Earth System Research Laboratory
Physical Sciences Division

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Denver

Seasonal Outlook through June 2012

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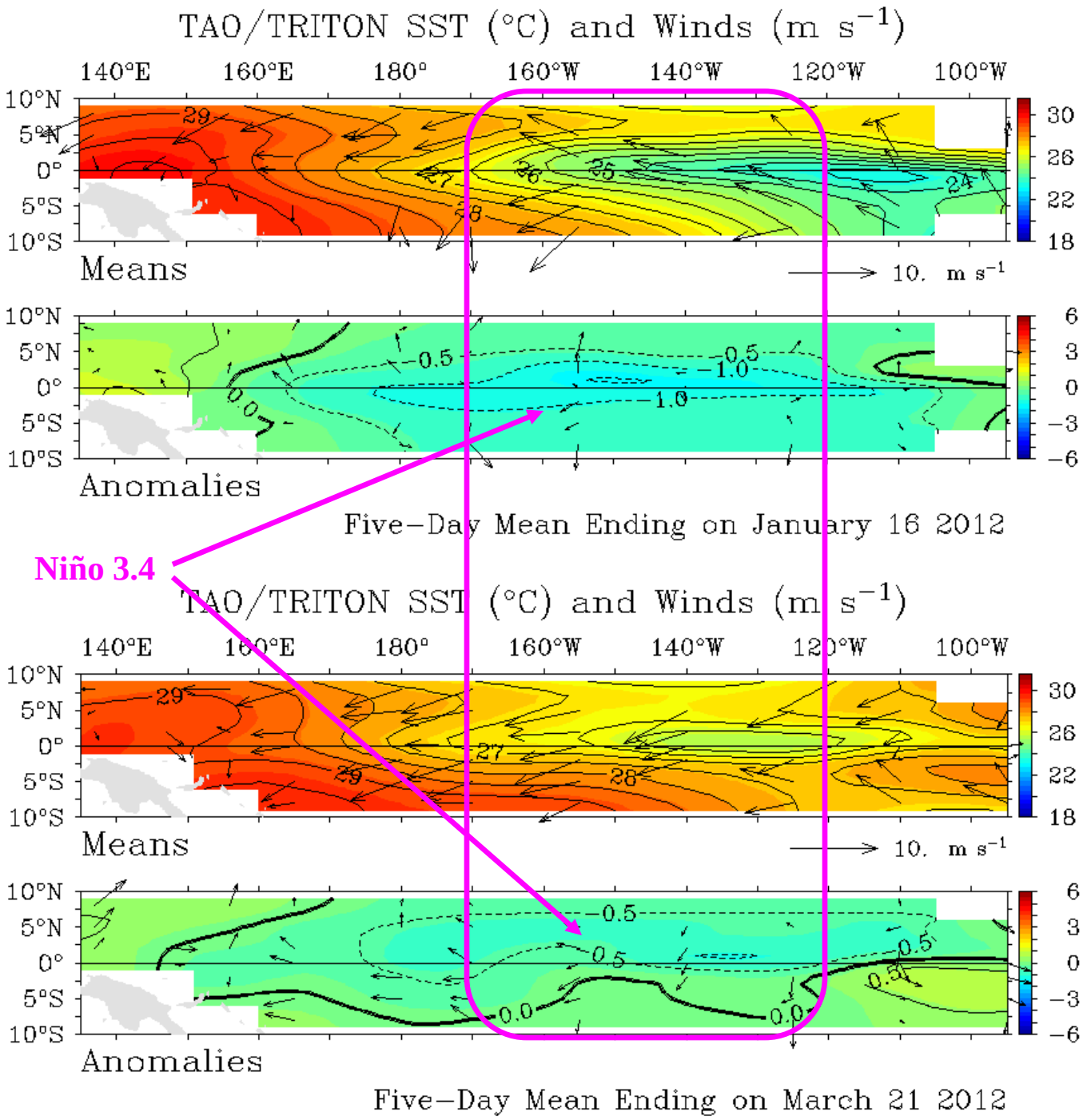
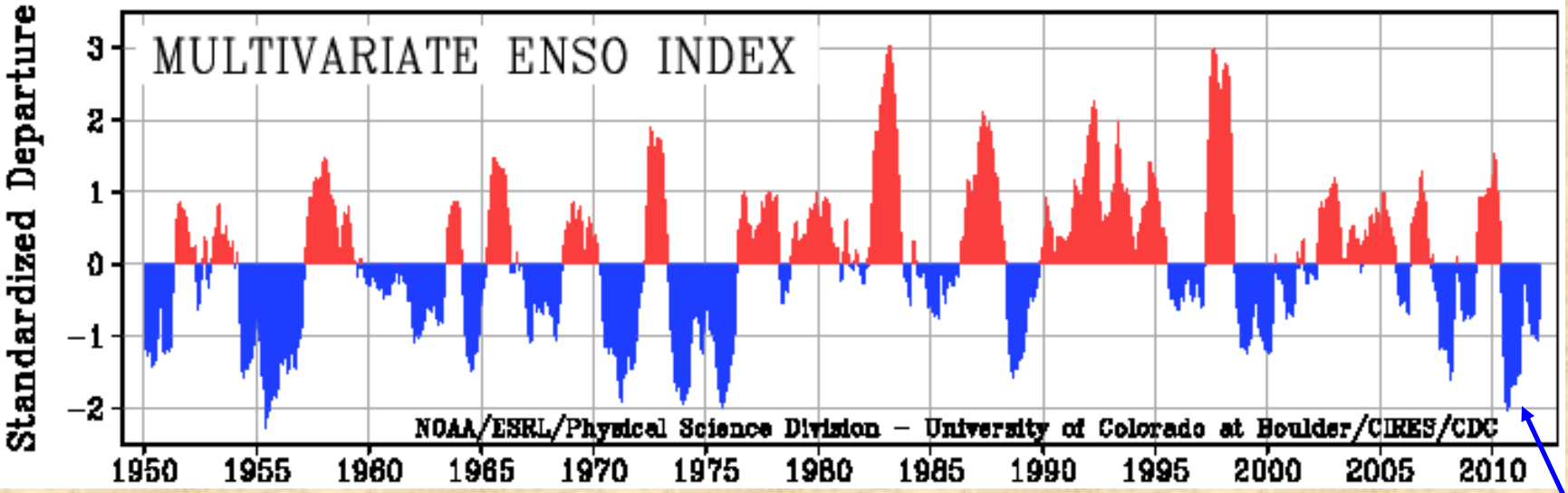
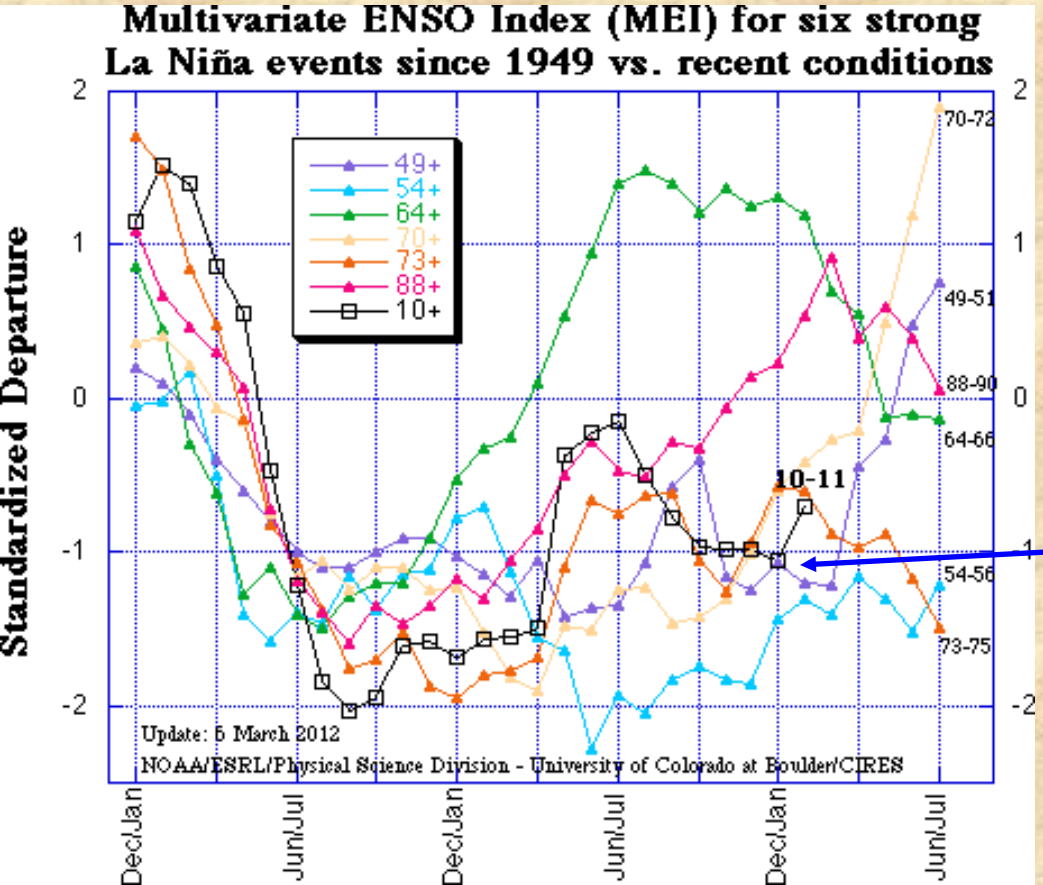
- **'Double-dip' La Niña coming to end of 'Round 2'**
- **What will happen next with La Niña, and what does that mean for us ?**
- **Expectations beyond next week**
- **CPC forecasts for March through June 2011**
- **Experimental Seasonal Forecast Guidance**
- **Executive Summary**

Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to two months ago (top): La Niña has weakened, but is still a factor. Key elements that continue in place: strong trade winds near the dateline, below -0.5°C anomalies in much of the equatorial Pacific, and a subsurface heat deficit that is actually bigger than a year ago.

