Earth System Research Laboratory
Physical Sciences Division

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*Colorado WATF,*
*21 November 2013*
*Denver*

# Seasonal Outlook through March 2014

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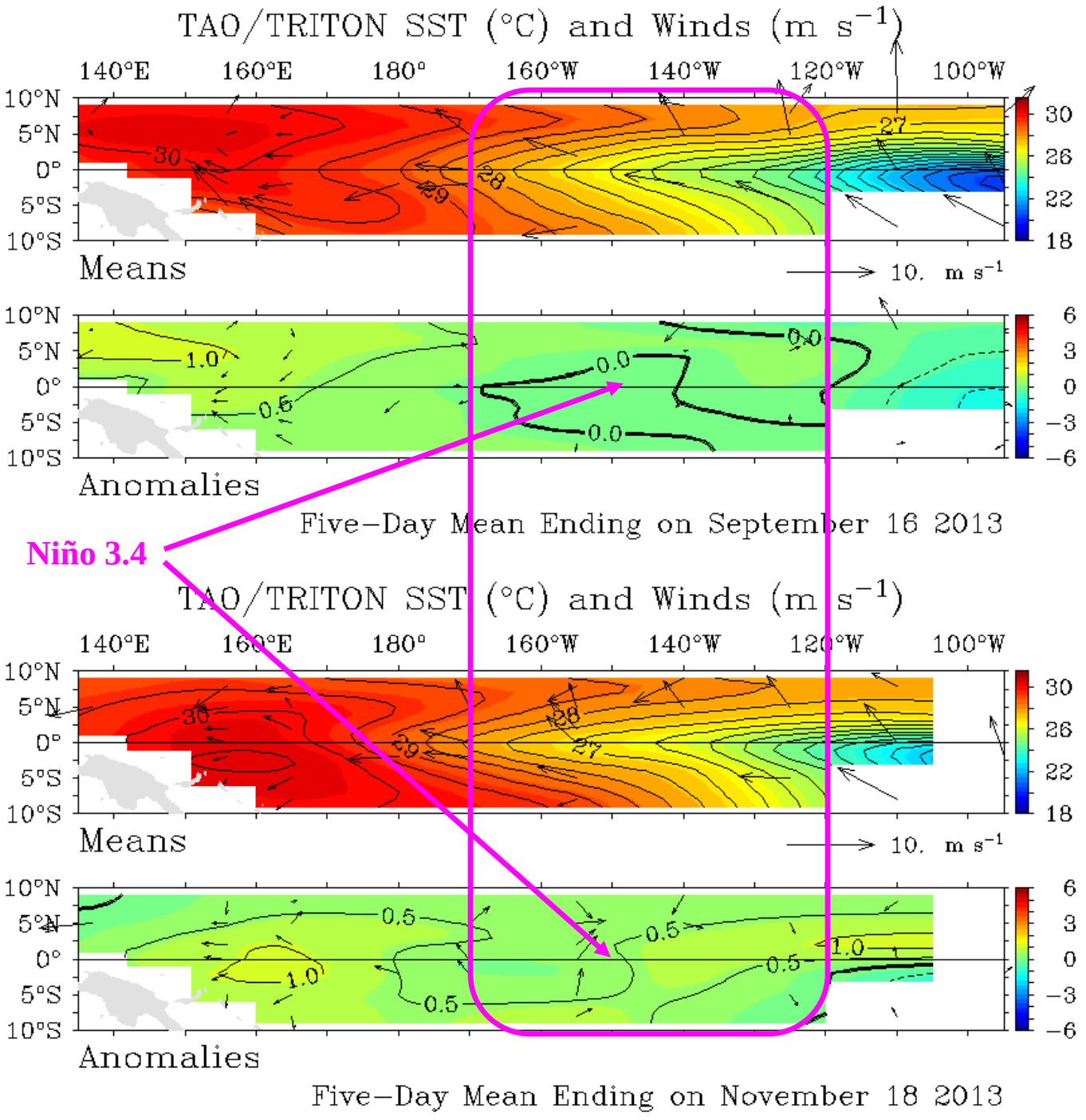
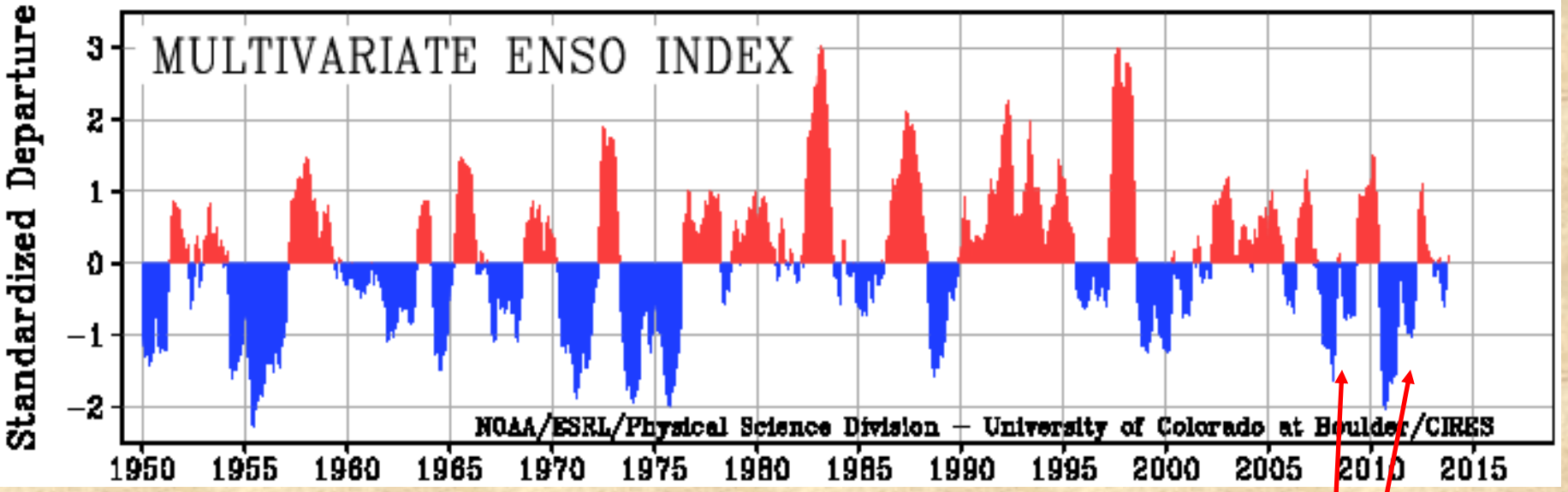
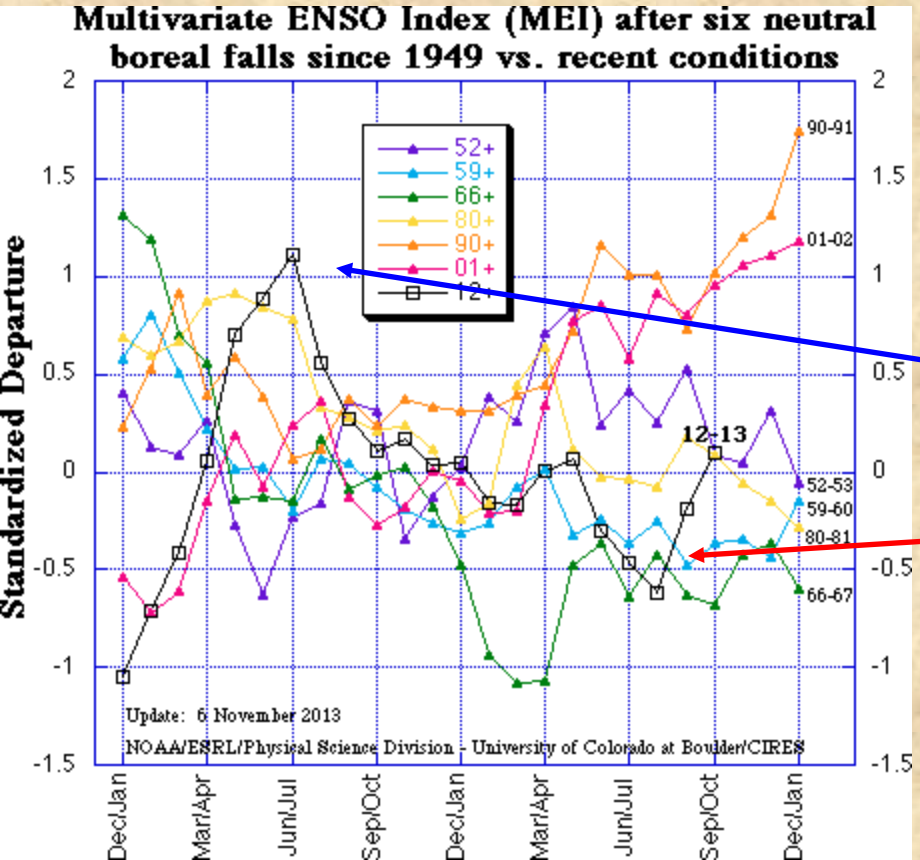
*<Thanks to Taryn for presenting!>*

- **What has happened to ENSO, what will happen next, and what does that mean for us ?**
- **Expectations for the next two weeks**
- **CPC forecasts for November '13 through March '14**
- **Seasonal Forecast Guidance for precipitation**
- **Other factors to consider**
- **Executive Summary**

**Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to September (top): looks like we are still stuck in ENSO-neutral in the central Pacific, with an overall warming that is mostly east and west of the critical Niño 3.4 box. Recent wind anomalies have remained weak, and are not conducive to rapid change.**

