

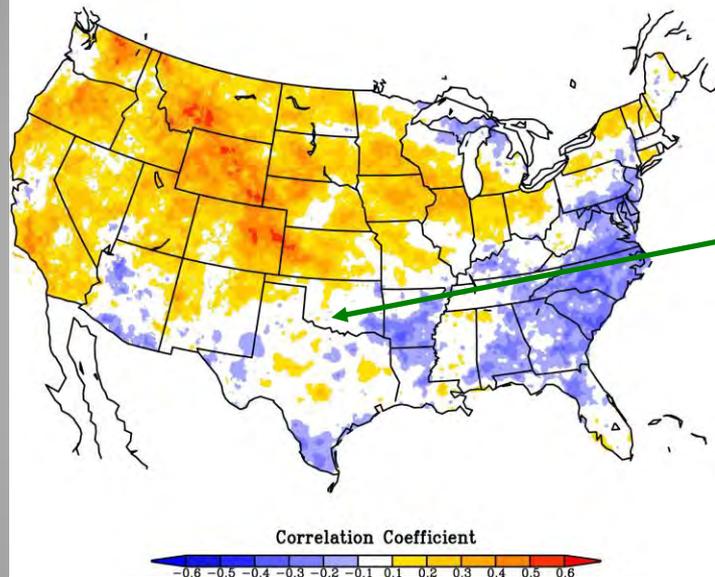
## *What can we say about the next 3-6 months?*

*Klaus Wolter*

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

- *Influence of El Niño/LA NIÑA in recent wet/DRY years*
- *Role of other factors in last two winters*
- *Postmortem on one year's worth of seasonal forecasts*
- *What is going to happen to ENSO next?*
- *Current thoughts about the next few weeks to months*
- *Summary*

JJA Precipitation versus MEI (1956–2005)

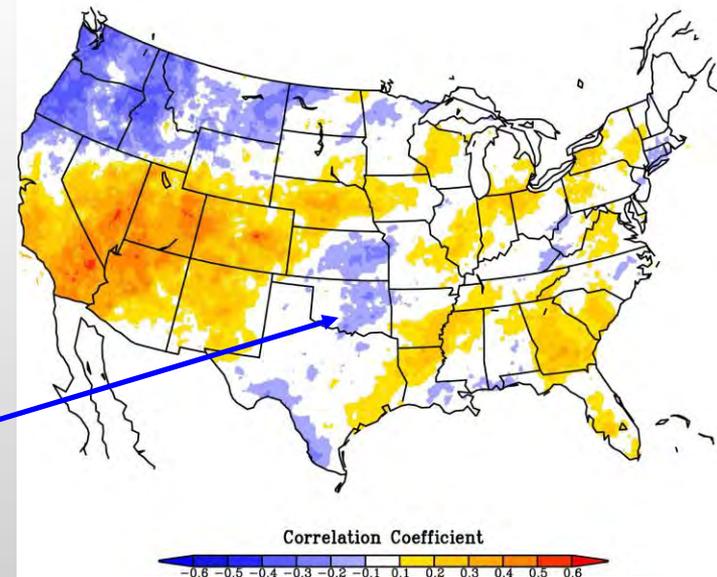


# Seasonal cycle of ENSO impacts

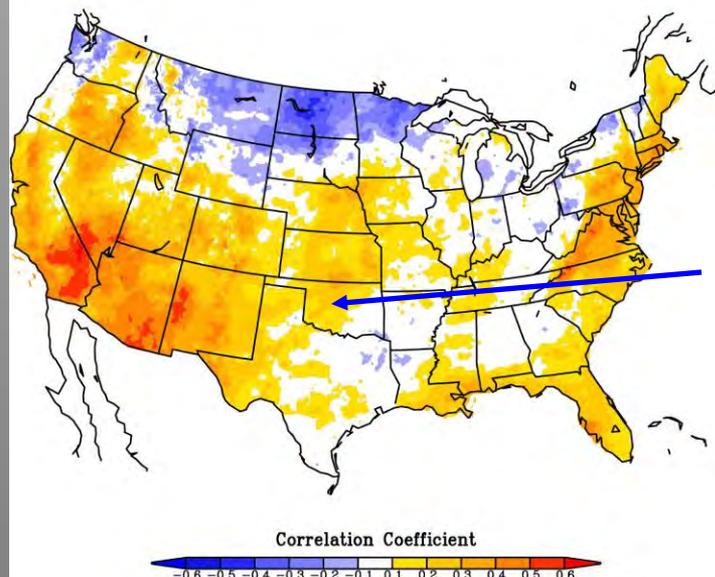
**Summer (left)** is weakly correlated with ENSO around here;

**Fall (right)** is the only season that tends to be wetter with La Niña than El Niño;

SON Precipitation versus MEI (1956–2005)



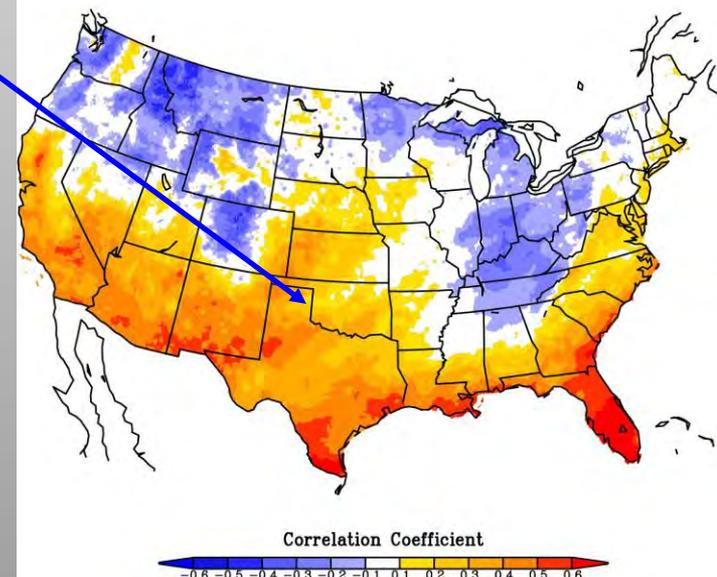
MAM Precipitation versus MEI (1956–2005)



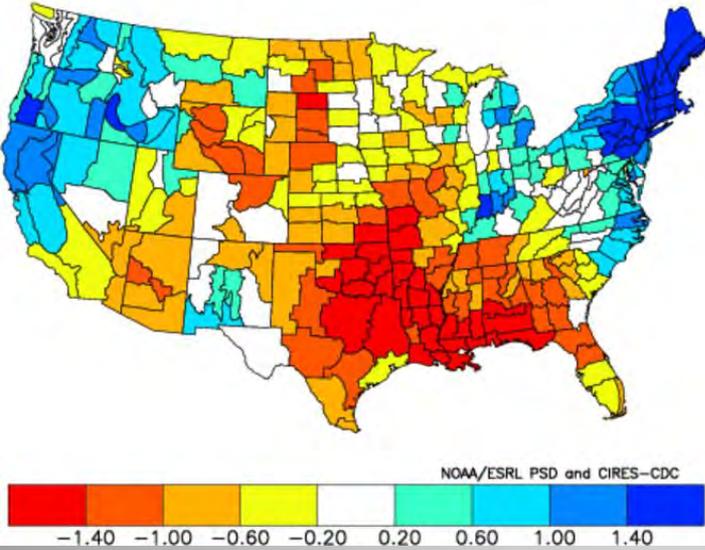
**Winter (right)** has the highest positive correlations with MEI, especially further south;

**Spring (left)** tends towards dry La Niña conditions.

DJF Precipitation versus MEI (1956–2005)



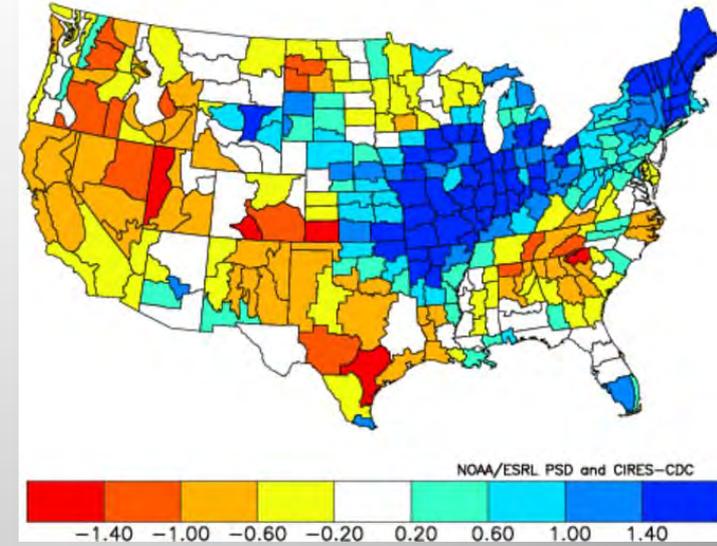
Standardized Precipitation Anomalies  
Oct to Sep 2005-06  
Versus 1981-2010 Longterm Average



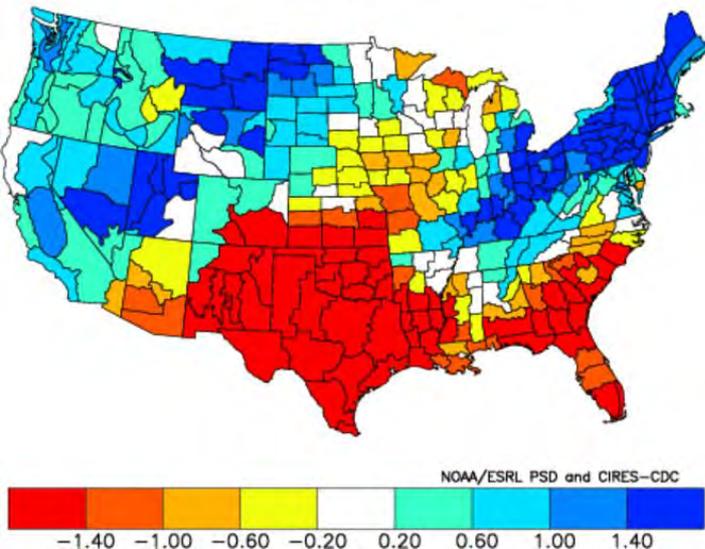
## Las Niñas since 2002

Last decade had more than its fair share of Las Niñas, in 05-06 (top left), 07-08 (top right), 08-09 (bottom right), and 10-11 (bottom left):

Standardized Precipitation Anomalies  
Oct to Sep 2007-08  
Versus 1981-2010 Longterm Average



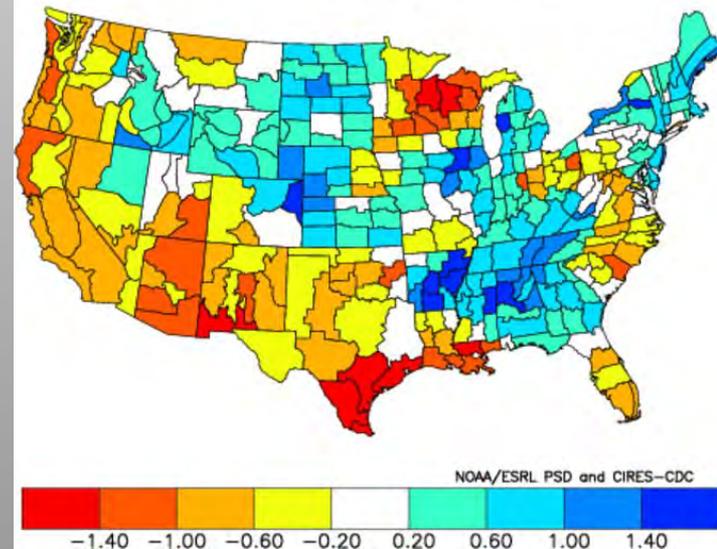
Standardized Precipitation Anomalies  
Oct to Sep 2010-11  
Versus 1981-2010 Longterm Average



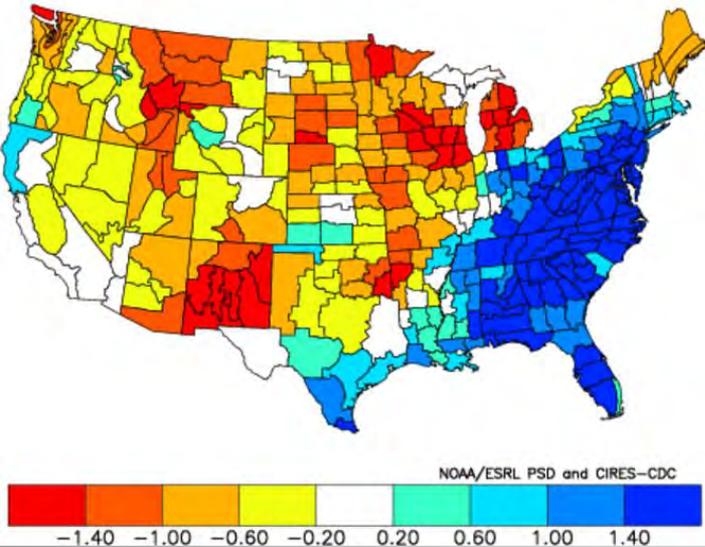
*All four cases were dry in Texas, while Oklahoma got 'lucky' in 2007-08'*