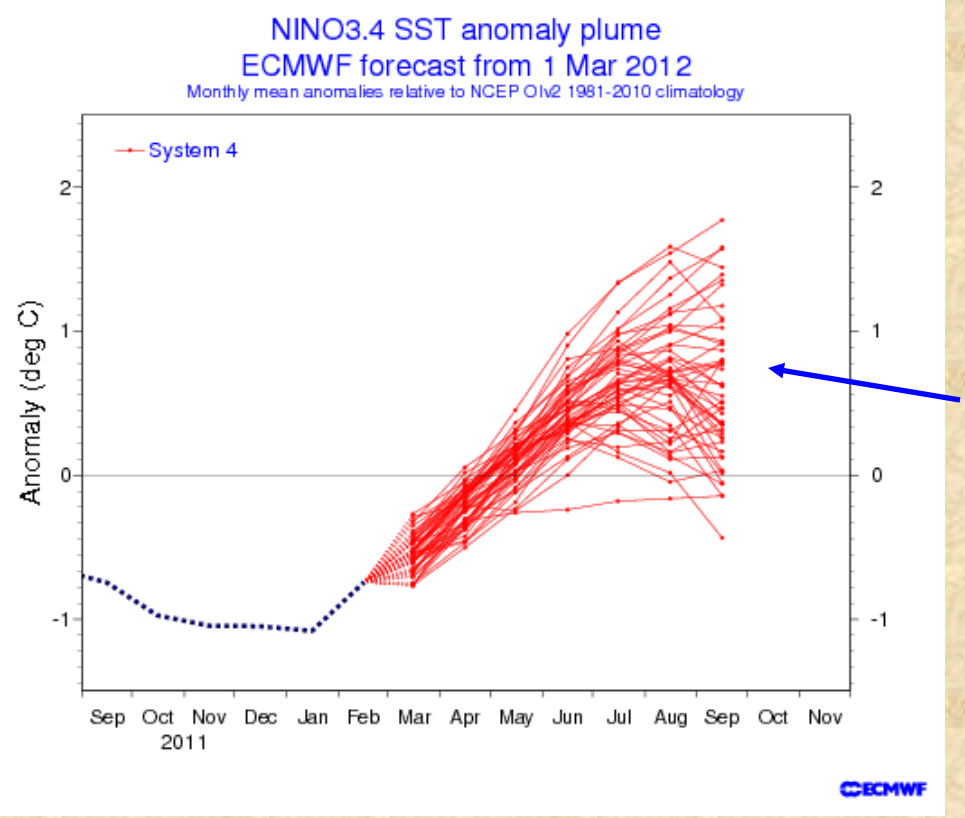






Current La Niña event reached its first peak in late 2010, followed by a brief excursion to ENSO-neutral conditions during mid-2011; it reached its second peak in December-January 2011-12, weakening rapidly at this point.