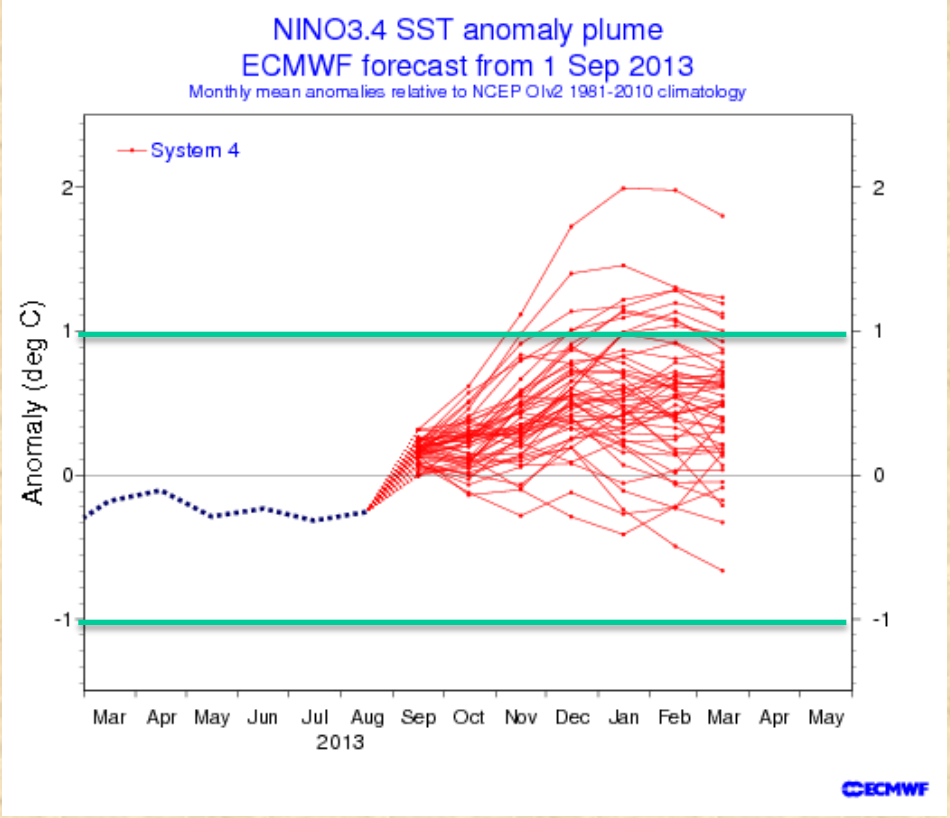




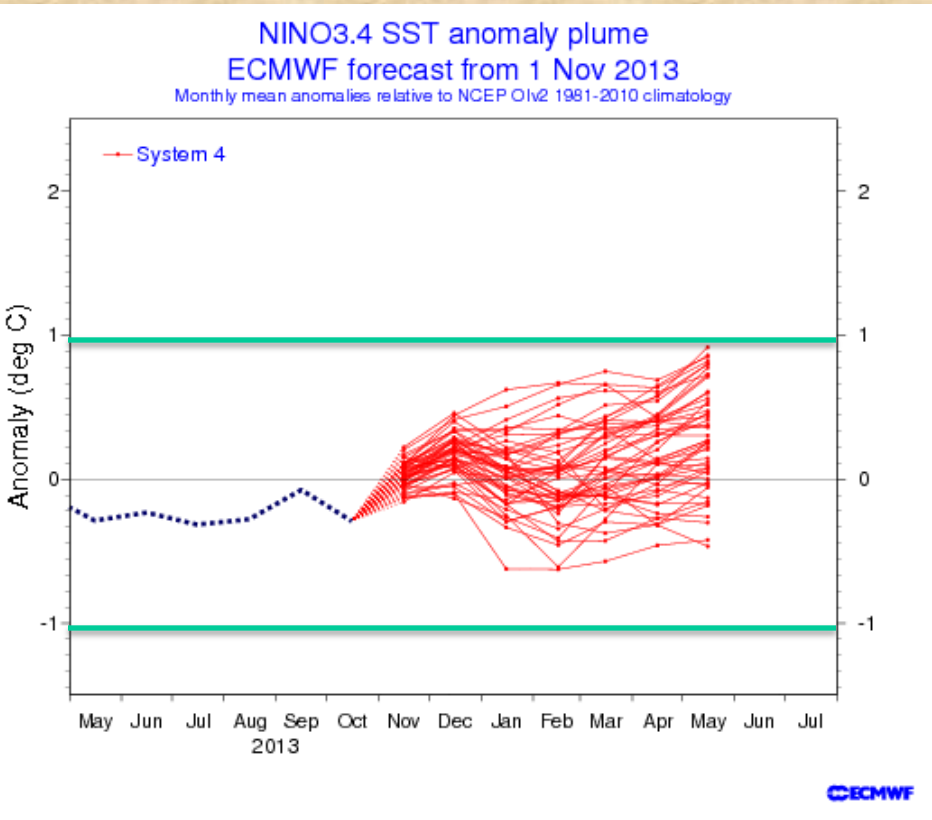




***Last five years have seen two 'double-dip' Las Niñas in a row, followed by a brief excursion to what looked like an El Niño event in 2012, a return to ENSO-neutral conditions as of last fall , and a recent dip towards La Niña that appears to have been shortlived.***

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

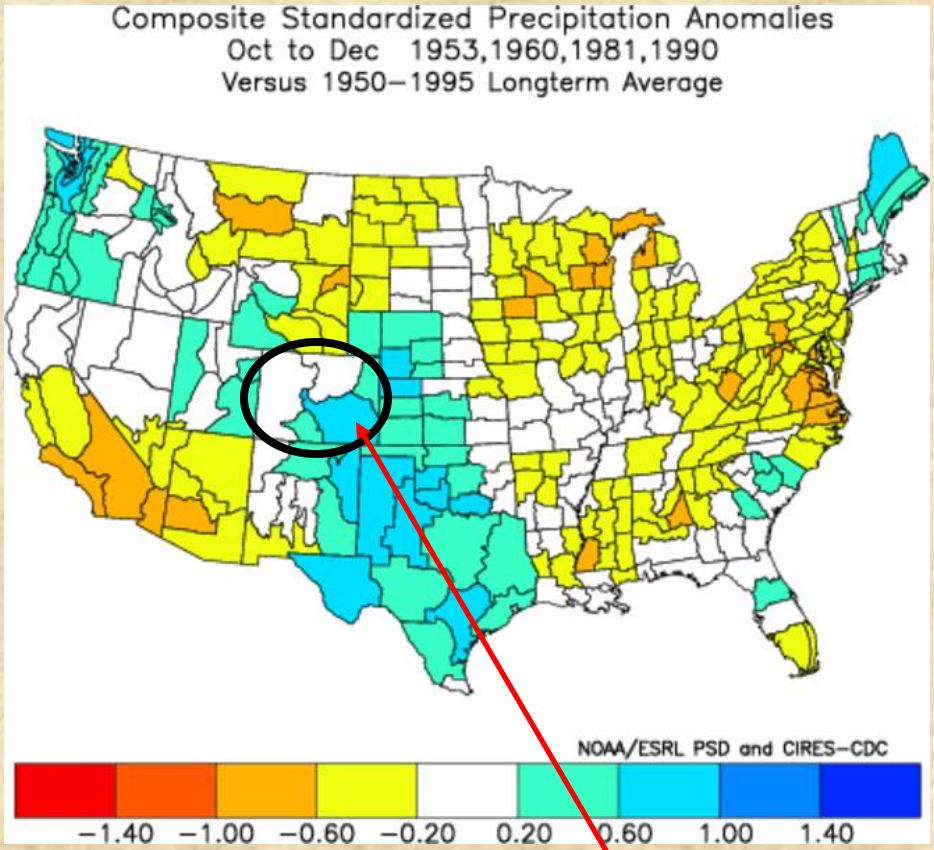


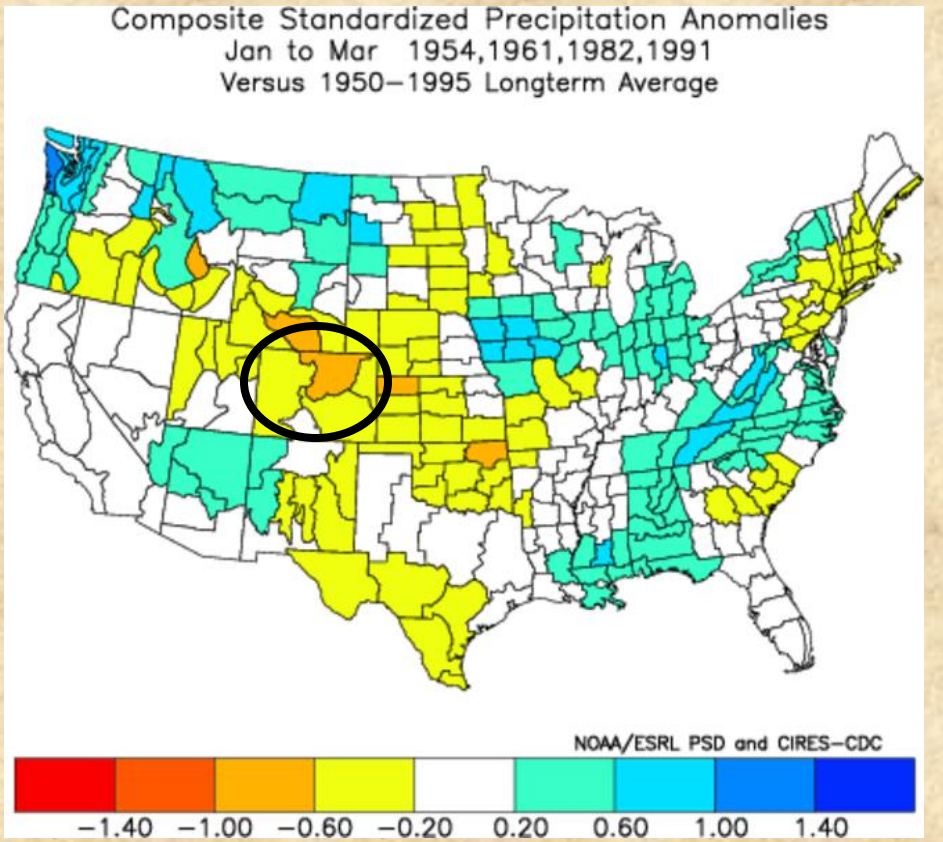

**The ECMWF September 2013 forecast (left) showed a drift from neutral conditions towards weak El Niño-like conditions by late 2013. While the scatter was large for this time of year, there was only ONE ensemble member drifting back towards La Niña by early 2014.**




**The ECMWF November 2013 forecast (right) shows the expected drop in range in possible outcomes through the next six months, but the typical outcome is closer to ENSO-neutral than before.** ***The IRI plume is not publicly available in time for this briefing, but it shows a similar bundling of ENSO-neutral runs through the next six month, with a slow drift towards El Niño.***

