Earth System Research Laboratory
Physical Sciences Division

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Colorado WATF,
18 September 2013
Denver

Seasonal Outlook through December 2013

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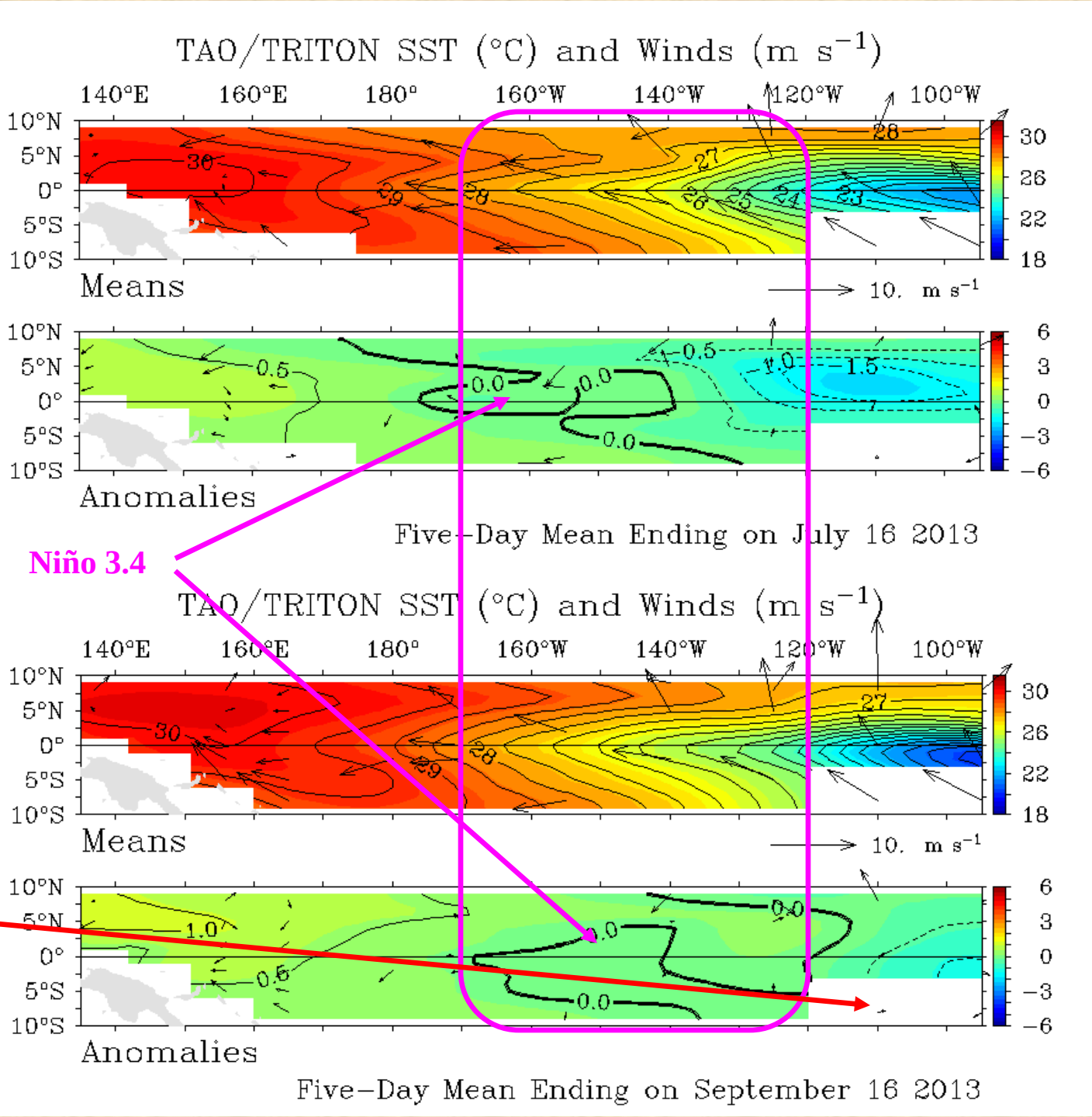
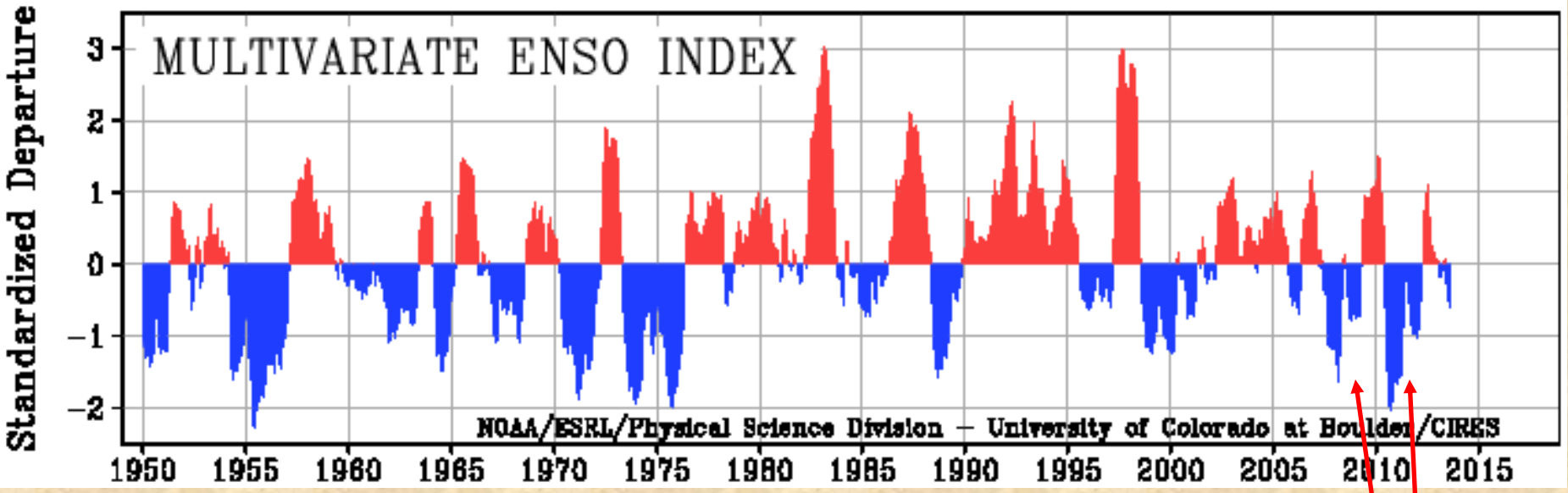
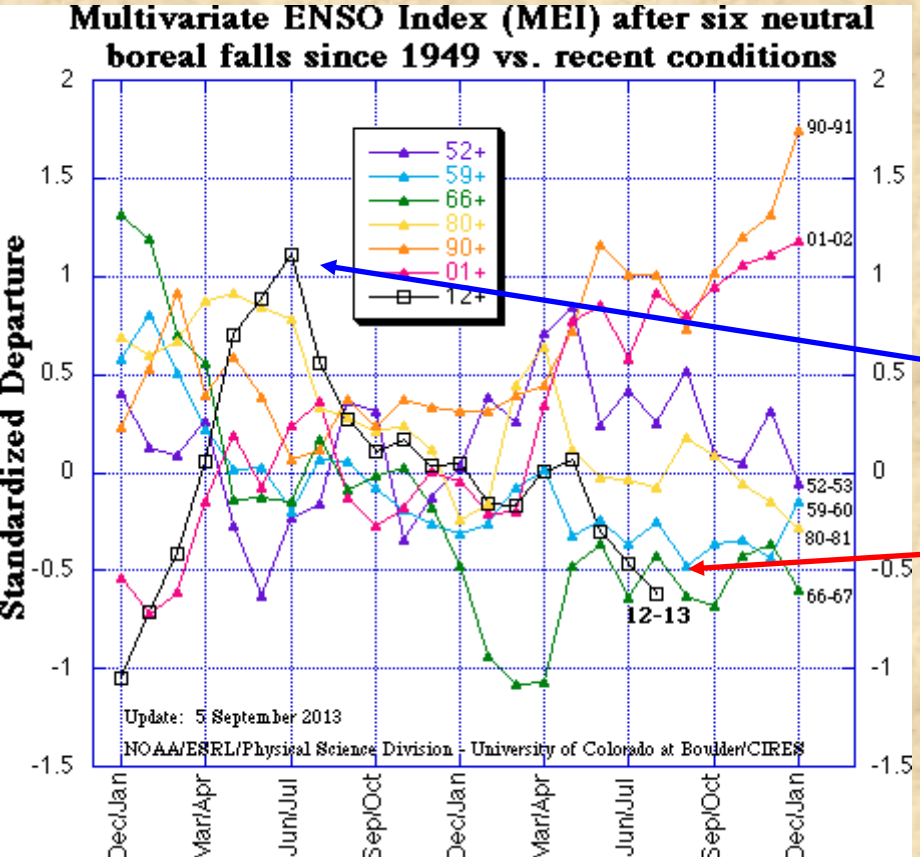
- **What has happened to ENSO, what will happen next, and what does that mean for us ?**
- **Expectations for the next two weeks**
- **CPC forecasts for October through December 2013**
- **Seasonal Forecast Guidance for precipitation**
- **Inaugural Colorado SWE forecast for January 1st, 2014**
- **Executive Summary**

Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to July (top): looks like we are still stuck in ENSO-neutral in the central Pacific, while La Niña's summer run petered out in the eastern Pacific. Recent wind anomalies have remained weak.

Note: serious data shortages present in recent TAO data!

