

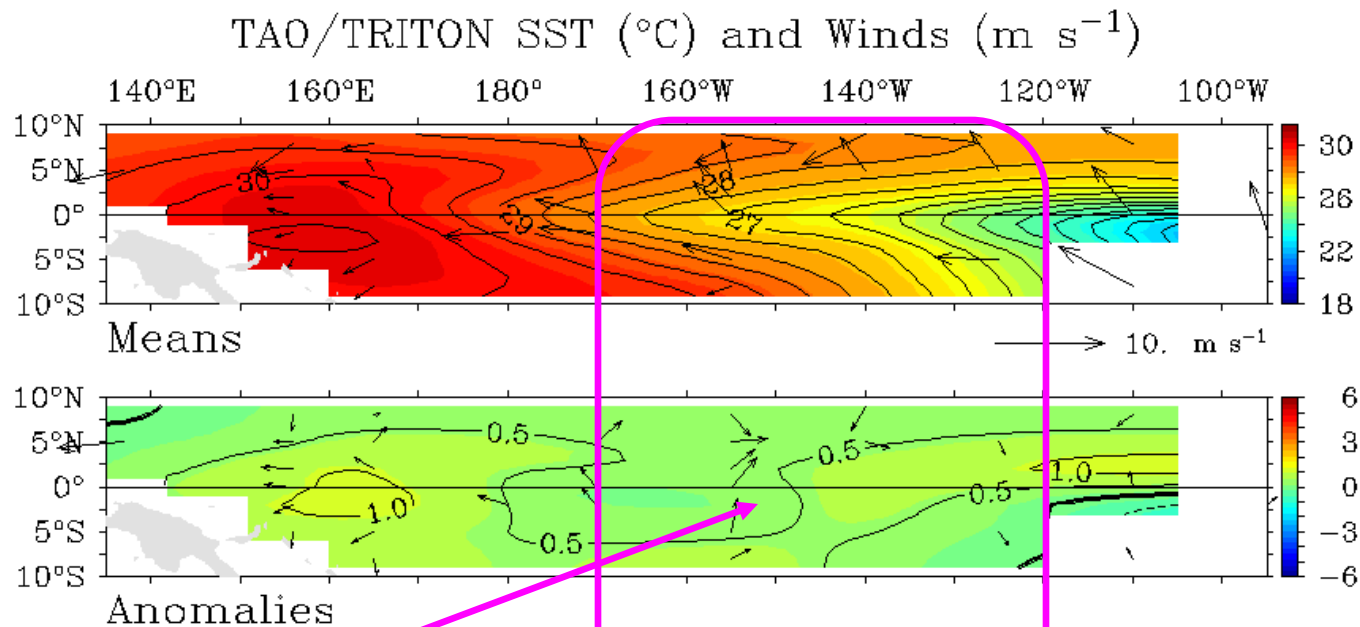
Seasonal Outlook for early 2014

Klaus Wolter

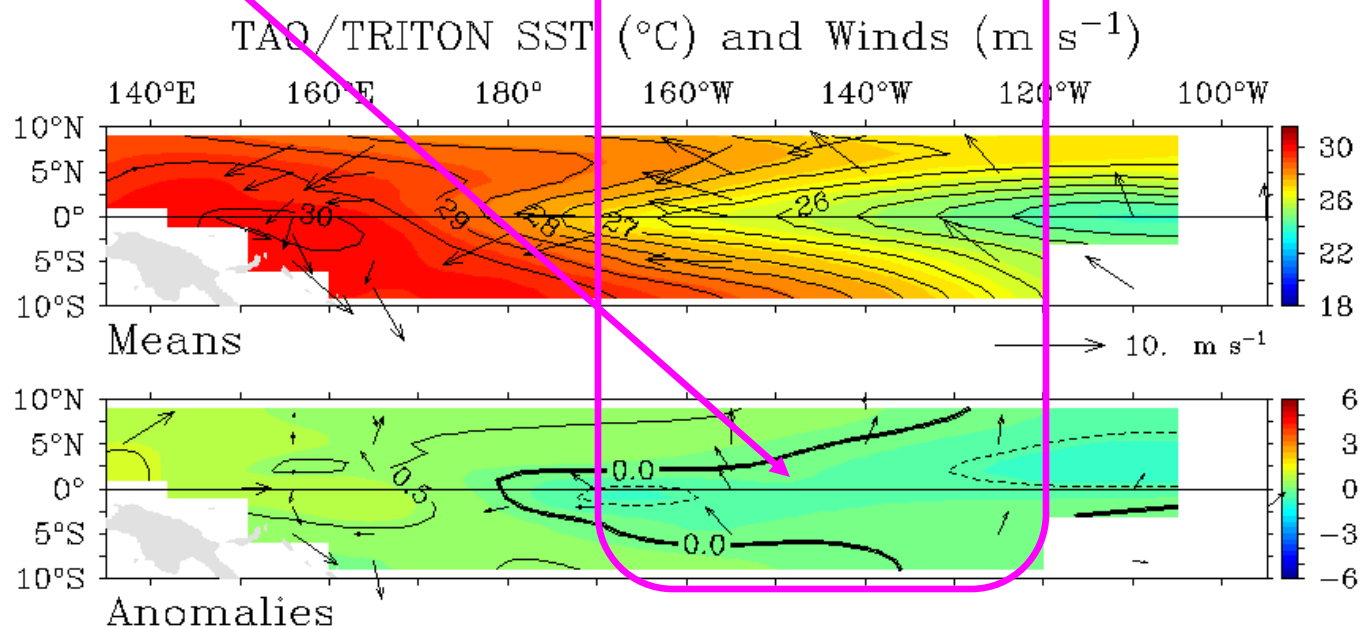
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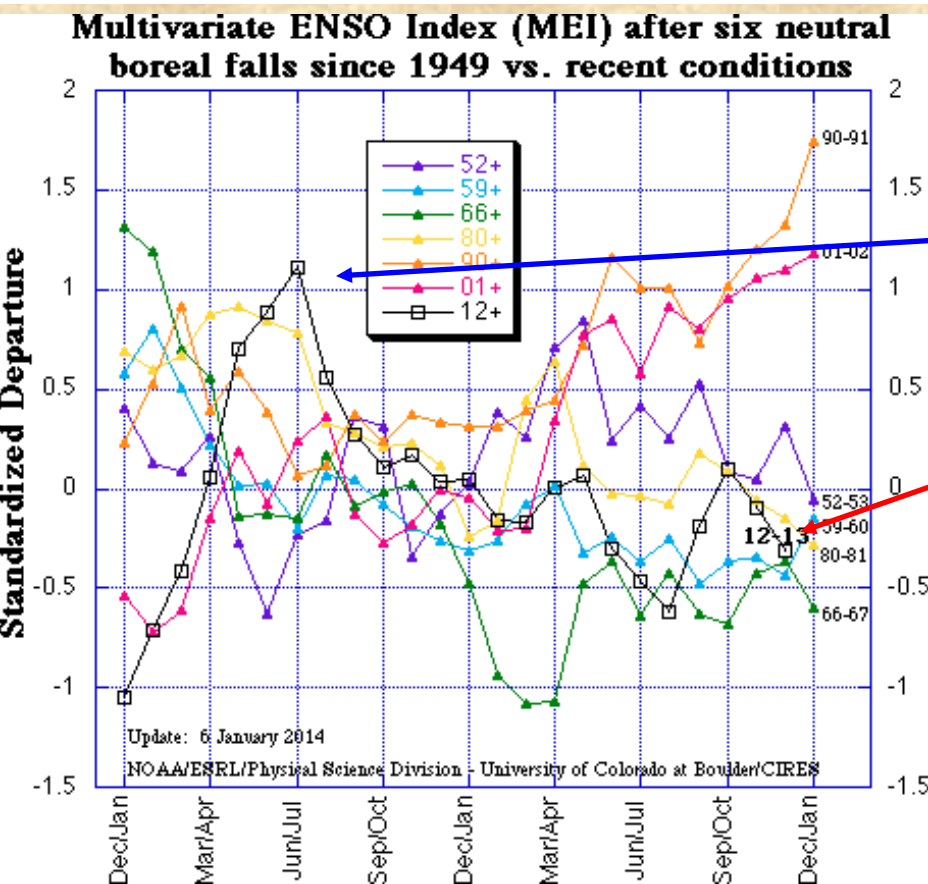
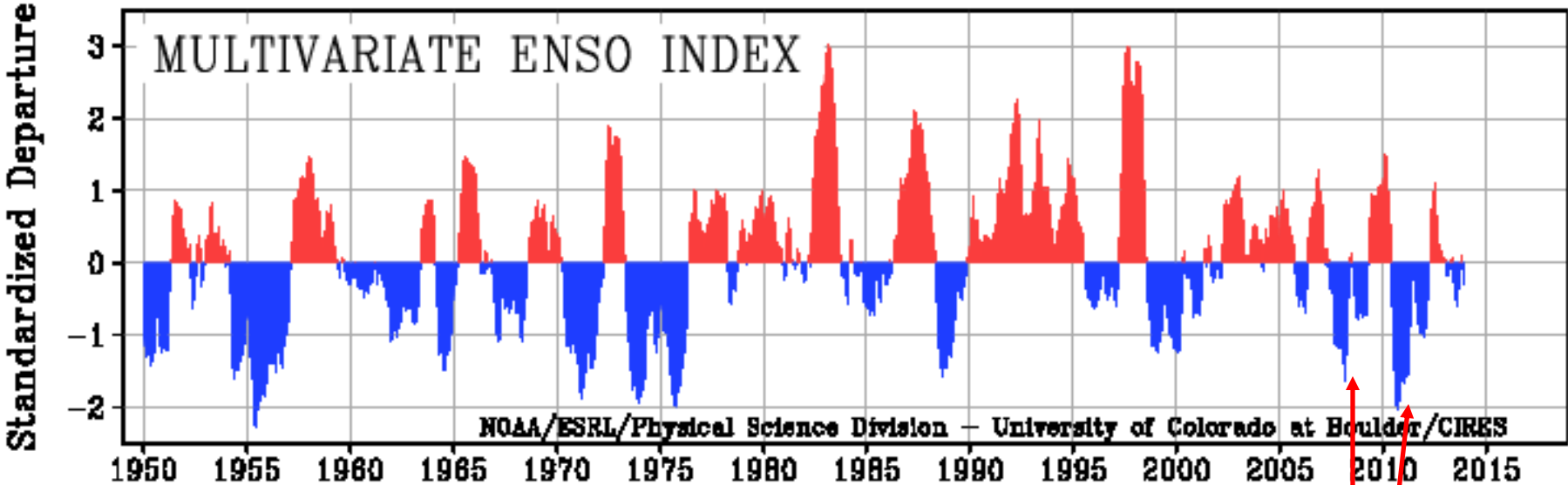
- **What has happened to ENSO(+), what will happen next, and what does that mean for us ?**
- **Expectations for the next two weeks**
- **CPC forecasts for February through June 2014**
- **Seasonal Forecast Guidance for precipitation & *1apr SWE***
- **Executive Summary**

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 cooling that is centered on the critical Niño 3.4 box (latest weekly: -0.7C). However, recent wind anomalies have remained weak, and are not conducive to rapid change.