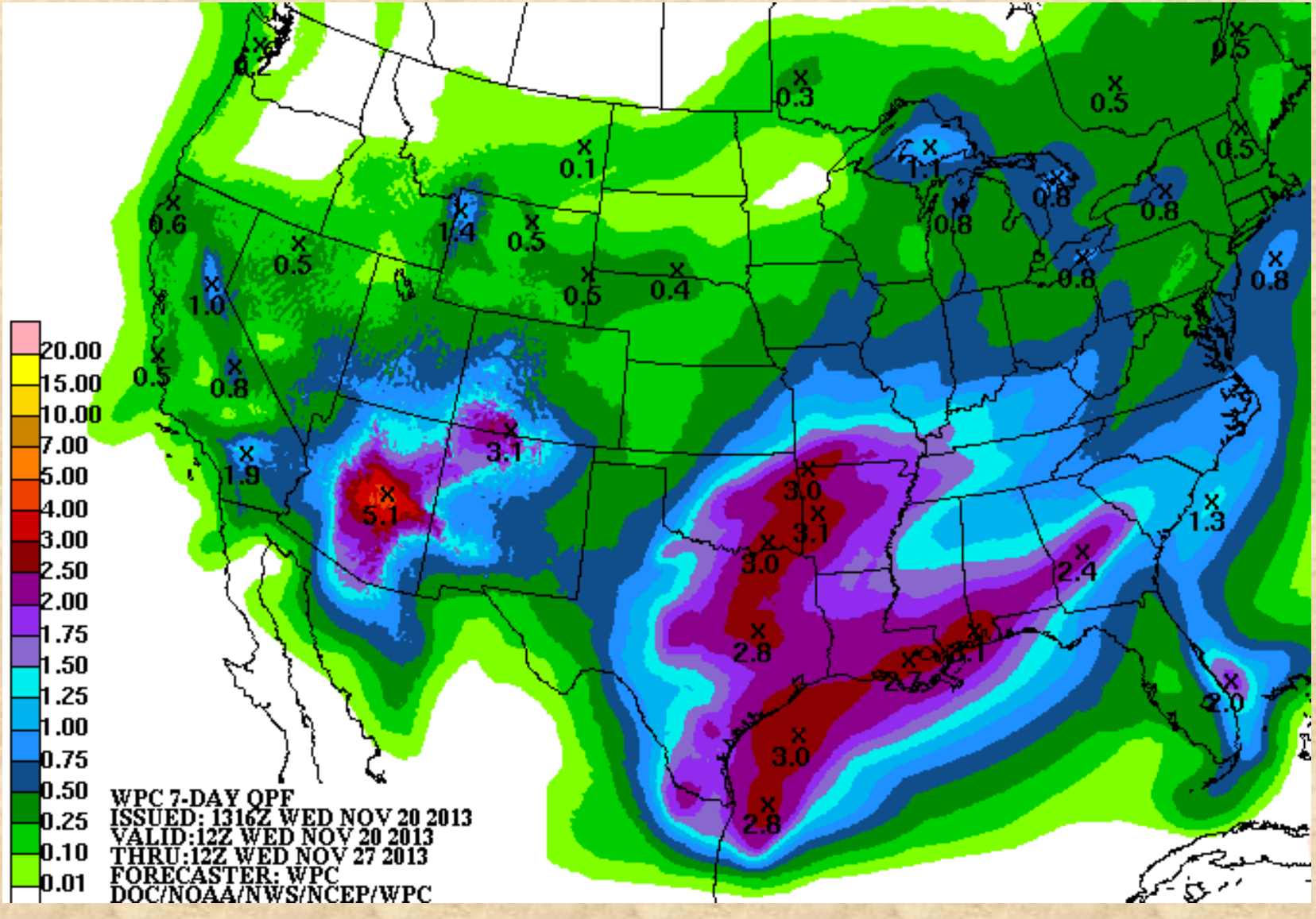
# 2nd year ENSO-neutral composites



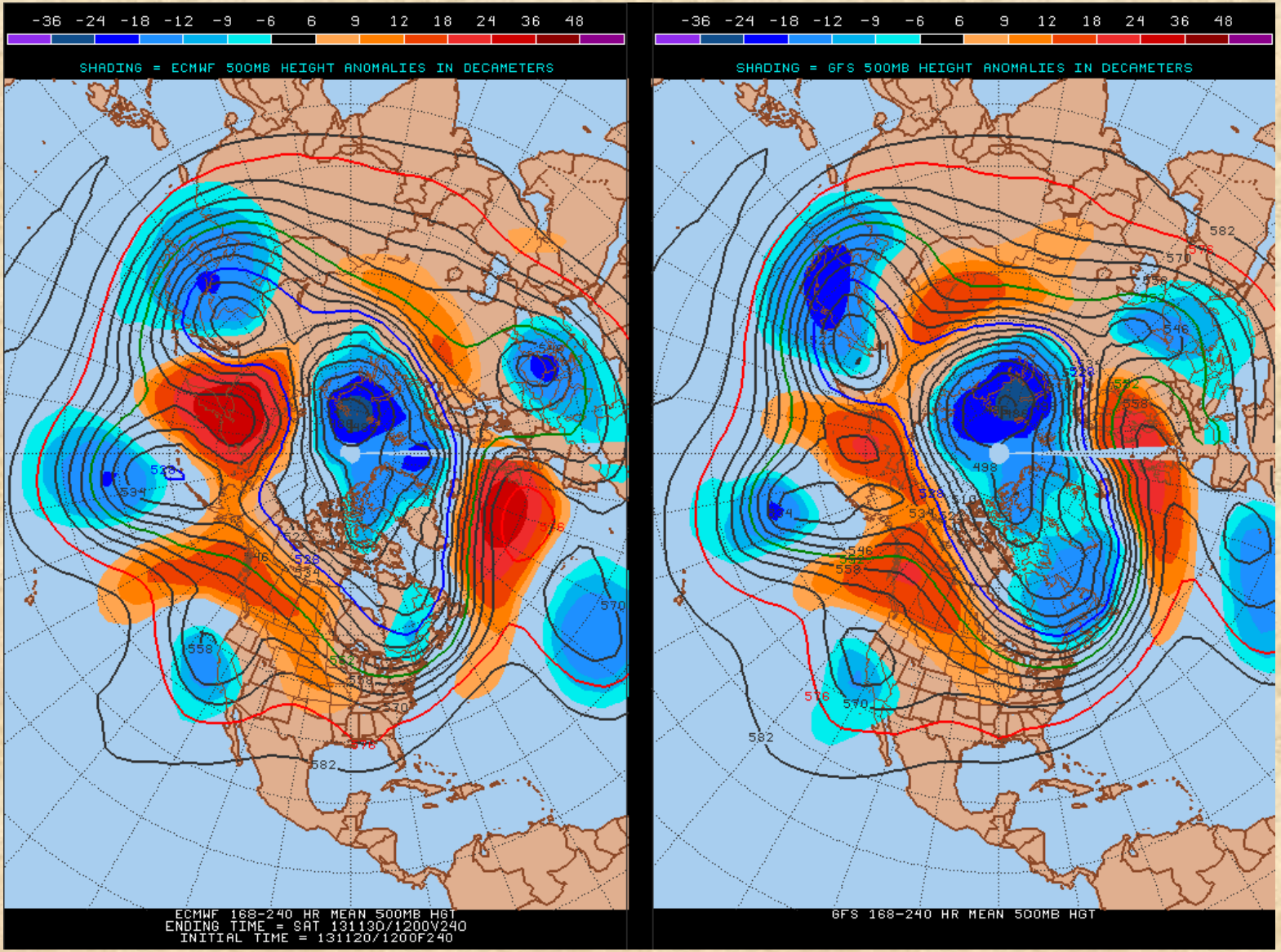

***Using four analog cases with 2nd year ENSO-neutral conditions, the precipitation odds for the 2nd year fall (Oct-Dec; left) are neutral (white) or enhanced (blue-green) over our state. This is succeeded by increased odds for dry conditions in the subsequent late winter season (Jan-Mar; right). The sample is so small that this should be considered for curiosity only.***

# What can we expect in the next seven days?



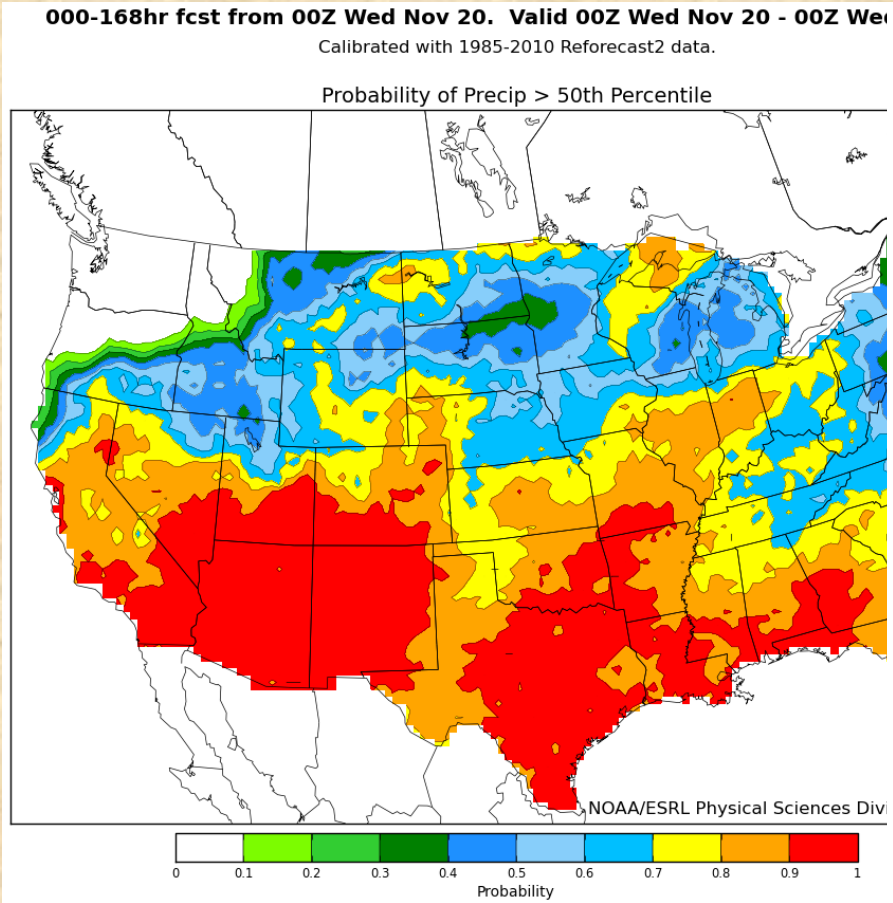

***Expected total precipitation, according to the Hydrological Prediction Center (NOAA): What looked like a very good moisture producer for CO has shifted its focus southward.***