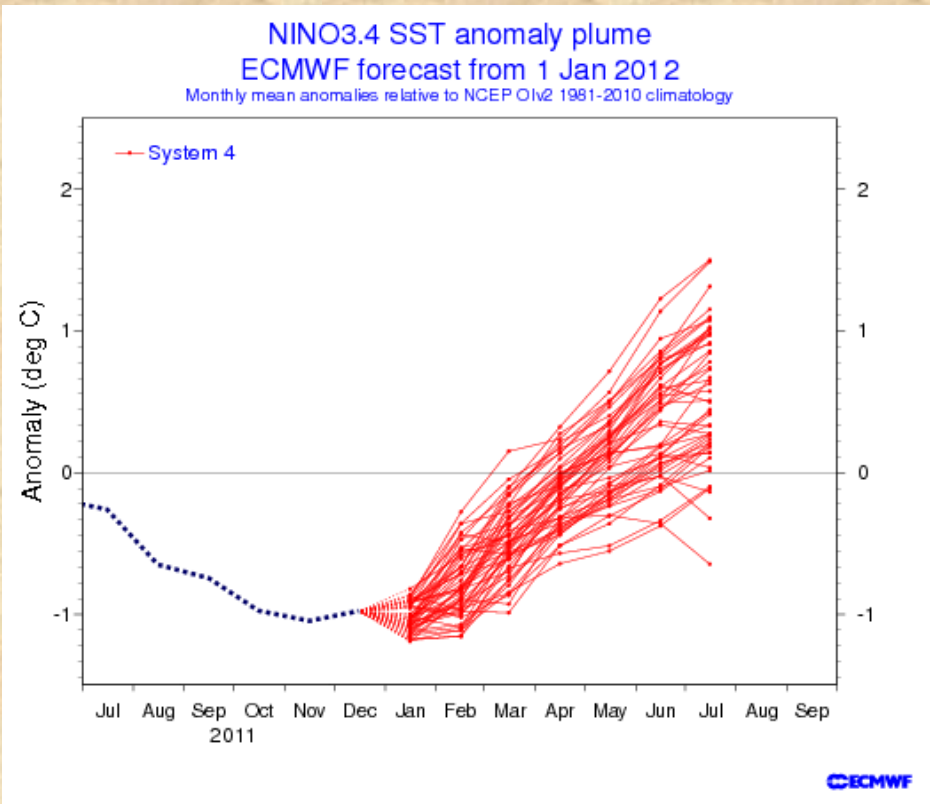
http://www.esrl.noaa.gov/psd/enso/mei



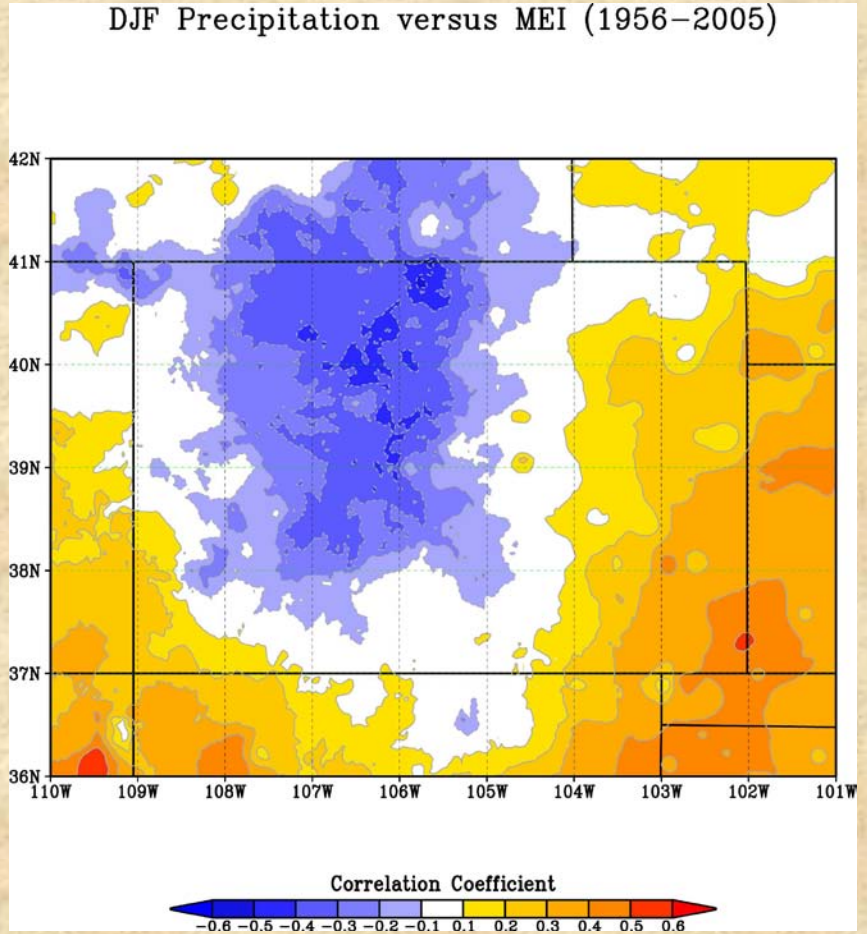
The latest ECMWF forecast (left) shows a fairly dramatic transition *towards* El Niño during the next six months; the majority of the 50 ensemble members ('spaghetti plot') reach at least weak strength (+0.5°C) at some point during our summer, while about five members hint at a return of La Niña (<0°C) by September.