*2011-12 was another La Niña Water Year, discussed further below*

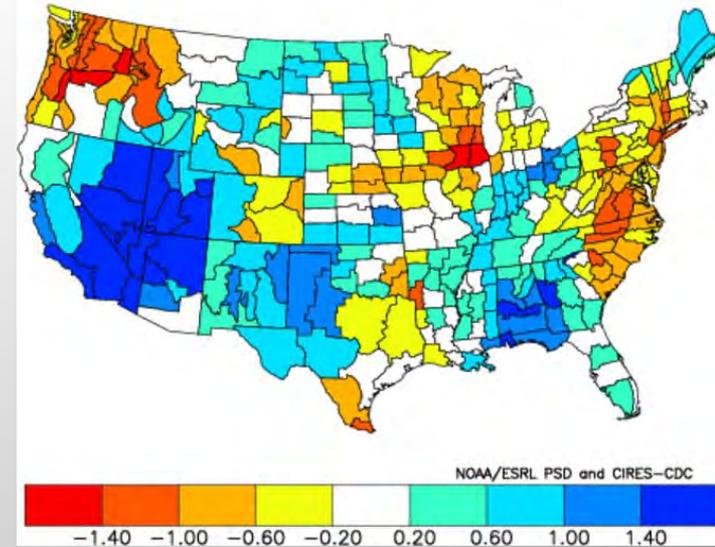
Standardized Precipitation Anomalies  
Oct to Sep 2008-09  
Versus 1981-2010 Longterm Average



Standardized Precipitation Anomalies  
Oct to Sep 2002-03  
Versus 1981-2010 Longterm Average

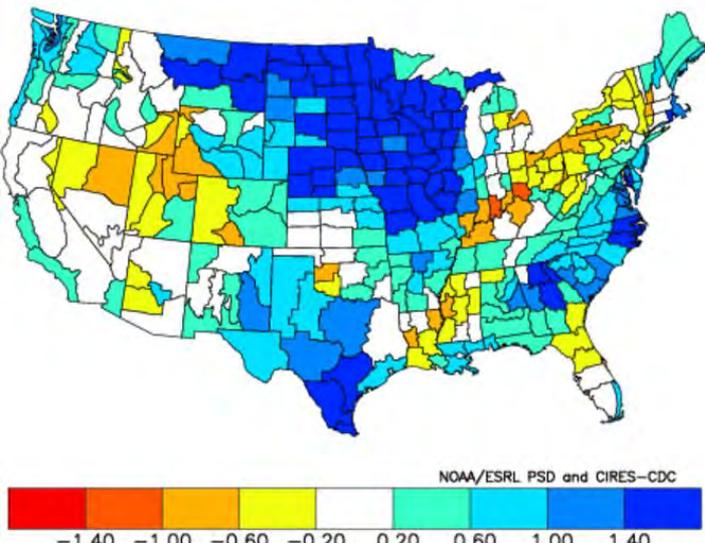


Standardized Precipitation Anomalies  
Oct to Sep 2004-05  
Versus 1981-2010 Longterm Average

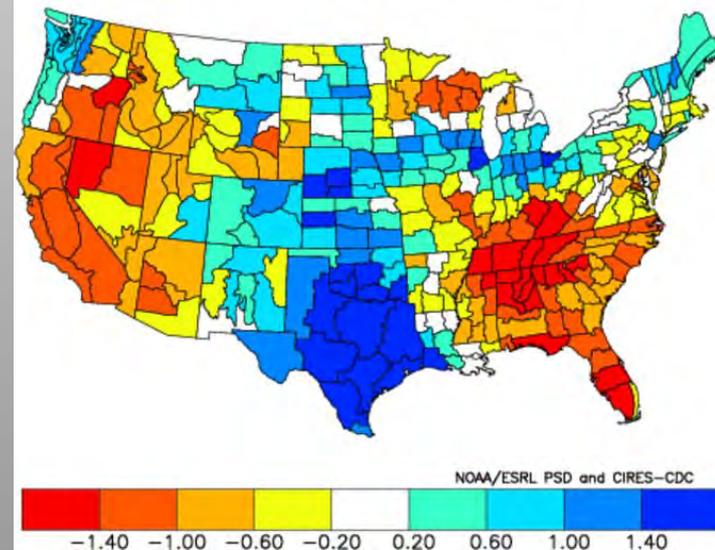


**Los Niños since 2002**  
Last decade also had many El Niño events, in 2002-03 (top left), 04-05 (top right), 06-07 (bottom right), and 09-10 (bottom left): *except for 2002-03, three out of four cases were wetter than 'normal' in most of Texas, while Oklahoma only did well in 2006-07.*

Standardized Precipitation Anomalies  
Oct to Sep 2009-10  
Versus 1981-2010 Longterm Average



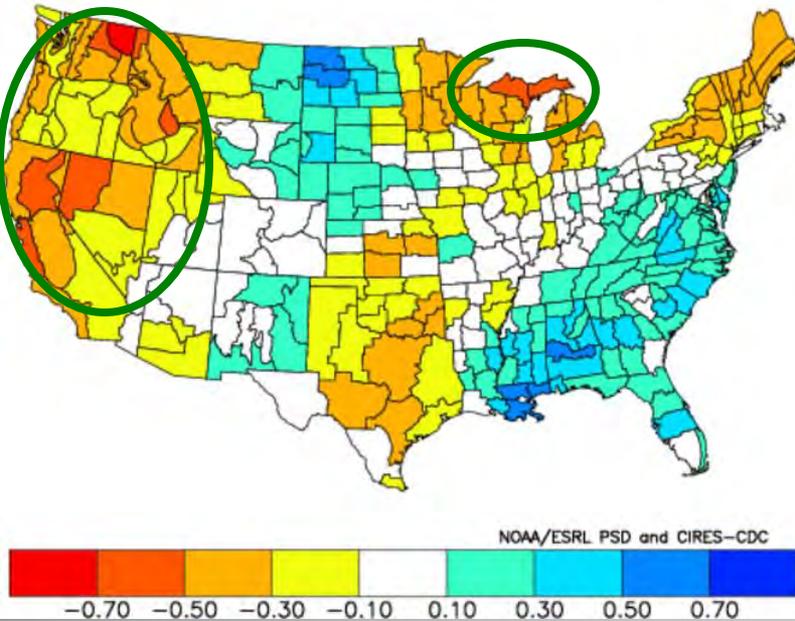
Standardized Precipitation Anomalies  
Oct to Sep 2006-07  
Versus 1981-2010 Longterm Average



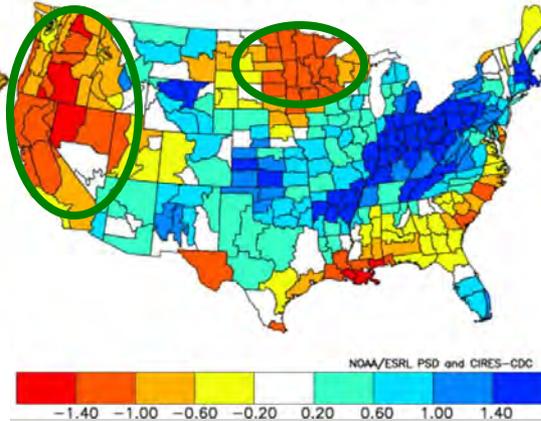
*In general, El Niño events had less predictable impacts in the U.S. than La Niña events. This is probably related to the recent cold phase of the Pacific Decadal Oscillation (PDO).*

# What happened in WY'12 – The role of the NAO

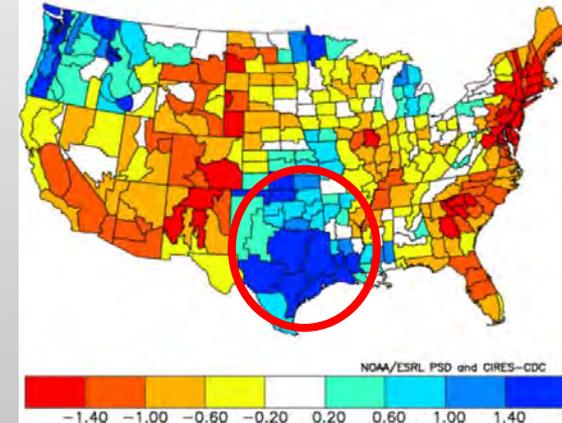
Composite Standardized Precipitation Anomalies  
Oct to Dec 1924, 1929, 1938, 1948, 1953, 1954, 1956, 1978, 1982, 1986  
Versus 1895–2000 Longterm Average



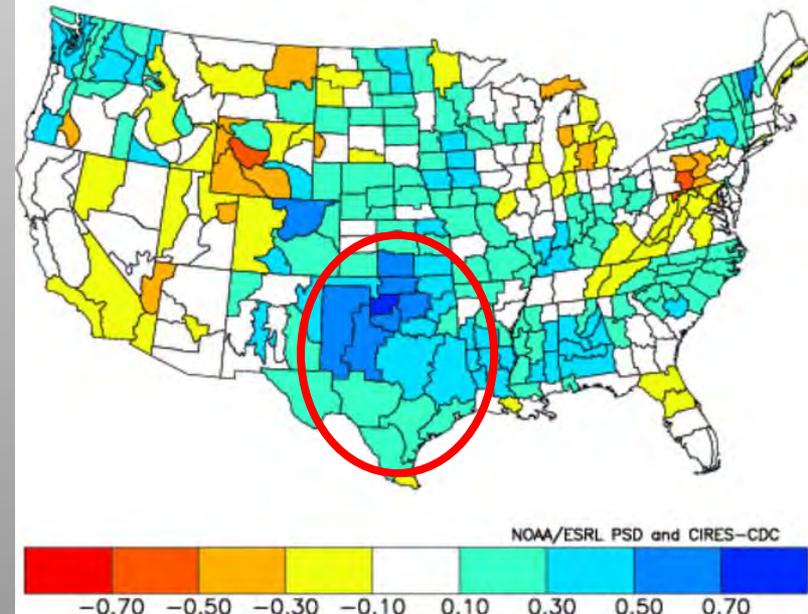
Standardized Precipitation Anomalies  
Oct to Dec 2011  
Versus 1895–2000 Longterm Average



Standardized Precipitation Anomalies  
Jan to Mar 2012  
Versus 1895–2000 Longterm Average



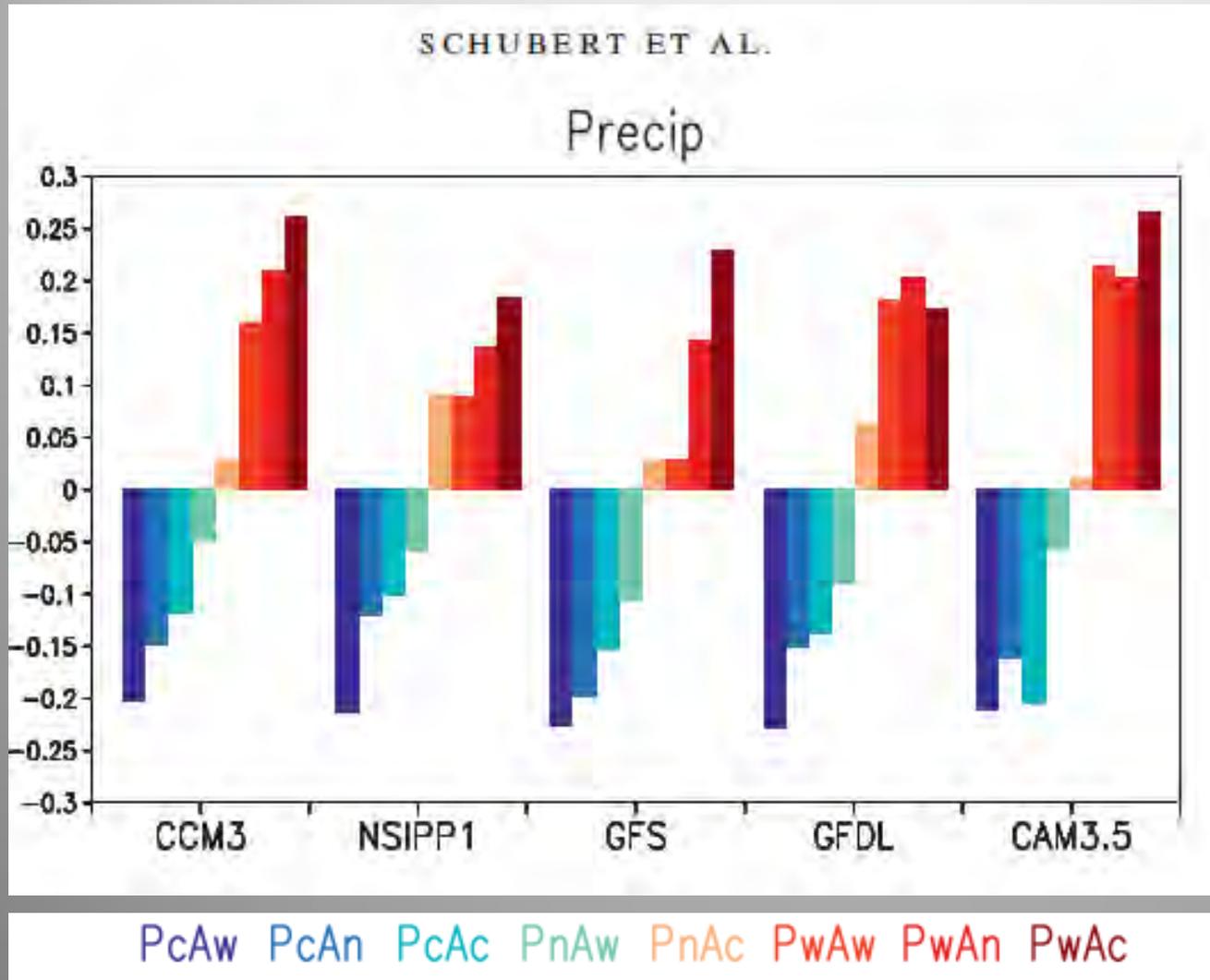
Composite Standardized Precipitation Anomalies  
Jan to Mar 1913, 1920, 1925, 1961, 1983, 1989, 1990, 1995, 2000, 2007  
Versus 1895–2000 Longterm Average



*Both fall and winter of 2011-12 were characterized by large positive anomalies of the NAO, seasons when its footprint would have been much bigger for the negative NAO phase.*