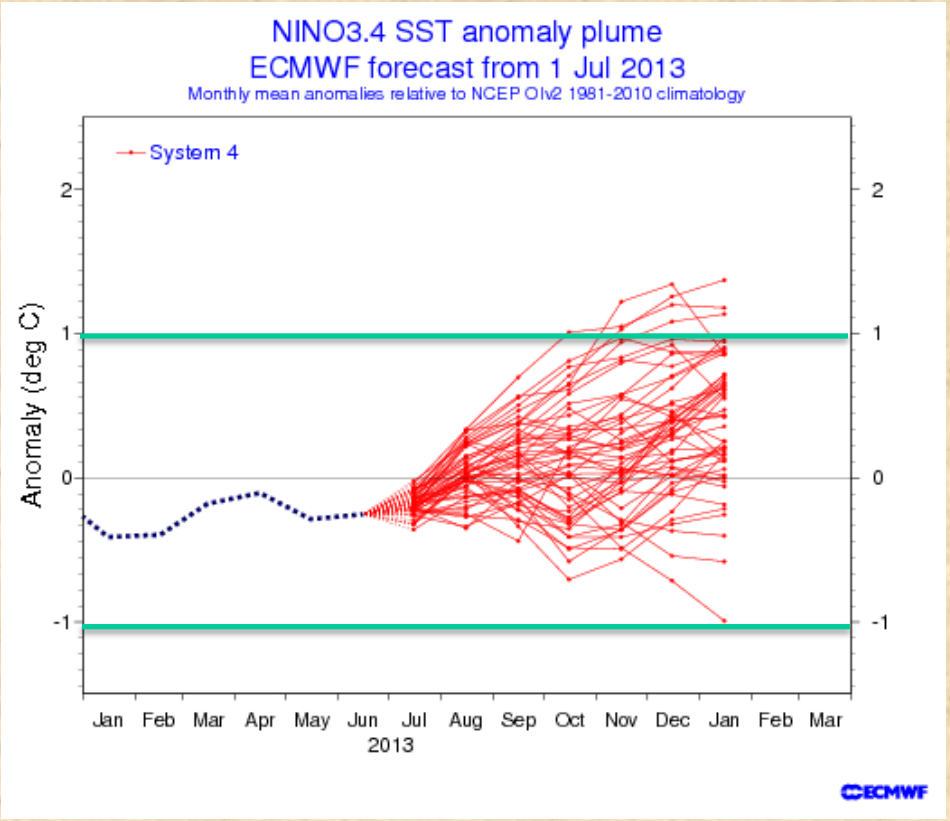




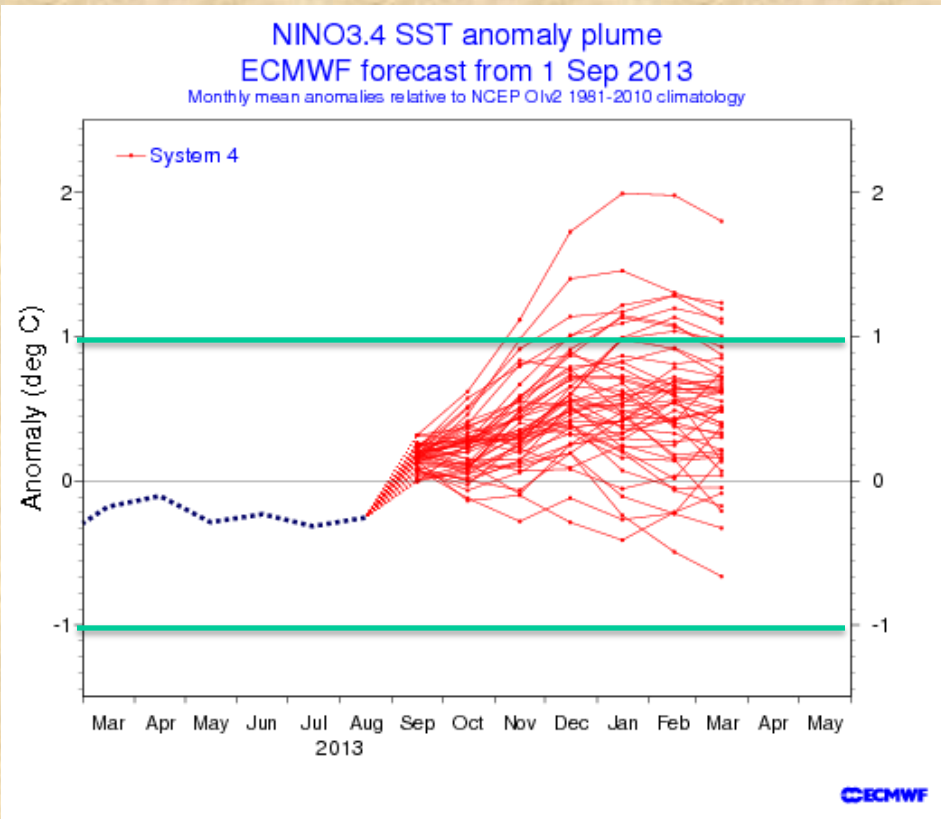


Last five years have seen two 'double-dip' Las Niñas in a row, followed by a brief excursion to what looked like an El Niño event in 2012, a return to ENSO-neutral conditions as of last fall , with a recent drift towards La Niña that appears to have been shortlived.

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

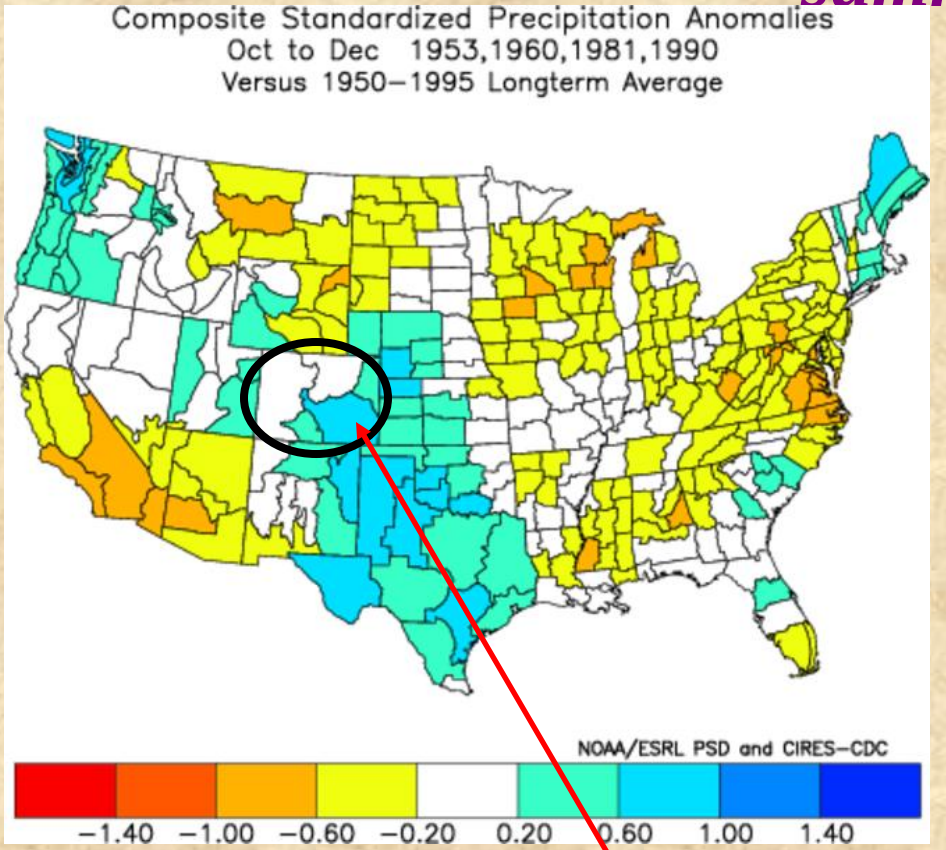


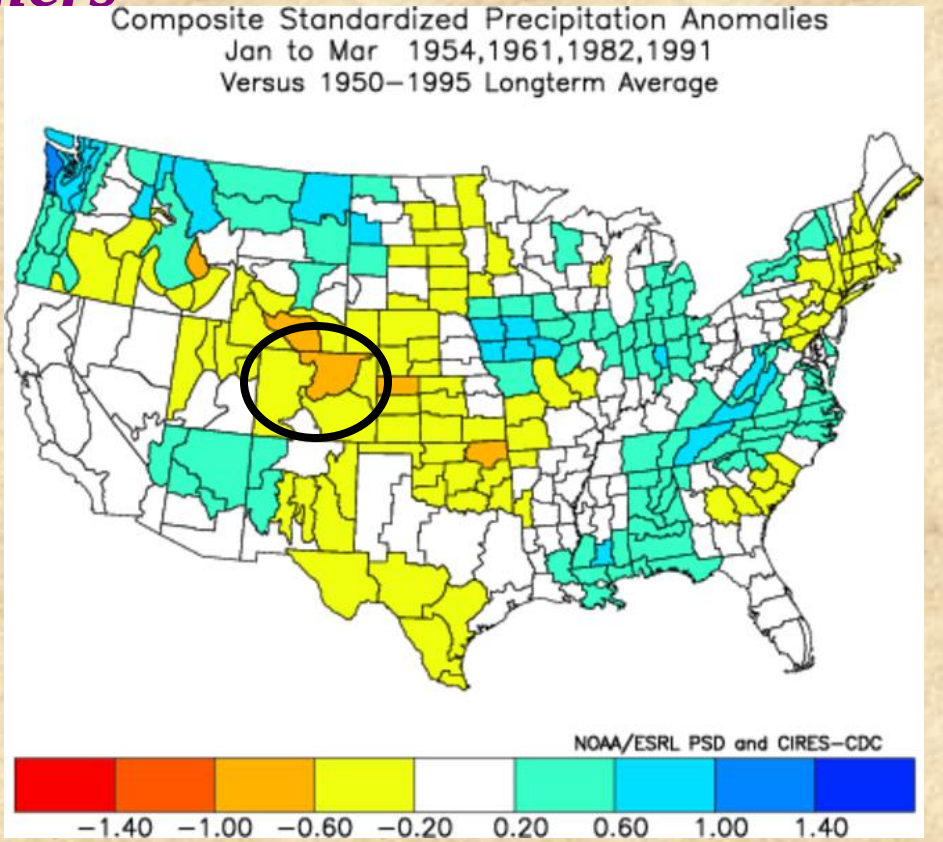
The ECMWF July 2013 forecast (left) showed a weak drift from neutral conditions towards very weak El Niño-like conditions by late 2013. Fairly large scatter for this time of year.