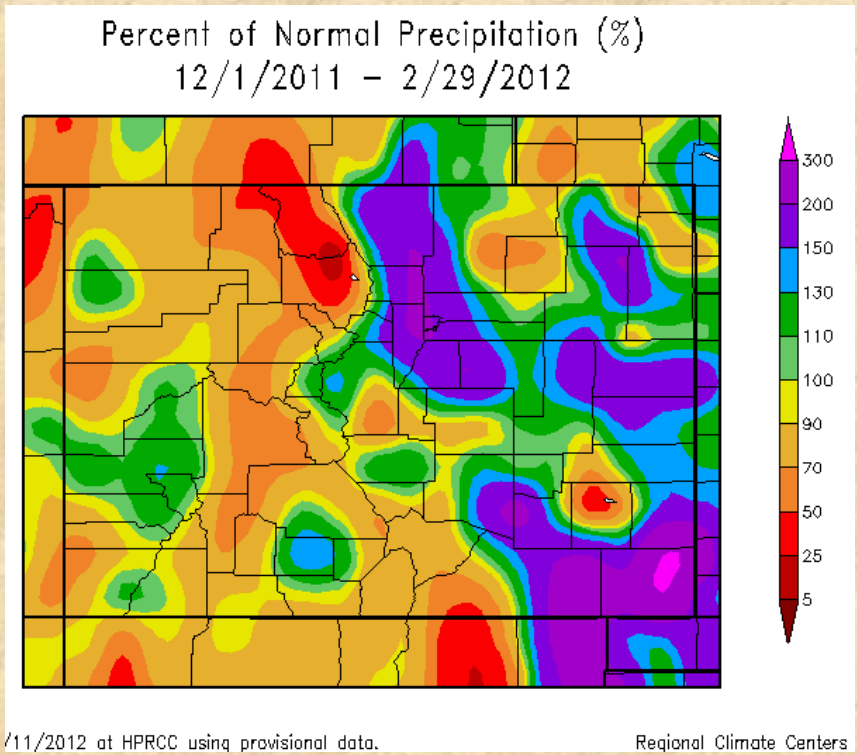
Two months ago (right) I showed a very similar plot – *this model remains the 'gold standard' for all ENSO forecast models.*

How could we get a transition all the way to El Niño by June? Hold that thought...