*Coverage for dry regions in OND'11 reached 76% of the composite positive NAO result, while the coverage of wet regions in JFM'12 matched 58% of the composite, to the great benefit of TX and OK.*

# Role of contrast of Atlantic vs. Pacific, or PDO-AMO

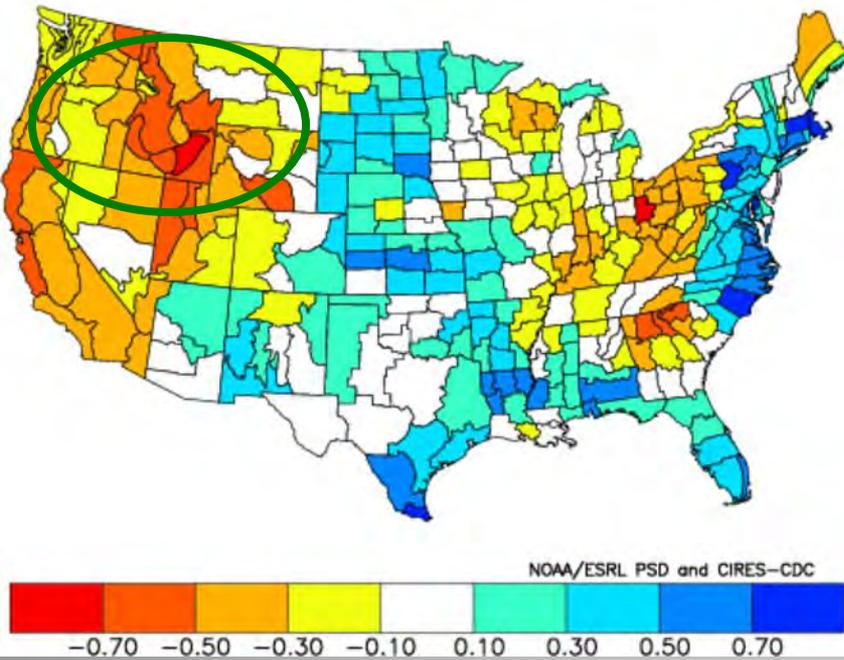


Schubert et al.  
(J. Climate,  
2009)

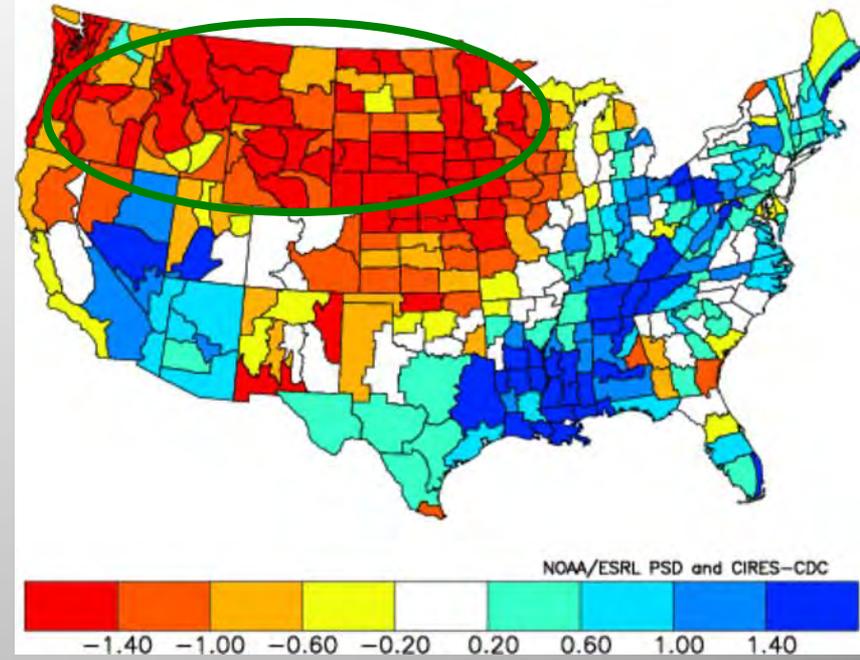
In five different GCMs, a cold Northeast Pacific combines with a warm North Atlantic to produce most pervasive drought conditions in continental U.S.

# What happened in WY'12 – Persistently negative PDO-AMO

Composite Standardized Precipitation Anomalies  
Jul to Sep 1933,1944,1950,1952,1955,1998,1999,2001,2008,2010  
Versus 1895–2000 Longterm Average



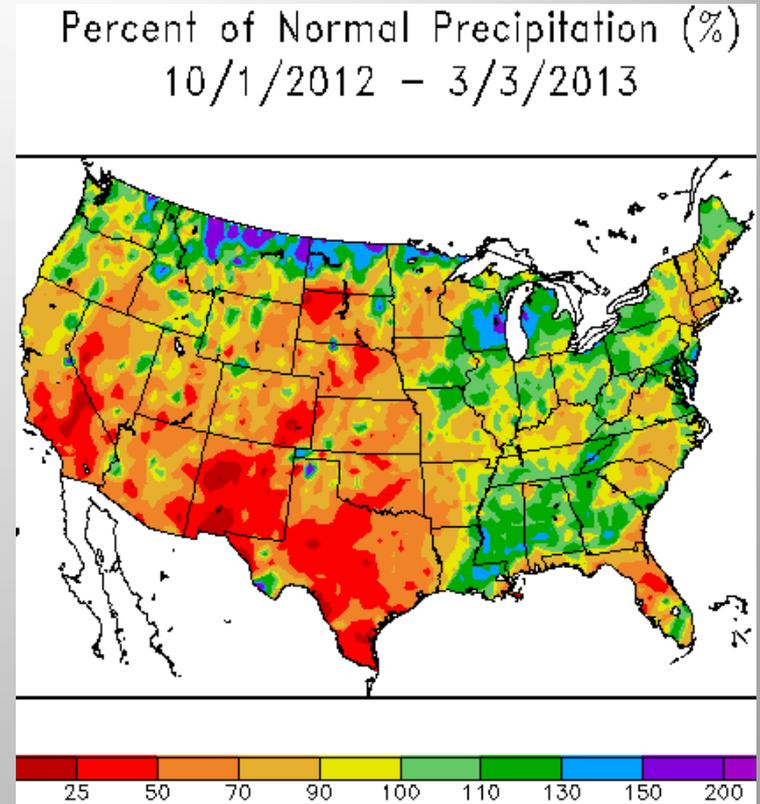
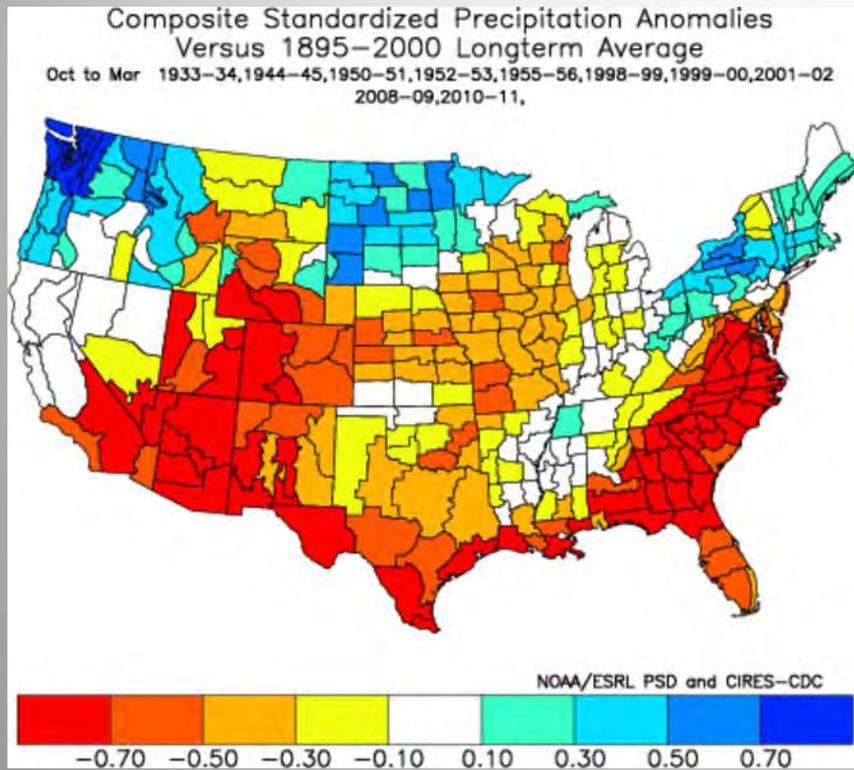
Standardized Precipitation Anomalies  
Jul to Sep 2012  
Versus 1895–2000 Longterm Average



*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. It appears that its impact was also strongest during that season, with 43% of the 'wet' climate divisions and 68% of the 'dry' climate divisions that matched expectations.*

*The opposite phase of the PDO-AMO difference (warm Pac-cold Atl) would have had an even greater impact on the U.S., covering 41% of it with 'wet' composites – unfortunately, we are a long way off from that scenario for now.*

# *How did the low <PDO-AMO> composite work out since October?*

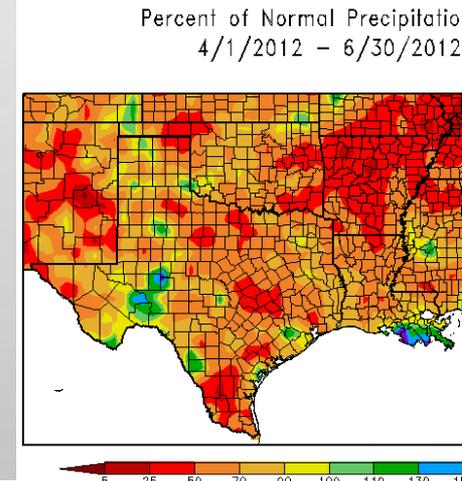
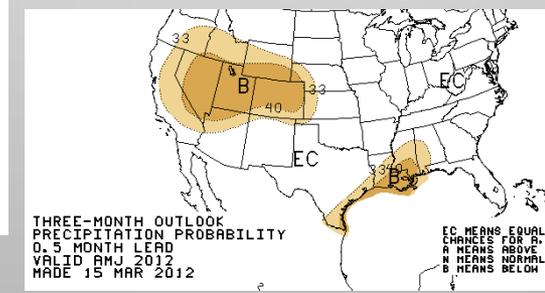
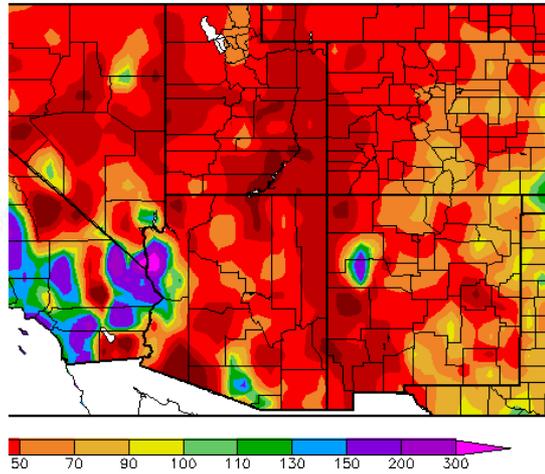
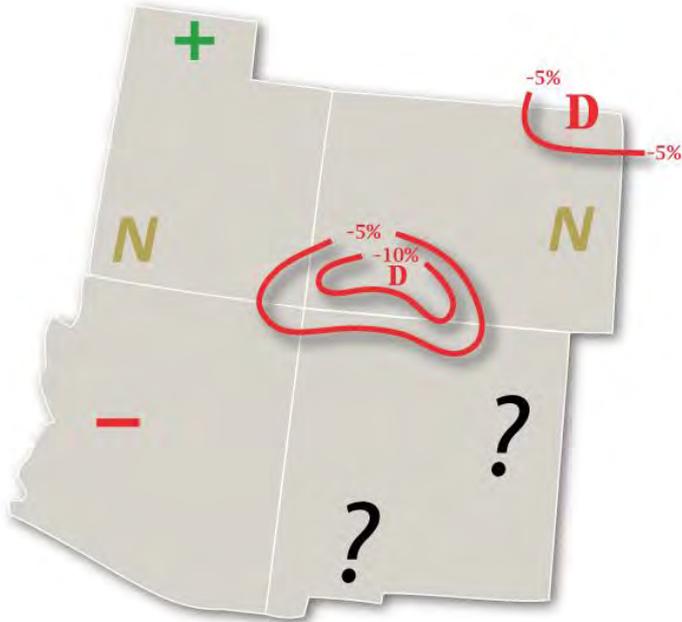


*Using the same years as specified by last summer's PDO-AMO index, the outlook for the last five+ months was to be dry in much of the southern U.S., perhaps a bit less around here (left). The verification so far (right) shows decent skill nationwide, so there were just a few 'climate surprises' (in places like WI and GA).*

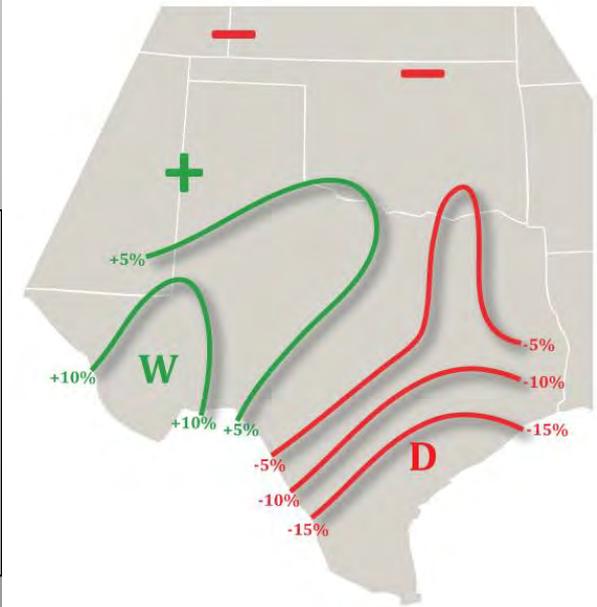
# How about CPC, my SWcast, or its new cousin, SCcast?