Niño 3.4



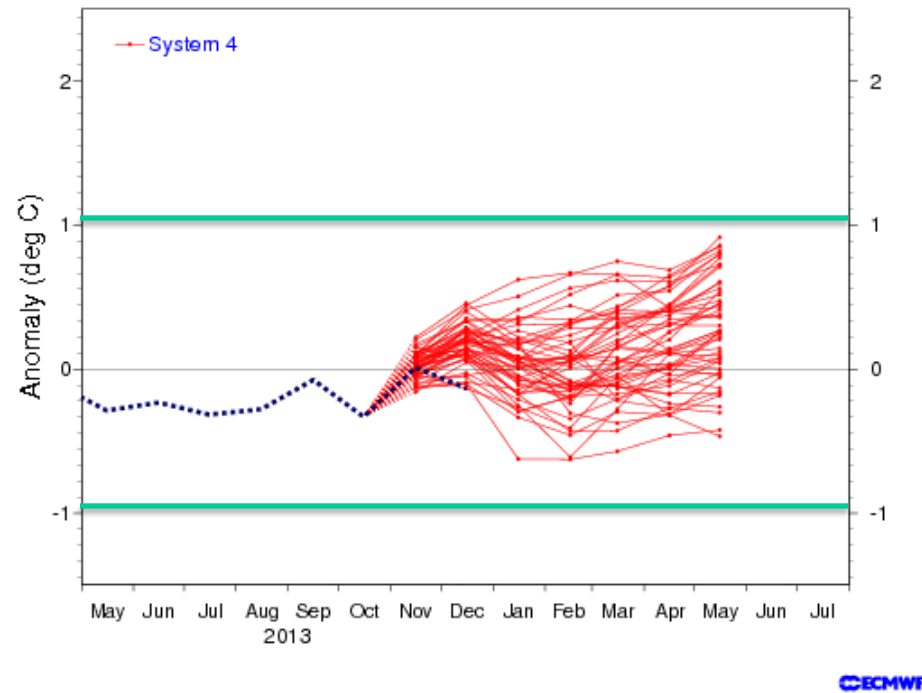


Last seven years have had two 'double-dip' Las Niñas in a row, followed by a brief excursion to what looked like an El Niño event in 2012, a return to ENSO-neutral conditions as of last fall, and a recent tendency towards La Niña that keeps coming back.

To see two neutral ENSO-winters in a row is fairly uncommon, but not unprecedented – analogous pairs occurred in 52-54, 59-61, 80-82, and 89-91.

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

NINO3.4 SST anomaly plume
ECMWF forecast from 1 Nov 2013
Monthly mean anomalies relative to NCEP OIv2 1981-2010 climatology

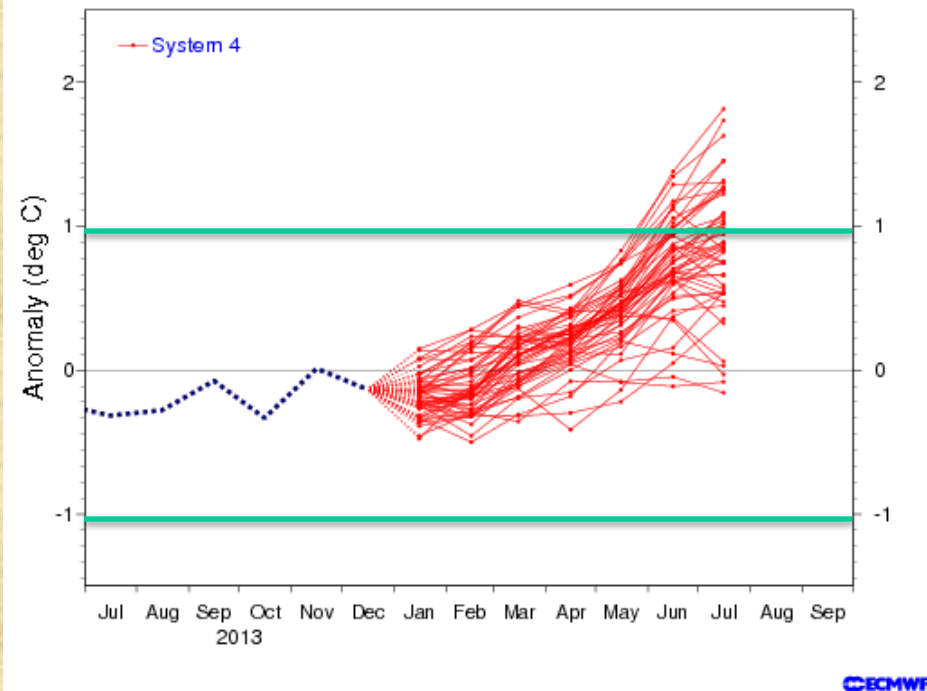


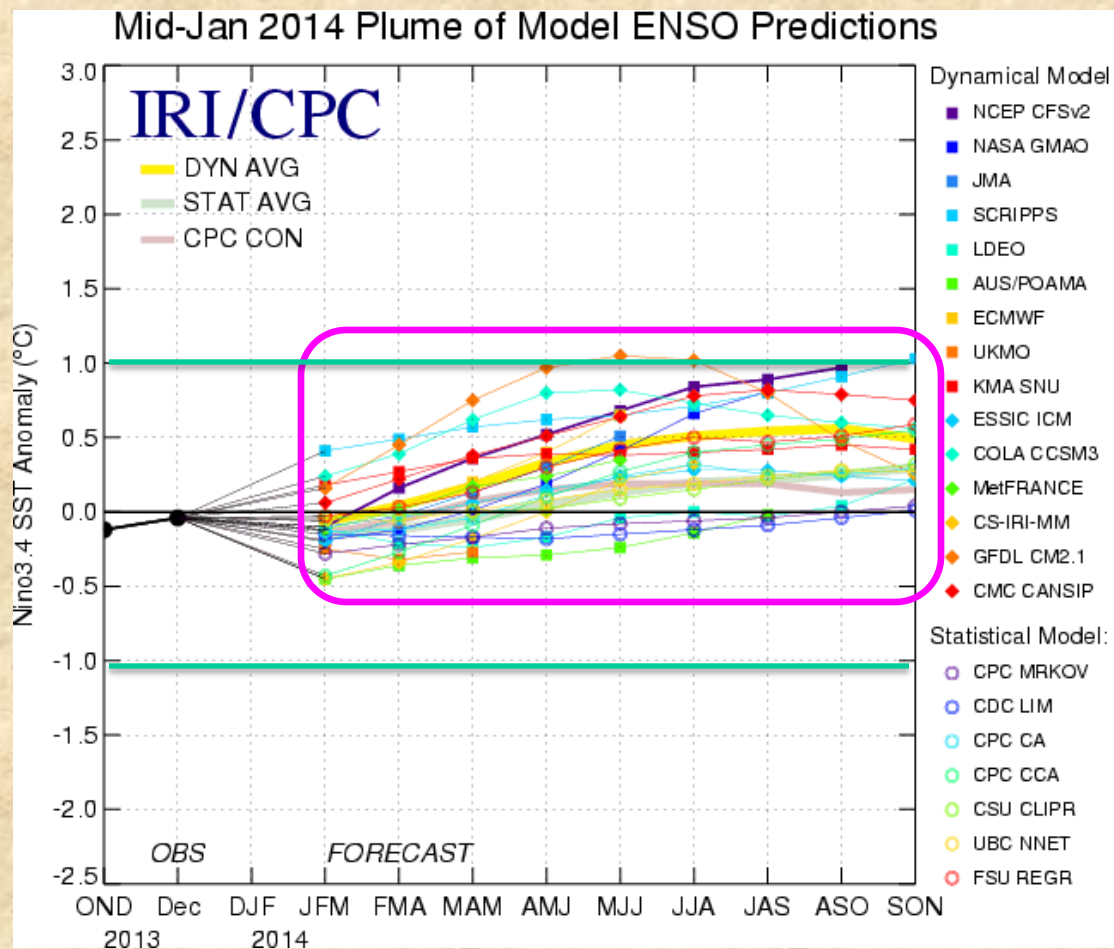
The ECMWF November 2013 forecast (left) showed continued ENSO-neutral conditions for the next few months, more so than in earlier runs, but with a final tally more above than below 0C. The scatter was smaller than earlier in 2013. The verification through December was on the low side.

The ECMWF January 2014 forecast (right) advertizes a pretty straightforward transition towards El Niño by mid-year, in fact about 20% of the 50 ensemble members show moderate El Niño conditions by July.

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

NINO3.4 SST anomaly plume
ECMWF forecast from 1 Jan 2014
Monthly mean anomalies relative to NCEP OIv2 1981-2010 climatology





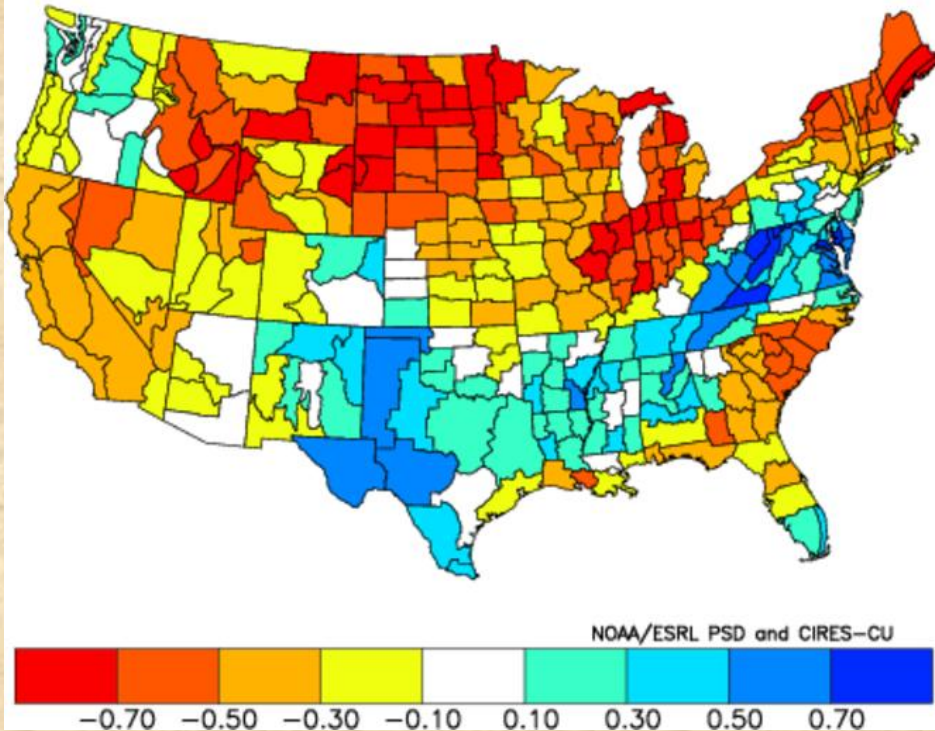
IRI plume of 15 dynamical and 7 statistical model forecasts shows a more muted trend from ENSO-neutral to slightly in favor of El Niño by this summer, more so for the dynamical than the statistical ones (we have seen that before – it did not work out in 2013, but it is almost overdue in 2014). In fact, if we get an El Niño in 2014, it would end the 3rd longest ‘dry spell’ since 1950.