The ECMWF September 2013 forecast (right) is more optimistic about staying out of La Niña, while more ensemble members than before reach weak El Niño status (+0.5˚ C) by mid-winter. ***The IRI plume was not available in time for this briefing.***

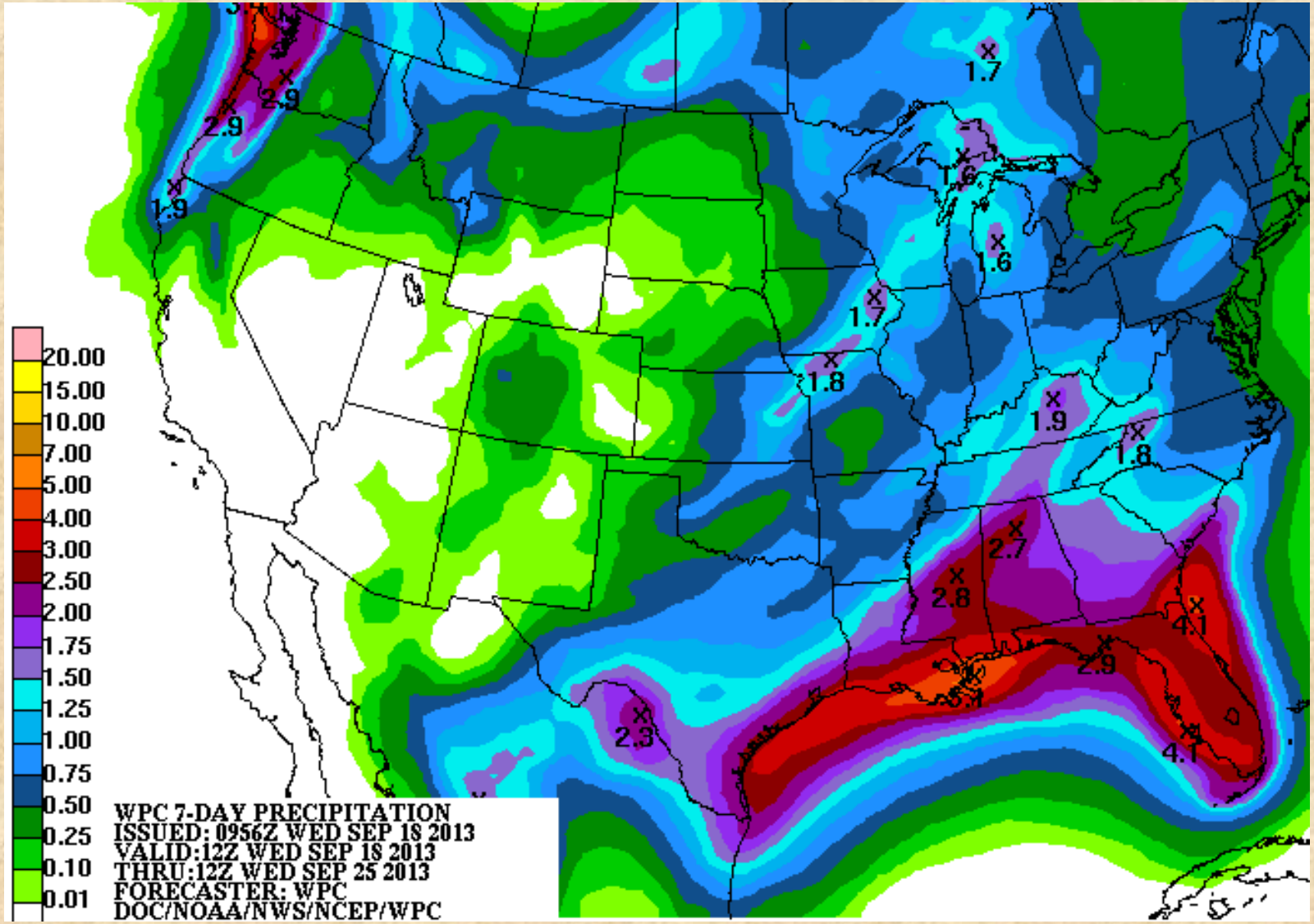
Post-low PDO-AMO and post-neutral ENSO summers





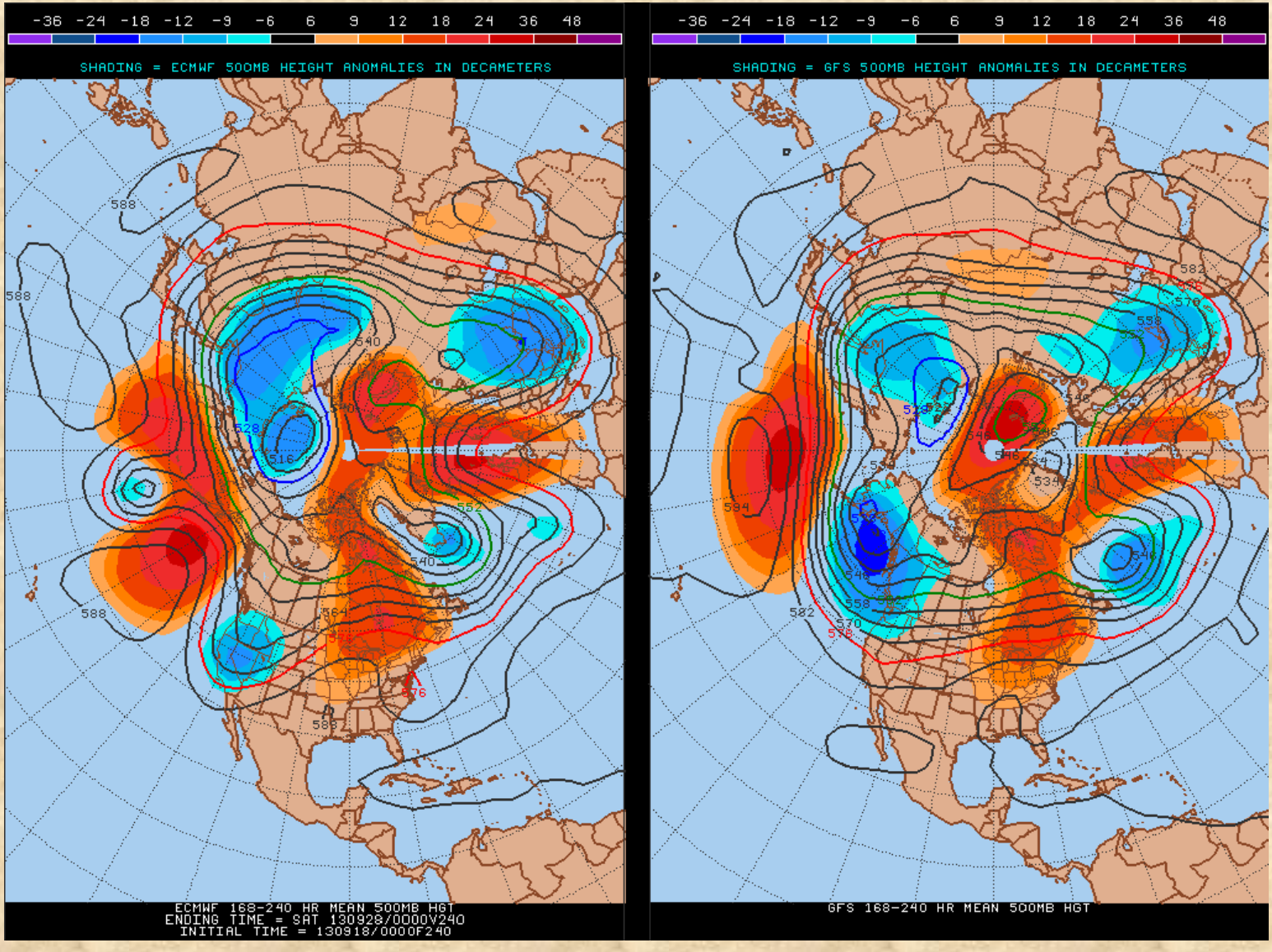
Using four analog cases with 2nd year ENSO-neutral conditions, the precipitation odds for the 2nd year fall (Oct-Dec; left) are neutral (white) or enhanced (blue-green) over our state. This is succeeded by increased odds for dry conditions in the subsequent late winter season (Jan-Mar; right). The sample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

What can we expect in the next seven days?



