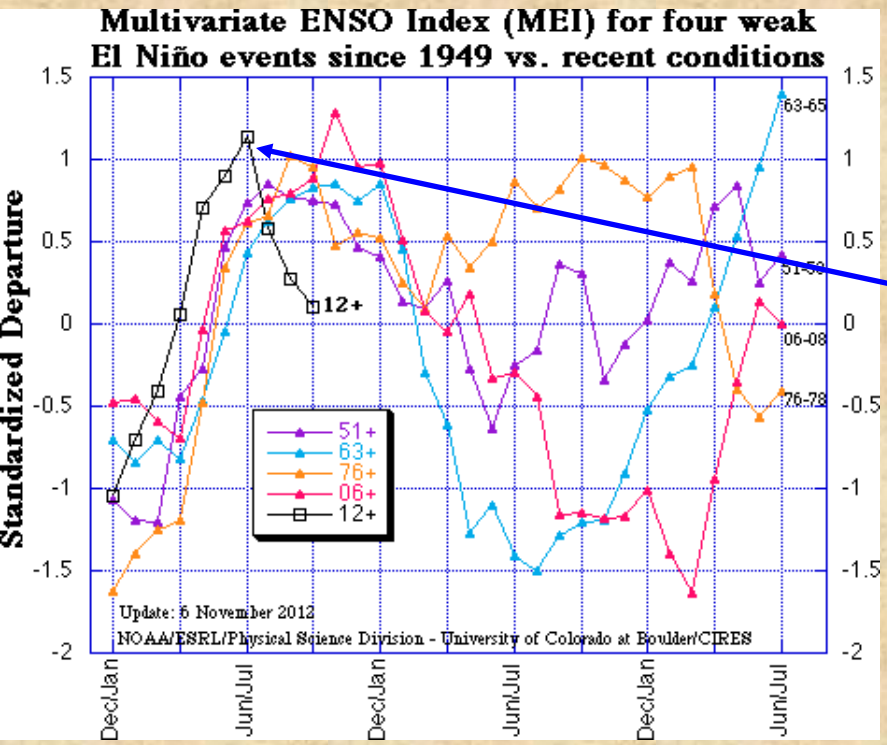
Klaus Wolter
University of Colorado, CIRES & NOAA-ESRL PSD 1, Climate Analysis Branch
klaus.wolter@noaa.gov

- **First ENSO-neutral winter in nine years**
- **Expectations for the next two weeks**
- **CPC forecasts for December 2012 through March 2013**
- **Experimental Seasonal Forecast Guidance**
- **Executive Summary**

Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to last time (top): Recent tropical Pacific wind anomalies are weak, and SST anomalies have shifted 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. I put the odds for this at <10%.

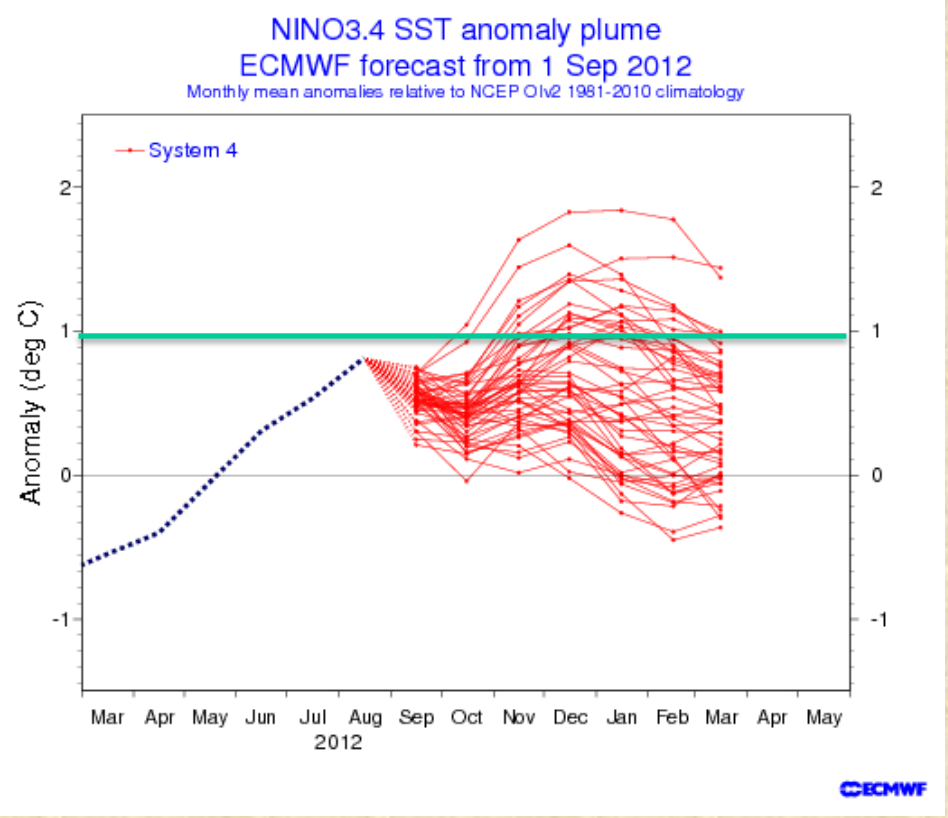




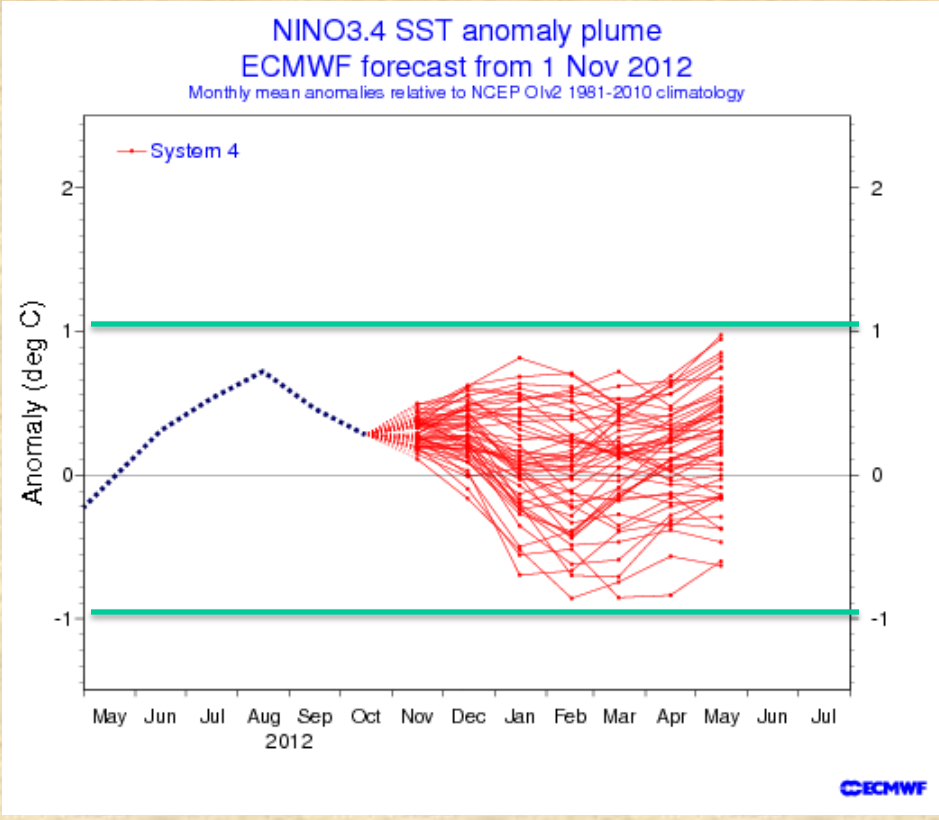


Last five years have seen two 'double-dip' Las Niñas in a row, followed by a brief excursion to what looked like an El Niño event a few months ago, and a return to ENSO-neutral conditions as of this fall – highly unusual behavior, but not completely unprecedented (1953 for aborted event, 2004-5 for intermittent event).