FWIW, 9 of 15 dynamical, but only 2 of 7 statistical models reach the +0.5C threshold of at least weak El Niño conditions by this summer.

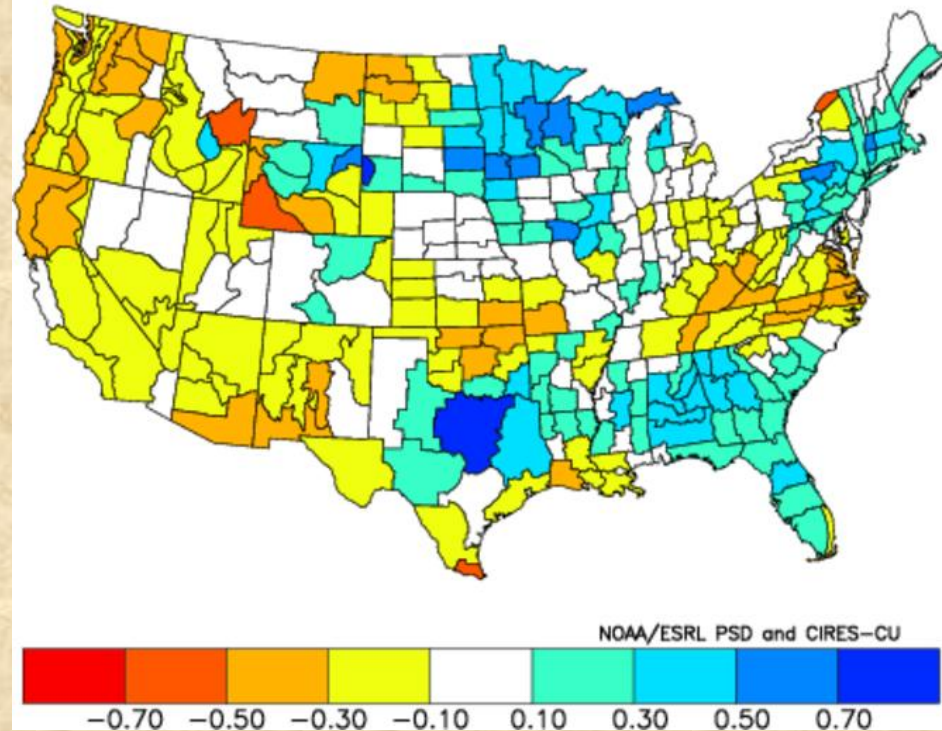
http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html

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

Composite Standardized Precipitation Anomalies
Jan to Mar 1957,1961,1981,1994
Versus 1950–1995 Longterm Average

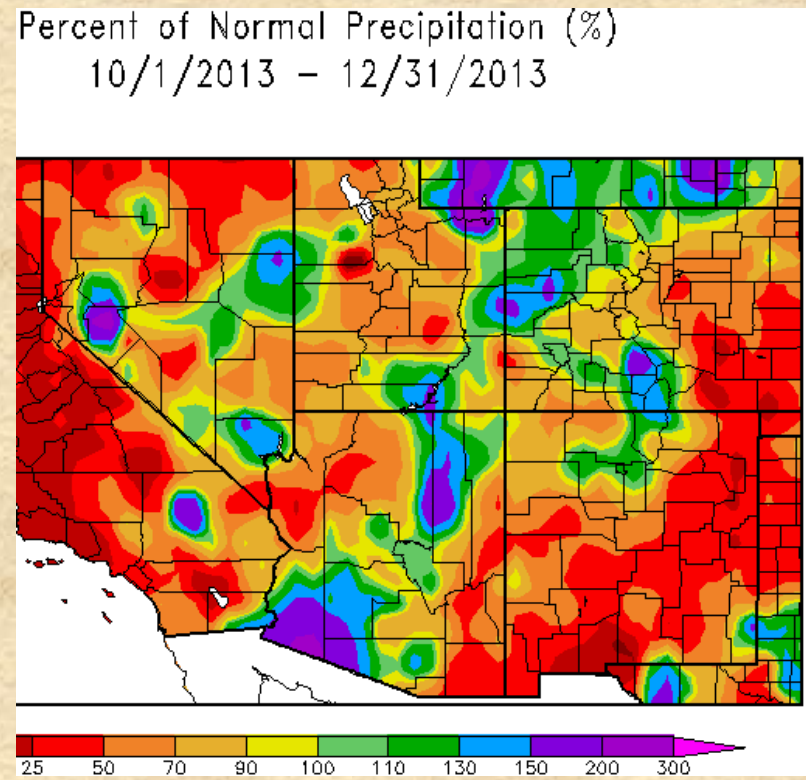
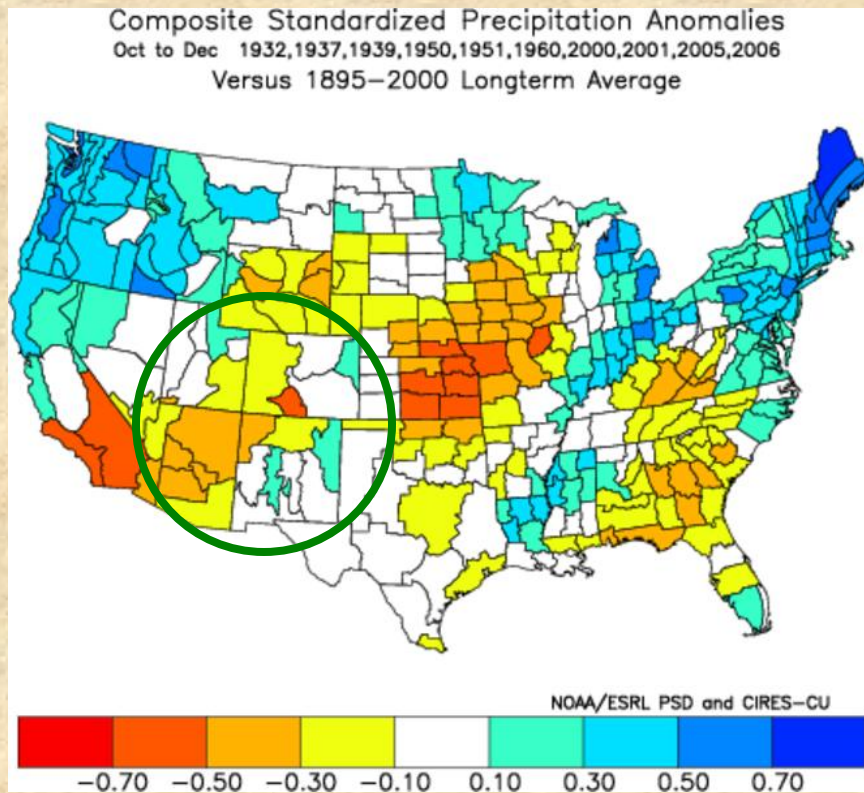


Composite Standardized Precipitation Anomalies
Jan to Mar 1964,1965,1970,1977,1979,1996,2001,2006
Versus 1950–1995 Longterm Average



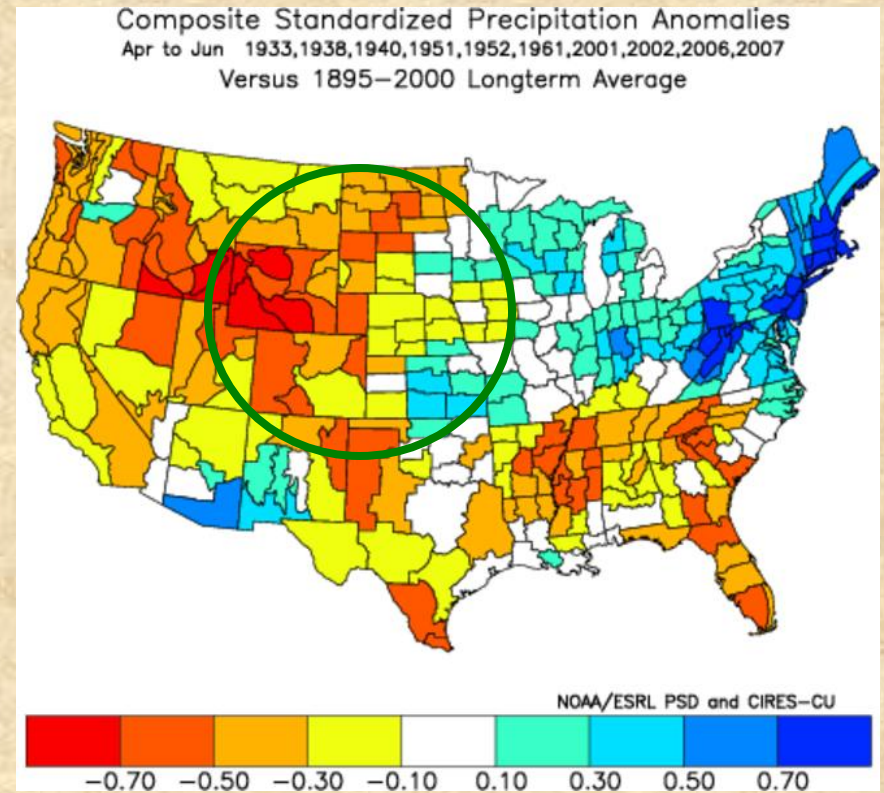
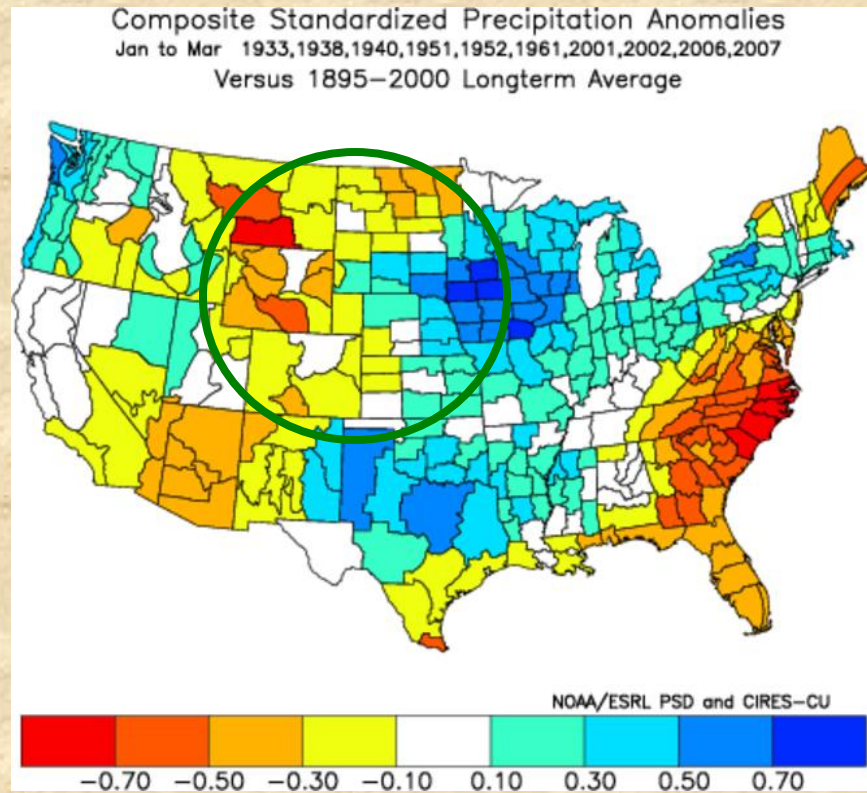
During positive NAO and neutral ENSO conditions (left), the winter season tends to be drier than normal from CA through the northern Rockies into the Midwest, but wetter than normal in northeast CO, again with a small sample; the negative NAO case is not that different for our state (perhaps more favorable over western CO...). It looks like the NAO is more likely to continue on a mildly positive note, so not much hope from that end.