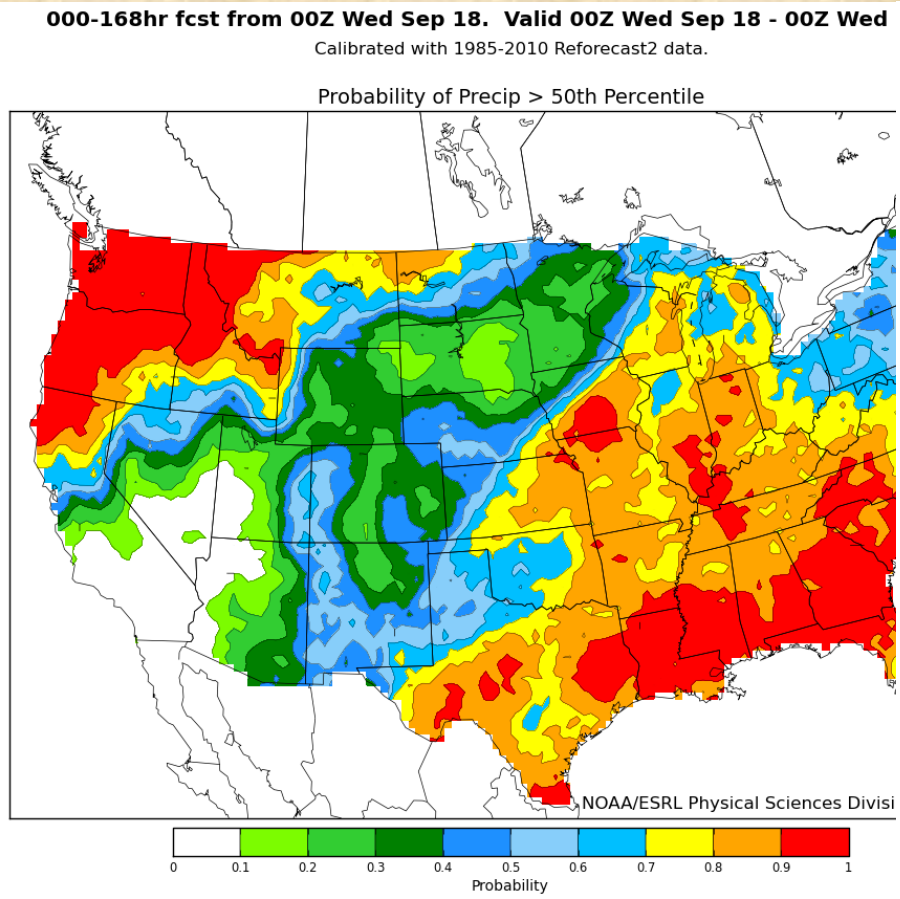
Expected total precipitation, according to the Hydrological Prediction Center (NOAA): For once, a dry week does not look so bad anymore…

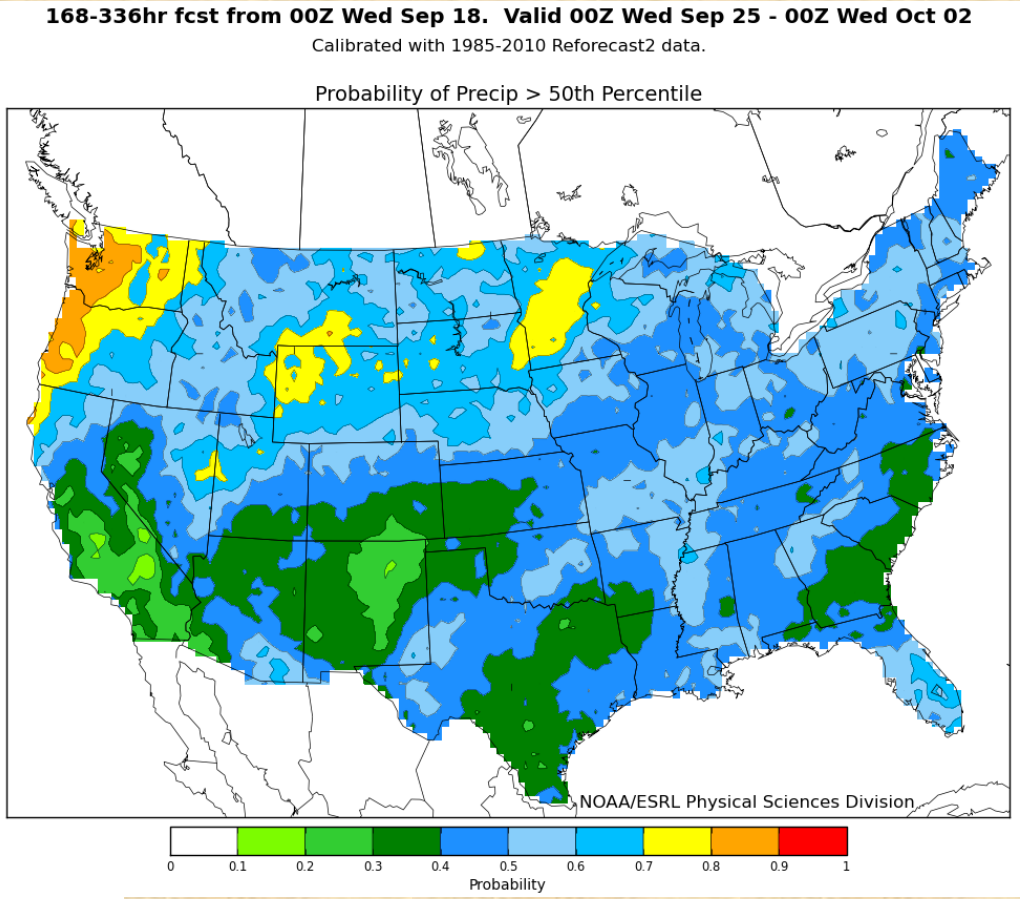
What can we expect by next weekend?



European & U.S. models show troughing in the Western U.S., opening the door to an early freeze and/or first snow of the season, at least for the higher elevations…

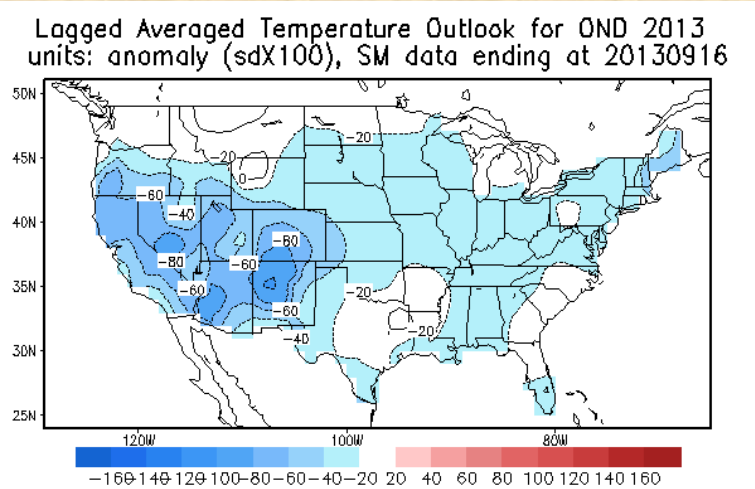
Reforecast precipitation odds

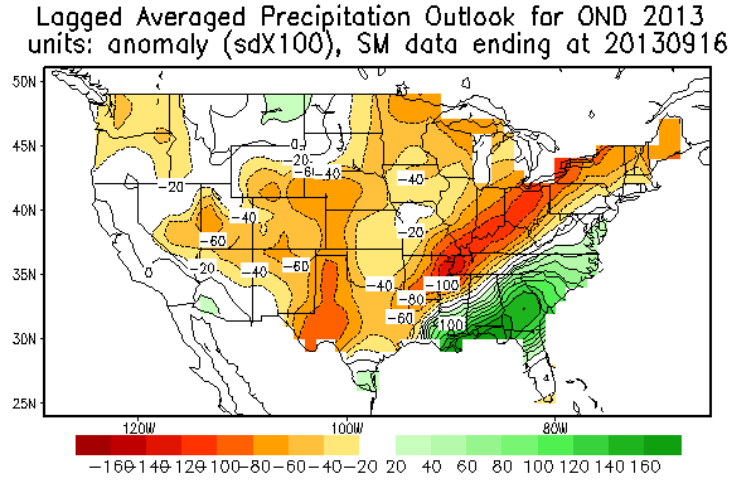


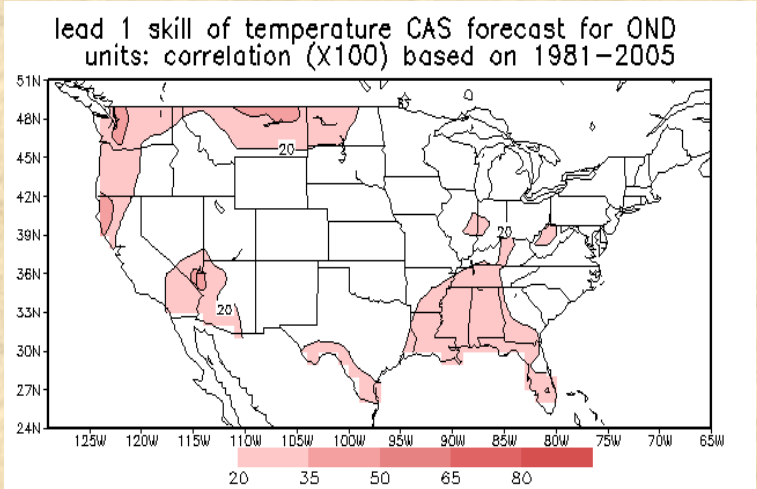


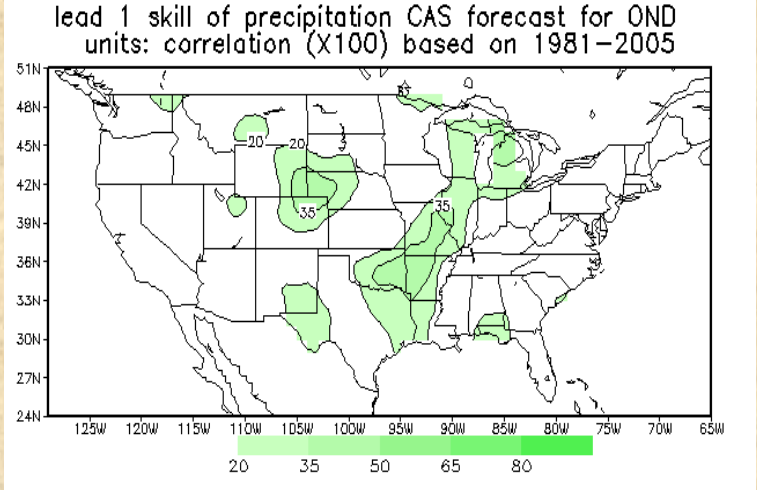
Precipitation chances for Week 1 (left), and Week 2 (right) from last night show a dry spell coming up for much of our state, especially in the southeast, normally not a cause for celebration...