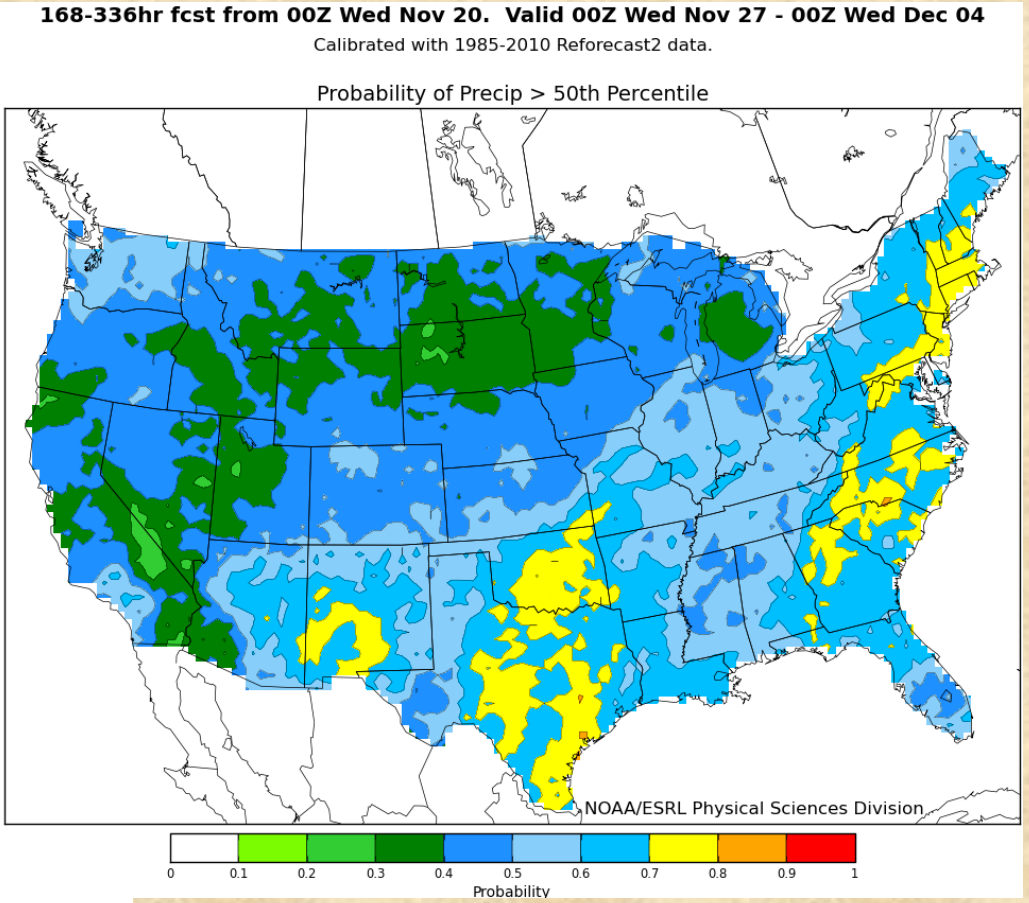
# What can we expect by next weekend?




***European & U.S. models show a 'split flow' over the Western U.S., keeping most of CO 'high and dry', while allowing for the possibility of moisture to sneak into the San Juans.***

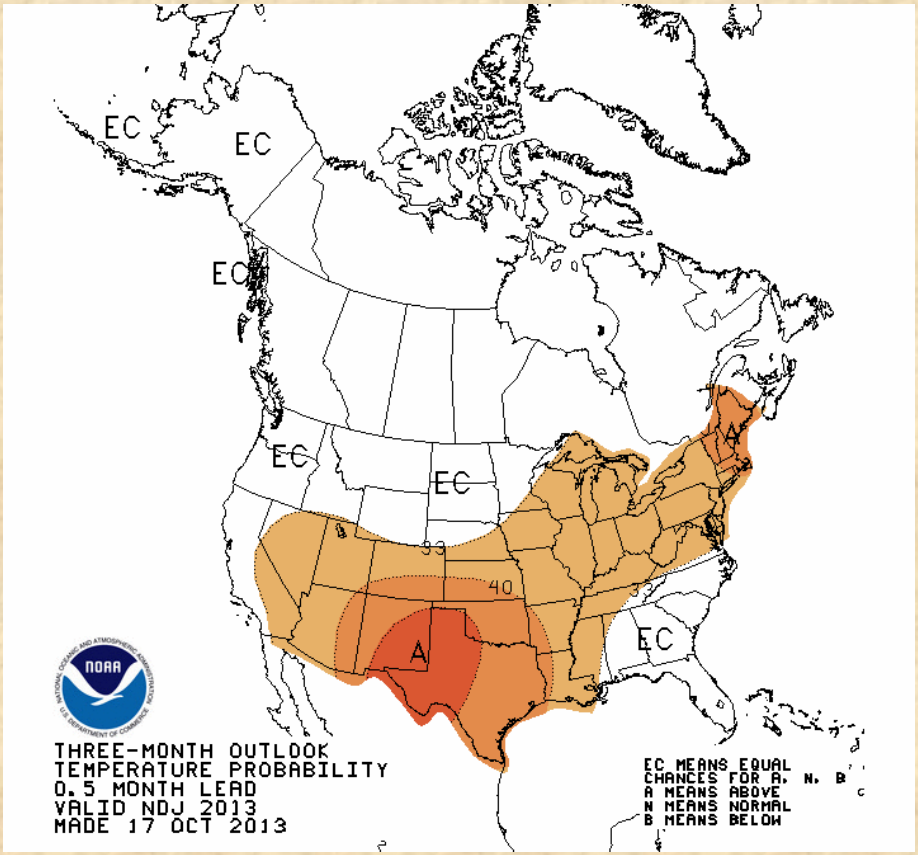
# Reforecast precipitation odds for Weeks 1&2

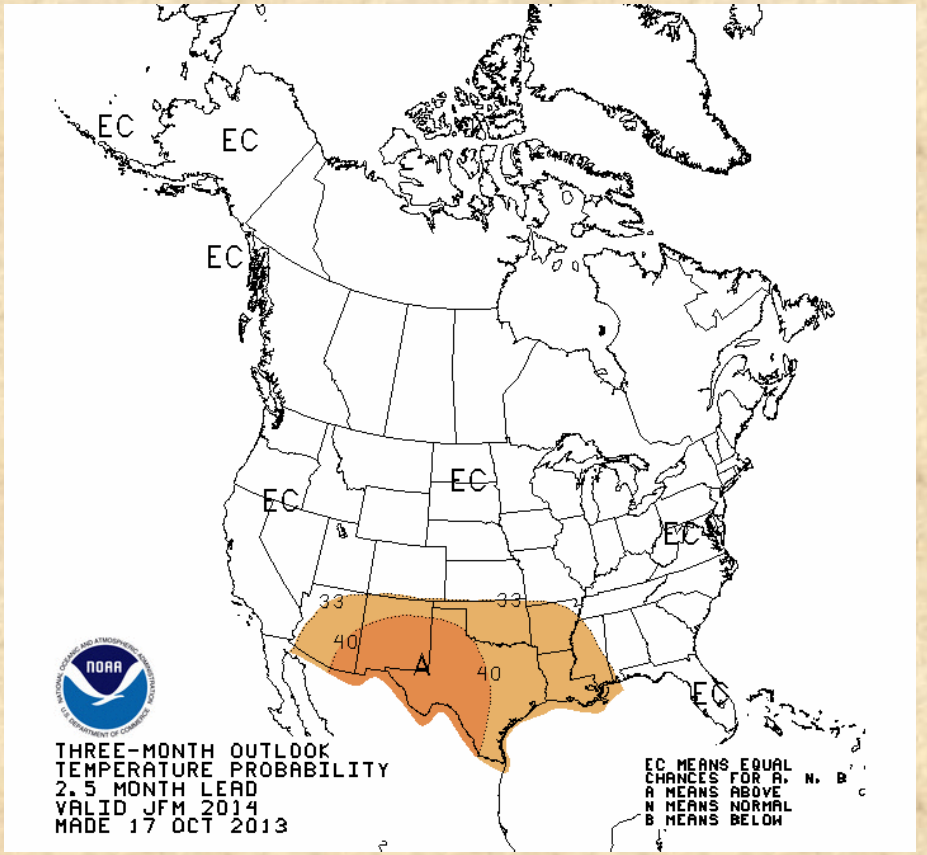



**Precipitation amounts are expected to be well-above normal for Colorado in Week 1 (left), especially over the San Juans, while Week 2 (right) shows a southward shift of the storm track that will reduce our chances for moisture slightly below normal. These odds were calculated early on the 20th of November.**