What might happen in WY'14—the PDO-AMO angle?



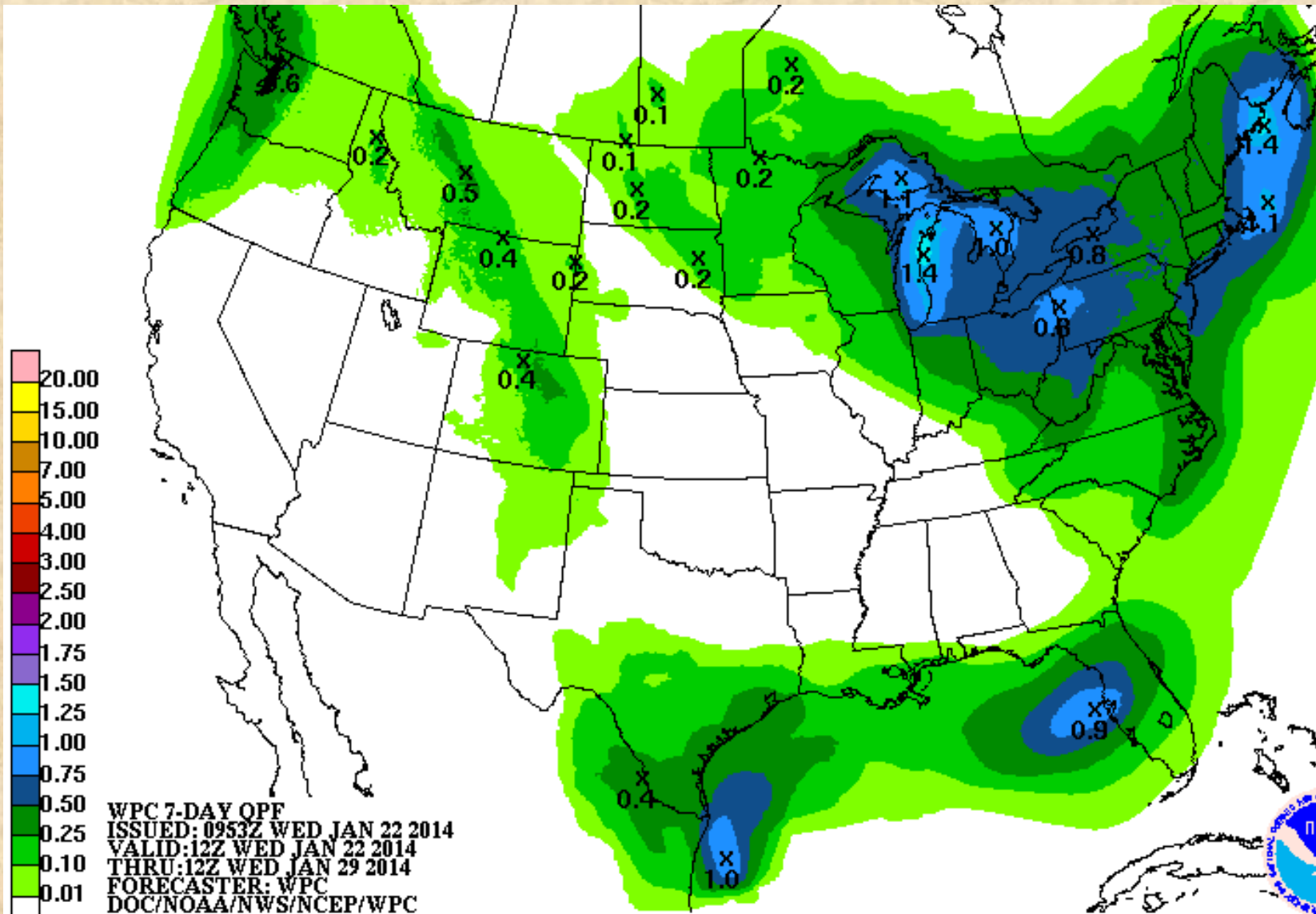
Not as pronounced a 'forecast' as last year for this part of the U.S. in the wake of a less extreme PDO-AMO summer (ranked 17th out of over 100, as opposed to 1st in 2012). BUT, not too bad for calling out drought conditions in southern high plains. Perhaps that big blizzard in early October makes this map look worse...

What might happen in WY'14—the PDO-AMO angle?



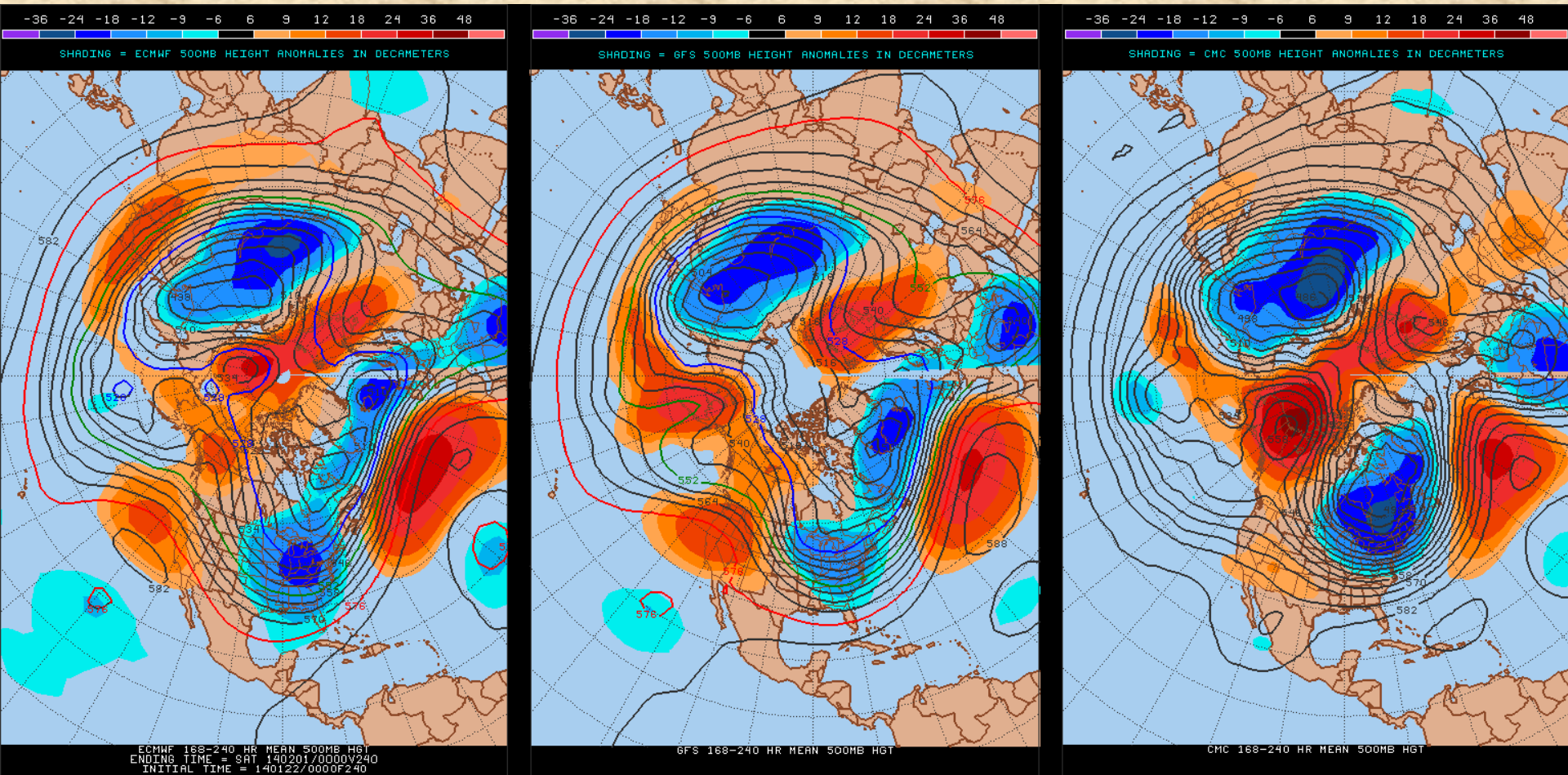
Both winter (left) and spring (right) show a tendency for dry conditions over CO (left: winter; right: spring), especially in the latter season – unless there is some interference, although even an El Niño onset is no guarantee for a moisture (2002 is one extreme example of that lack of success).

What can we expect in the next seven days?



*Expected total precipitation, according to the Hydrological Prediction Center (NOAA):
Most of this should fall in the next 24h...*

What can we expect by next weekend?



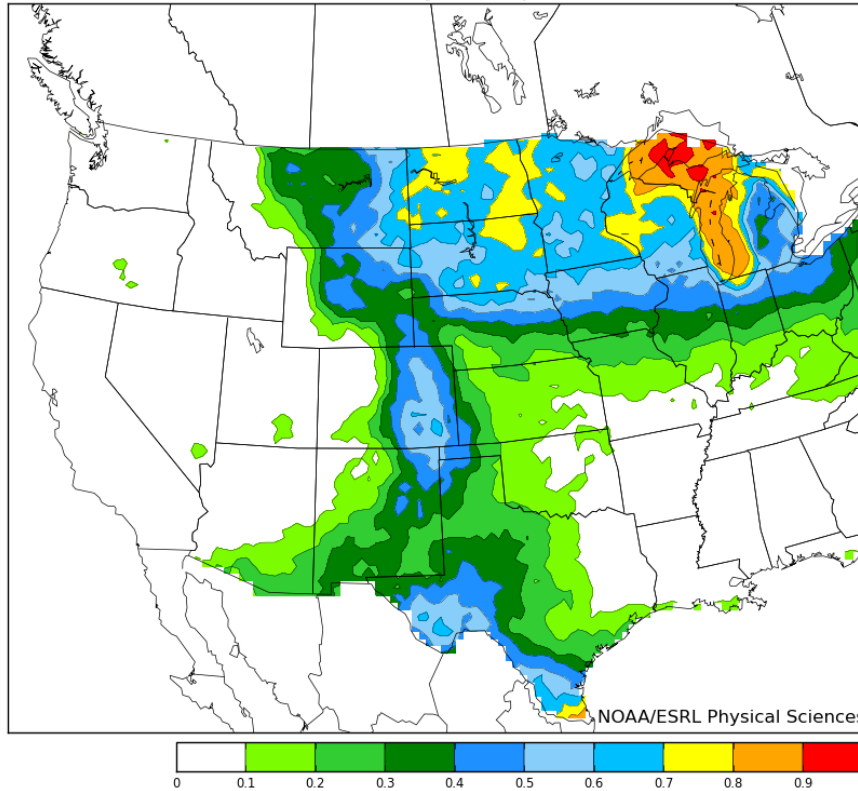
European (left), U.S. (middle), and Canadian (right) models are unanimous that the eastern U.S. will remain COLD, with Colorado remaining on the edge of this (with occasional intrusions of that air to keep us from ‘overheating’. More importantly, the persistent ridge west of us is showing signs of change, especially in the Canadian model (right).