Climate Prediction Center 'Analog' Forecasts





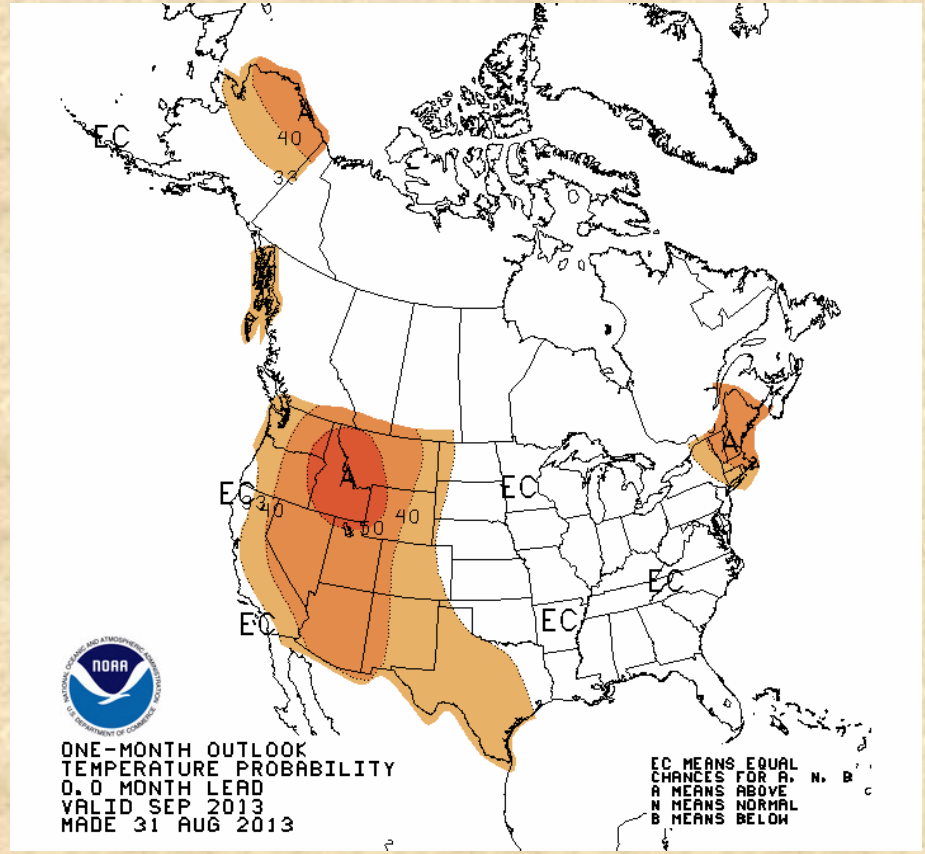


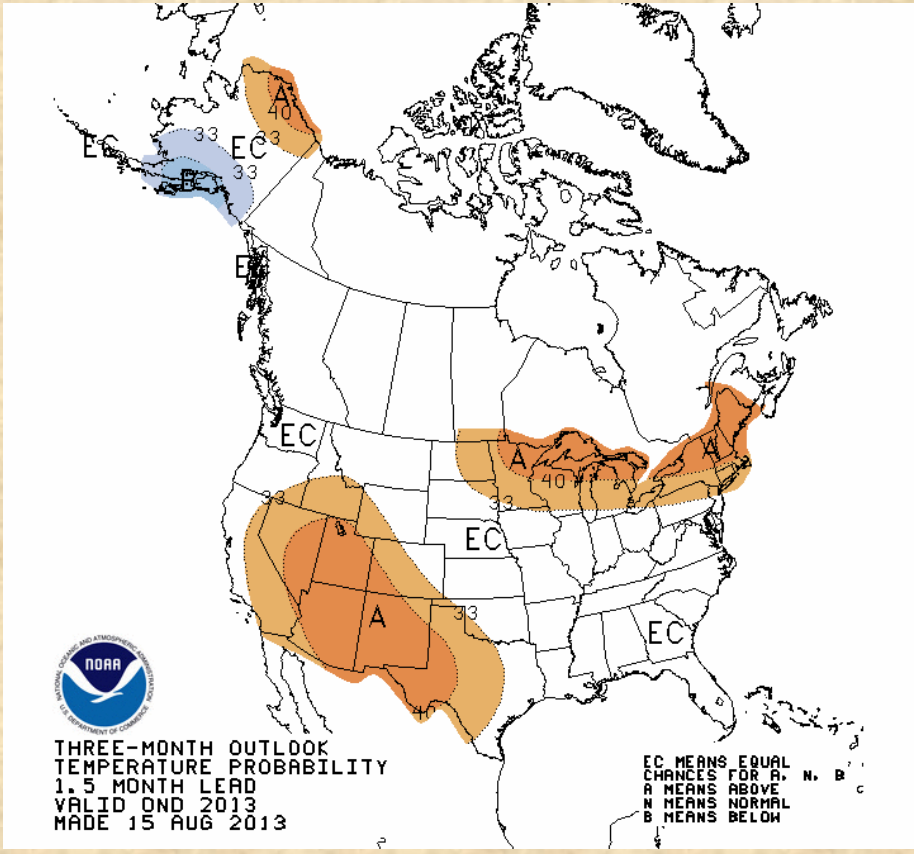


According to the soil-moisture analog forecast, Colorado faces a modest risk of renewed drought conditions in the next three months (left). Skill at this lead-time (right) is decent over northeast Colorado where the driest conditions are expected.