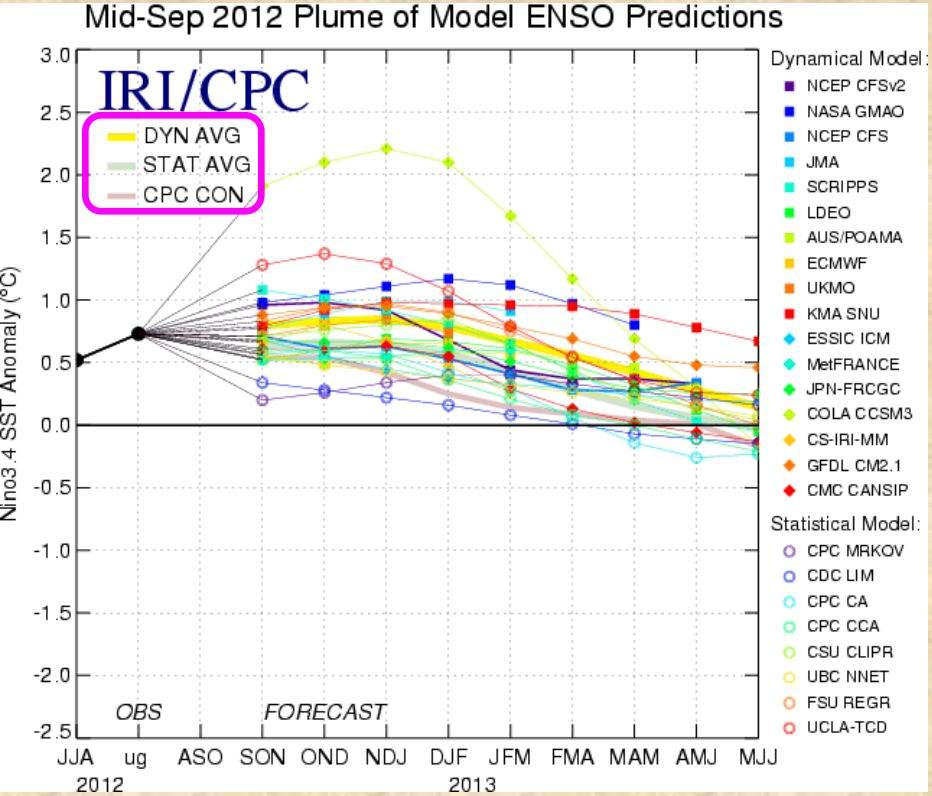
http://www.esrl.noaa.gov/psd/enso/mei



The ECMWF September 2012 forecast (left) showed an *odd* evolution: a weakened El Niño overall, with a peak around the turn of 2012-13, but mostly remaining below 1˚ C. *Compared to earlier forecasts, this El Niño looked weaker, with no 'Super-El Niño-members'.*

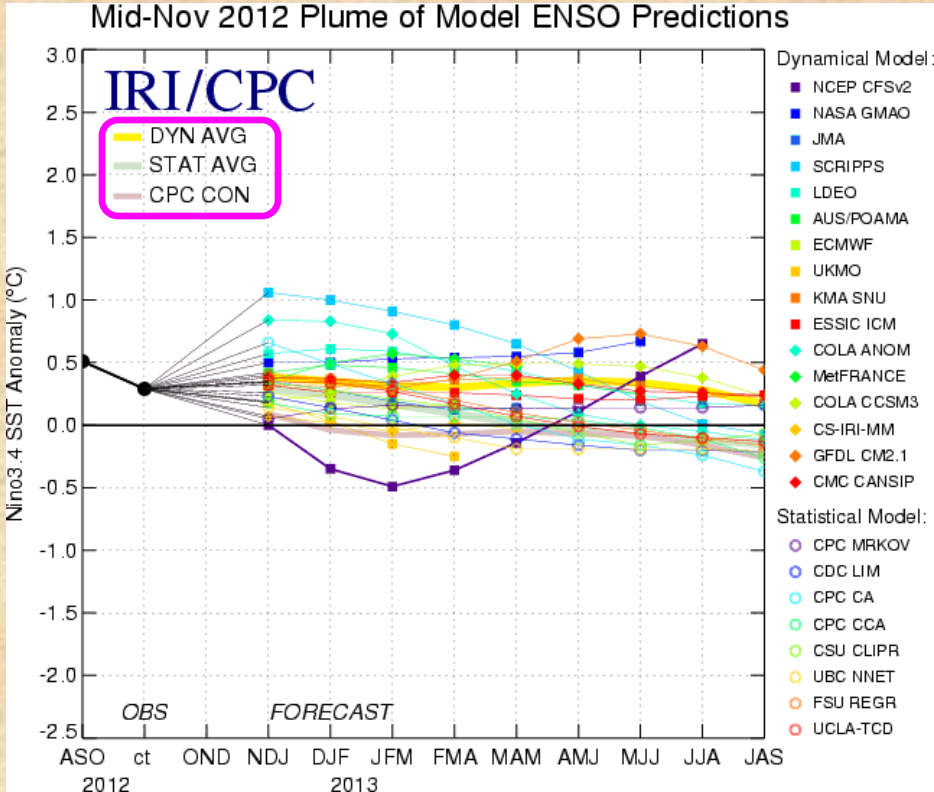


The ECMWF November 2012 forecast (right) has settled on an ENSO-neutral scenario for this winter, with no ensemble member outside the +/-1˚ C range. *There is a hint of drifting towards El Niño again next spring.*