Reforecast precipitation odds for Weeks 1&2

000-168hr fcst from 00Z Wed Jan 22. Valid 00Z Wed Jan 22 - 00Z

Calibrated with 1985-2010 Reforecast2 data.

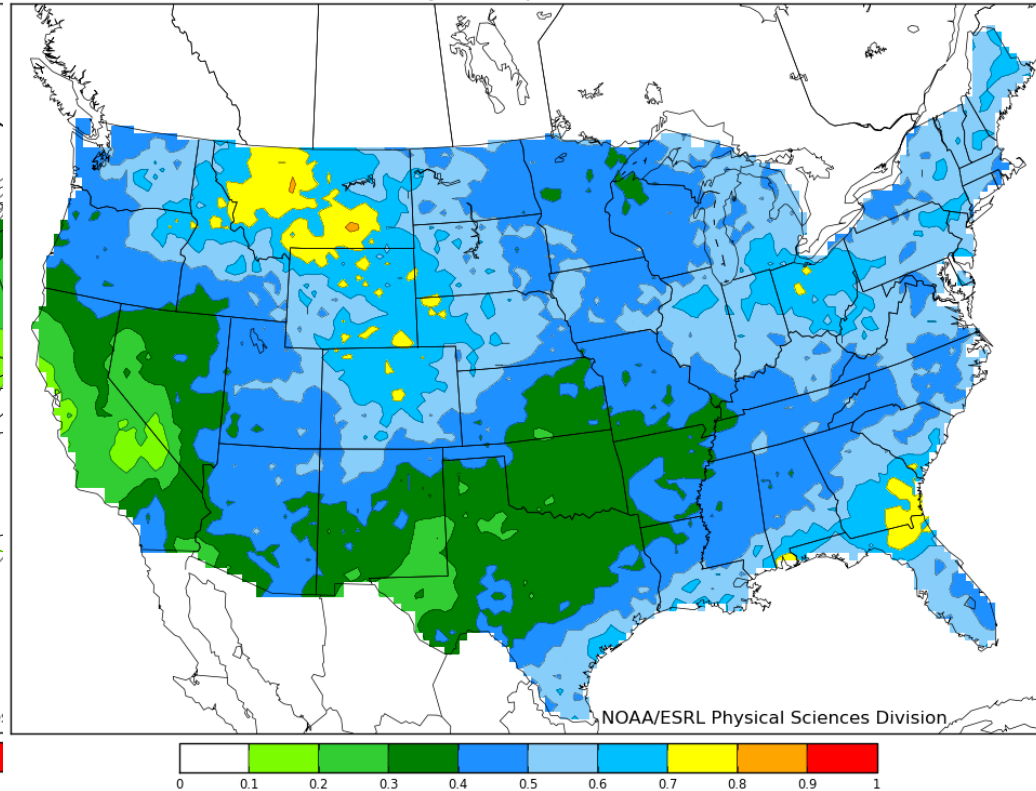
Probability of Precip > 50th Percentile



168-336hr fcst from 00Z Wed Jan 22. Valid 00Z Wed Jan 29 - 00Z Wed Feb 05

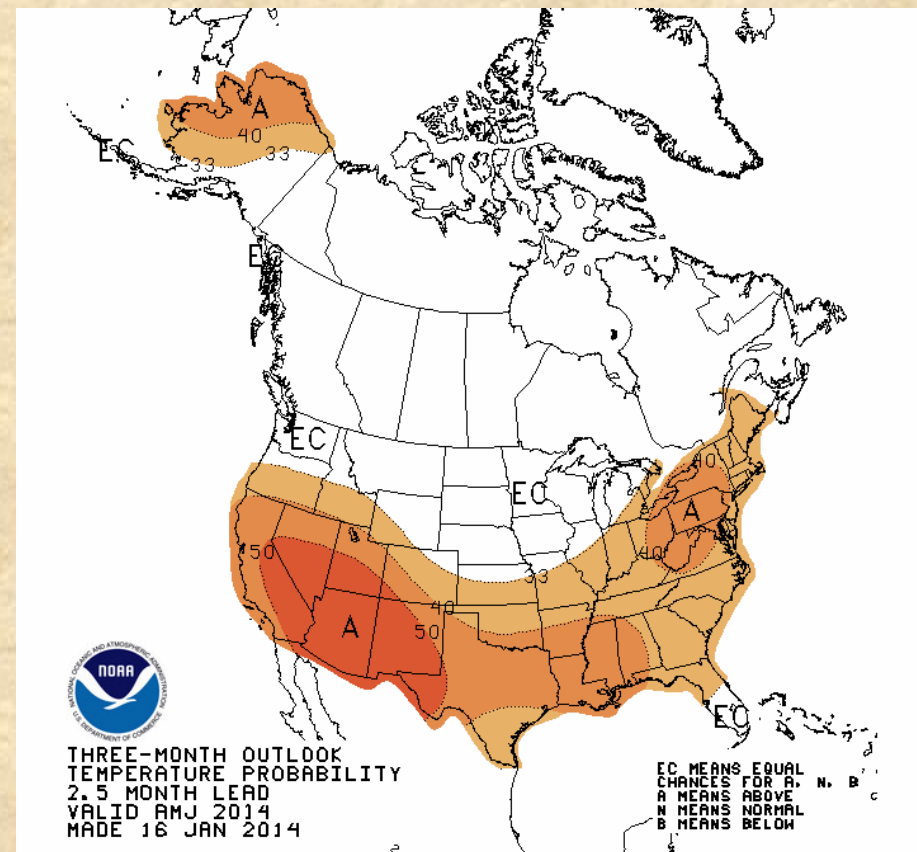
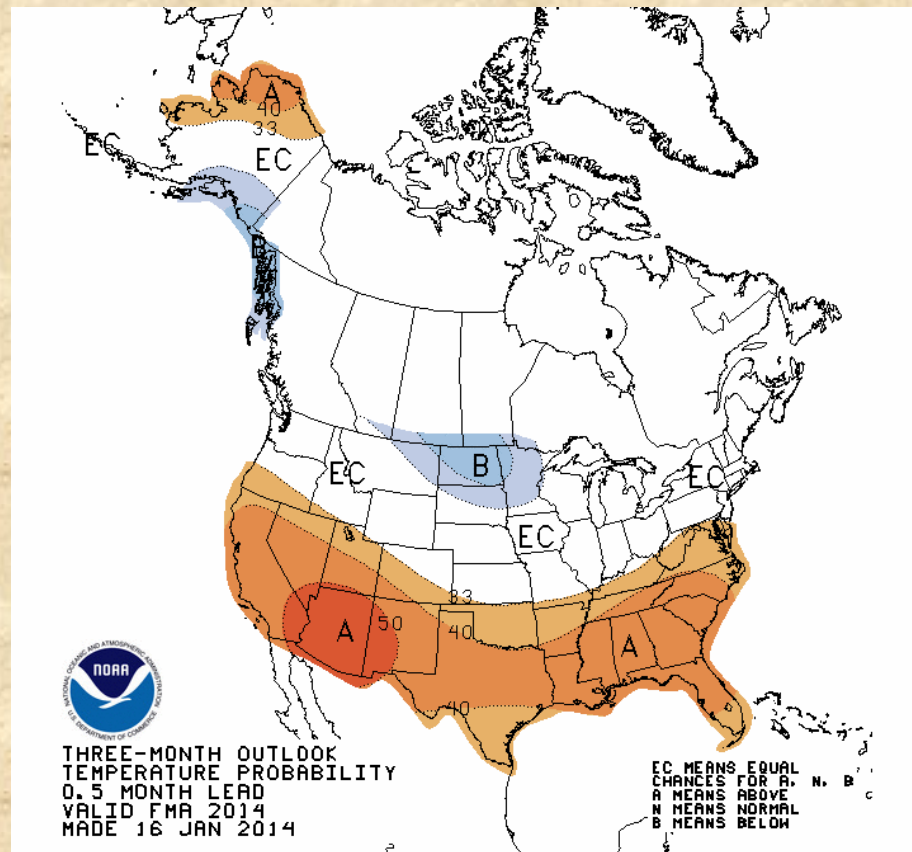
Calibrated with 1985-2010 Reforecast2 data.

Probability of Precip > 50th Percentile



Precipitation amounts are expected to be well-below normal for western Colorado in Week 1 (left), while Week 2 (right) shows a return of normal to even above-normal moisture, especially over the north-central mountains. Tonight's snow may bring the Front Range close to normal moisture for January.