Source: ***http://www.cpc.ncep.noaa.gov/soilmst/cas.shtml***

Climate Prediction Center Temperature Forecasts

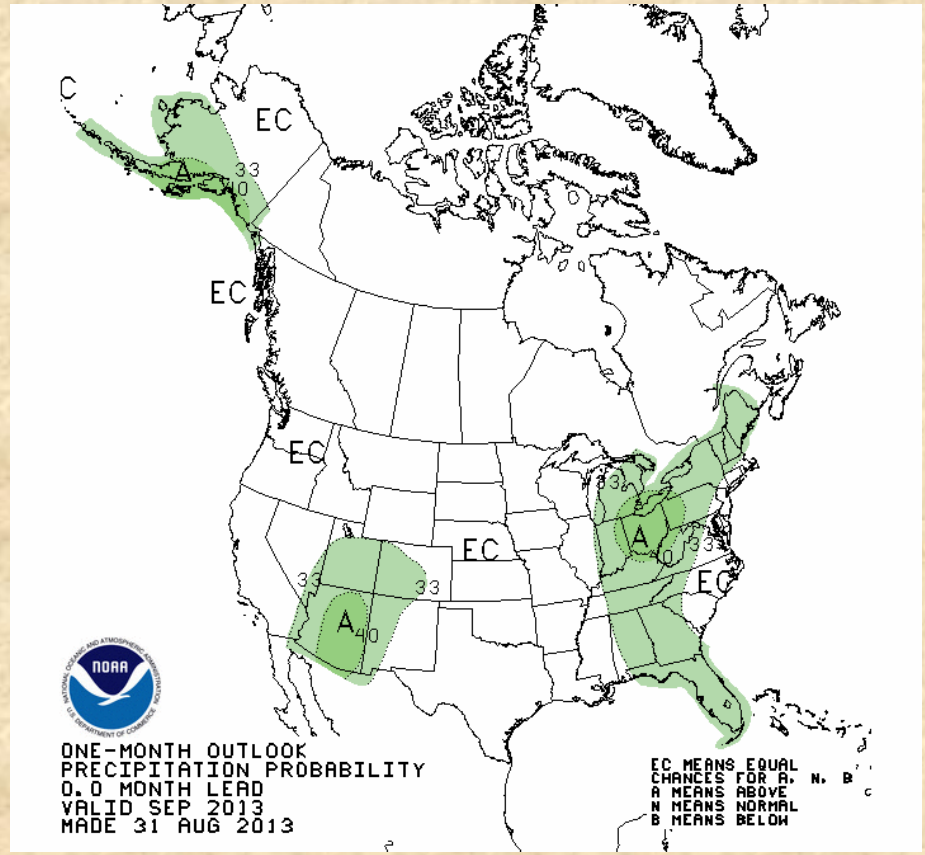


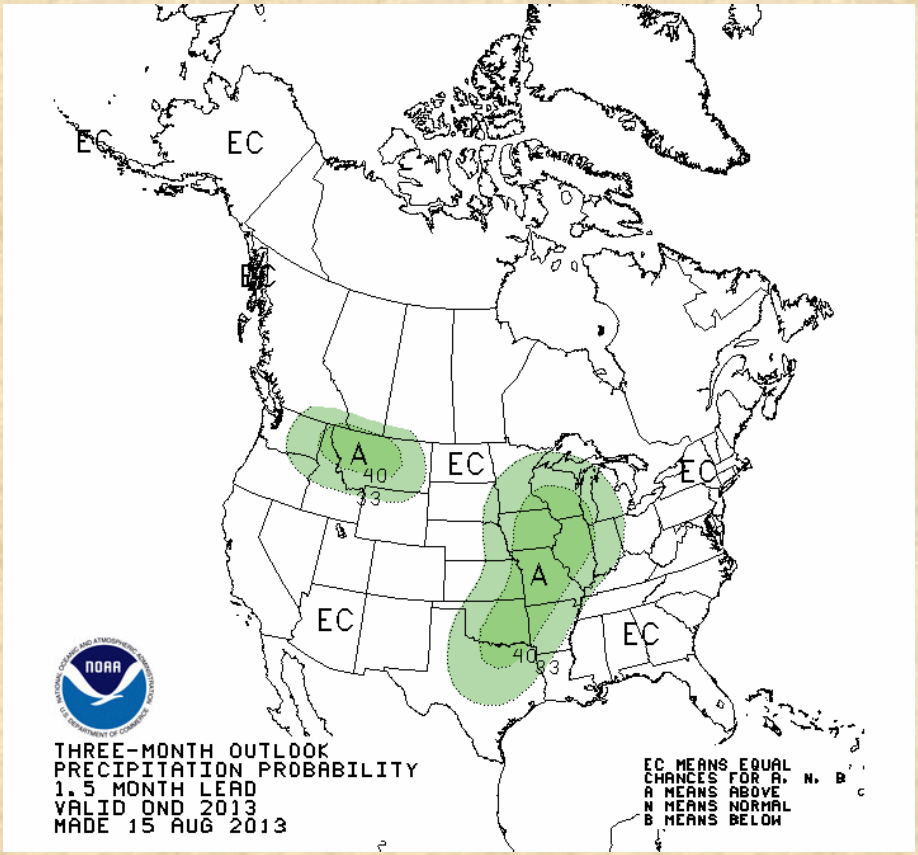


CPC's temperature forecast for September (left) and October-December (right) reflects recent warming trends – ENSO-neutral conditions do not alter this outlook. Note that this is from last month's forecast round (to be updated tomorrow).

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

Climate Prediction Center Temperature Forecasts

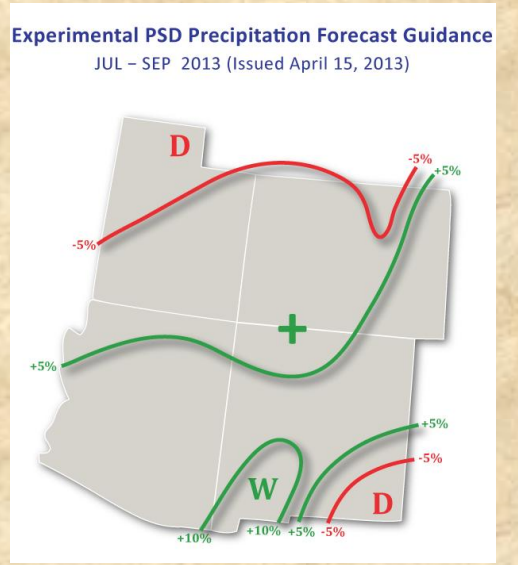


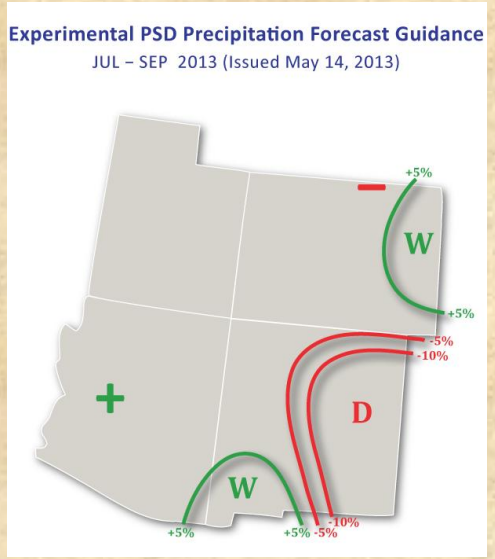


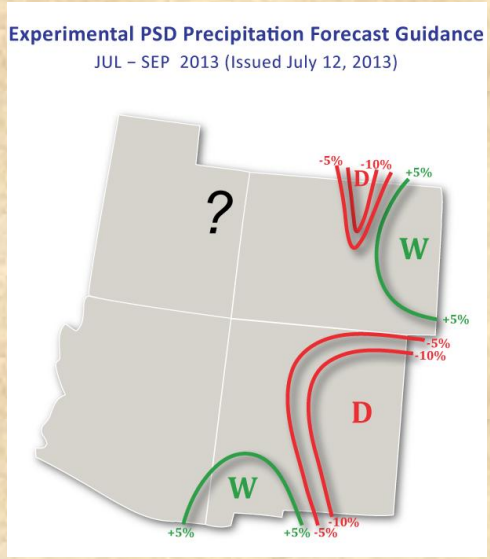
CPC's precipitation forecast for September (left) and October-December (right) shows *correct anticipation* of an enhanced monsoon pattern for this month (left), but no tilt in the odds for the rest of the year, something to be expected with an ENSO-neutral basis.