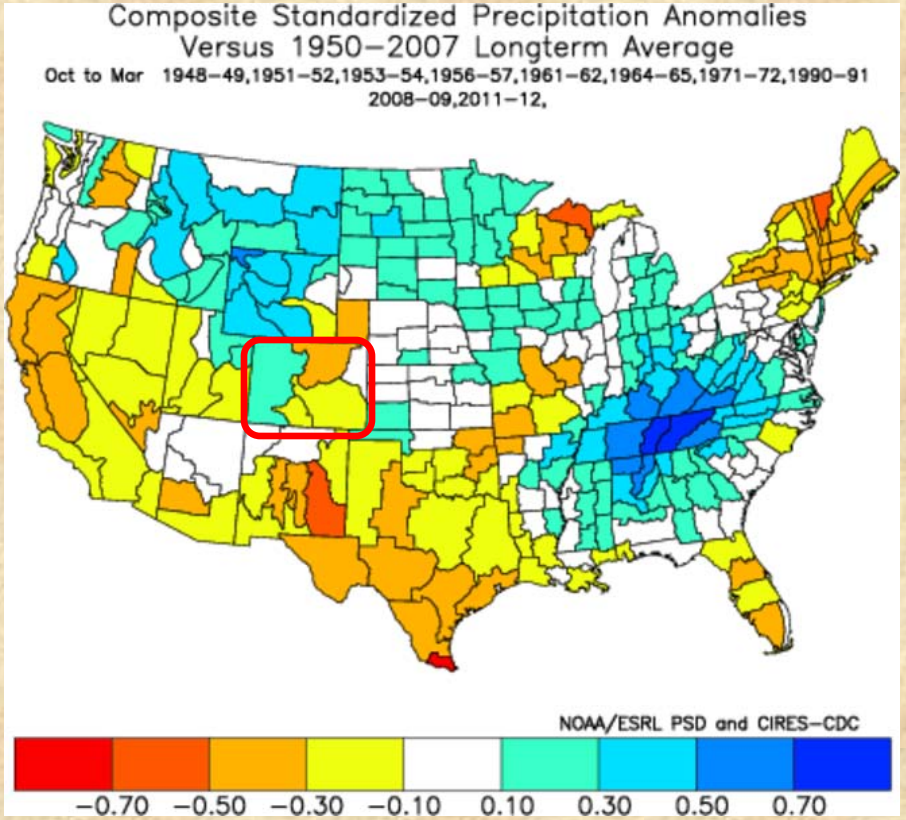


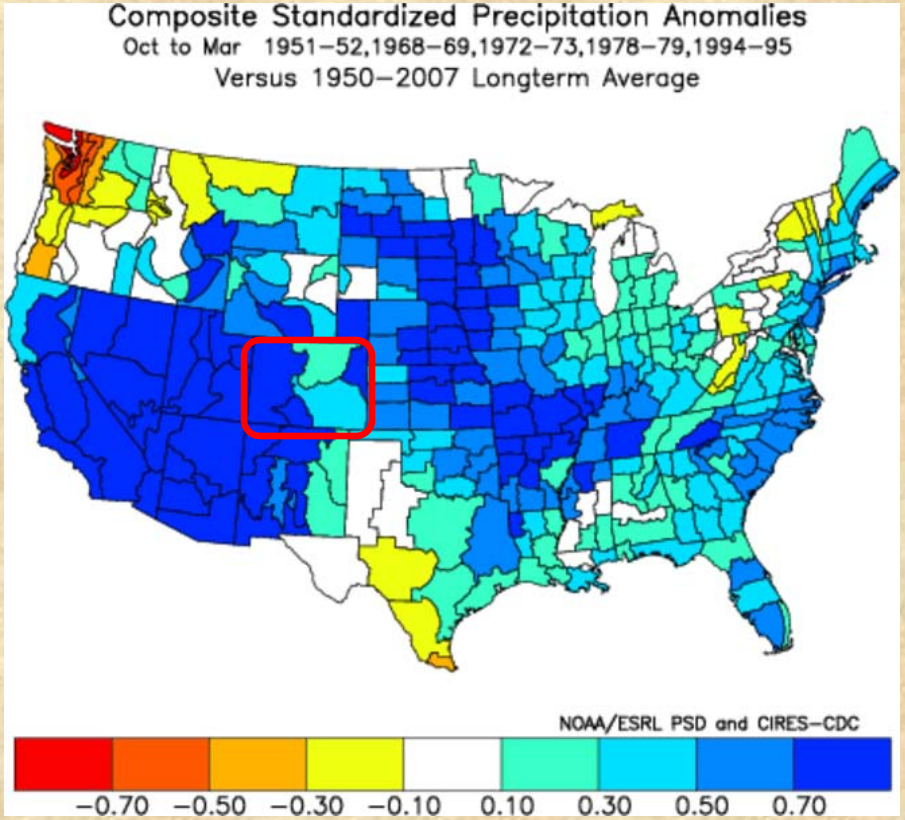
ENSO forecasts from 17 dynamical & 8 statistical forecast models from September (left): Dynamical models (yellow average) showed slightly stronger preference for El Niño than statistical models which appear to do better after all (for late 2012).

Except for a few die-hard dynamical models, overwhelming consensus is now for ENSO-neutral. Interesting outliers: CFS2 (CPC) goes for a weak La Niña in early 2013, while Scripps has the most pronounced (initial) El Niño; last month's COLA outliers have settled down again – *month-to-month variability of dynamical forecasts remains unusually high.*



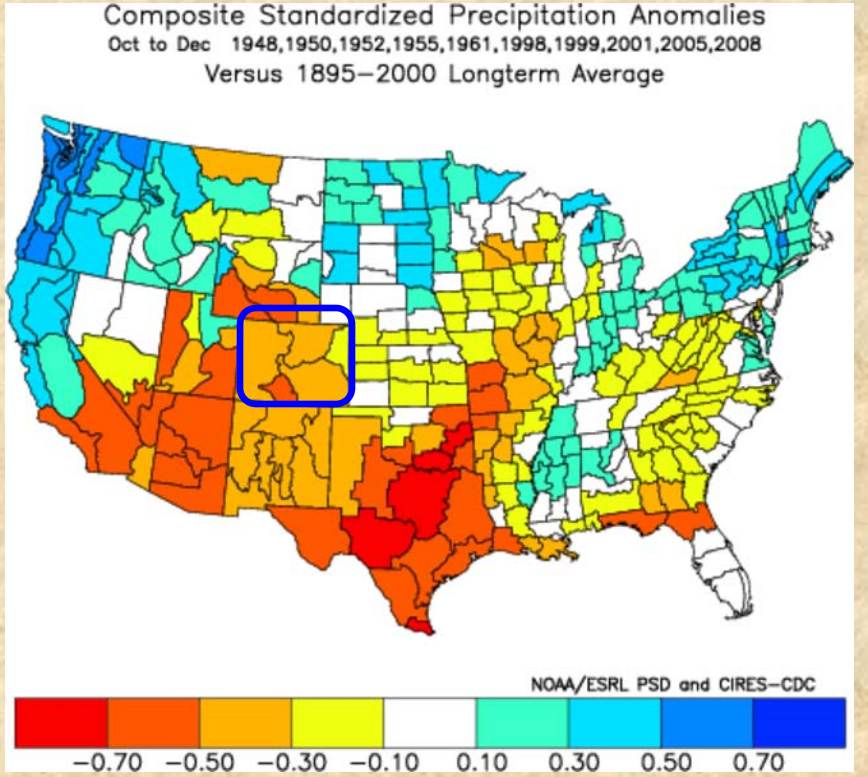
Neutral ENSO (left) or El Niño (right) with negative PDO

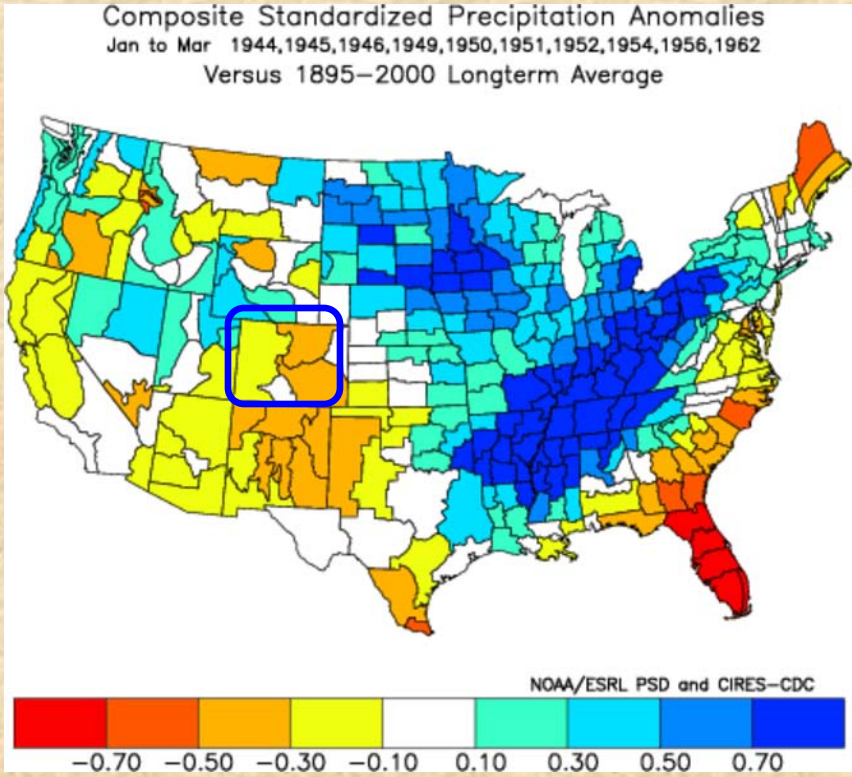




During negative PDO and no moderate to strong ENSO event of either phase, the winter half-year (Oct-Mar) tends to be close to normal in Upper Colorado Basin (left) while eastern Colorado would be less favored. If El Niño were to come back to life (at this point, a near miracle; right), it would dramatically increase the odds of a wet winter half-year in all of the southwestern U.S. But the odds for that are extremely slim. *It is fairly uncommon to get negative PDO and positive ENSO conditions, hence the small sample on the right (5 cases).*