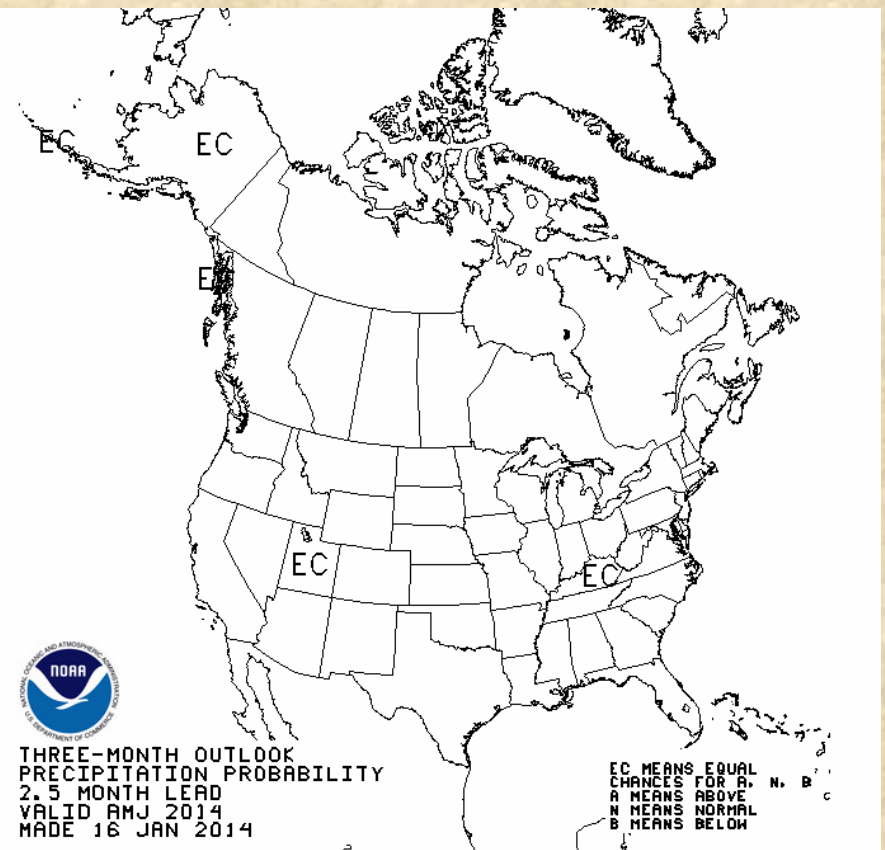
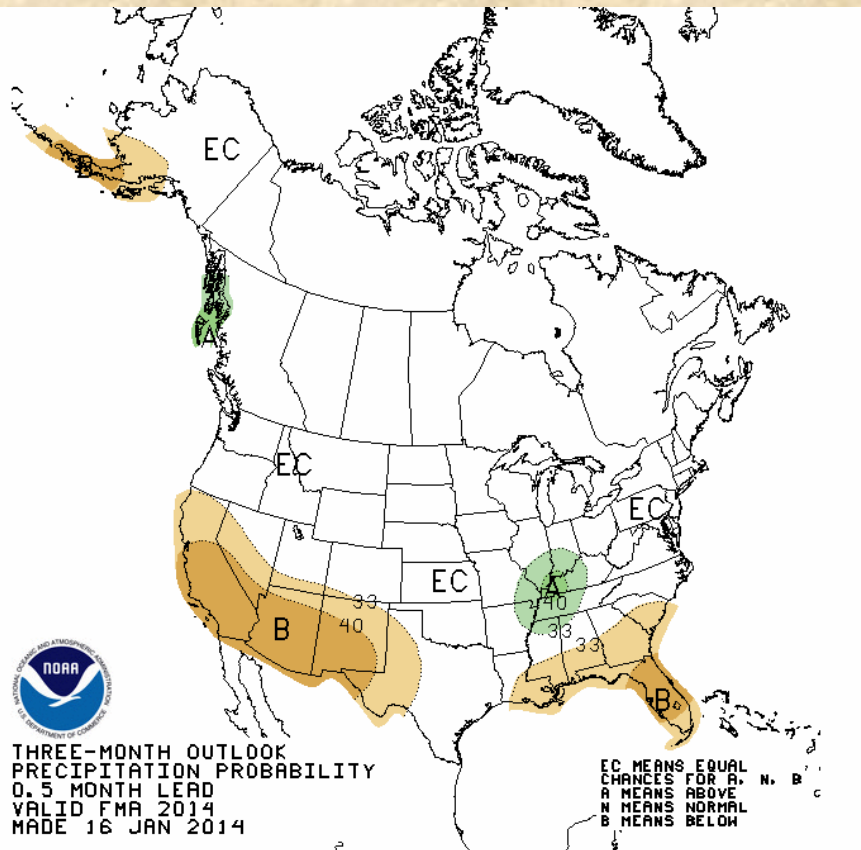
Climate Prediction Center Temperature Forecasts



CPC's temperature forecast for February-April (left) and April-June (right) reflects recent warming trends mainly to our south and west – ENSO-neutral conditions do not alter this outlook.

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

Climate Prediction Center Precipitation Forecasts

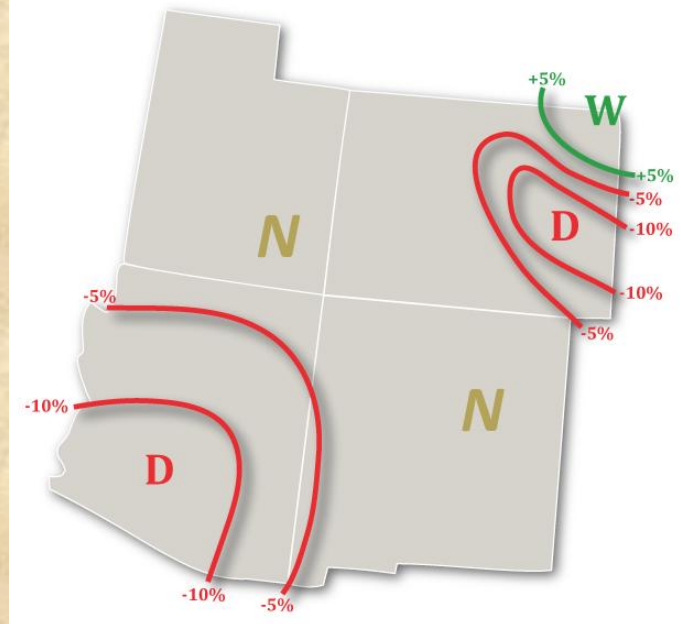


CPC's precipitation forecast for February-April (left) and April-June (right) shows initially *decreased odds for moisture to our south and west* (left), while there are no clear-cut odds for spring (right). Continued negative PDO-conditions explain some of this map. *I will run my first April-June moisture forecast later this month.*

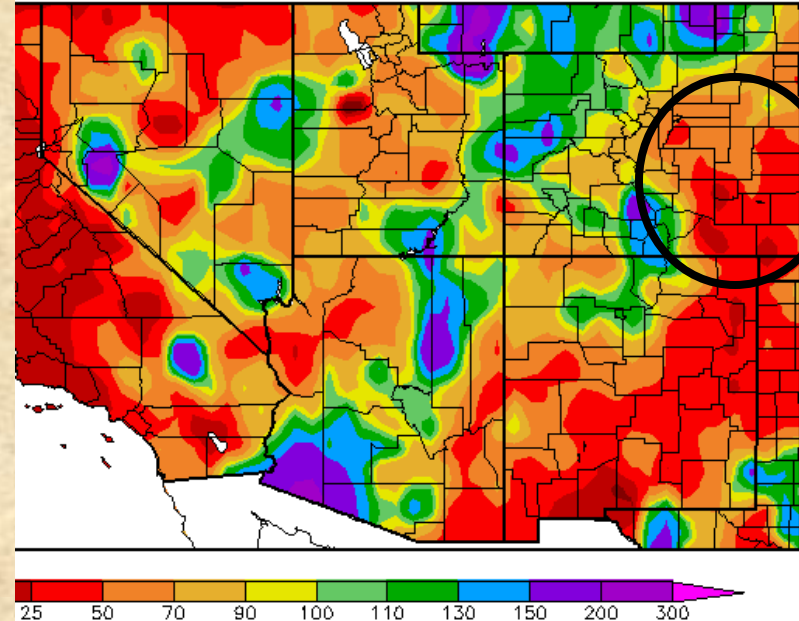
Source: <http://www.cpc.ncep.noaa.gov/products/predictions/>

'Postmortem' for October-December 2013

Experimental PSD Precipitation Forecast Guidance
OCT - DEC 2013 (Issued September 11, 2013)