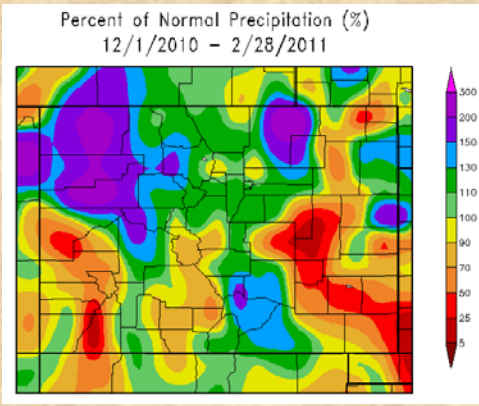


La Niña winters vs. Dec'11-Feb'12

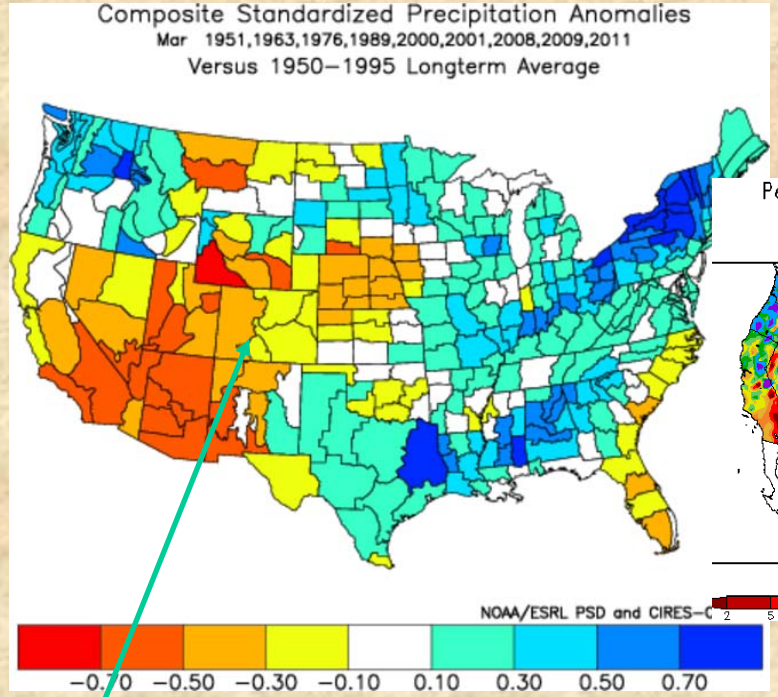


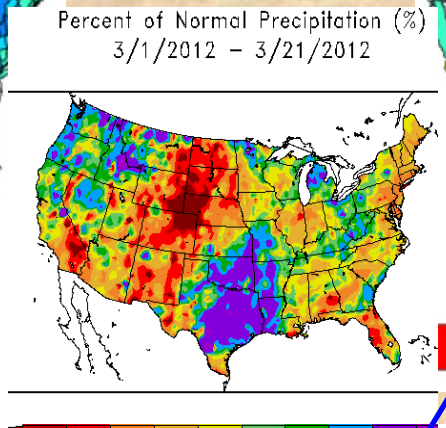


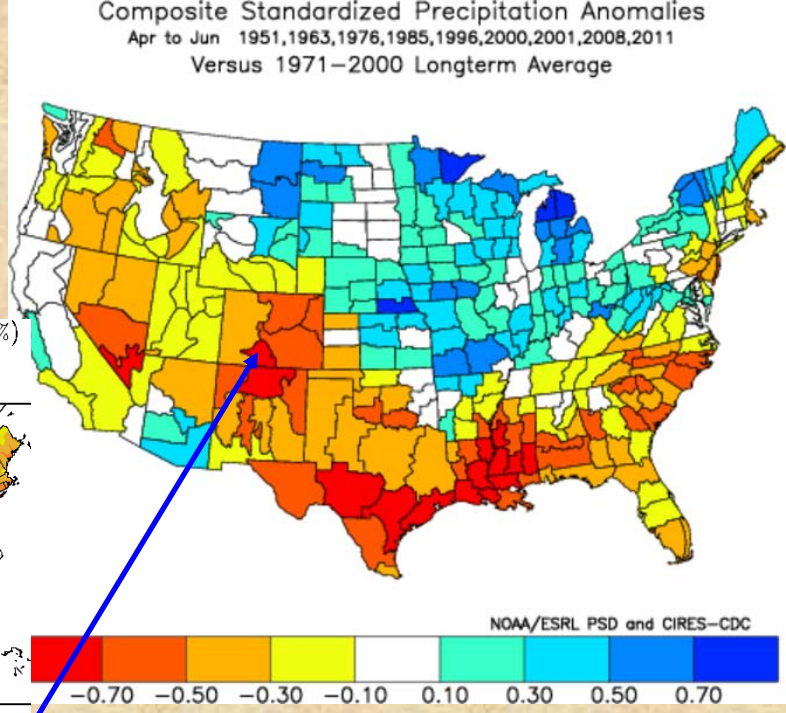
Our mountain winters tend to be WET with La Niña, reversing typical footprint of La Niña during rest of the year; instead, the 2011-12 winter ended up wet along the Front Range (no strong ENSO signal), and in Arkansas Valley (often dry in La Niña). Our mountains played catch-up for about six weeks from mid-Jan to late Feb, but that was not enough to reach a surplus, *in contrast to 2011!*