# Climate Prediction Center Temperature Forecasts

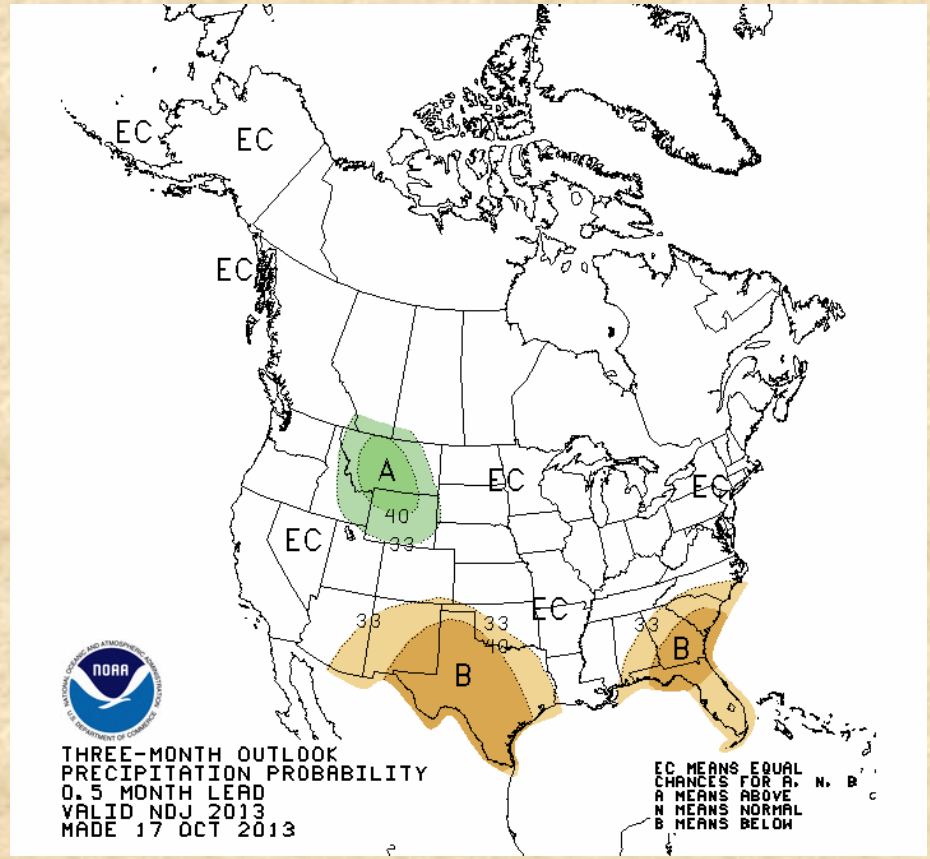


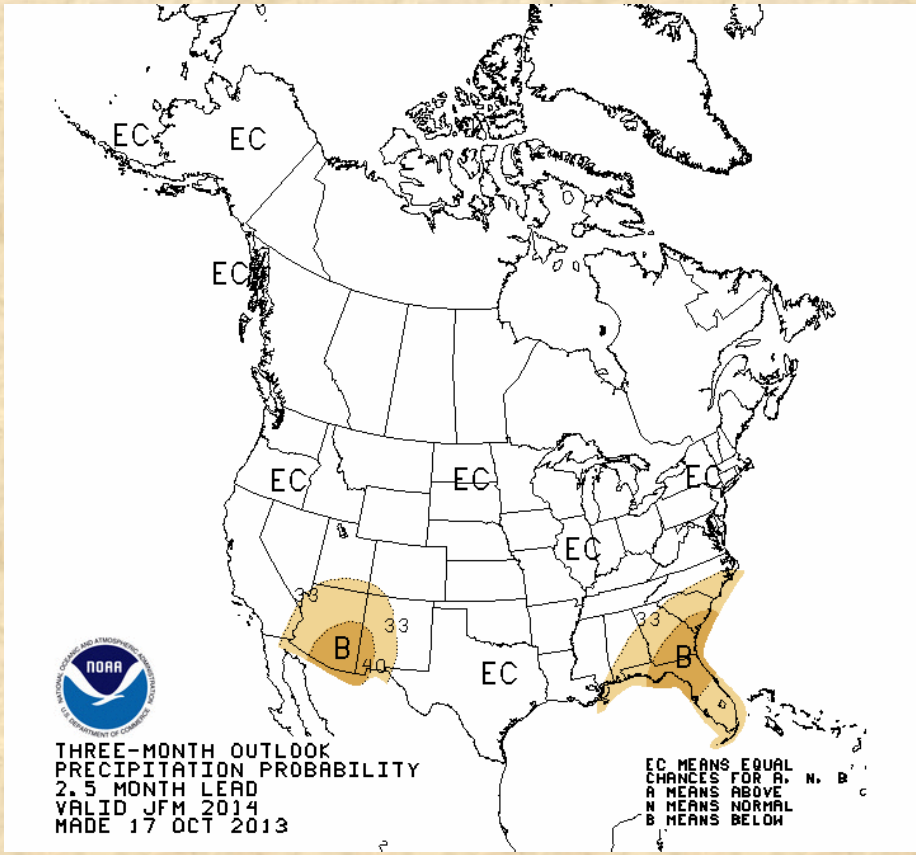




**CPC's temperature forecast for November-January (left) and January-March (right) reflects recent warming trends – ENSO-neutral conditions do not alter this outlook. Note that this is from last month's forecast round (to be updated today). Really don't anticipate radical changes...**

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

# Climate Prediction Center Temperature Forecasts

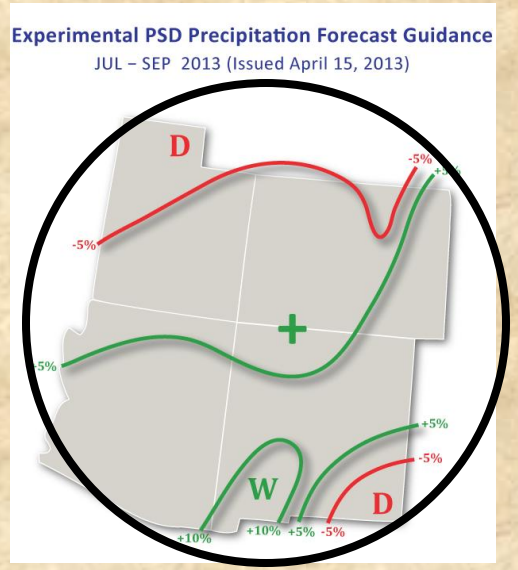


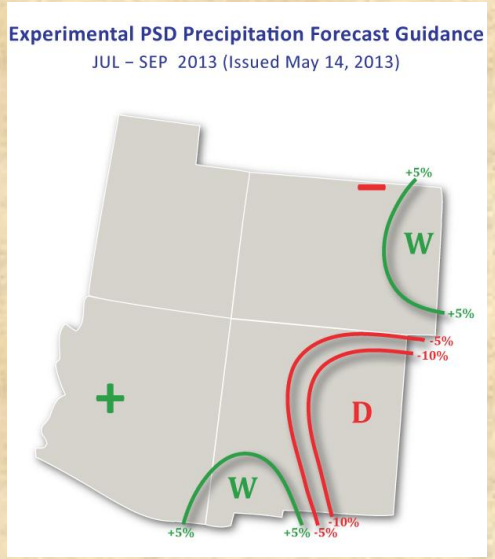



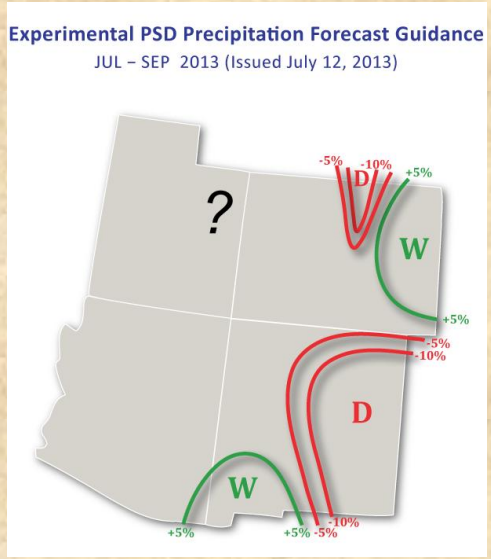

**CPC's precipitation forecast for November-January (left) and January-March (right) shows *increased odds for moisture just to our north* (left), while there are no clear-cut odds for late winter (right). Drought conditions keep 'lurking' to our south. Continued negative PDO-conditions explain some of this map.**

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

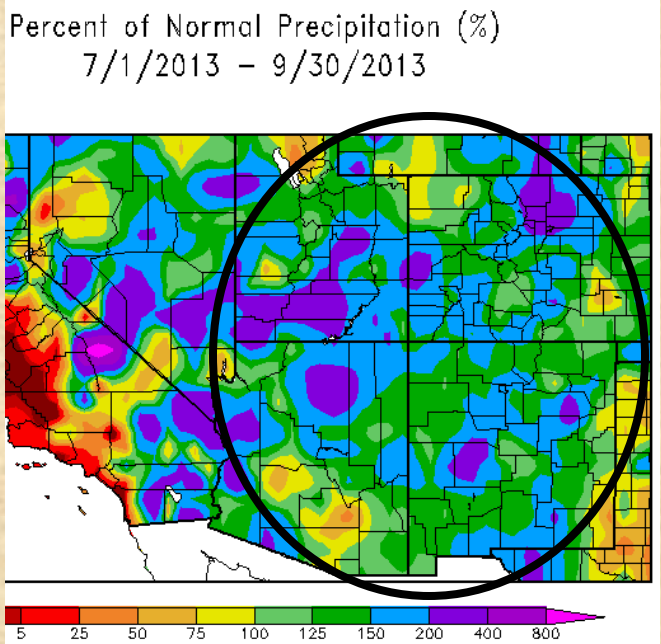
# ‘Postmortem’ for July-September 2013



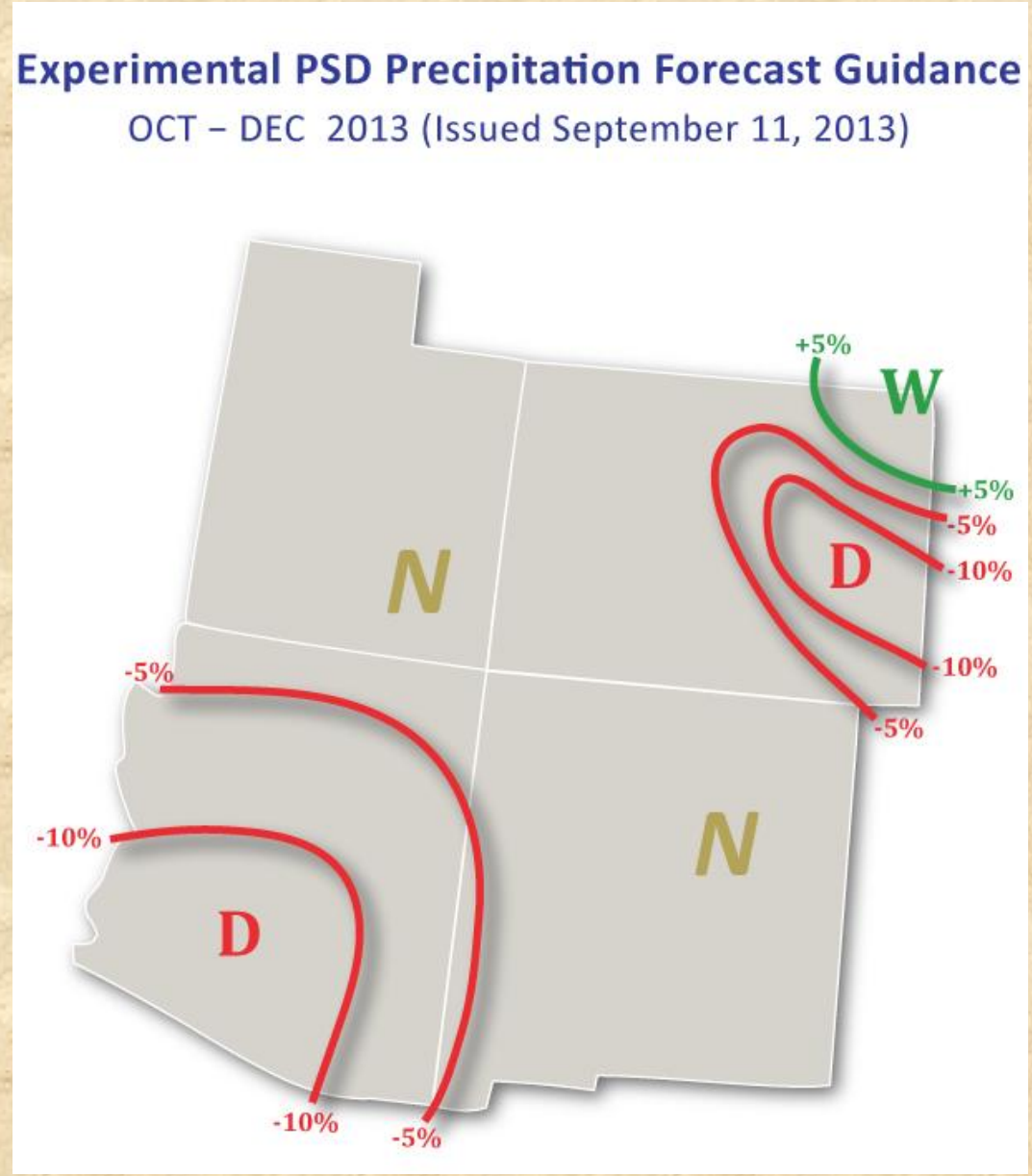




**The *April* forecast for July-September 2013 (left) was fairly confident that the monsoon axis would be shifted eastward, from NM into eastern CO – *this ended up being the best forecast*. The May update (middle) reduced tilts in the odds pretty much across the board, except for increased dry probabilities in eastern NM. The final update (top right) kept the eastern plains of CO “wet”, while raising the threat of a dry summer right along the northern Front Range. *Almost everybody ended up wetter than average, mostly due to the first half of September (bottom right).***