Experimental PSD Precipitation Forecast Guidance 4/1/2012 – 6/30/2012

APR – JUN 2012 (Issued March 12, 2012)



Experimental PSD Precipitation Forecast Guidance  
APR – JUN 2012 (Issued April 21, 2012)



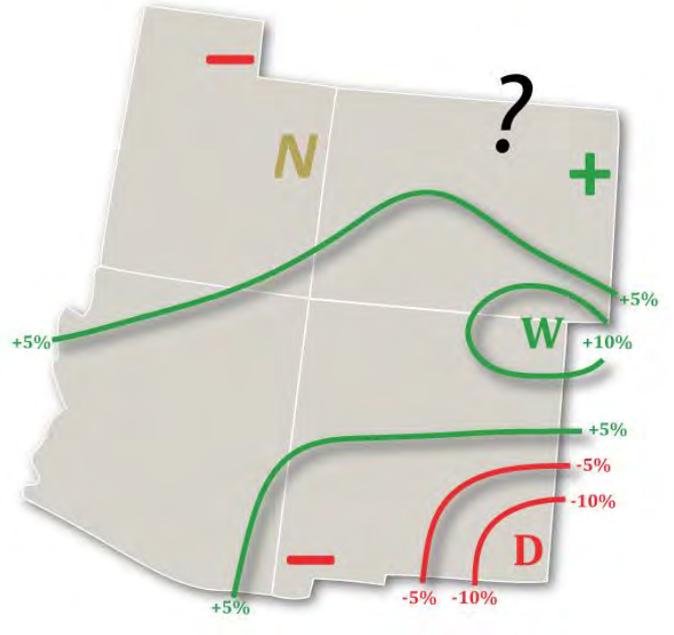
*April-June 2012 reminded Texas that the drought was not over just yet, and brought an early start to a vicious wildfire season to the southwestern U.S.*

*All of the dry forecasts were 'hits', while wet forecasts verified near-normal at best.*

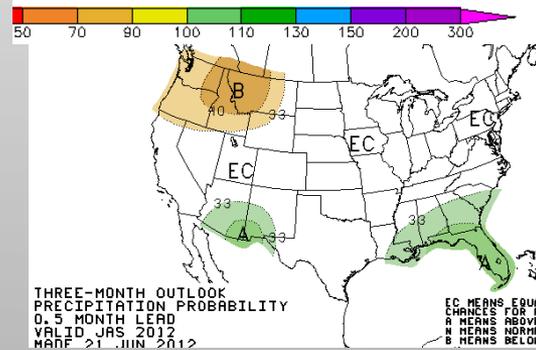
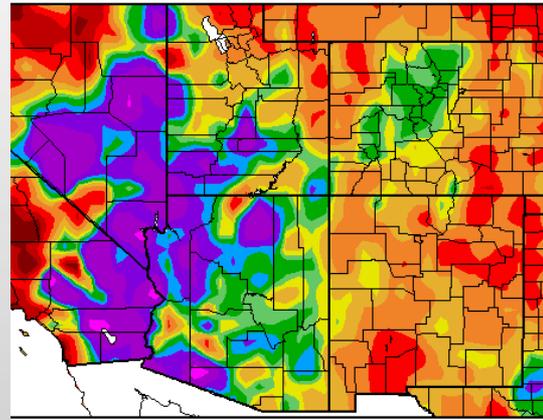
# How about CPC, my SWcast, or its new cousin, SCcast?

## Experimental PSD Precipitation Forecast Guidance

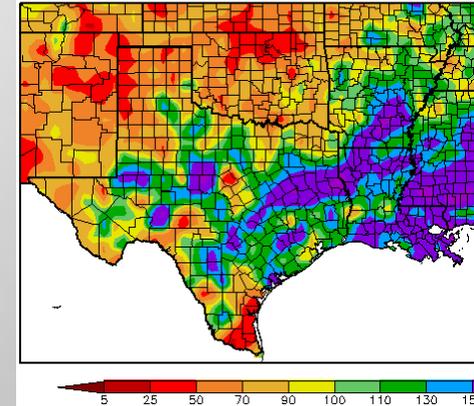
JUL - SEP 2012 (Issued May 16, 2012)



7/1/2012 - 9/30/2012

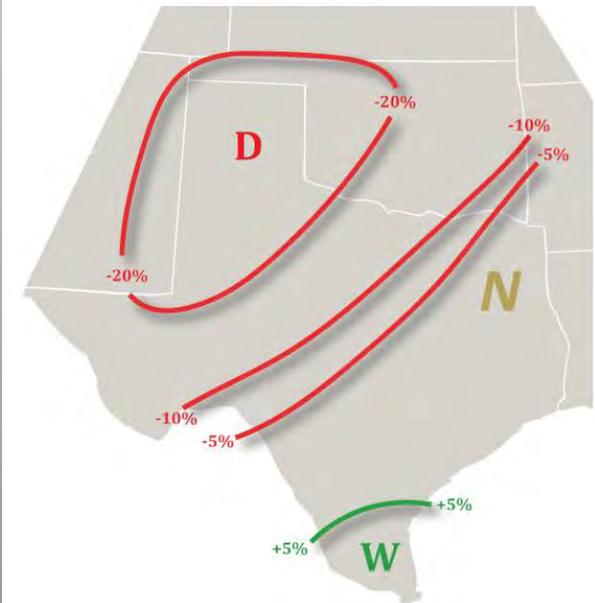


Percent of Normal Precipitation  
7/1/2012 - 9/30/2012



## Experimental PSD Precipitation Forecast Guidance

JUL - SEP 2012 (Issued June 29, 2012)

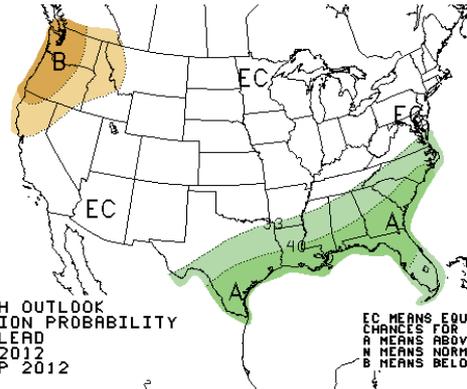
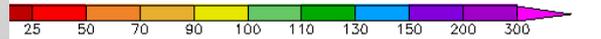
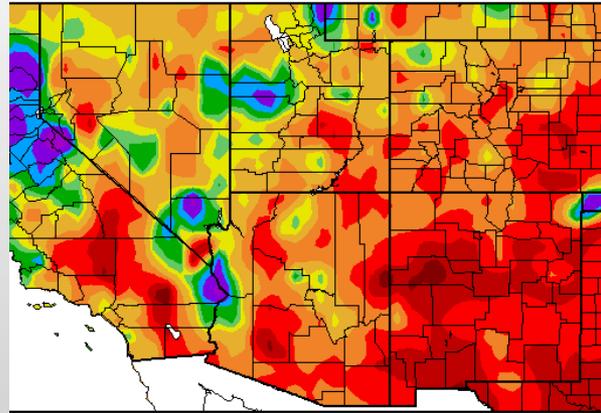


*July-September 2012 saw a westward-shifted southwest monsoon, stretching from AZ into north-central CO. It was wet from southern TX into LA, while drought conditions remained entrenched from NM into OK.*

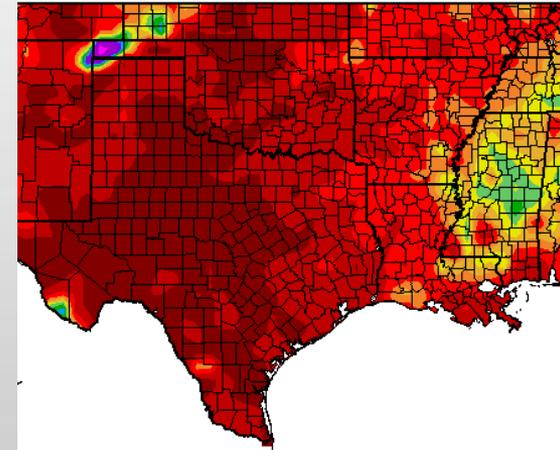
*A fair amount of this was anticipated by my regional forecasts, except for dryness from eastern CO into NM (lingering impacts from smoky haze over region).*

# How about CPC, my SWcast, or its new cousin, SCcast?

10/1/2012 - 12/31/2012

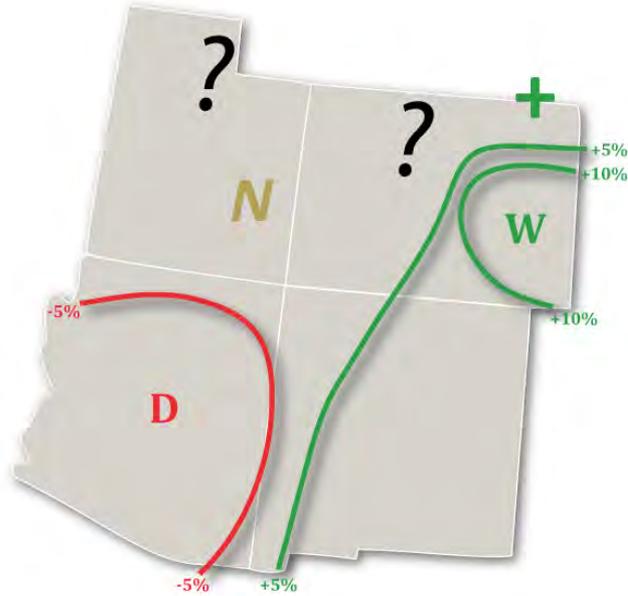


10/1/2012 - 12/31/2012



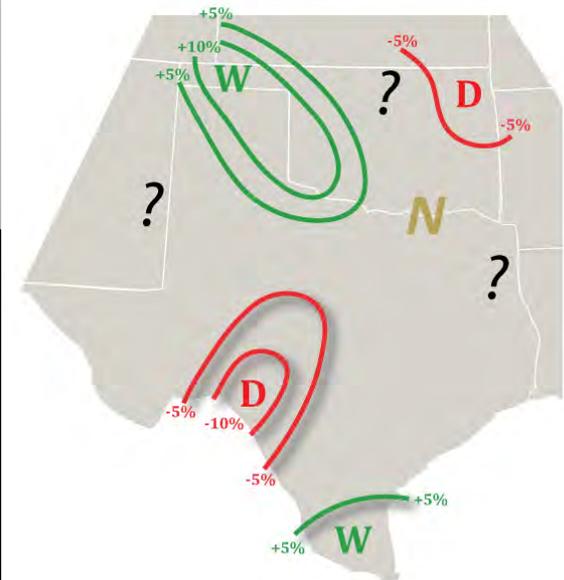
## Experimental PSD Precipitation Forecast Guidance

OCT - DEC 2012 (Issued September 18, 2012)



## Experimental PSD Precipitation Forecast Guidance

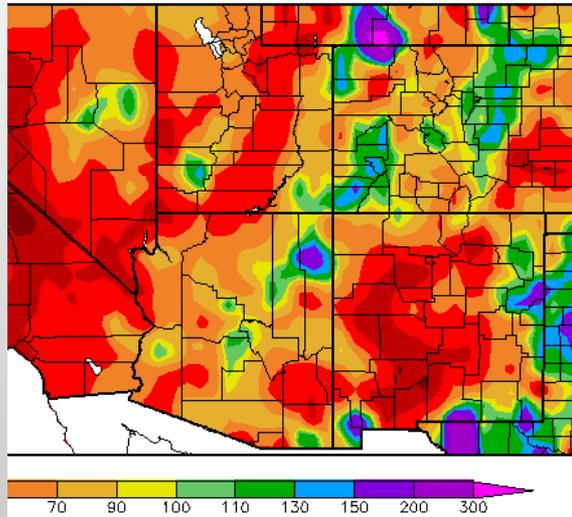
OCT - DEC 2012 (Issued September 18, 2012)



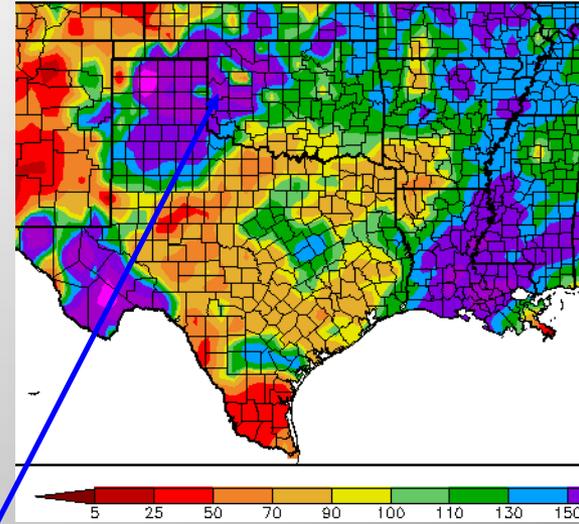
*Fall is one of the hardest season to predict, hence the many question marks on my forecast maps. In the Colorado basin (left), previous years with similar forecasts had verified on the dry side. My SCcast (right) showed a tilt towards wetness right around here, while southwest TX and northeast OK were more likely to stay dry. **Dry forecasts verified better than wet ones!***