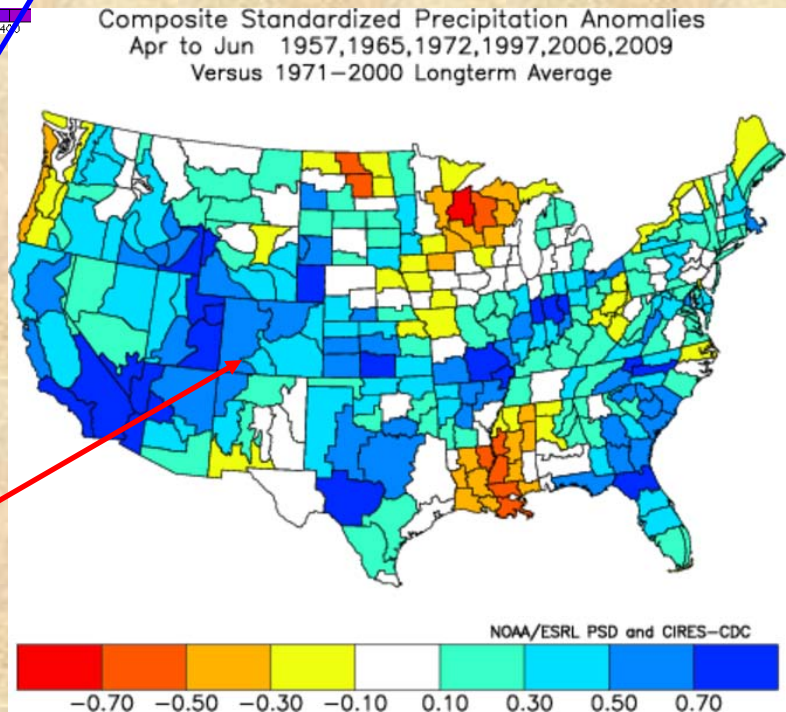


Post-La Niña springs





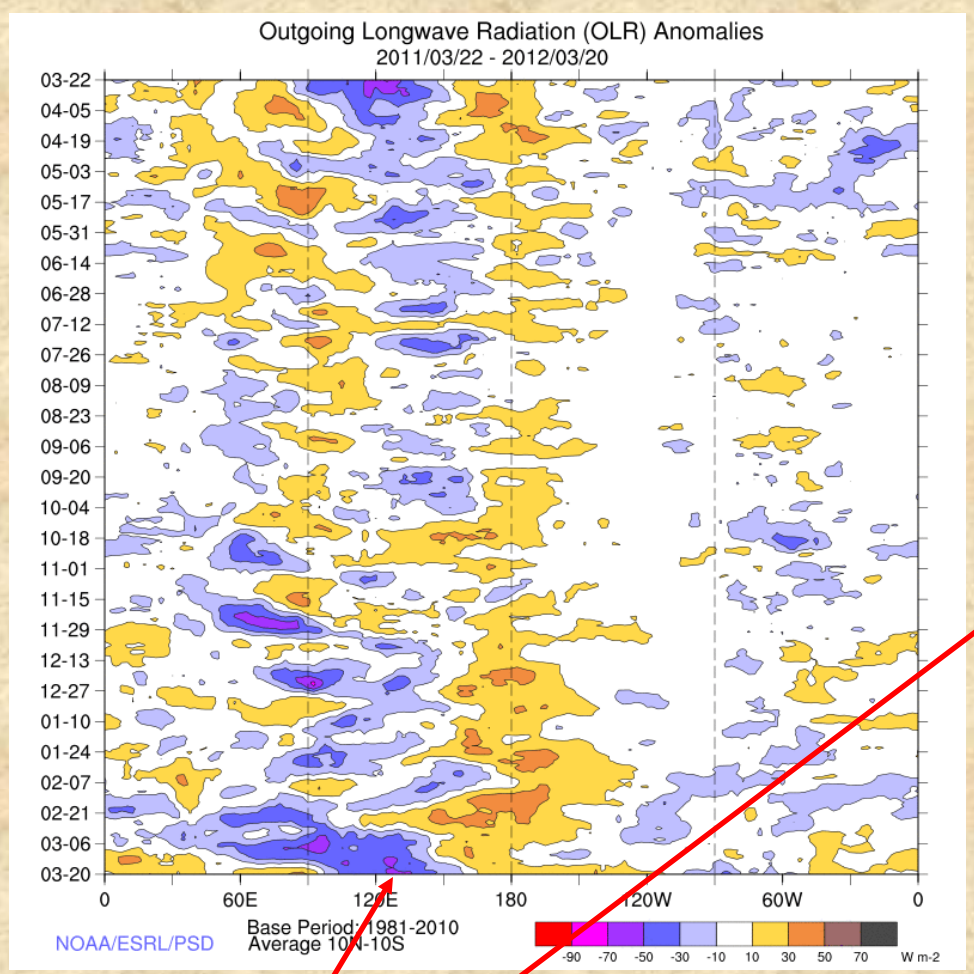


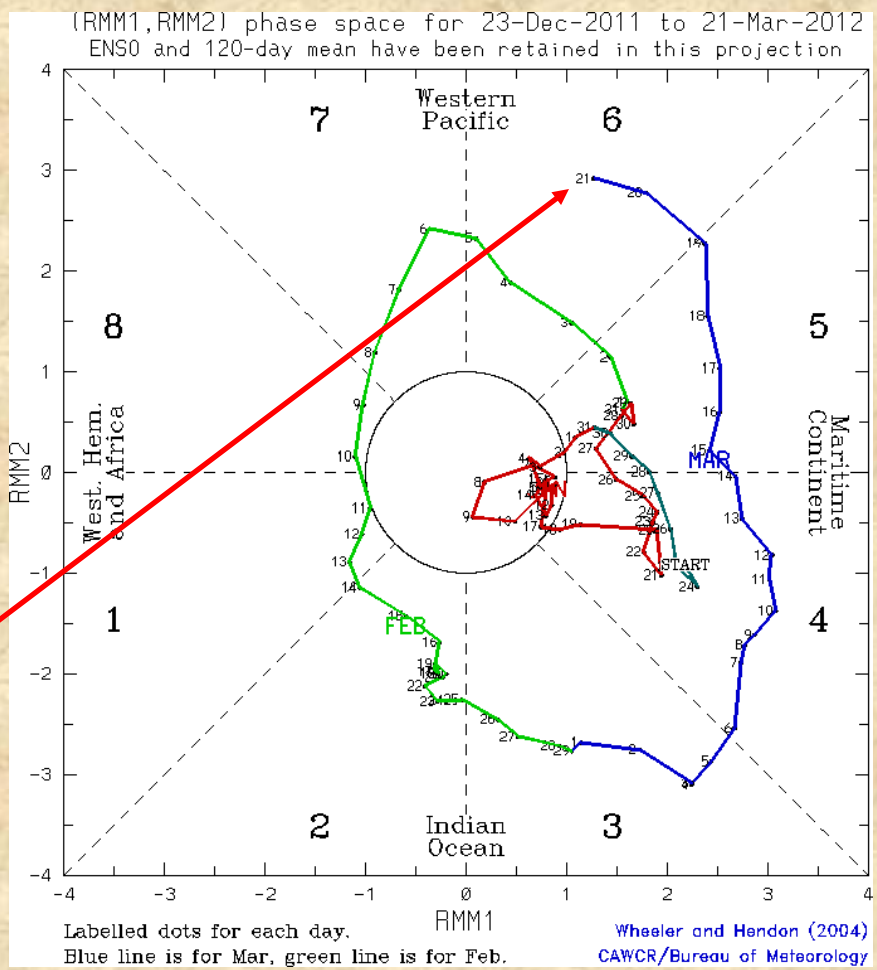


March is often dry in the wake of La Niña in Colorado (top left; observed: middle). IF we go from La Niña in winter to ENSO-neutral conditions by May-June, we tend to end up with a dry spring (top right). <If we stay in La Niña, ditto>