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

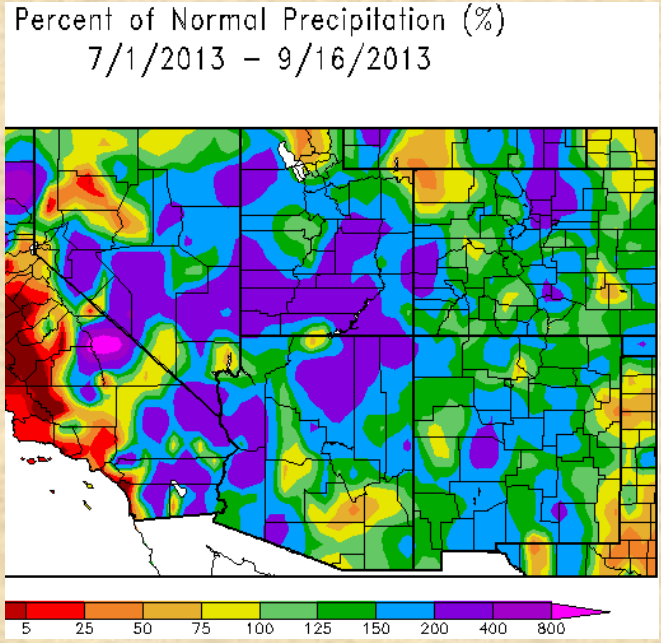
‘Postmortem’ for July-September 2013



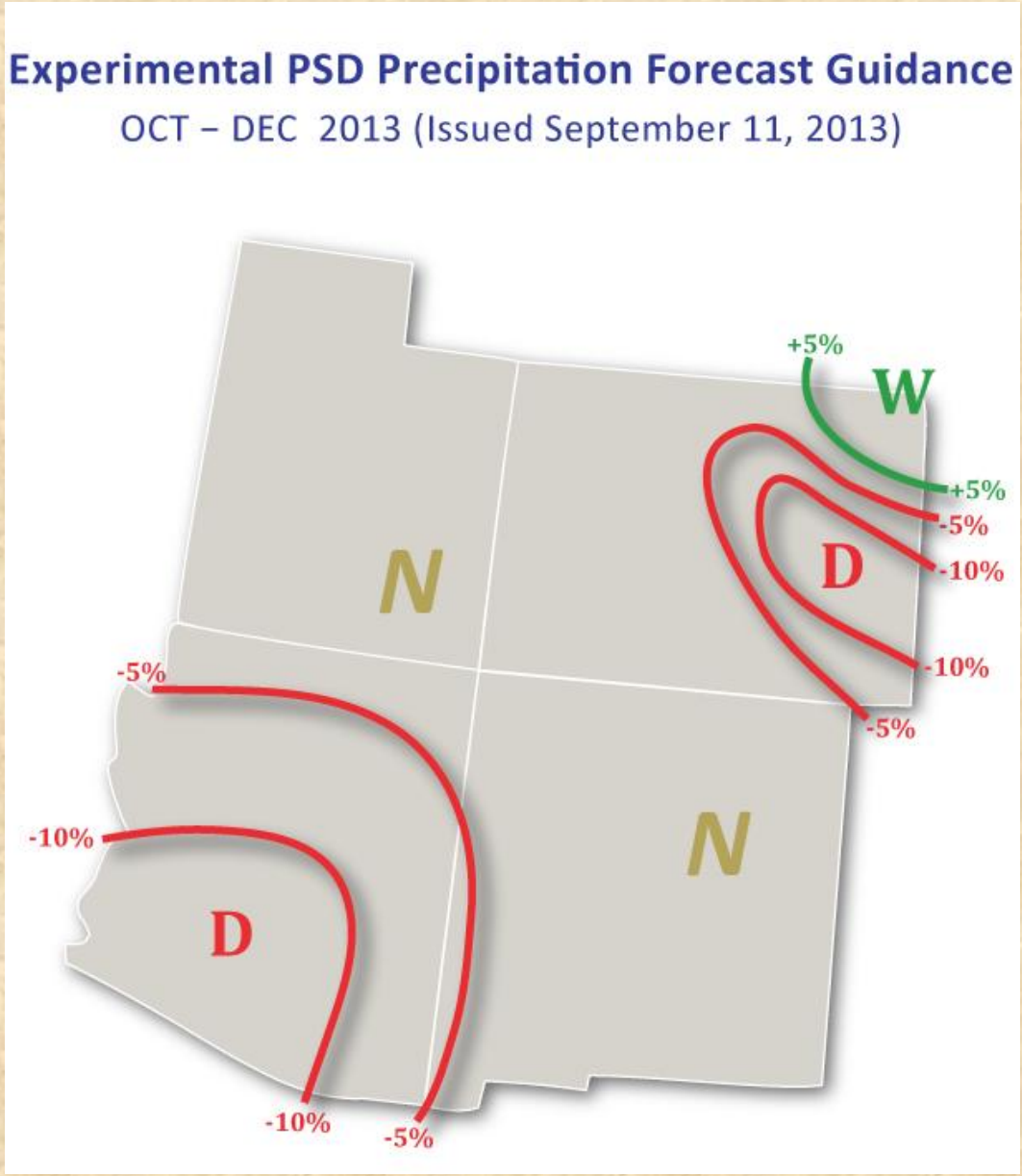




The April forecast for July-September 2013 (left) was fairly confident that the monsoon axis would be shifted eastward, from NM into eastern CO. The May update (middle) reduced tilts in the odds pretty much across the board, except for increased dry probabilities in eastern NM. The final update (top right) kept the eastern plains of CO “wet”, while raising the threat of a dry summer right along the northern Front Range, leaving all else up to chance. *After last week, almost everybody ended up wetter than average, except for parts of southern AZ & eastern NM (bottom right).*



Statistical Forecast for October-December

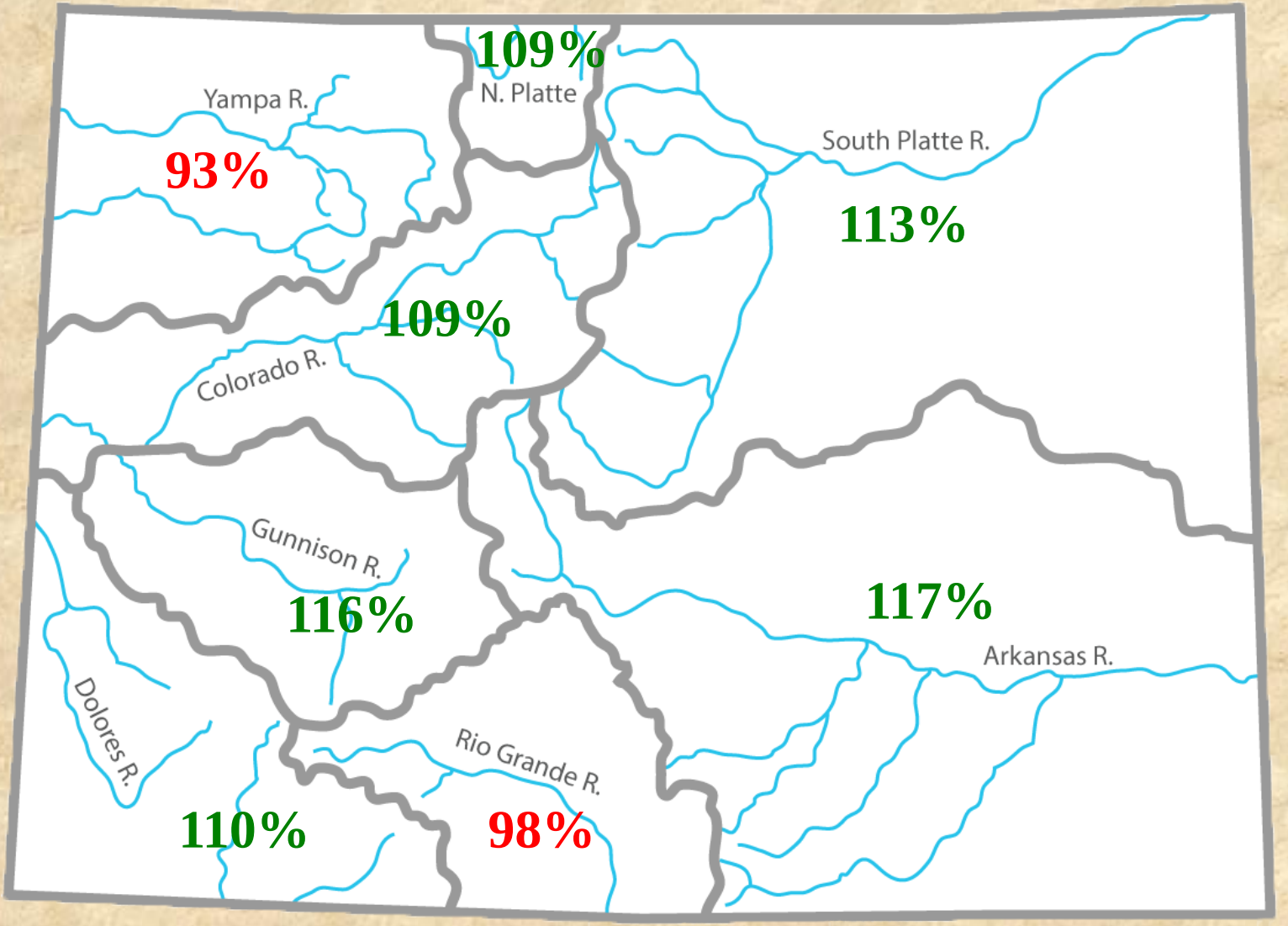


The precipitation forecast for October-December (left) is dry for southeastern Colorado, "wet" in the northeast corner, and climatological for the rest of the state.

Historically, my fall forecasts have shown the least skill in the verification period since 1999. So, *caveat emptor!*

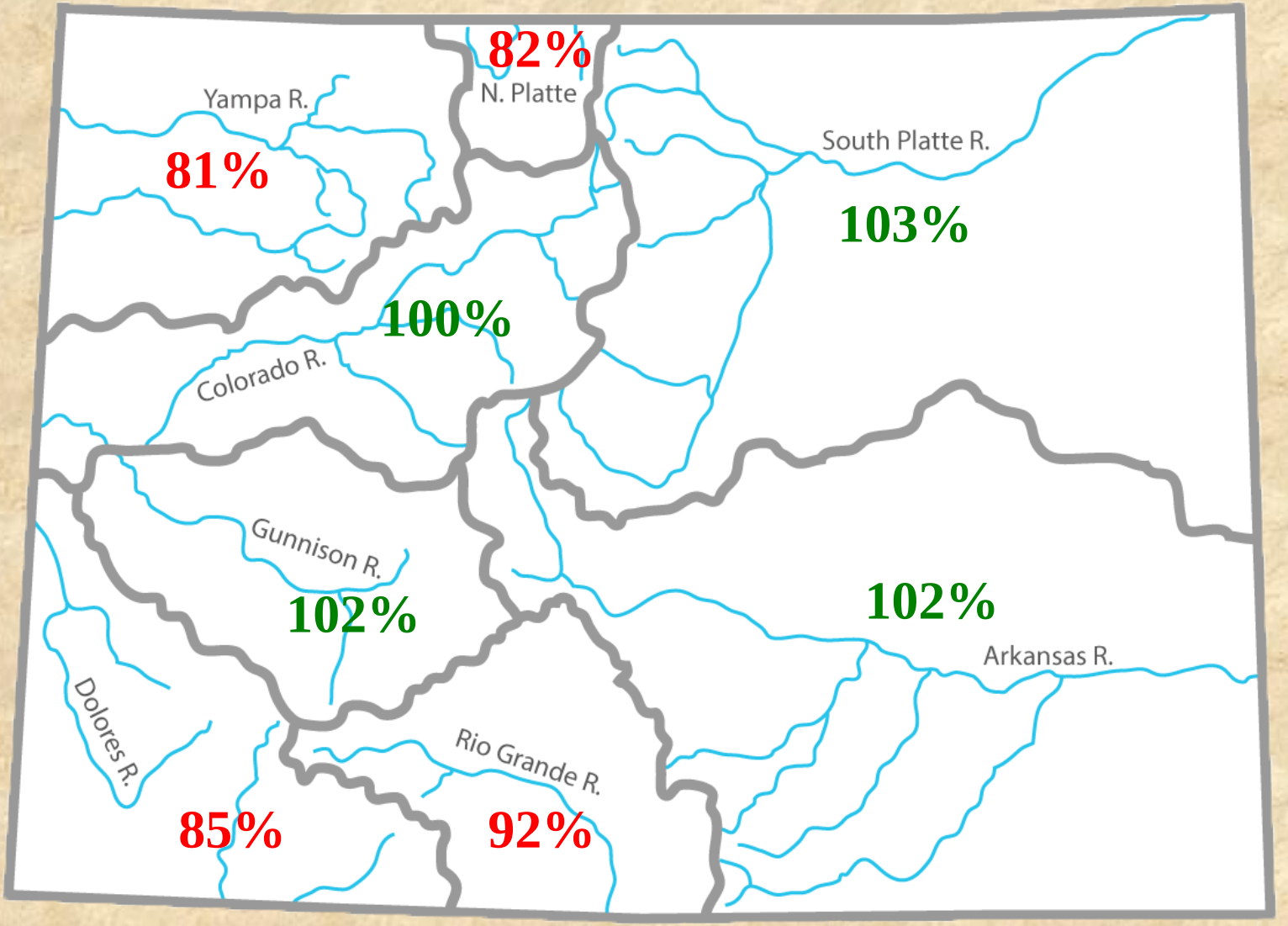
Meanwhile, the first of the two key predictors for annual Colorado River runoff has come in near-normal for the 1st time in several years (it was rather extreme in predicting WY'13 correctly as being low).