# How about CPC, my SWcast, or its new cousin, SCcast?

1/1/2013 - 3/5/2013

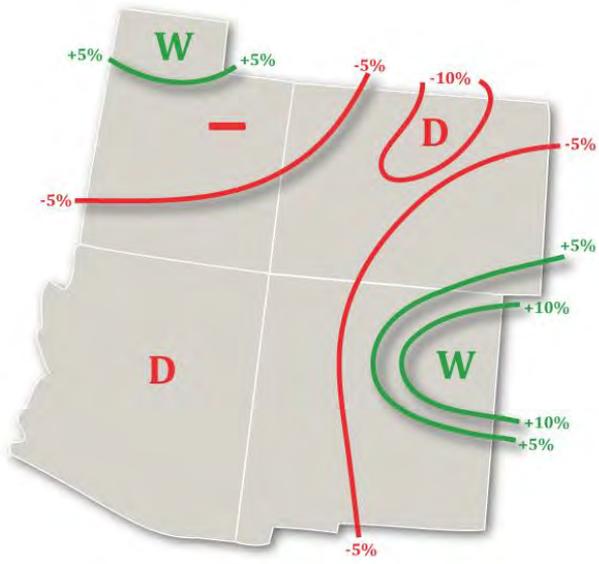


1/1/2013 - 3/5/2013



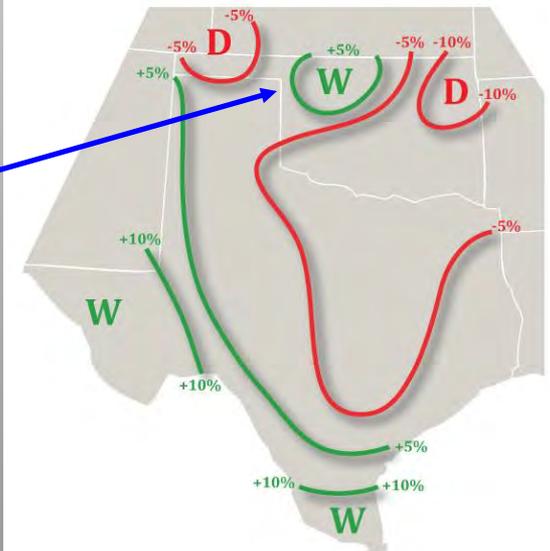
## Experimental PSD Precipitation Forecast Guidance

JAN - MAR 2013 (Issued November 19, 2012)

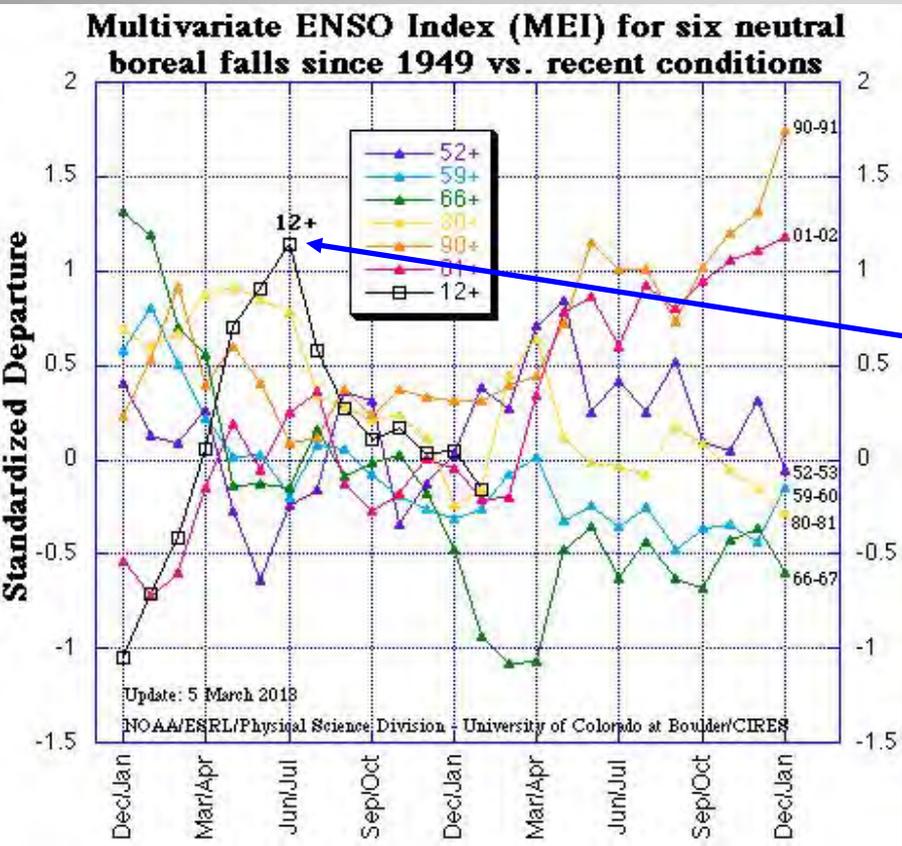
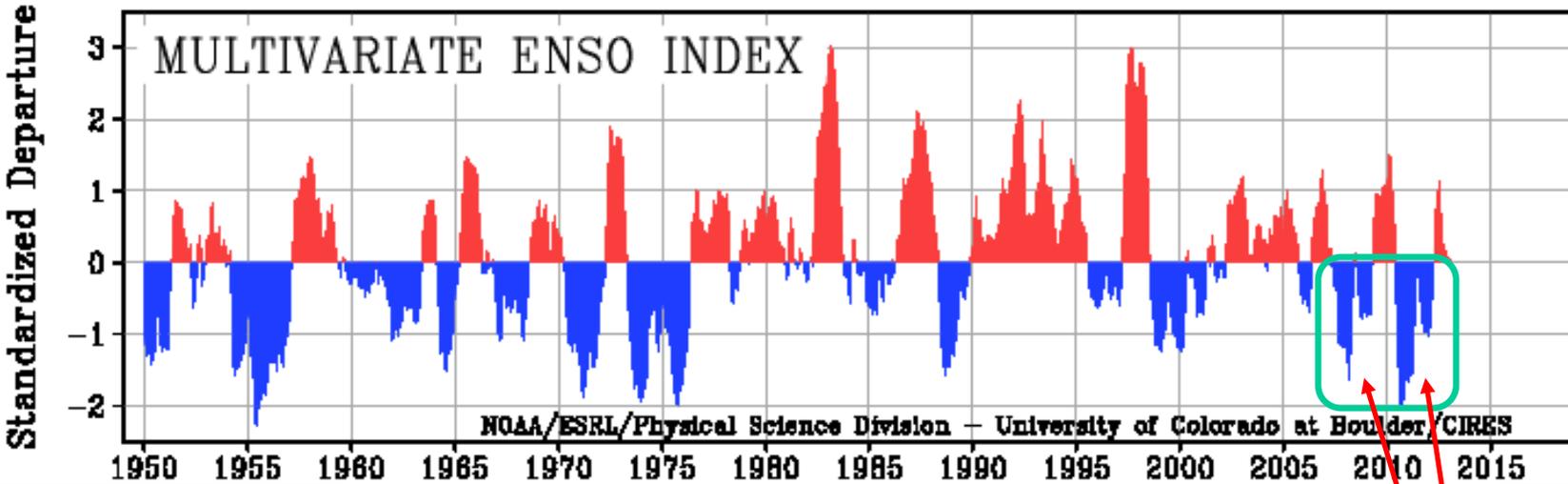


## Experimental PSD Precipitation Forecast Guidance

JAN - MAR 2013 (Issued December 19, 2012)



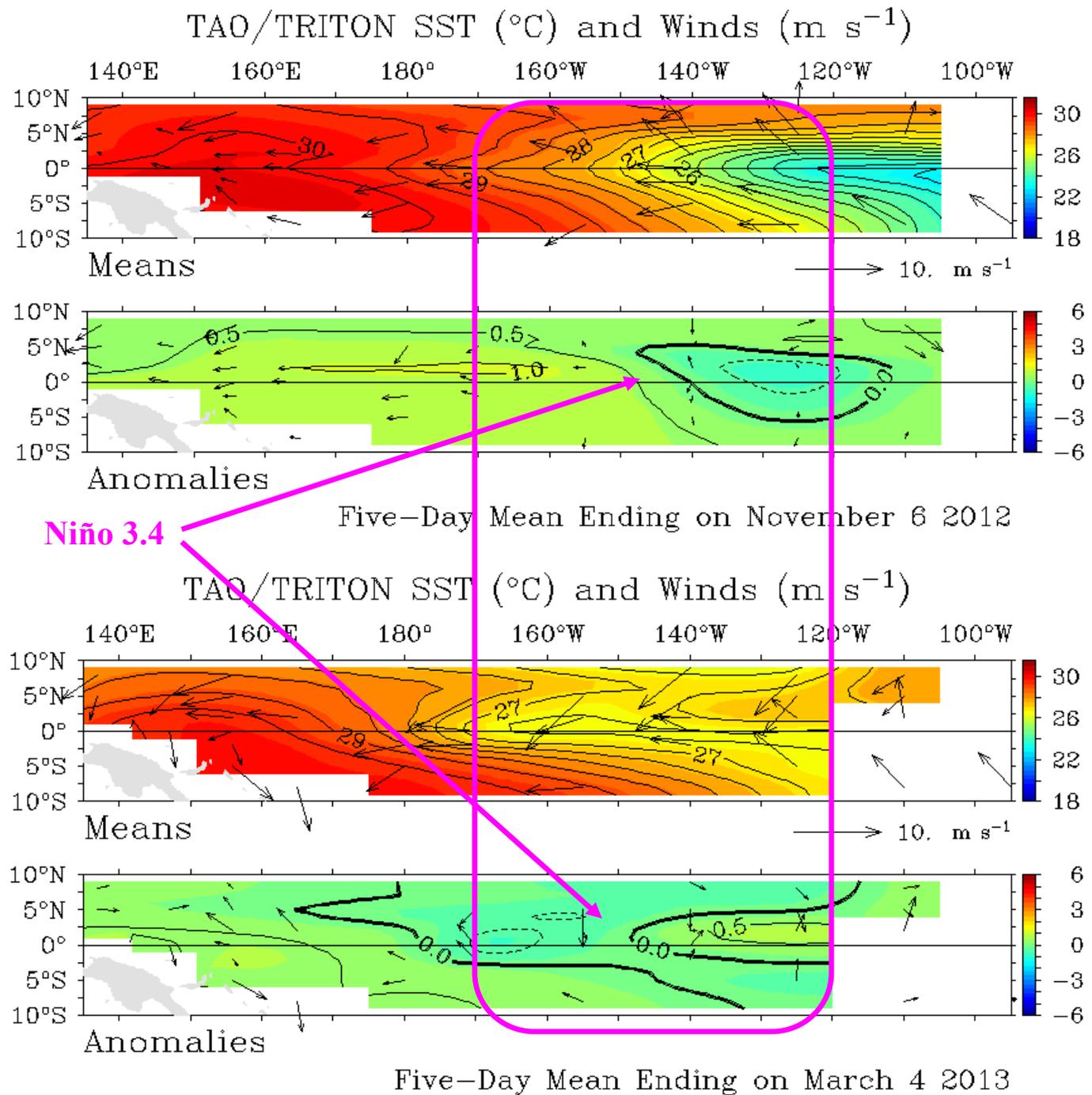
*So far not bad, on my latest round of forecasts for the interior Southwest (left), and the southern Great Plains (right). It is nice to see that, for once, wet forecasts (around here) are verifying...*



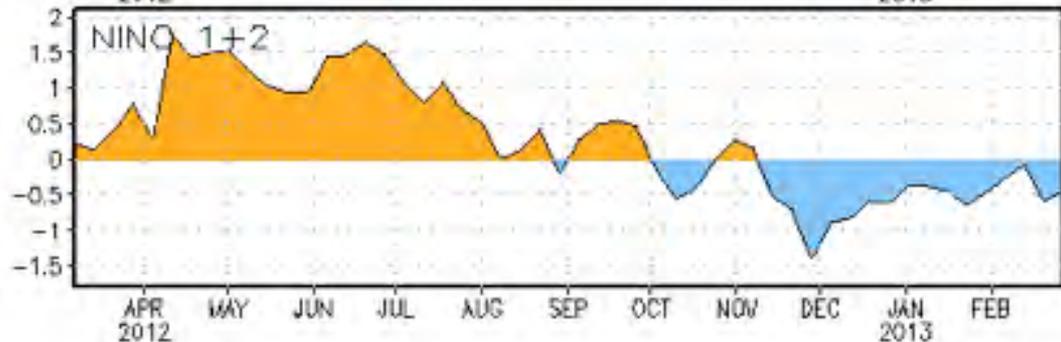
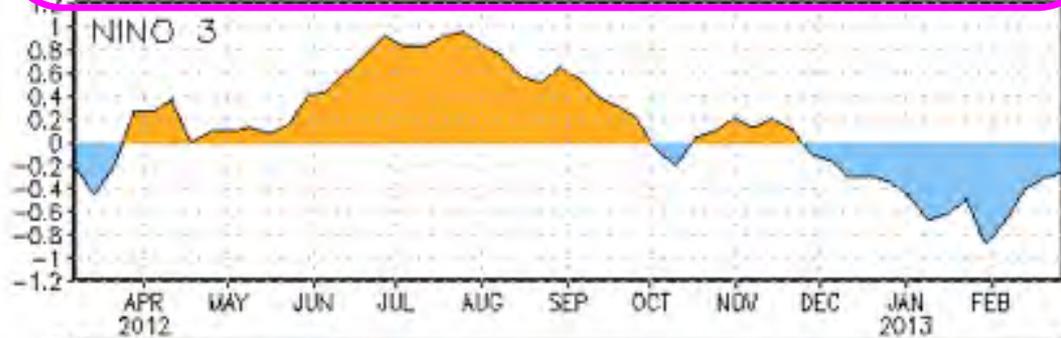
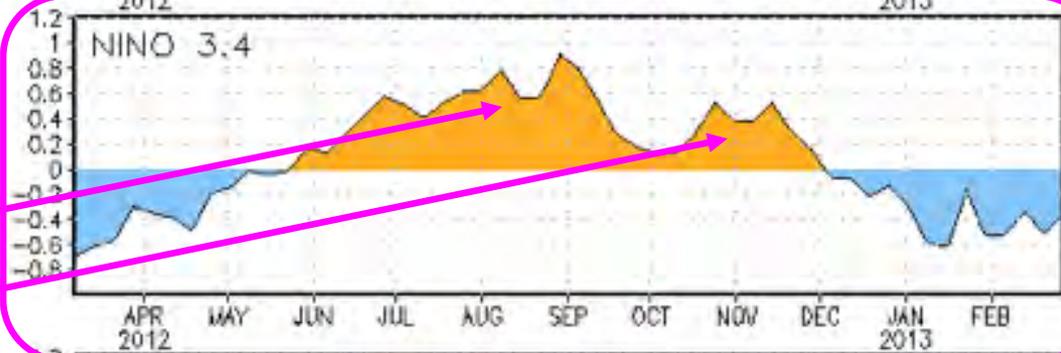
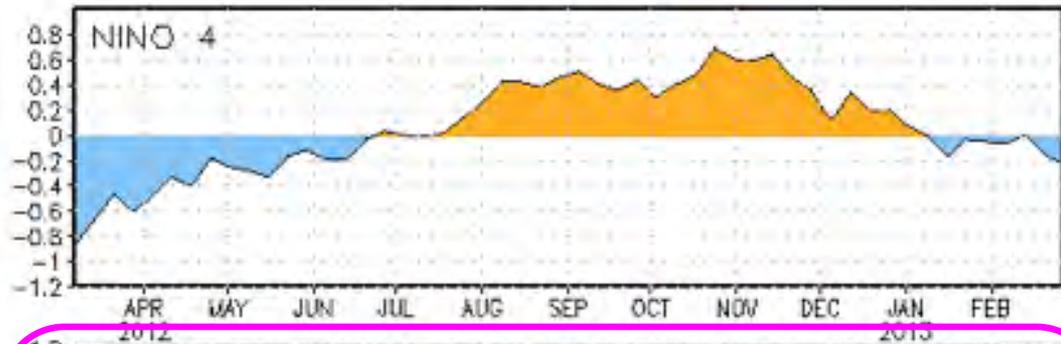
*Last five years have seen two 'double-dip' Las Niñas in a row, followed by a brief excursion to what looked like an El Niño event in 2012, and a return to ENSO-neutral conditions as of last fall – highly unusual behavior, but not completely unprecedented (for instance in 1953).*