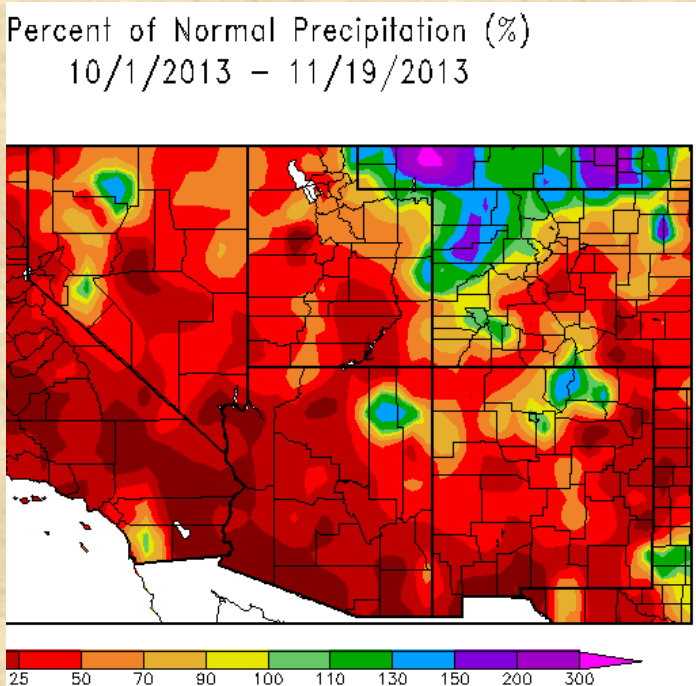


# Statistical Forecast for October-December

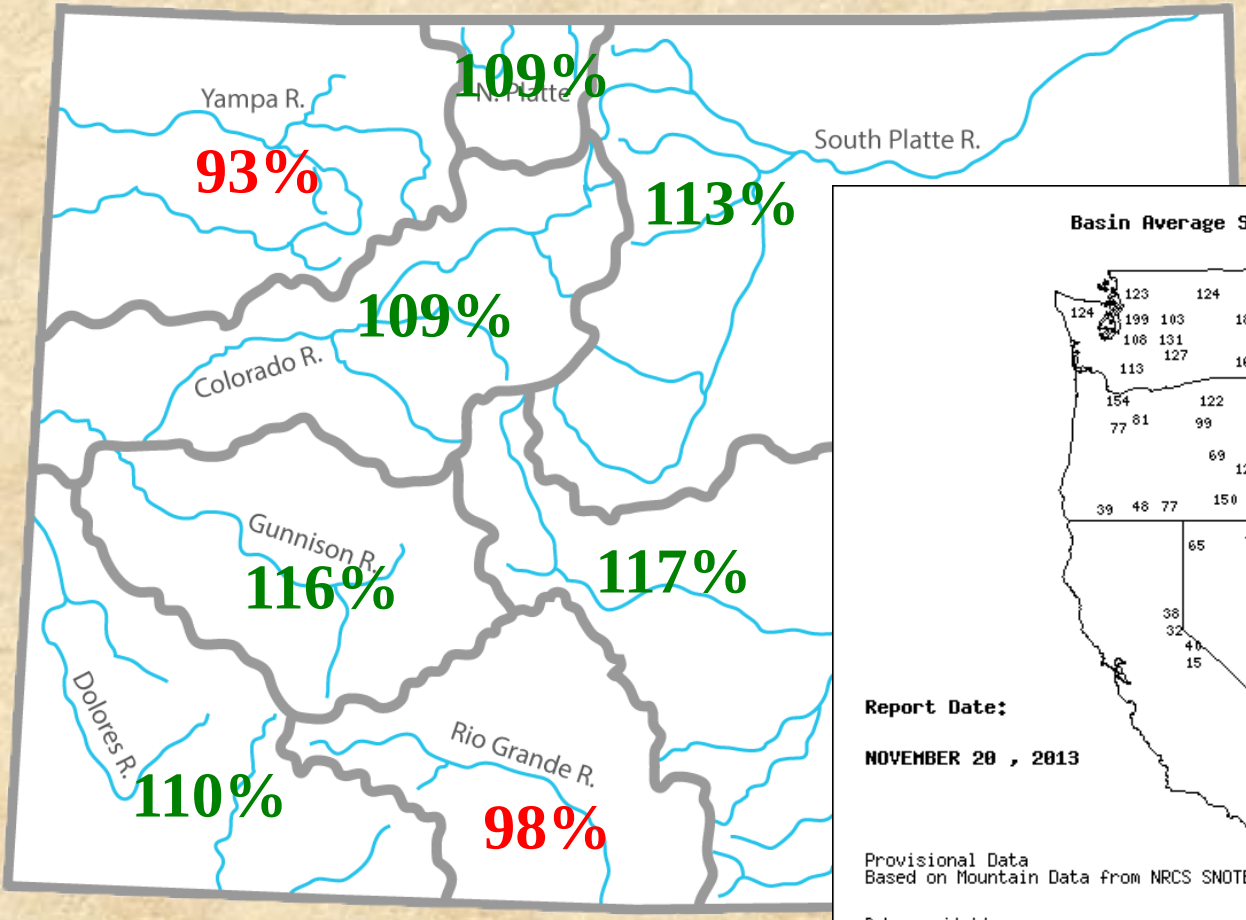


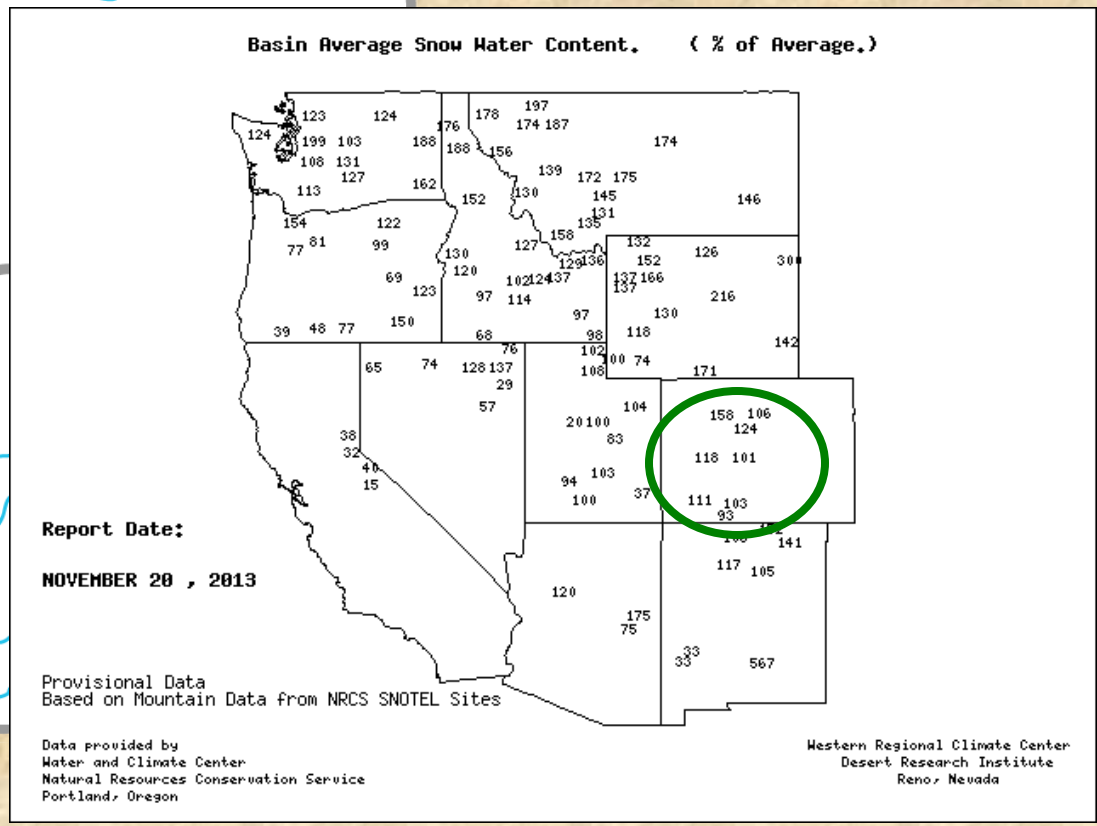

**The precipitation forecast for October-December (left) was dry for southeastern Colorado, "wet" in the northeast corner, and climatological for the rest of the state. Historically, my fall forecasts have shown the least skill in the verification period since 1999. So, *caveat emptor!***