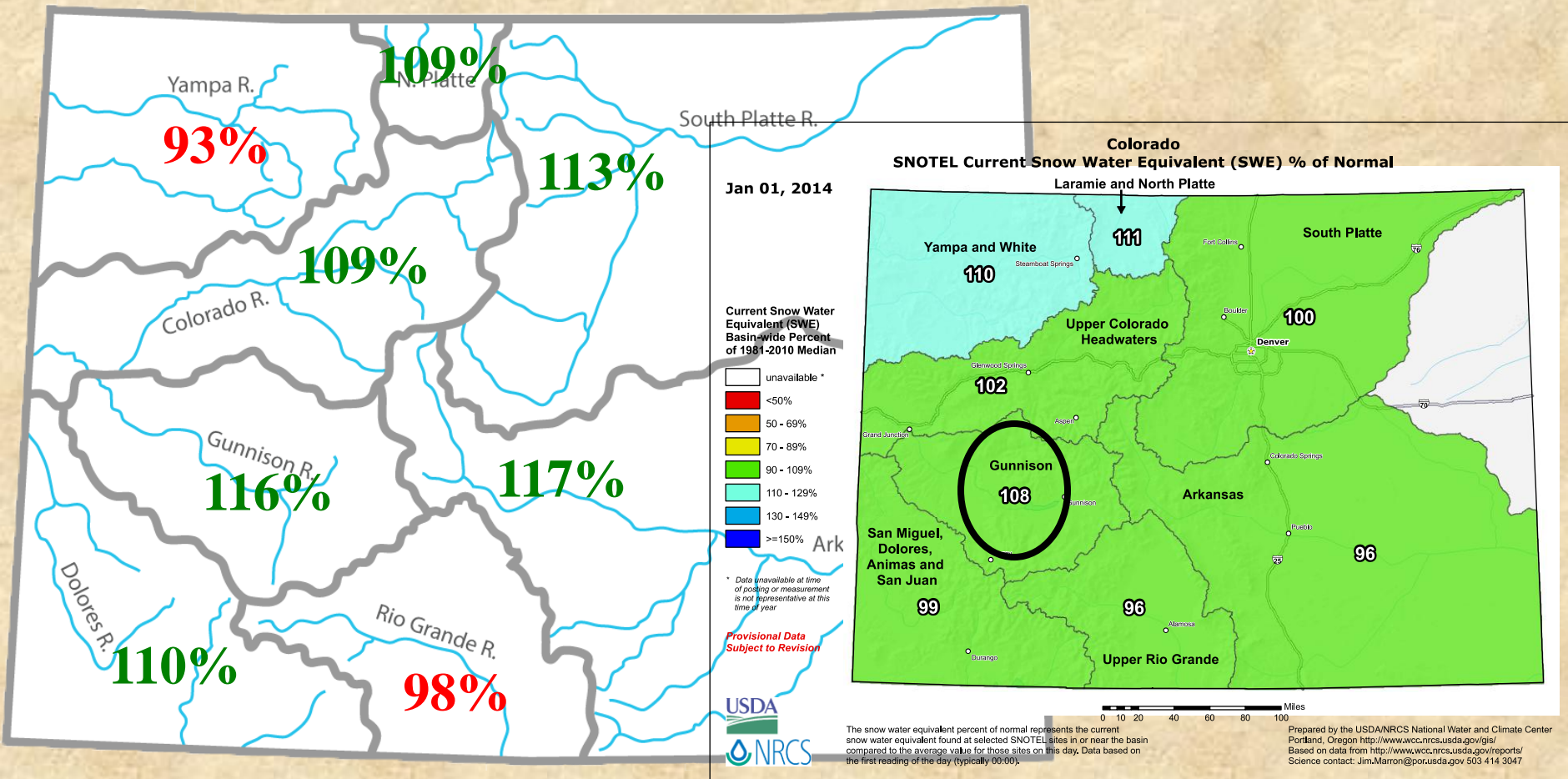


Percent of Normal Precipitation (%)
10/1/2013 - 12/31/2013



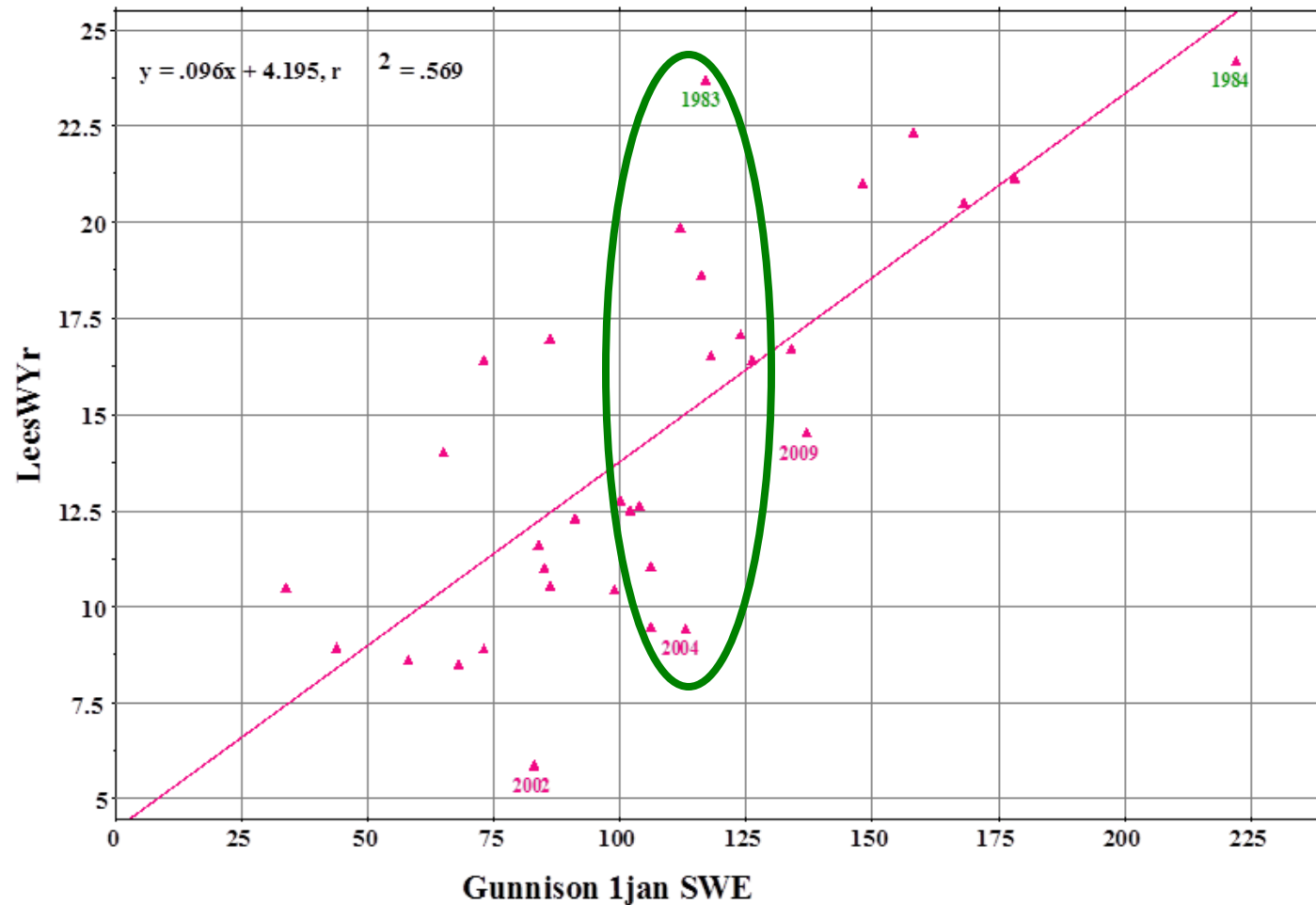
My Fall forecast (left) was mostly dry over the southwestern U.S., especially AZ and the (south-)eastern plains of CO. Near-normal appeared most likely over SE UT and eastern NM. Verification was mixed over AZ (*wet pockets were not expected*), drier than expected for eastern NM, reasonable over eastern UT, **dry as expected over eastern CO**, and wet to the north. *Note that there was no tilt over mountains of northern CO and UT, making the 1janSWE forecast all the more interesting...*

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. Verification (right) averaged about 5% lower than expected, worst in Arkansas basin (21% lower than median forecast, the only basin below the predicted 25%ile forecast), and surprisingly high in Yampa basin (17% higher than median forecast). *Note relatively high outcome in Gunnison basin.*

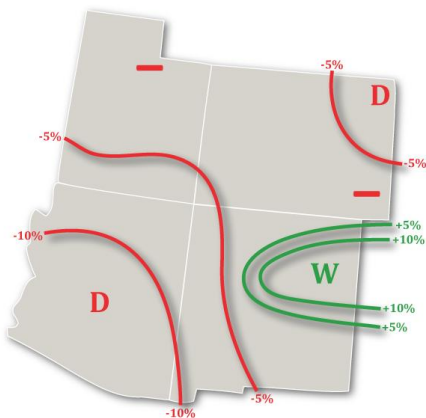
WY'14 – Relationship of Gunnison basin to Lees Ferry inflow



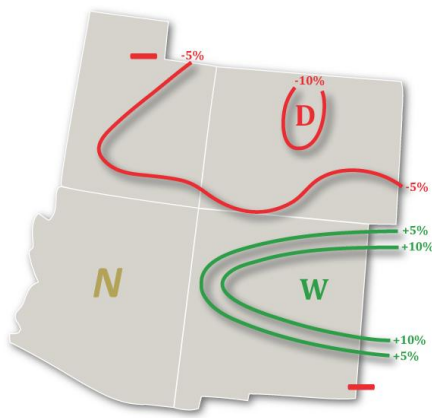
The Gunnison Basin 1 January SWE correlates highest with ‘natural’ Water Year runoff at Lees Ferry, explaining over 50% of the variance. January 1st SWE ended up at 108%, right where the possible range for WY runoff is quite large: 2004 on the low end versus 1983 on the high end, but it certainly beats 2002...

Statistical Forecast for Jan-Mar '14

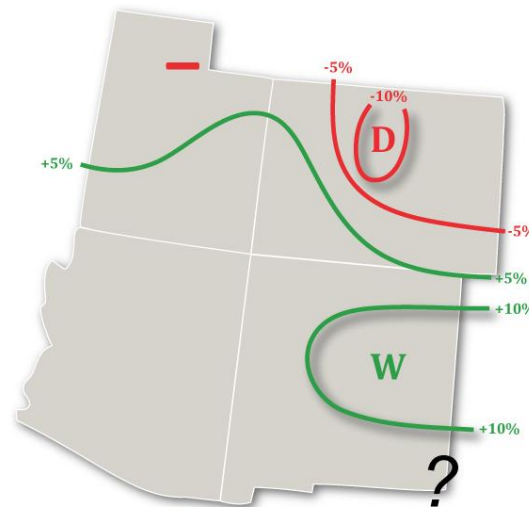
Experimental PSD Precipitation Forecast Guidance
JAN – MAR 2014 (Issued September* 2013)



Experimental PSD Precipitation Forecast Guidance
JAN – MAR 2014 (Issued November 13, 2013)

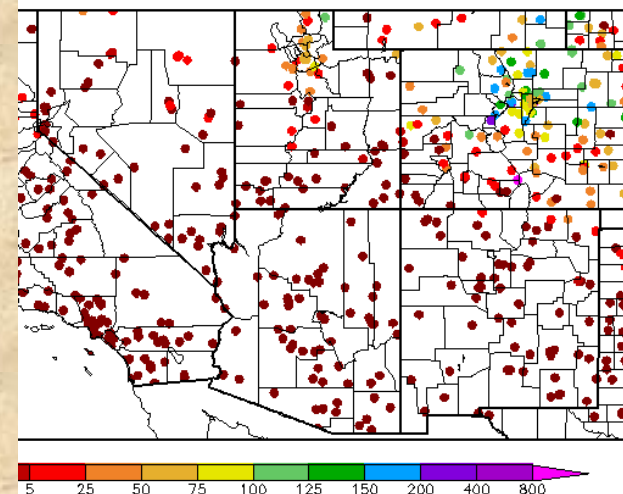


Experimental PSD Precipitation Forecast Guidance
JAN – MAR 2014 (Issued January 17, 2014)