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

**Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to November (top): ENSO-neutral does not mean that there are no anomalies, they are just weak and unsystematic!**



## SST Anomalies

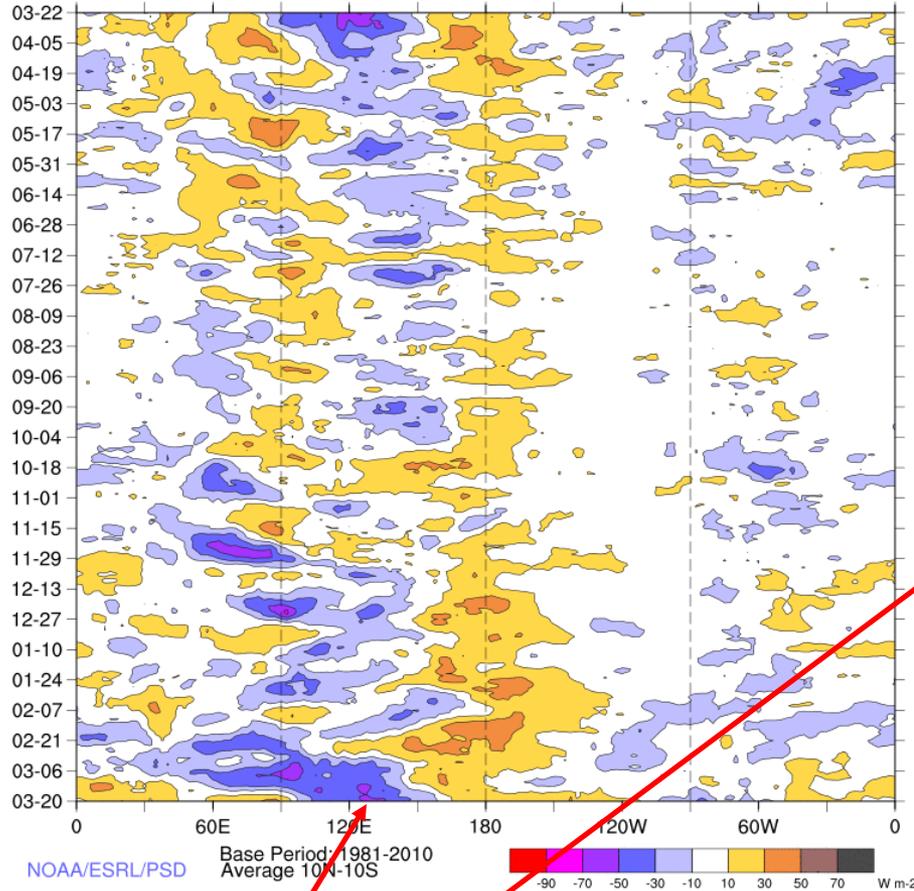


*Sea surface temperature anomalies along the equatorial Pacific, from west of the dateline to the coast of South America (top to bottom): there were El Niño-like conditions from late June to early September, and around Halloween – too short for CPC standards!*

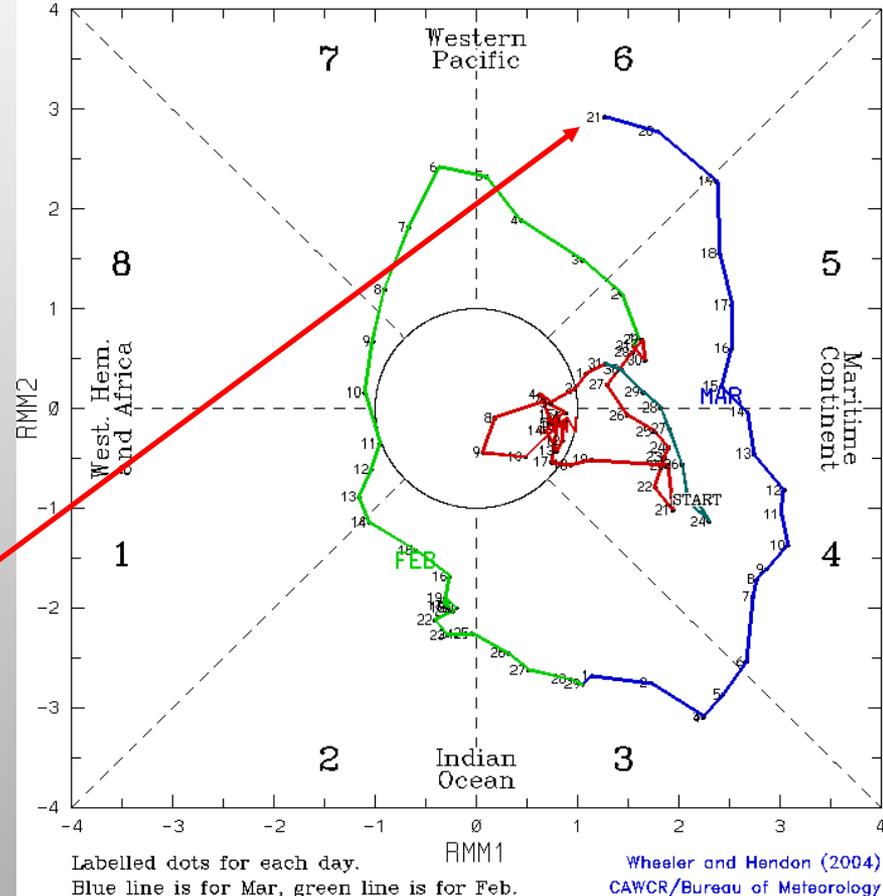
*Don't be fooled by talk about a mini-El Niño in last few weeks, we are still dealing with ENSO-neutral conditions.*

# Last year's 'Hail Mary pass' to El Niño

Outgoing Longwave Radiation (OLR) Anomalies  
2011/03/22 - 2012/03/20

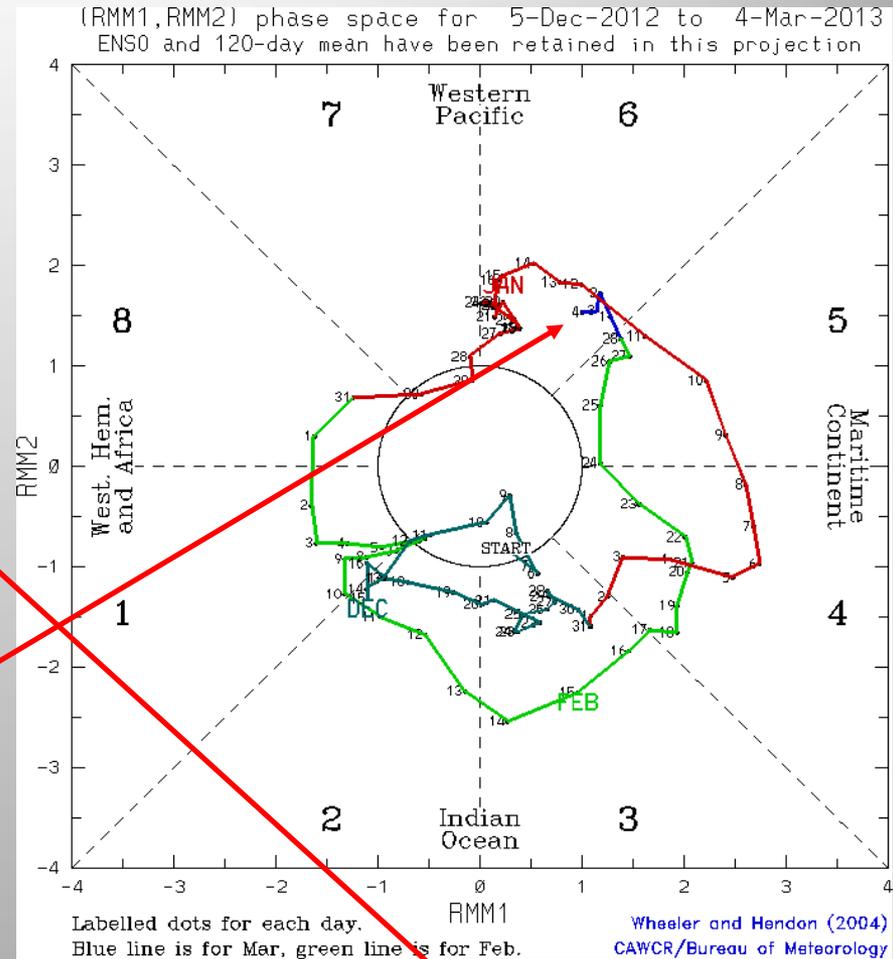
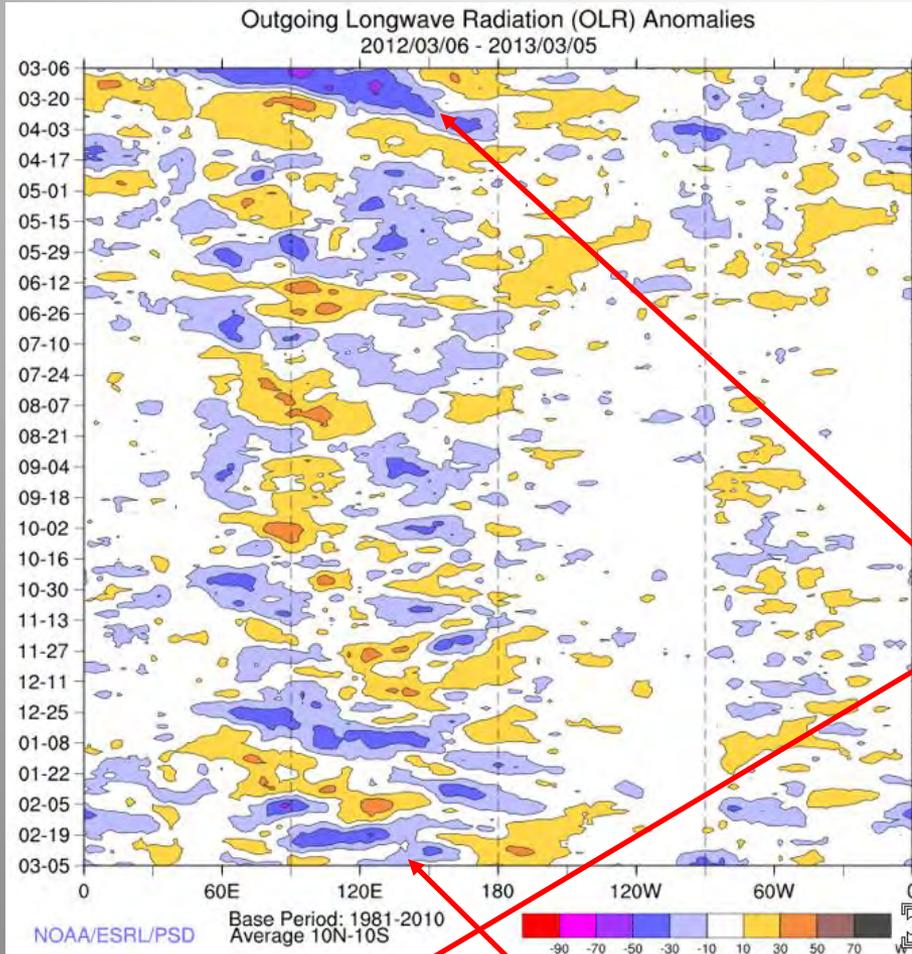