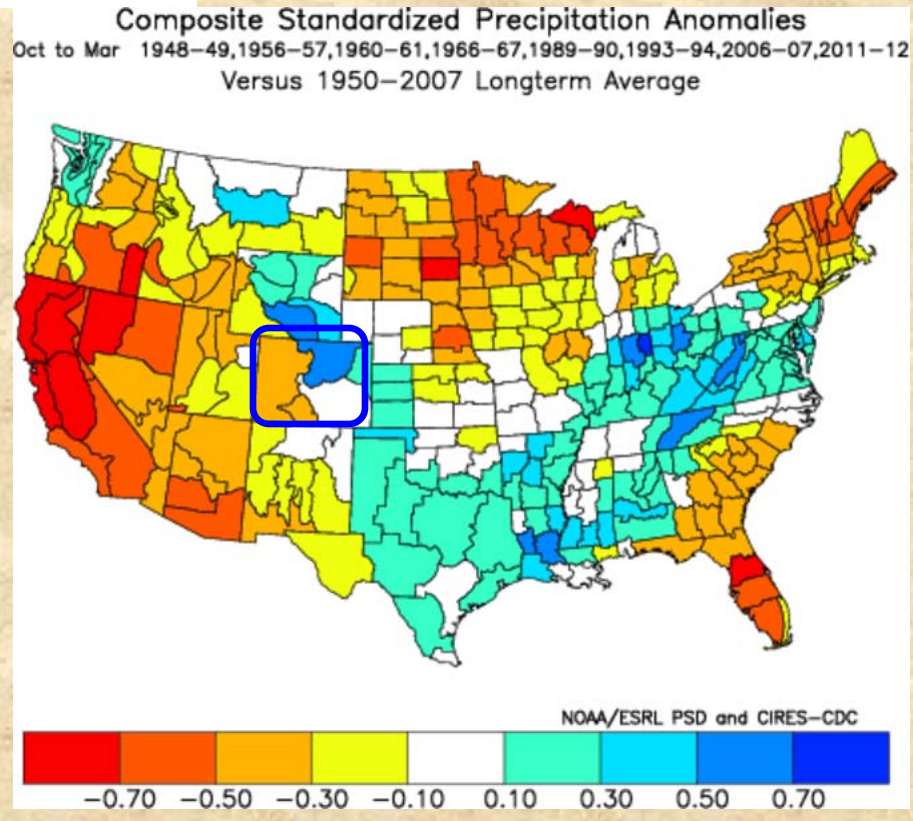
What typically happens if we keep low <PDO-AMO>

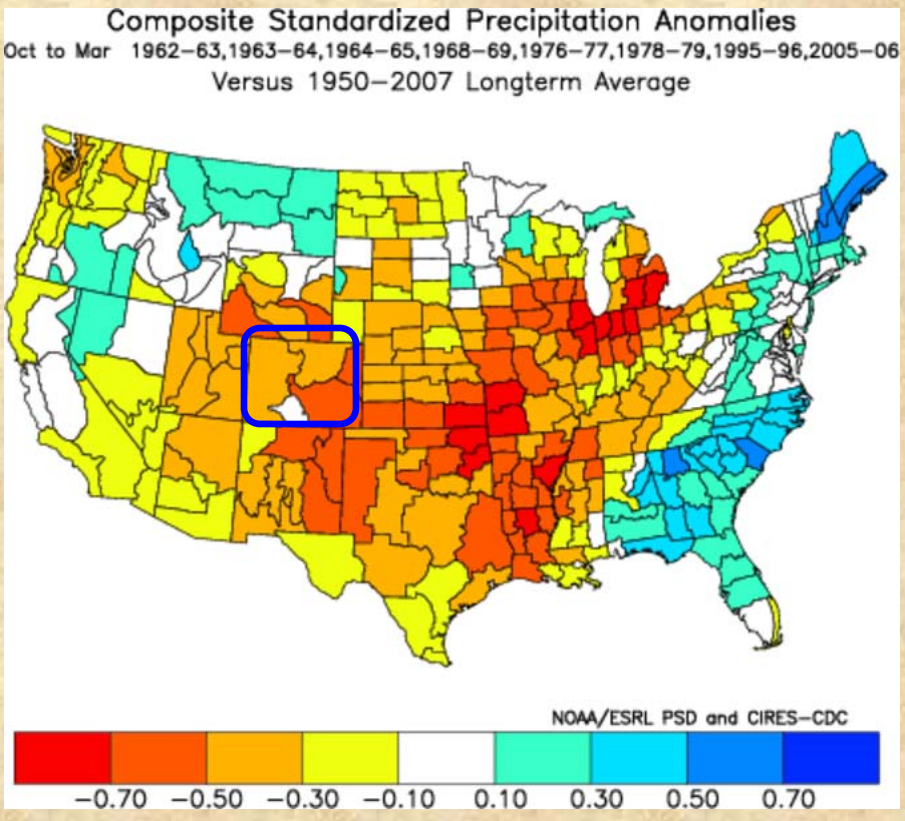




After being consistently low for much of the last decade, the difference in normalized anomalies between PDO and AMO reached its lowest value on record this summer. In late fall (left), precipitation tends towards the dry side in all of Colorado. Late winter (right) shows slightly less unfavorable odds for western Colorado, but still mostly dry for our state.