**So far, not too bad (below):**



# SWE forecast for 1 January 2014 (50%ile)

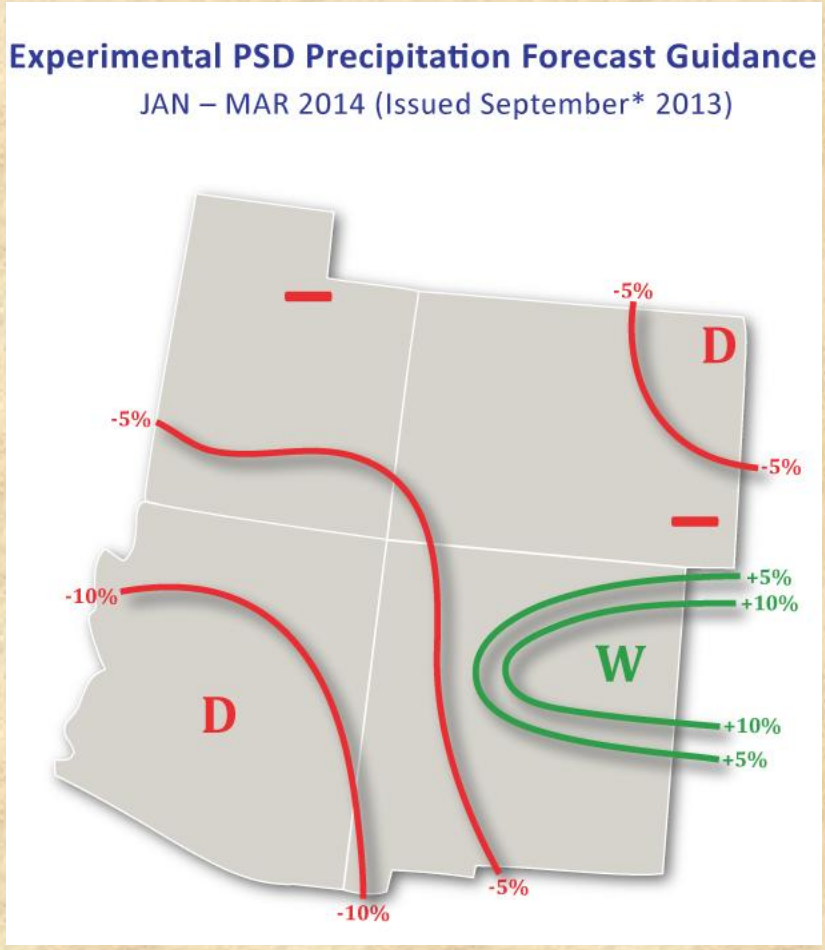


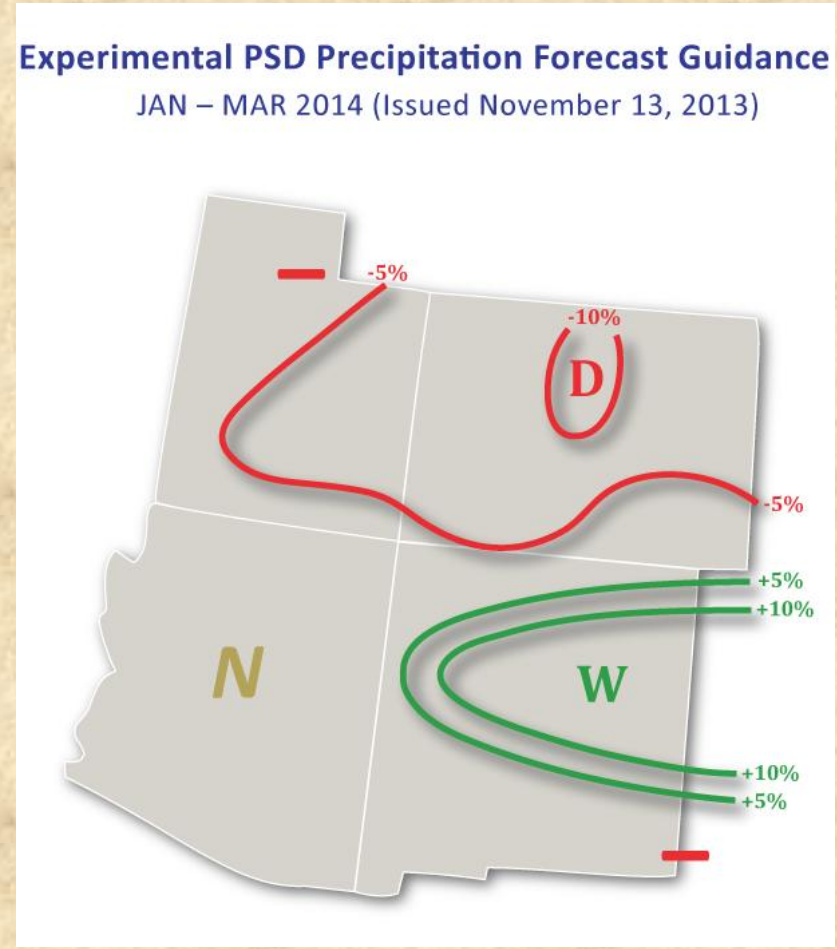




**The median forecast for early season snowpack back in September (left) was mostly better than the long-term median in our state, except for the Yampa and Rio Grande basins.**

***So far, so good (right)!***

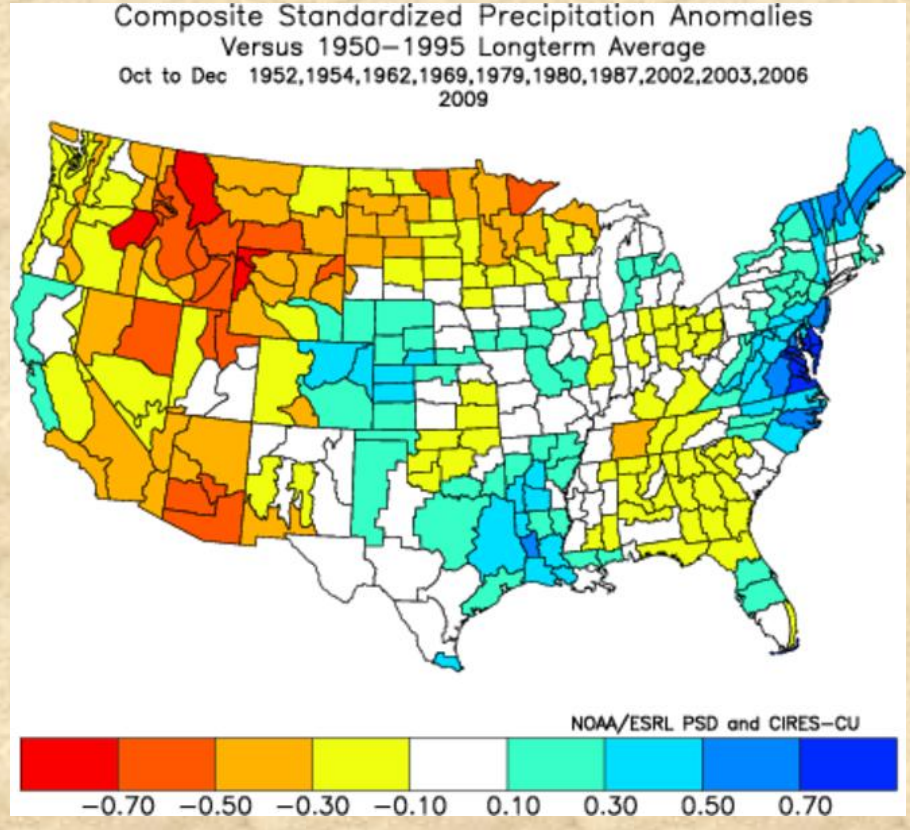
# Statistical Forecast for January-March 2014

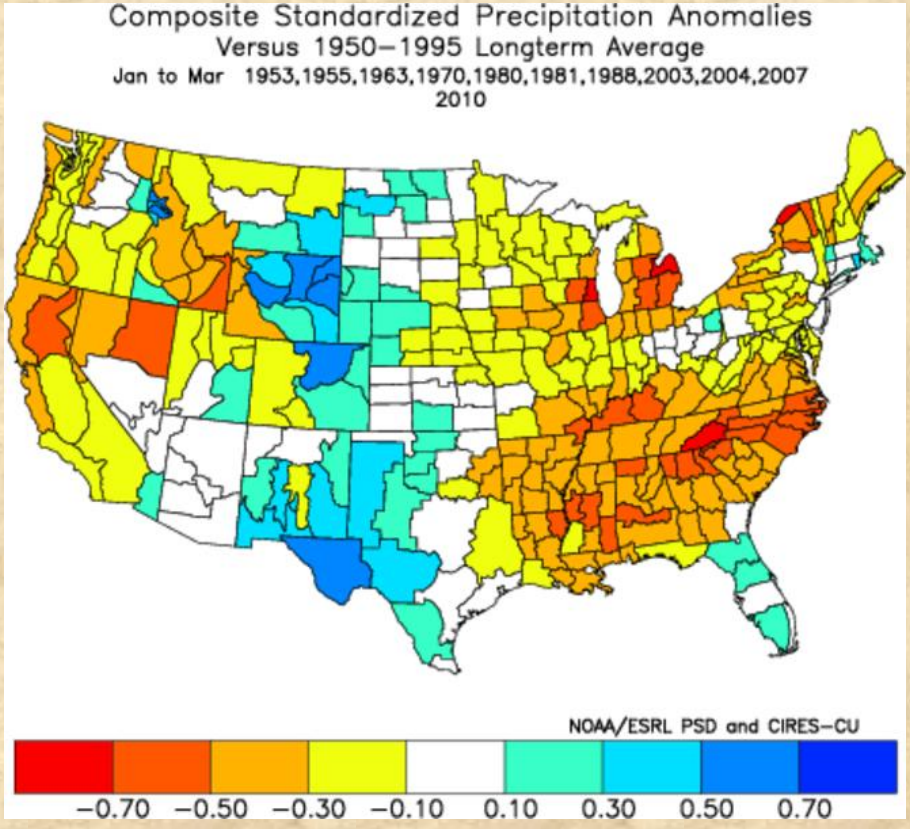



**The precipitation forecast for January-March ’14 from September initial conditions, but delayed in its calculation (left) was dry for much of the Southwest, neutral over Colorado’s mountains, and dry over our eastern plains. The updated forecast (right) is more ‘bearish’ (dry) for our state, but has actually shown less operational skill since 2000 than the September forecast, so ‘not all hope is lost’.**