(RMM1, RMM2) phase space for 23-Dec-2011 to 21-Mar-2012  
ENSO and 120-day mean have been retained in this projection



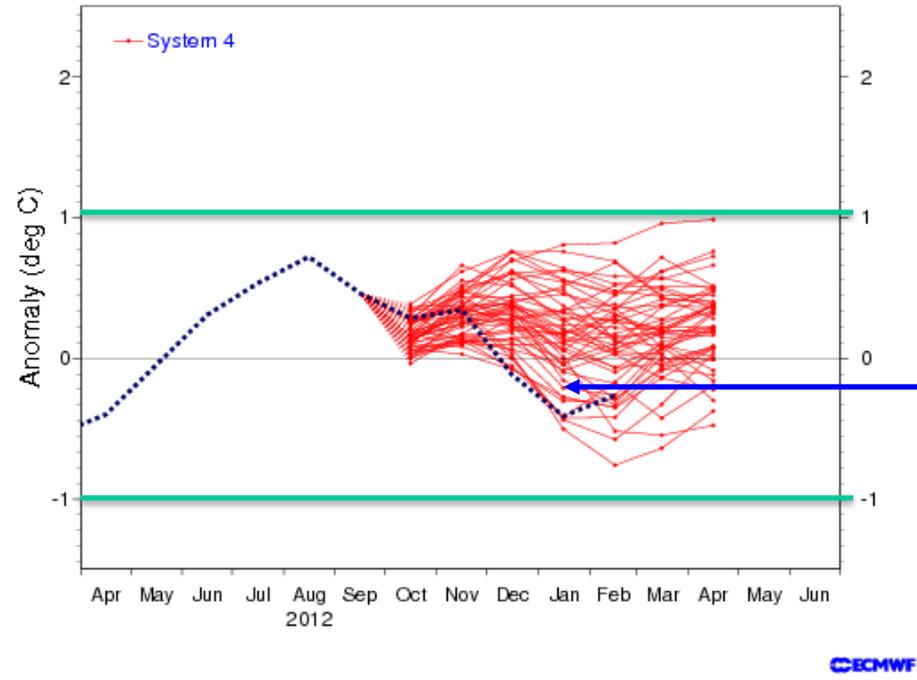
*This one had a good run for about two months – I called this the 'Rick Perry' event*

# *“Herman Cain” MJO run is sputtering?*



*This one did not rise to the level of last year's “Rick Perry” event!*

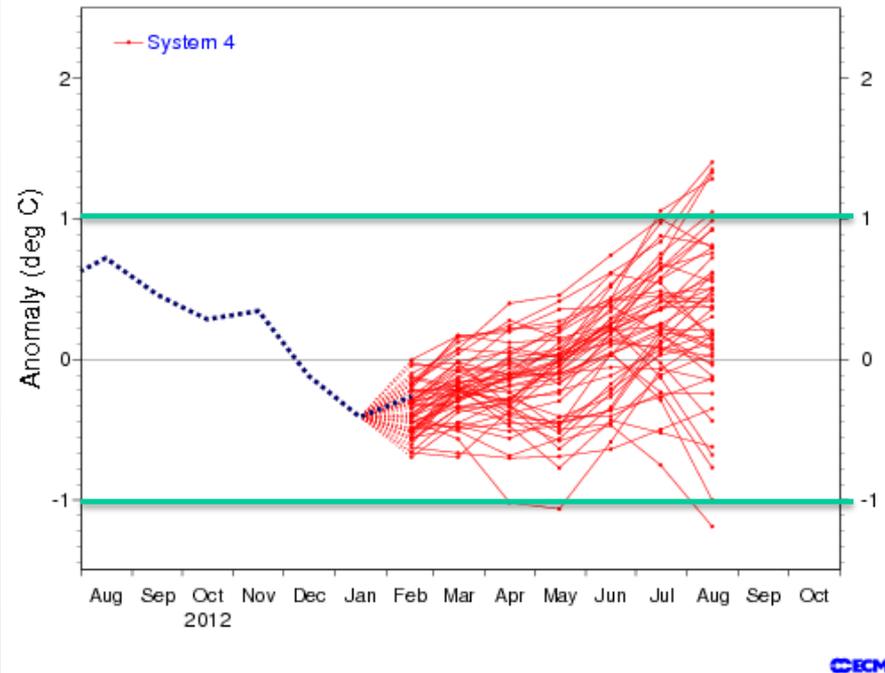
NINO3.4 SST anomaly plume  
 ECMWF forecast from 1 Oct 2012  
 Monthly mean anomalies relative to NCEP OIv2 1981-2010 climatology



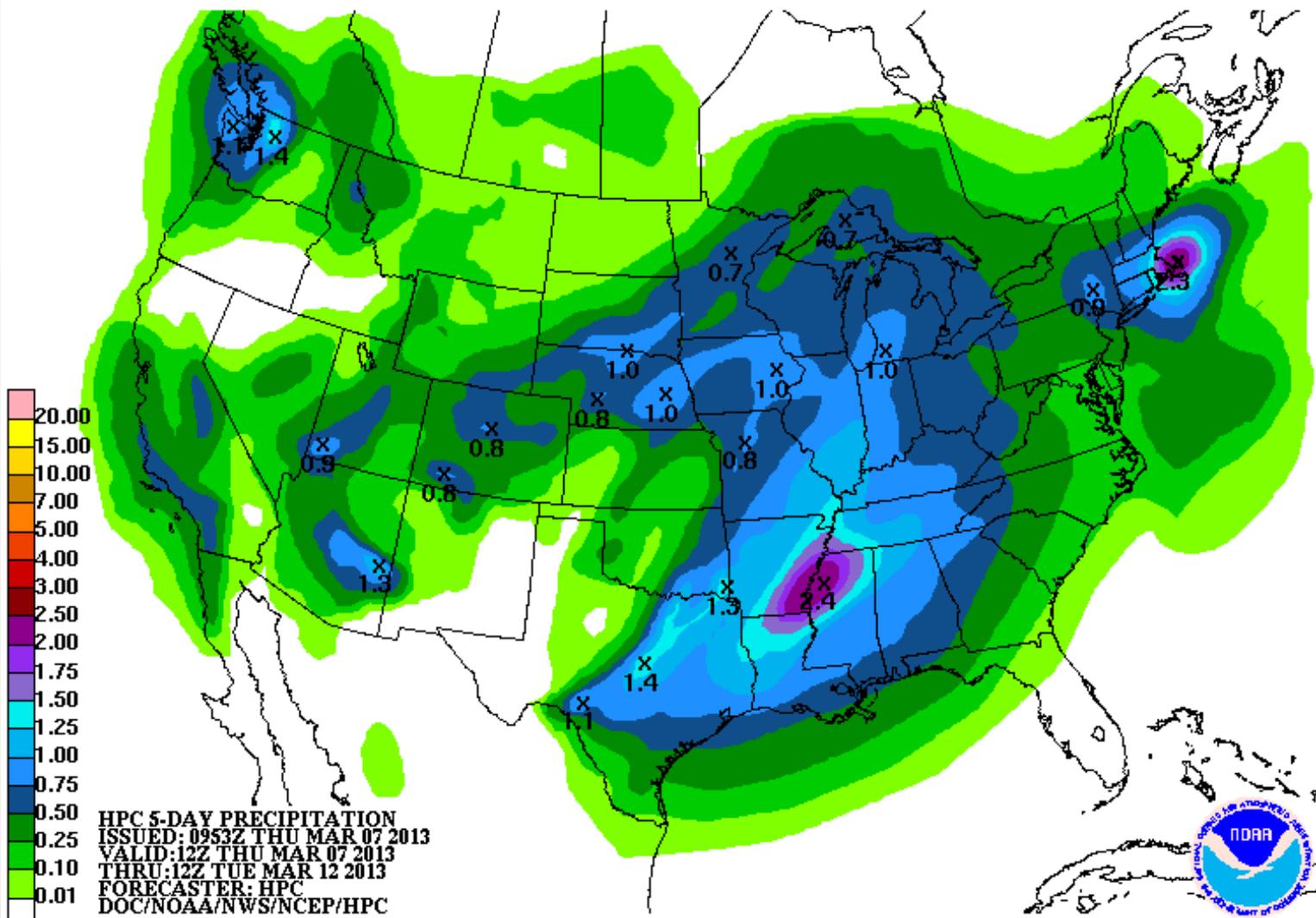
*The ECMWF October 2012 forecast (left) maintained weak El Niño-like conditions; as it turns out that was too optimistic, since the tropical Pacific slipped back into almost La Niña territory, based on the Niño 3.4 SST index. For the last three months, that was in the lowest 10%ile of expected outcomes.*

*The ECMWF February 2013 forecast (right) anticipates a ‘gentle rebound’ towards El Niño-like conditions by the summer, with more ensemble members ending up above 0.5 ° C than below -0.5 ° C. As is typical for the time of year, the most extreme possible outcomes have gotten more extreme, reaching moderate El Niño (+1 ° C) or La Niña (-1 ° C)*