SWE forecast for 1 January 2014 (50%ile)



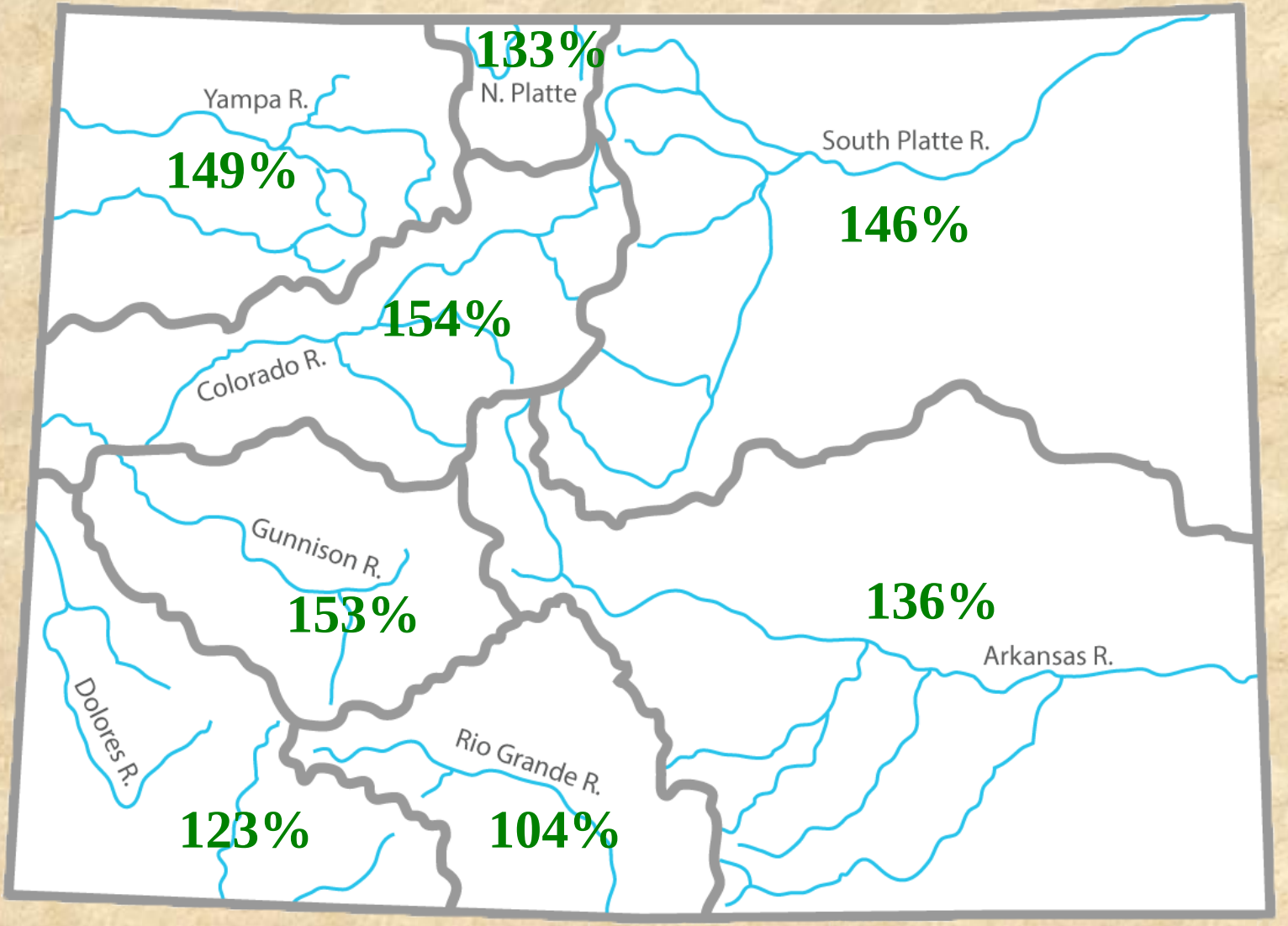
The median forecast for early season snowpack is mostly better than the long-term median in our state, except for the Yampa and Rio Grande basins.

SWE forecast for 1 January 2014 (25%ile)



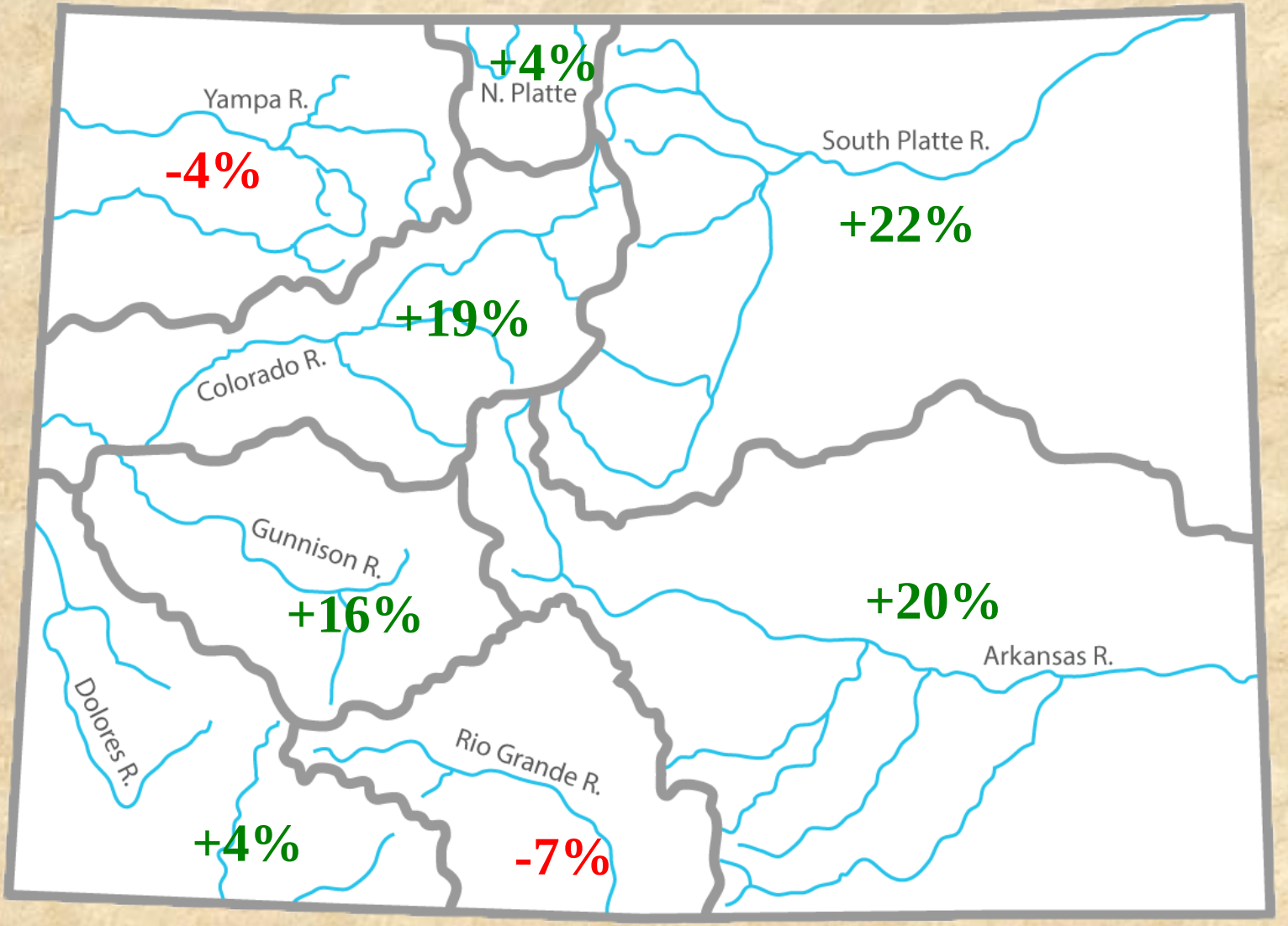
The lower quartile forecast for January 1st snowpack is higher than the long-term median in our state, except for the Yampa, North Platte, Rio Grande, and Dolores basins which are still better than the long-term average for the 25%ile.

SWE forecast for 1 January 2014 (75%ile)



The upper quartile forecast for January 1st snowpack is well above the long-term median in our state, except for the Rio Grande basin which is looking like the most likely to end up dry.

SWE forecast for 1 January 2014 (tilt in odds)



The average shift in the distribution for January 1st snowpack is mostly positive in Colorado, except for the Yampa and Rio Grande basins. It is particularly optimistic east of the divide, and in the Gunnison and Colorado basins.

Executive Summary (18 Sep '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 may be handicapped in the same sense.***
- **July was off to a decent start, the monsoon arrived in a timely fashion, and ended up staying longer than usual, and certainly "more intense than usual" by the 2nd week in September. All-time records were either broken from southwest of Denver all the way to Ft. Collins last week, especially around Boulder and Aurora.**
- **My statistical forecast for October-December anticipates 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. In my experience, fall is the hardest season to predict, but there has been skill east of the divide.**
- **The inaugural forecast for snowpack (SWE) on January 1st is fairly optimistic for much of our state, with the exception of the Yampa and Rio Grande Basins. Early season snowpack (and moisture) appears to have more bearing on the final runoff yield than any other season.**
- ***Bottomline: What a difference a week makes! Boulder went from one of its driest summers on record to its wettest calendar year totals already, and we have more than three months to go! From a drought perspective, expectations for early season snow in the mountains are better than in the previous two years, so the ski season should get off to a better start. Water demand should remain low this fall around Denver...***