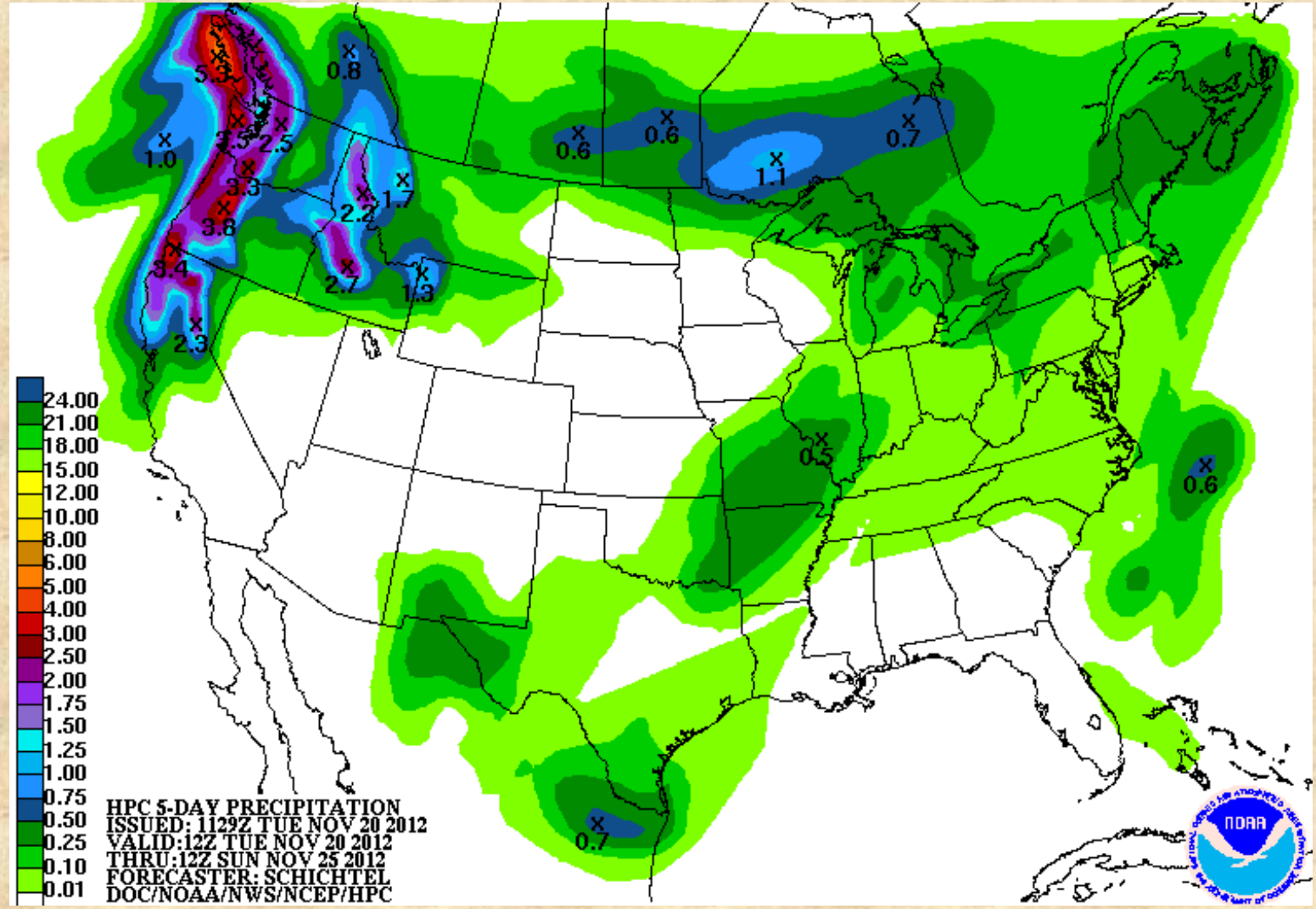
Neutral ENSO vs. NAO+ (left), or NAO-





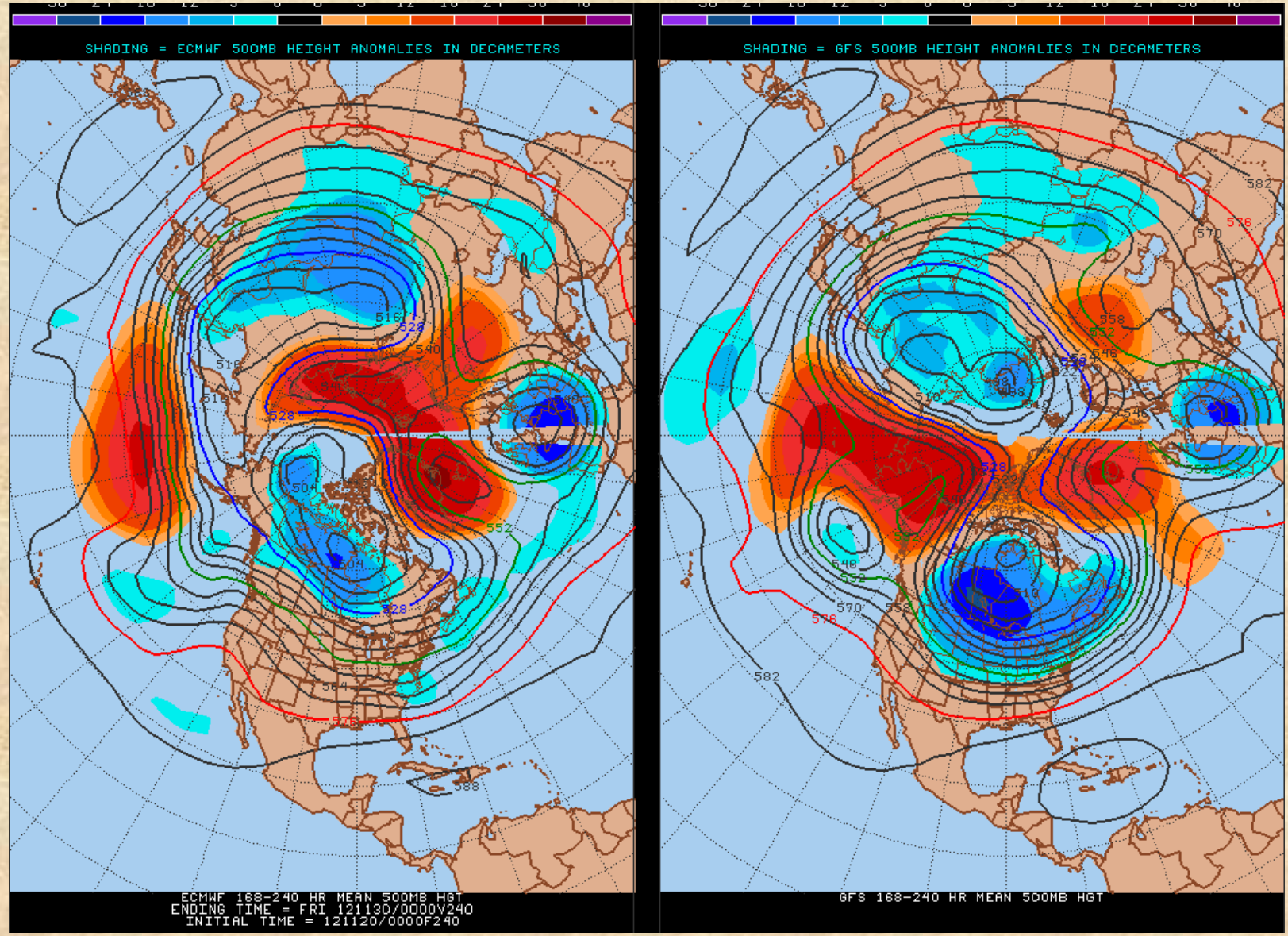
During positive NAO and no moderate to strong ENSO event, the winter half-year (Oct-Mar) tends to be <u>drier</u> than average over the Upper Basin (left), while the Front Range would be favored. In the negative NAO case (right), the focus of dry conditions shifts eastward to leave all of Colorado dry. At present, we are not able to predict the state of the NAO more than two weeks out.

What can we expect in the next five days?



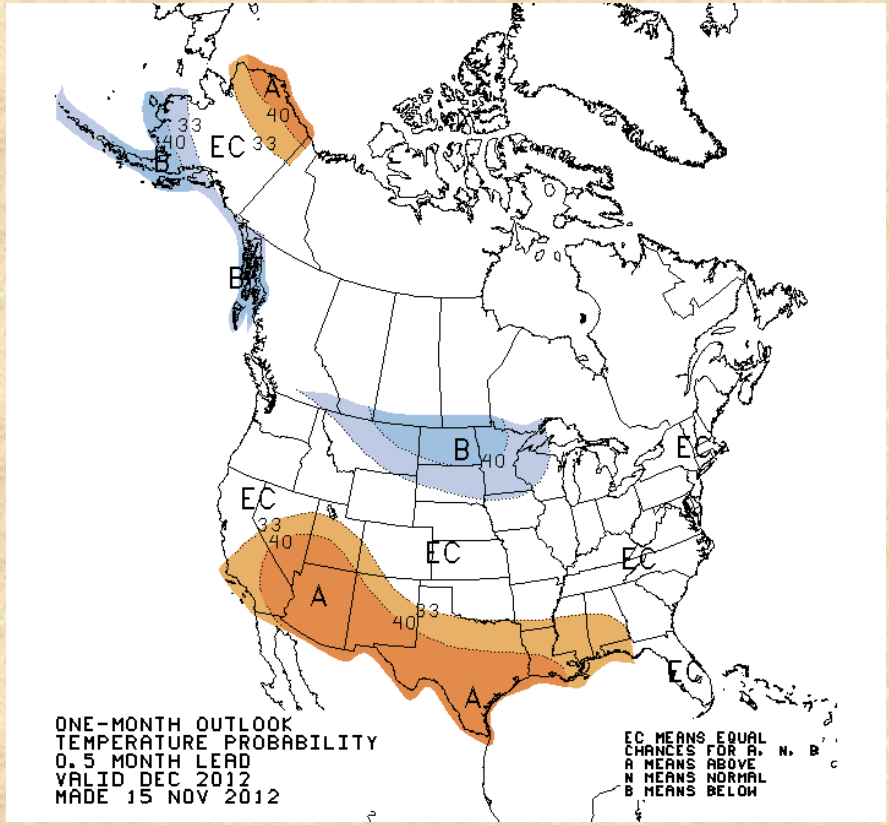
Expected total precipitation thru Sunday morning, according to the Hydrological Prediction Center (HPC): ***More of the same: DRY!***