# Other factors: Fairbanks October warmth

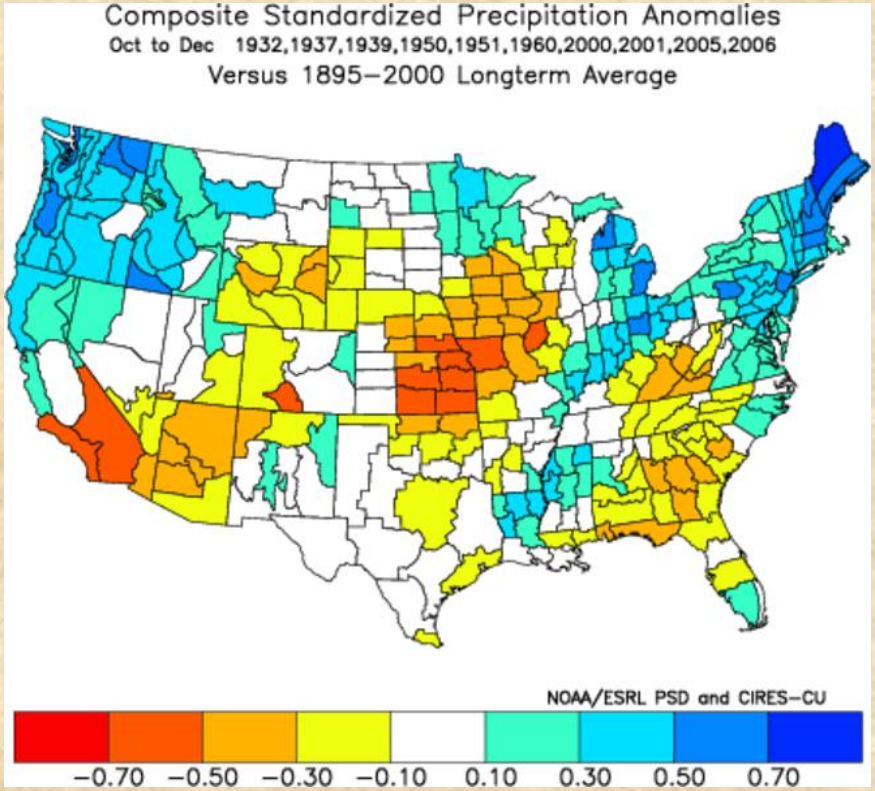


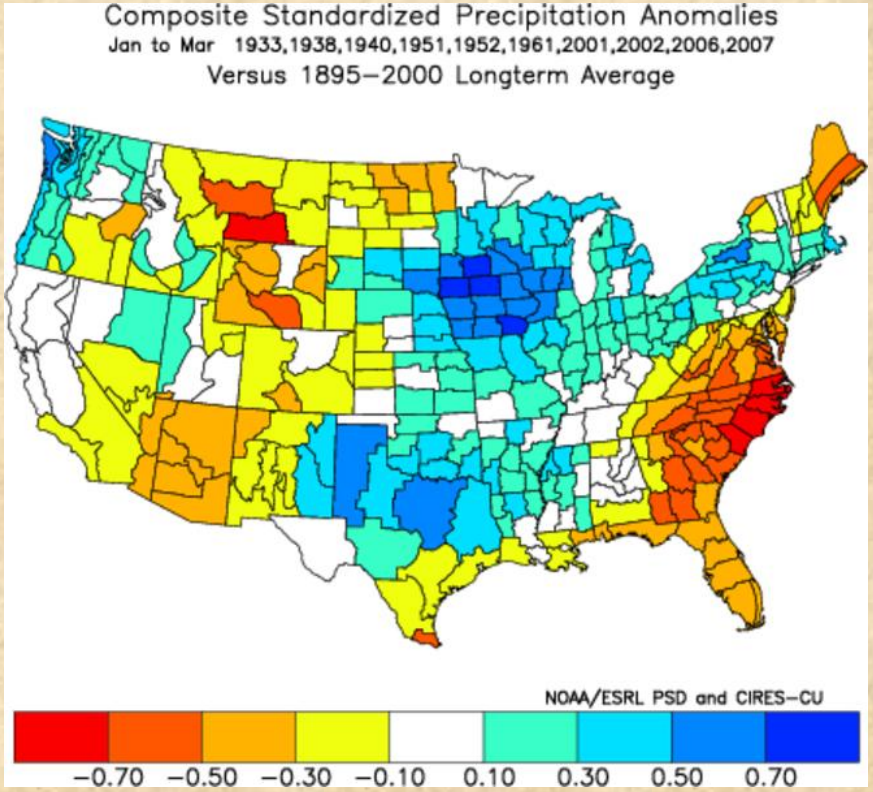




**After several cold fall seasons, interior Alaska remained very warm in October. This is typically associated with dry weather in Oct-Dec over much of the interior the western U.S. (left), but apparently allows for wetter conditions east of the divide. In subsequent late winters (right), this overall pattern has tended to stick around over the Western U.S.**

***Note that about half of these cases are associated with El Niño, not likely in near future.***

# Other factors: PDO-AMO (still negative, but weaker than last year)

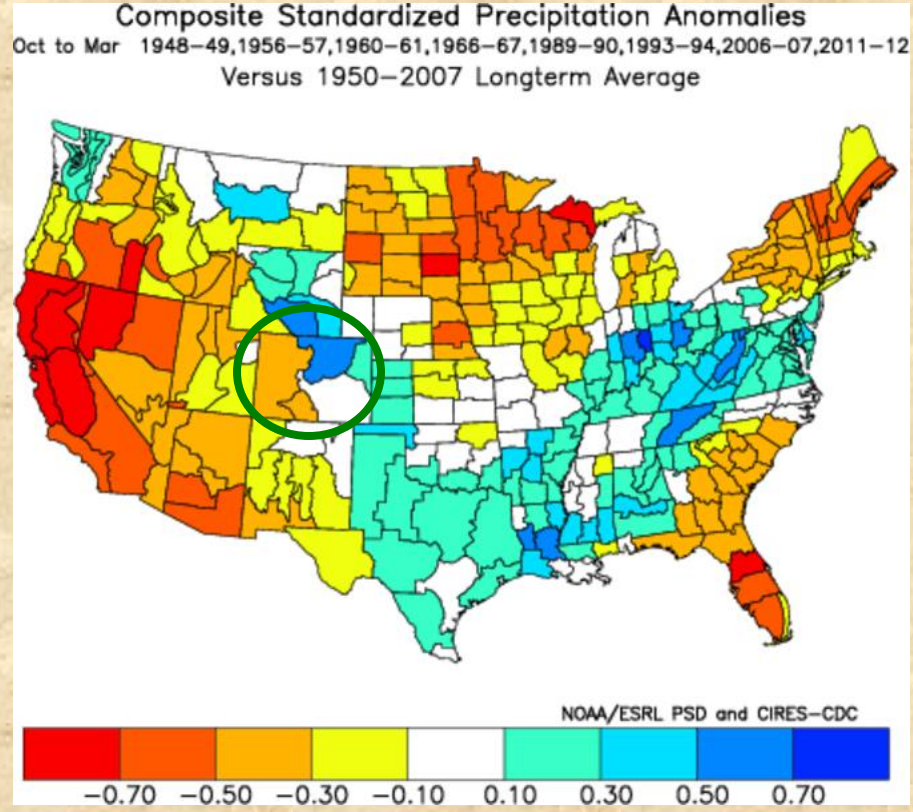


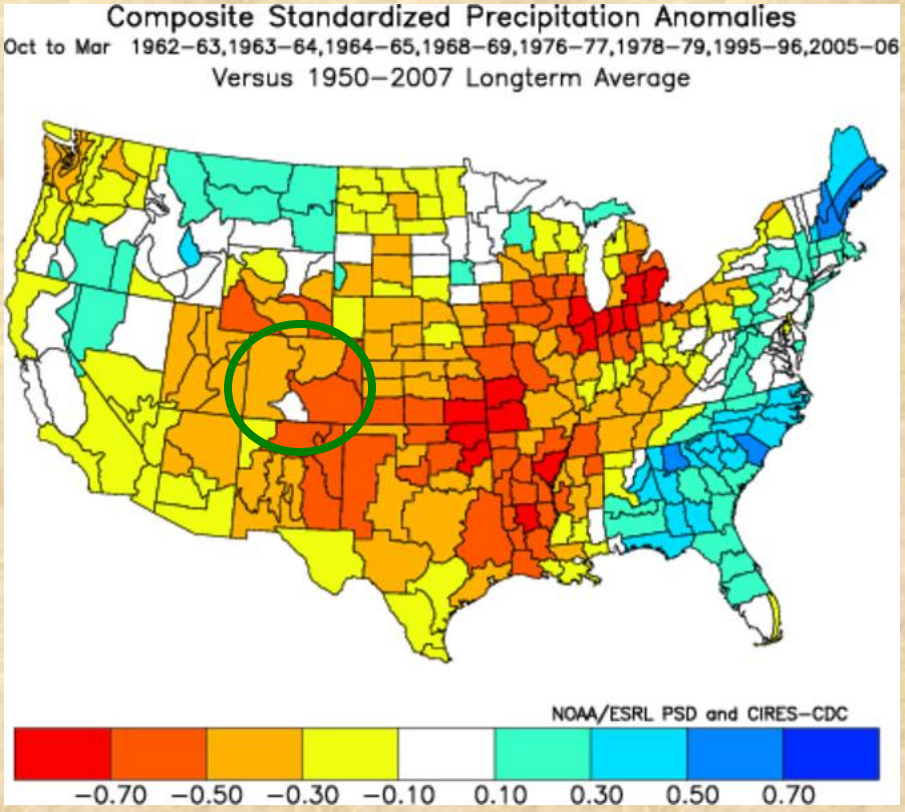




**While the summer of 2012 was associated with the most negative PDO-AMO index on record, and a somewhat predictable dry 'response' over the southwestern U.S., more recent PDO-AMO values have relaxed somewhat, but are still at the low end of the range.**

**For Oct-Dec (left), this often yields a dry San Luis valley, but otherwise little tilt in the odds for Colorado. For Jan-Mar (right), there is a similar absence of strong signals in Colorado. Compared to last year, this is an improvement...**

# Other factors: *ENSO-neutral vs. NAO*




***During neutral ENSO and positive NAO conditions (left), the winter half-year tends to be wet east of the divide and dry to its west. In the opposite NAO phase (right), the outcome has been typically dry over the state. However, if one looks at 1 April SWE, more of the negative NAO cases (right) have been wet in the mountains than dry, especially for the three most recent cases ('79, '96, and '06). However, my current best guess for the NAO this winter is <u>positive</u>.***

# Executive Summary (21 Nov‘13)

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- **While El Niño/La Niña can provide decent guidance for climate outlooks around here, this is less true for ENSO-neutral situations. A cold NE Pacific combined with a warm North Atlantic stacked the deck towards drought in the southwestern U.S. in WY’13.** ***WY’14 appears to be less handicapped in that sense.***
- **After a record-wet September, October ended up with above-average SWE in our mountains. Despite a dry start to November, statewide snowpack is still running ahead of ‘normal’. Our storm of the week should add to this surplus. Thus, my snowpack forecast for 1 January is on track for now.**
- **My statistical forecast for October-December anticipated mostly dry conditions in the southeastern two thirds east of the divide, but a hint of wetness continues in the northeast corner. The rest of CO has climatological odds. For January-March 2014, my statistical forecast is mostly on the dry side, although the mountains would have ‘better odds’ with the September-based forecast than this month’s.**
- **Of the other factors considered here, the Front Range appears to be slightly favored over other parts of the state this winter. More on that at my next briefing.**
- ***Bottomline: After a decent start to the snow accumulation season, the current outlook for late winter is less optimistic than some indicators were two months ago. However, 2013-14 appears to be less handicapped overall than 2012-13. While not explicitly predicted, a switch to El Niño appears possible next spring which could improve our precipitation odds. Stay tuned!***