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

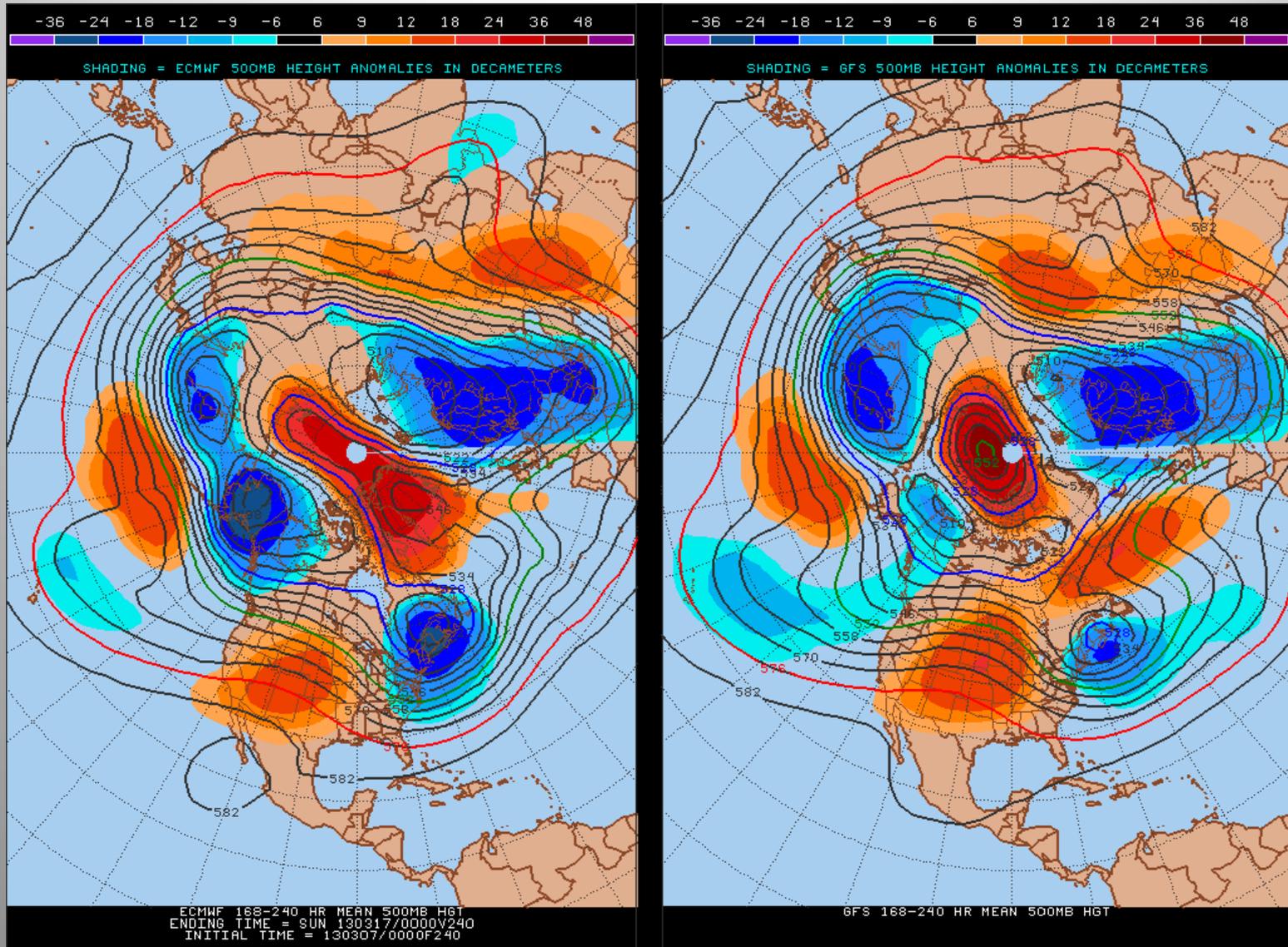


# What can we expect in the next seven days?



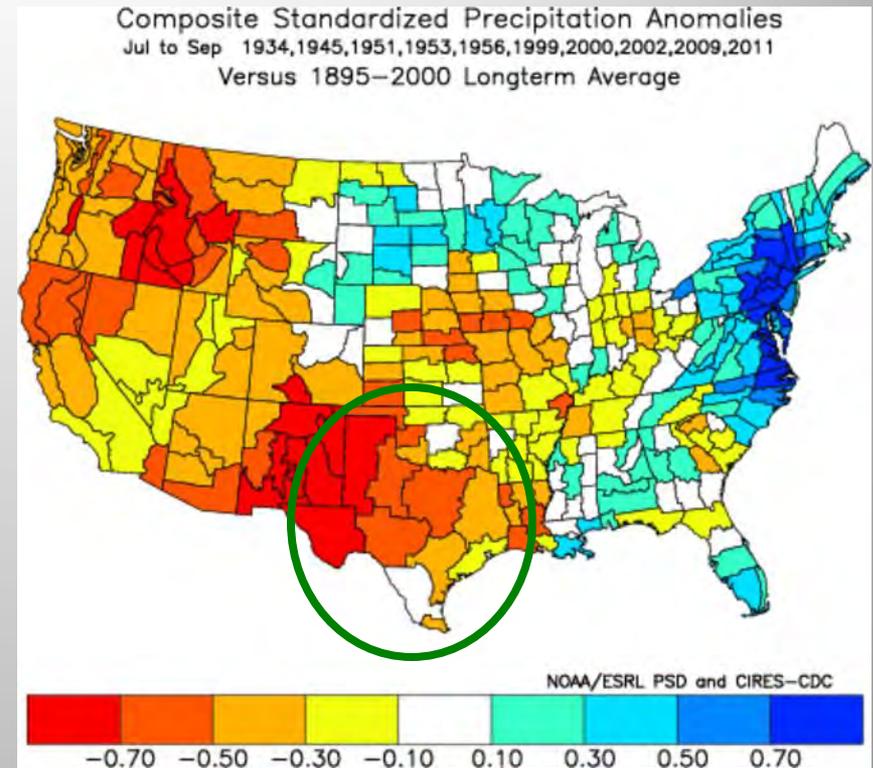
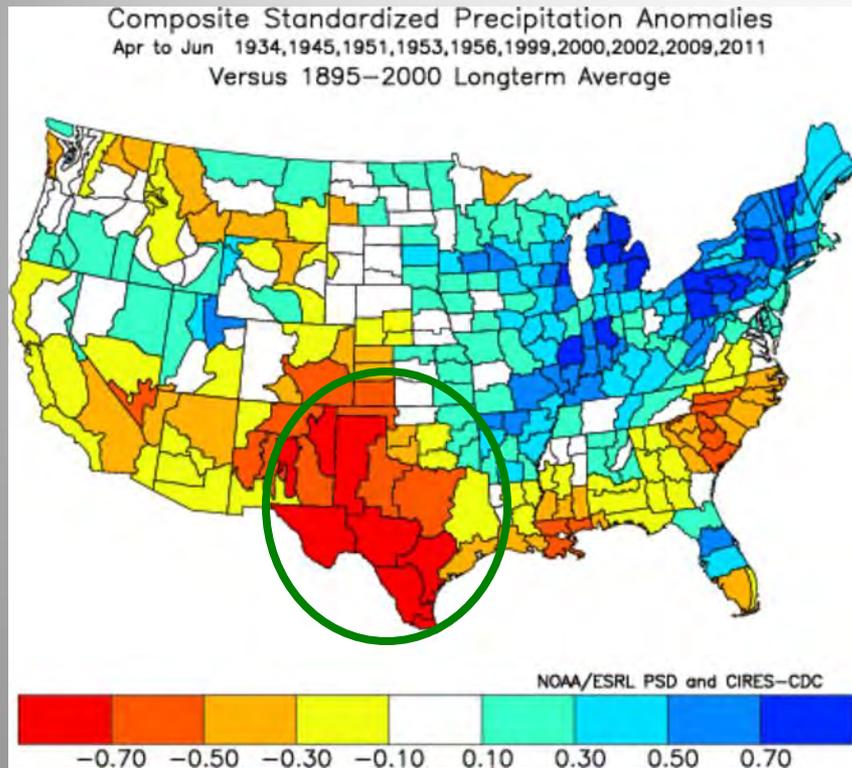
Expected total precipitation thru early next week, according to the Hydrological Prediction Center (HPC): *Our weekend storm will apparently 'dry-slot' the panhandle region, sorry – this was better predicted by ECMWF than GFS!*

# *What can we expect towards the end of next week?*



*ECMWF (left) and GFS (right) threaten a return to drought and warmth. This is a bit unnerving, but could also be quite temporary (unusual forecast so far this month).*

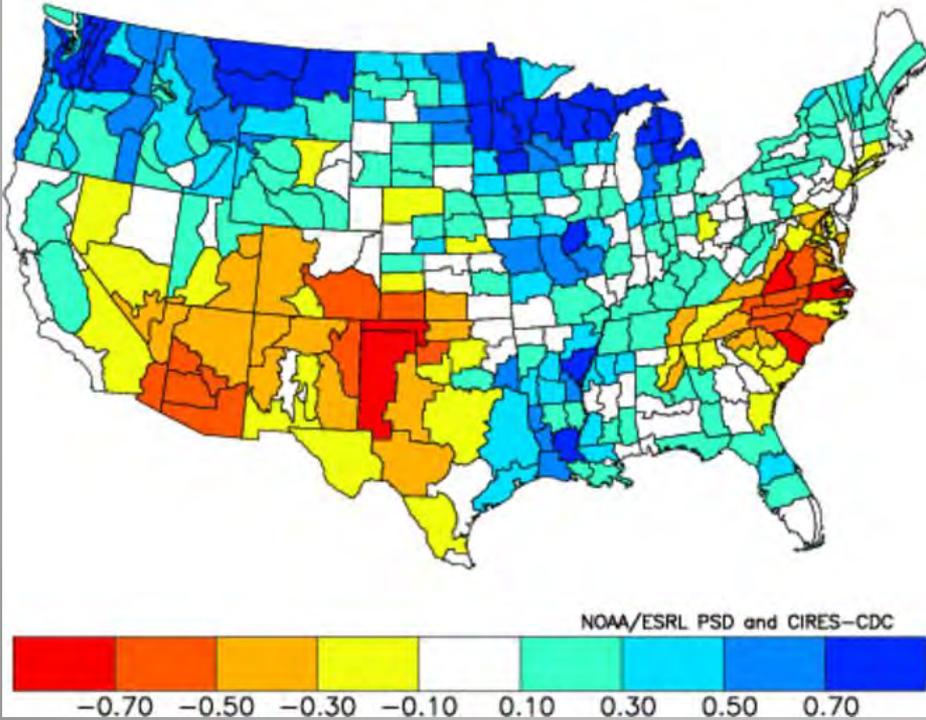
# What might happen in WY'13 if we keep very low $\langle \text{PDO-AMO} \rangle$



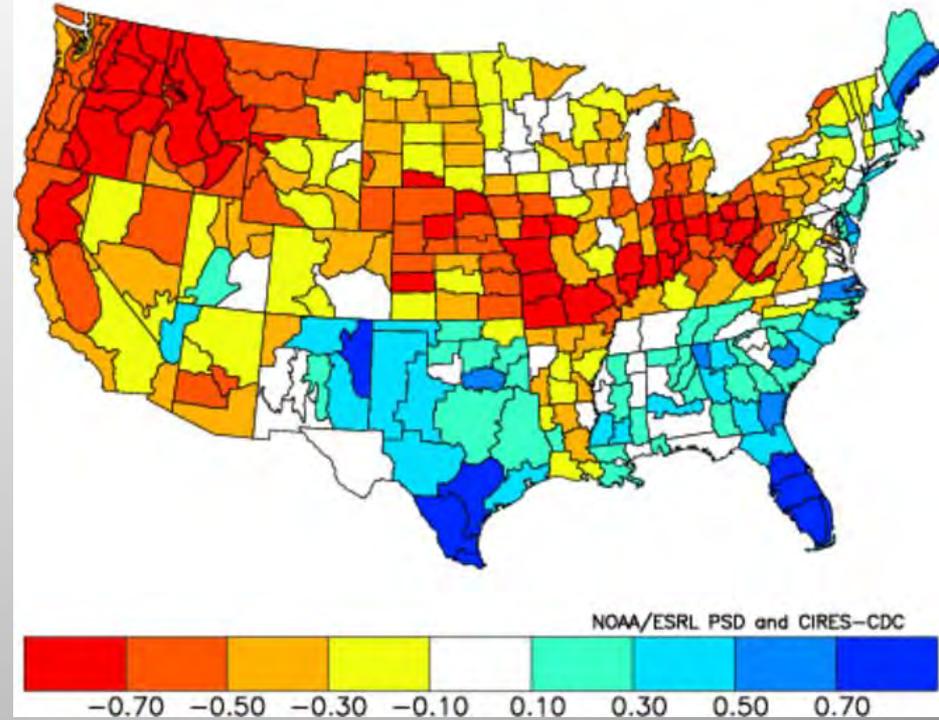
*Using the same set of 10 years based on low  $\langle \text{PDO-AMO} \rangle$  conditions, late spring precipitation (Apr-Jun; left) appears to be often suppressed with this combination. In late summer (Jul-Sep; right), precipitation odds remain suppressed.*

# *Post-Neutral ENSO springs*

Composite Standardized Precipitation Anomalies  
Apr to Jun 1953,1960,1967,1981,1991,2002  
Versus 1950–2007 Longterm Average



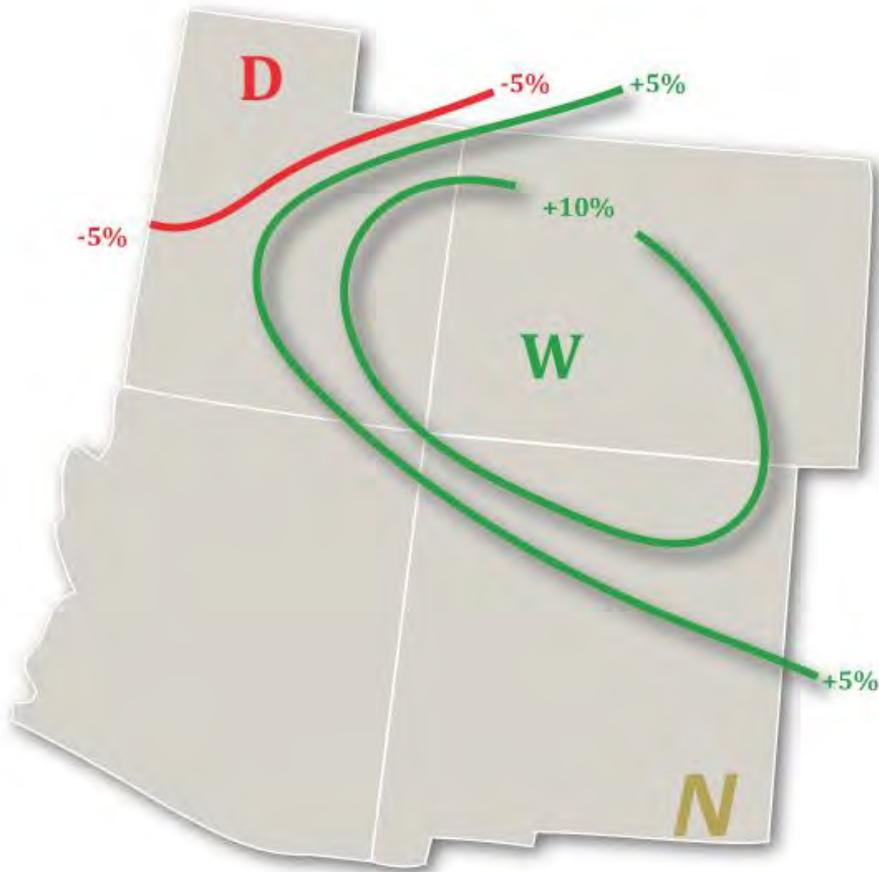
Composite Standardized Precipitation Anomalies  
Jul to Sep 1953,1960,1967,1981,1991,2002  
Versus 1950–2007 Longterm Average



**Similar ENSO-neutral patterns in the fall and early winter have often ‘produced’ dry springs in this region (left), although eastern Oklahoma and eastern Texas may fare better. The six years chosen ended up more on the wet side during the summer (right). So, this would argue for a less dire outlook than the (weakening) PDO-AMO scenario.**

## Experimental PSD Precipitation Forecast Guidance

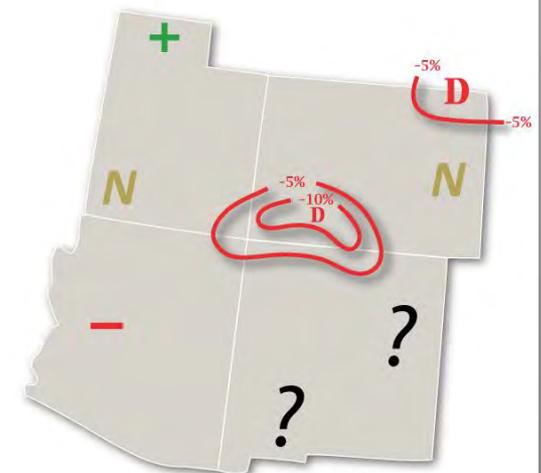
APR – JUN 2013 (Issued March 5, 2013)



My new forecast for spring (left) is surprisingly optimistic (wet) for Colorado and into the Oklahoma panhandle region, and very different from last year's (below). *I will be issuing a new 'SCcast' by next month.*

## Experimental PSD Precipitation Forecast Guidance

APR – JUN 2012 (Issued March 12, 2012)



# Summary

- **While El Niño/La Niña can provide decent guidance for climate outlooks around here, this is not very helpful during ENSO-neutral situations like 2012-13.**
- **Over the last two years, the North Atlantic Oscillation has helped to get this region wet during the winter of 2011-12, but remains unpredictable beyond two weeks. The cold northeastern Pacific (negative PDO) and warm North Atlantic (positive AMO) combined to keep much of the southern U.S. dry through the 2012-13 Water Year so far.**
- *Cross your fingers – there are some statistical indications that recent wetness may continue into the spring season from Colorado into Oklahoma; however, lingering effects of the low PDO-AMO index and typical ENSO-neutral argue for a drier spring (a.k.a., “prepare for the worst/hope for the best”).*
- *Looking beyond 2013: for the next 2-5 years, we will probably remain in a regime that favors La Niña, which in turns favors drought in the south-central plains.*

*You can reach me at: [klaus.wolter@noaa.gov](mailto:klaus.wolter@noaa.gov)*