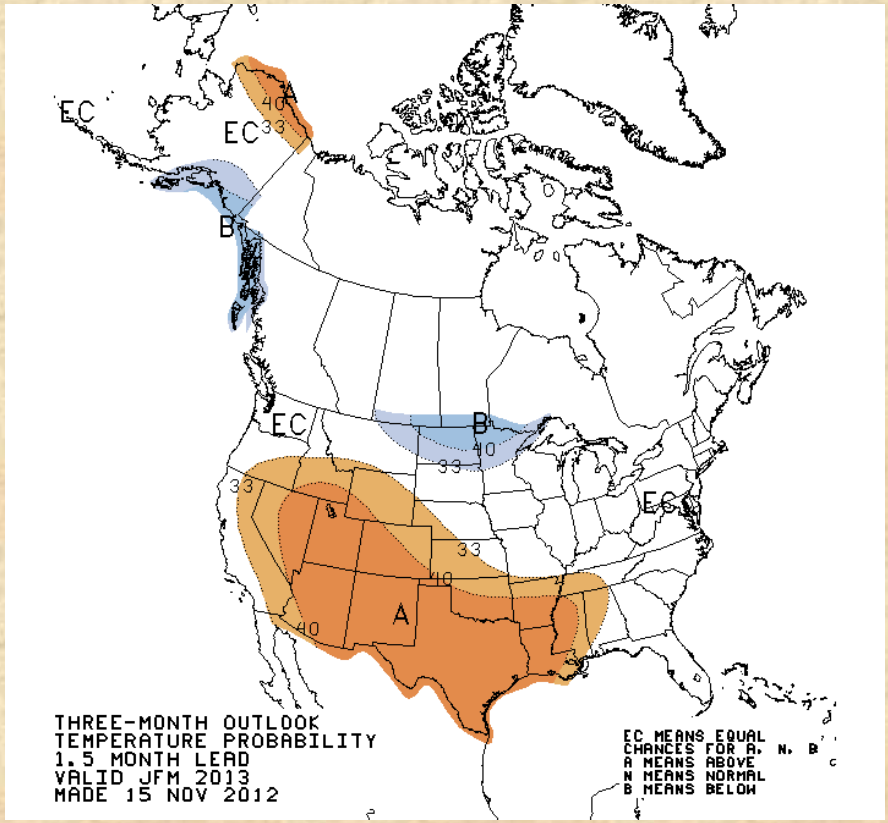
What can we expect next week?



ECMWF and GFS show a contrast over Colorado: near-normal flow in the former, and enhanced colder northwesterly flow in the latter. Yesterday's runs were more favorable…

Climate Prediction Center Temperature Forecasts

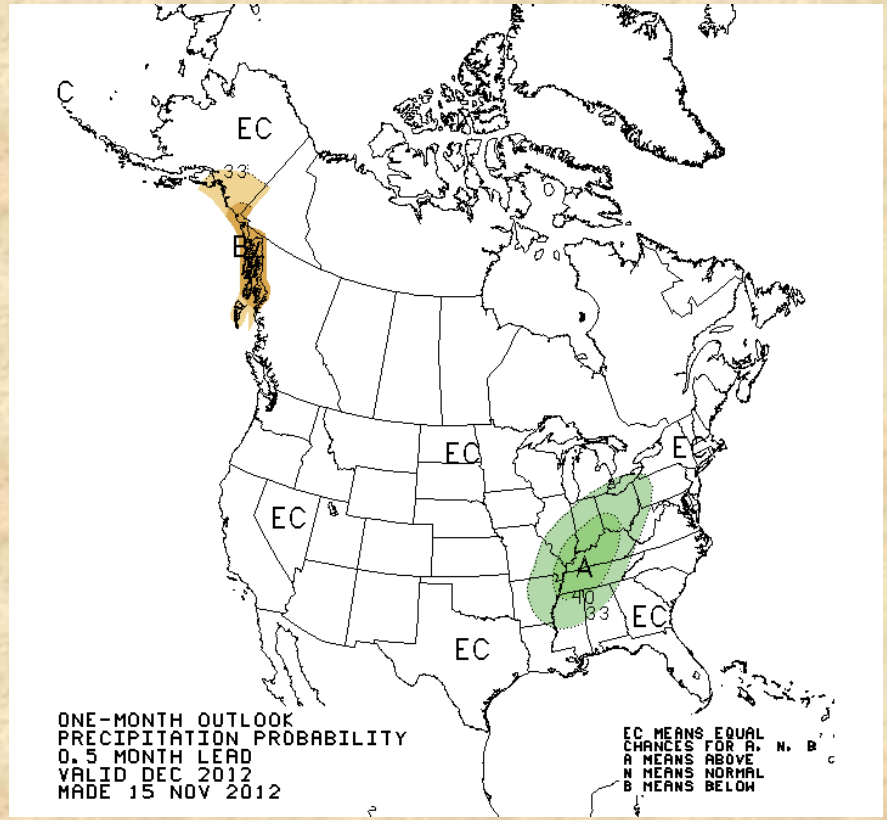


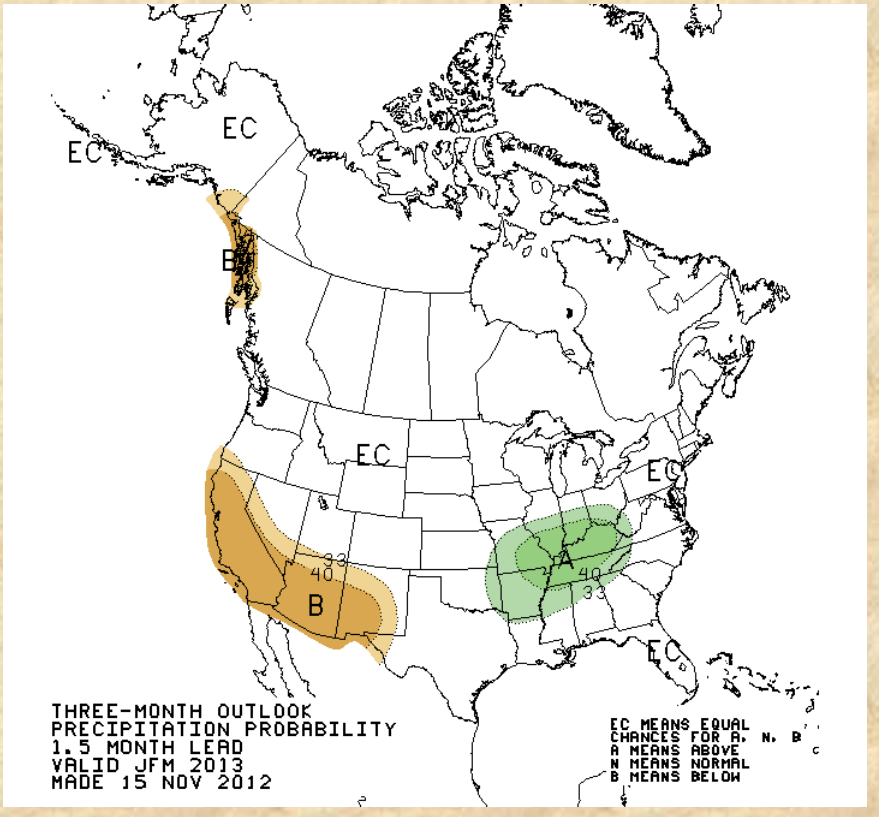


CPC's temperature forecasts for December (left) and January-March (right) reflect recent warming trends plus negative PDO conditions which are explicitly used for what seems to be the first time ever. Colorado is expected to be warmish this winter (mostly trend), although a big snowstorm could upend this scenario with a subsequent cold spell on either side of the divide.