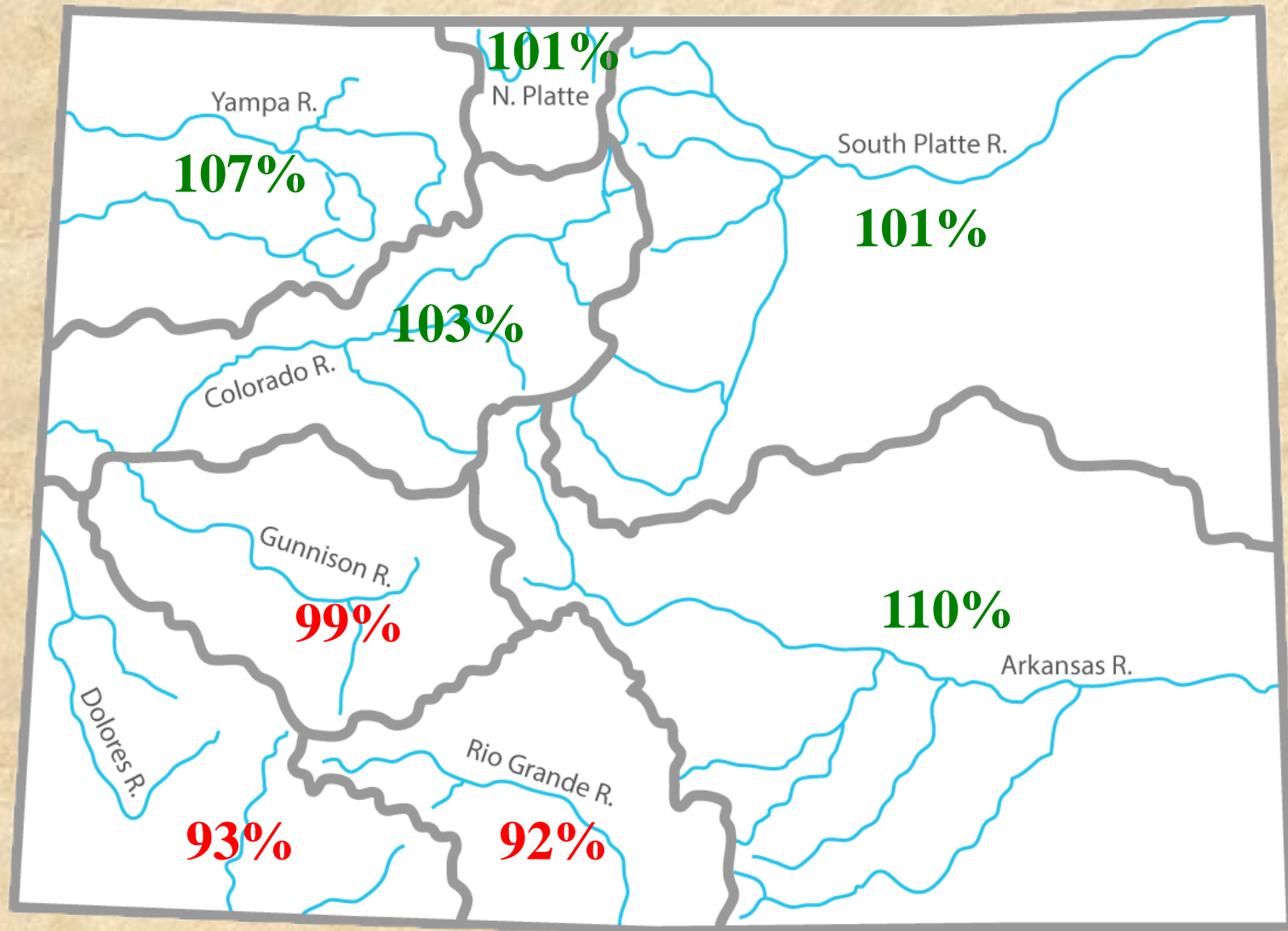


The precipitation forecast for January-March '14 from September initial conditions (left) was dry for much of the Southwest, neutral over Colorado's mountains, and dry over our eastern plains. The November forecast (middle) was drier for our state. The latest update (right) keeps it dry over northern and eastern Colorado, while increasing the odds for moisture to our south. The 1st three weeks of January show roughly the inverse of this forecast, so we are not off to a good start.

Percent of Normal Precipitation (%)
1/1/2014 – 1/21/2014

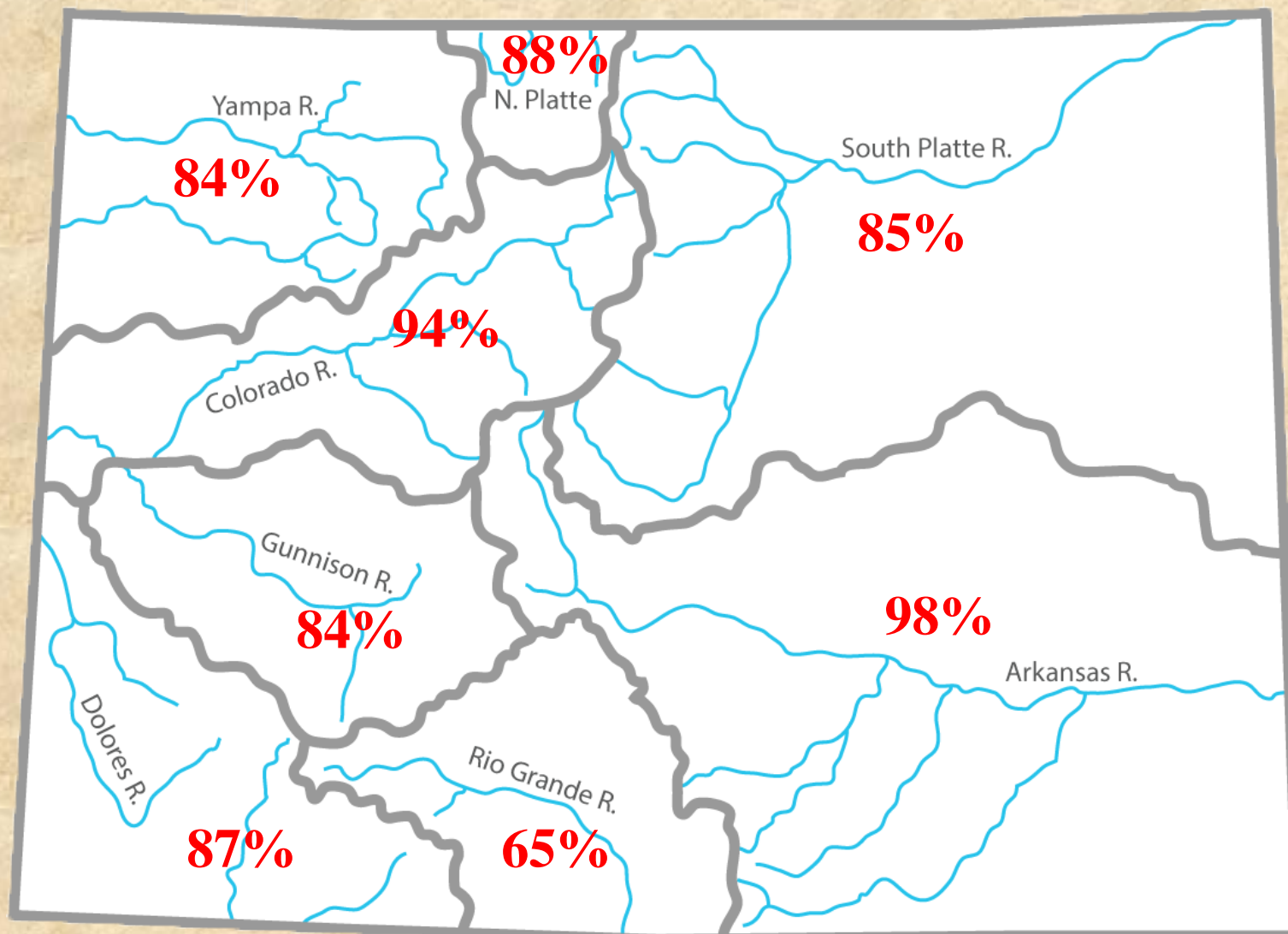


SWE forecast for 1 April 2014 (50%ile)



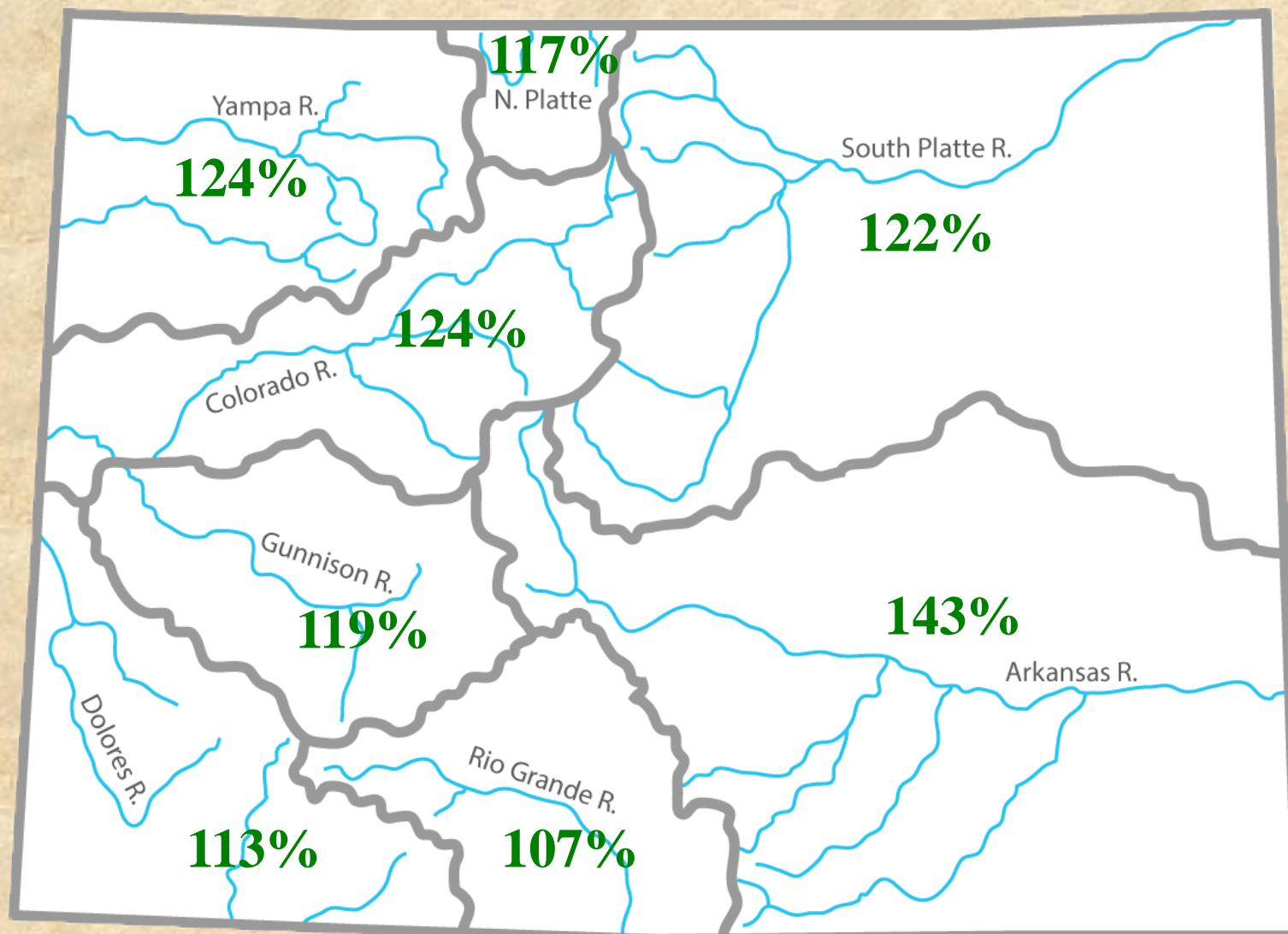
The **NEW** median forecast for 1 April snowpack is better than the long-term median in the northern and eastern basins, while the Southwest appears headed towards <100%.

SWE forecast for 1 April 2014 (25%ile)



The lower quartile forecast for April 1st snowpack is higher than or equal 84% for all basins except the Rio Grande which appears headed for trouble. Dolores right at the 1981-2010 25%ile, Gunnison just under, Rio Grande really under...

SWE forecast for 1 April 2014 (75%ile)



The upper quartile forecast for April 1st snowpack is well above the long-term median in most of our state. Compared to 1981-2010, Dolores is just under 75%ile, ditto for North and South Platte, Yampa a bit more so, and 'worst' for Rio Grande.

- 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.*
- While the fall precipitation forecast was 'climatological' for our mountains, the new snowpack forecast raised expectations for normal to even above-normal 1jan'14 SWE values. They came in slightly lower than expected (by about 5%), but mostly not far from the median forecast. Overall, not a bad start for the season, especially for the Gunnison basin which has the best track record of 'predicting' the full Water Year runoff of the Colorado River at Lees Ferry.
- My statistical forecast for January-March 2014 is mostly on the dry side, especially in the northern mountains, but the historic skill of the latter is quite low. On the other hand, my new 1apr SWE forecast comes in near-normal for the northern and eastern basins, but below-normal for the San Juans.
- *Bottomline: Near-normal is good, if that is what we can expect this year, it certainly beats the previous two years. While not explicitly predicted, a switch to El Niño appears possible this spring which could improve our precipitation odds. Stay tuned!*