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

Climate Prediction Center Precipitation Forecasts

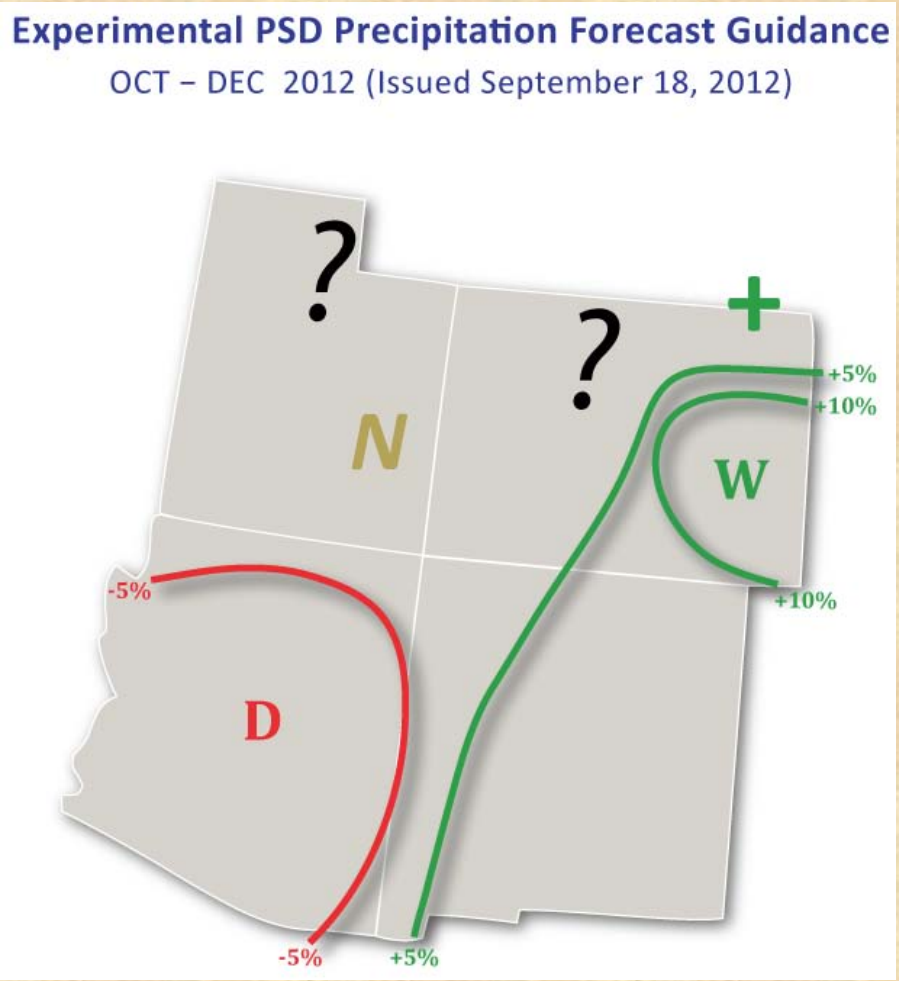




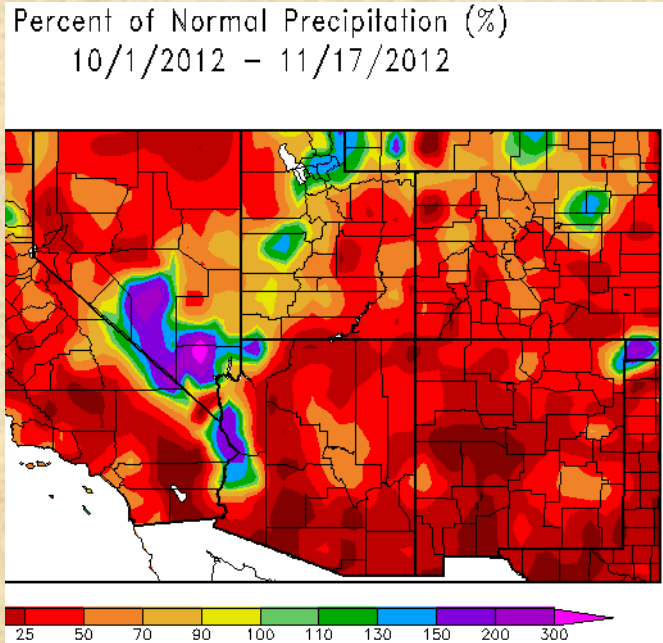
CPC's precipitation forecasts for December (left) and January-March (right) reflect recent mostly negative PDO conditions which do not have a big footprint around Colorado, but the south and west (dry). In one week, an updated forecast for the month of December will probably have less areal coverage of 'EC' based on weather forecast models at that time.

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

Statistical Forecast for OND'12 – Verification so far



"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."*

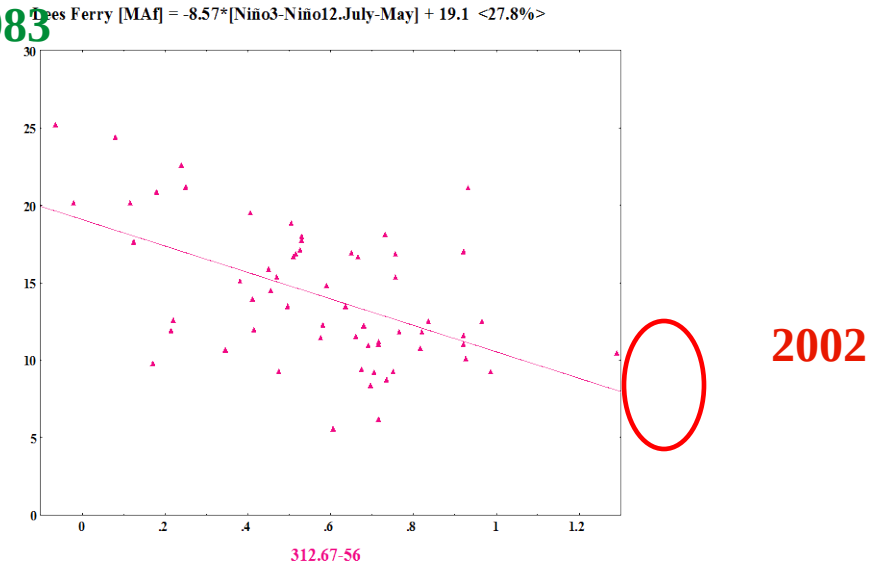


Observed H_2O (right) so far has been on the dry side, not a good start to the season…

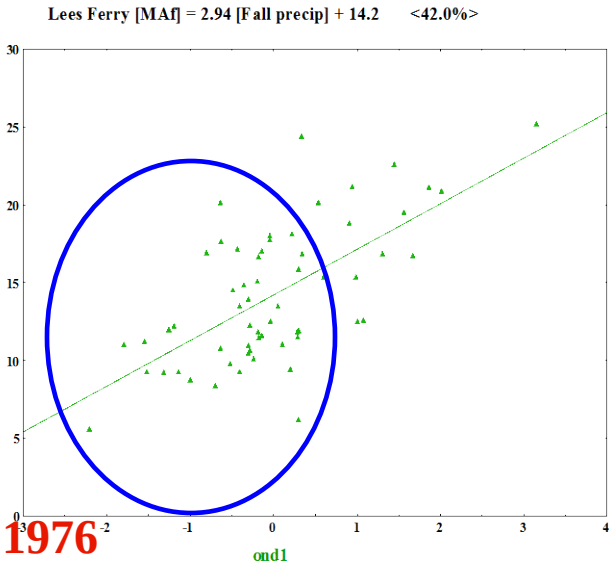
Lees Ferry Naturalized Runoff in Water Year 2013 - Key predictors:

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

1983

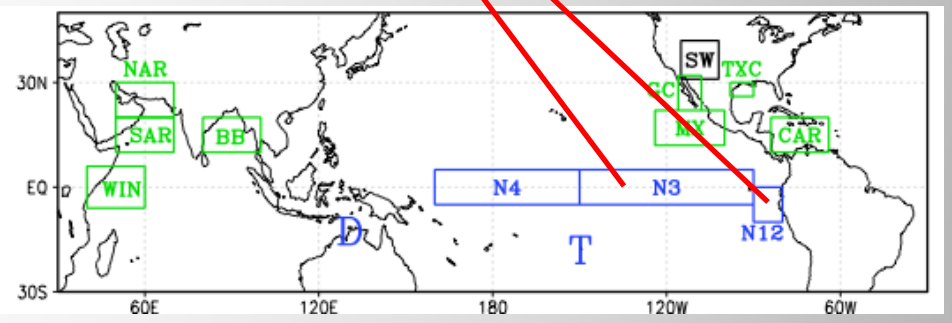


2002

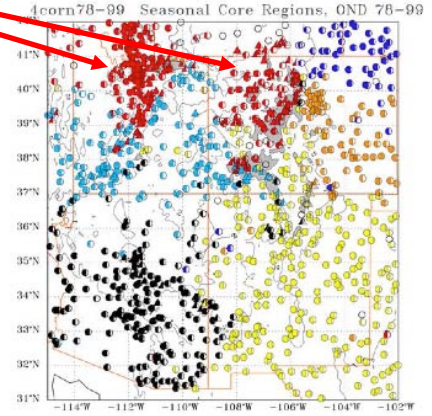


1983

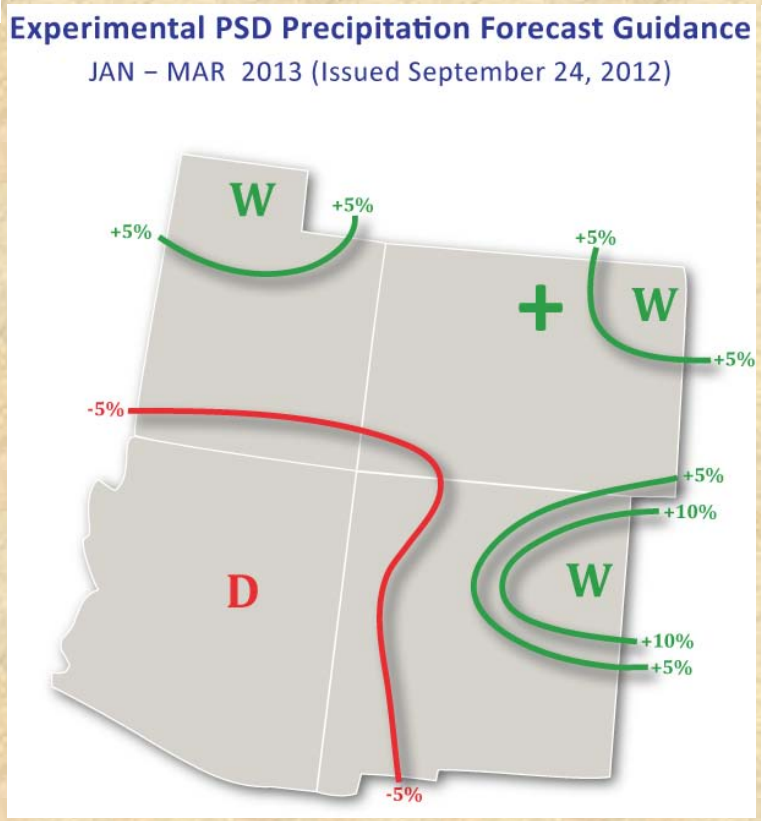
1976

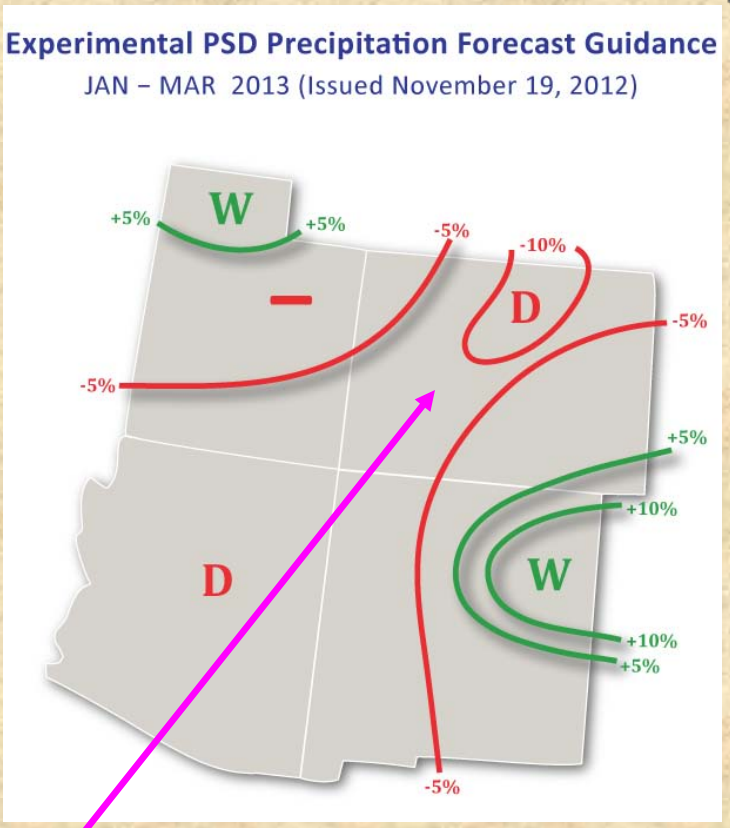


ENSO flavor favors low runoff (left), while fall precip in Upper Colorado Basin does the same unless we get a big turnaround in December (right). This would result in another low runoff year.



Statistical Forecast for JFM'13





For much of this domain (not N CO), winter is fairly predictable in September (left). This year's forecast was modestly optimistic over UT, CO, and most of NM. The updated forecast (right), shows a new tilt towards dryness in our state, covering all but the southeast corner with 'dry' odds.

The reduced odds of a wet winter in much of the southwestern U.S. reflect the reduced odds of El Niño over the next few months. FWIW, forecast skill in northern CO remains marginal at this lead-time.

Executive Summary (20 nov 2012)

klaus.wolter@noaa.gov

- **For the first time in nine years, ENSO-neutral conditions appear to be on tap this winter.**

- **While Thanksgiving will remain dry, snowy and cold conditions will try to invade our state next week, but the odds for that have dropped again.**

- **My forecast for late winter (January-March) shows below-normal odds for moisture in much of CO, most likely related to a cold North Pacific (PDO) in conjunction with a warm North Atlantic (AMO). This is less optimistic than two months ago when El Niño was more likely.**

- ***While a strong intraseasonal event could help with a transition back to El Niño by next spring, it could also bring us additional moisture before then. There is currently no capability to predict such an event more than a few weeks in advance (there is nothing on the horizon for now).***

- **Bottomline: For once, we will not be able to lean on El Niño or La Niña to explain this winter forecast. Of the 10 'double-dip' Las Niñas observed in the last century, three ended up clearly on the wet side (five on the dry side) for the Upper Colorado basin in Year 3.**