IF we were to reach El Niño conditions by May-June, we could get a much wetter scenario (bottom right). ***Current events in Western Pacific could have bearing on this...***

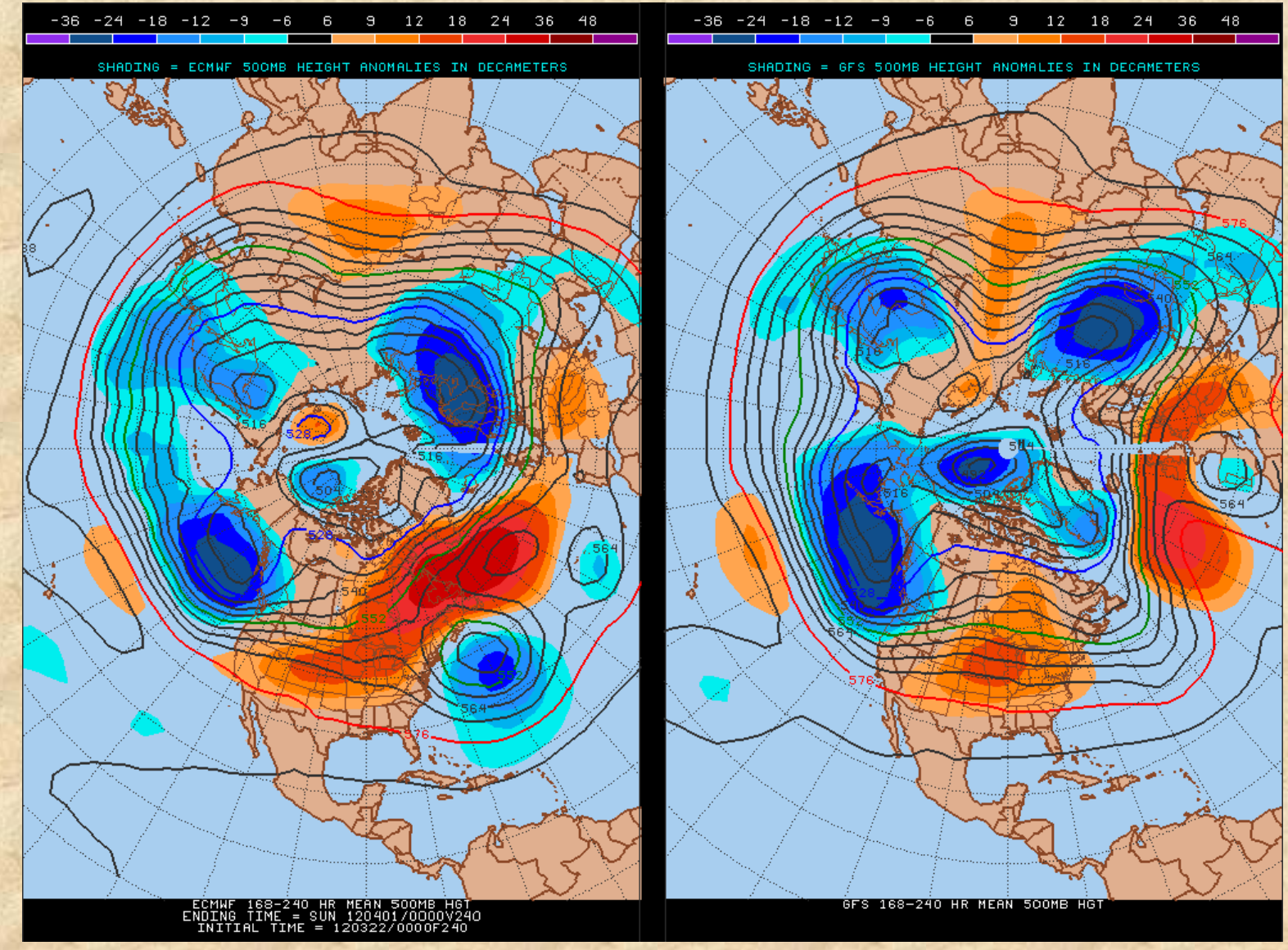
'Hail Mary pass' to El Niño?





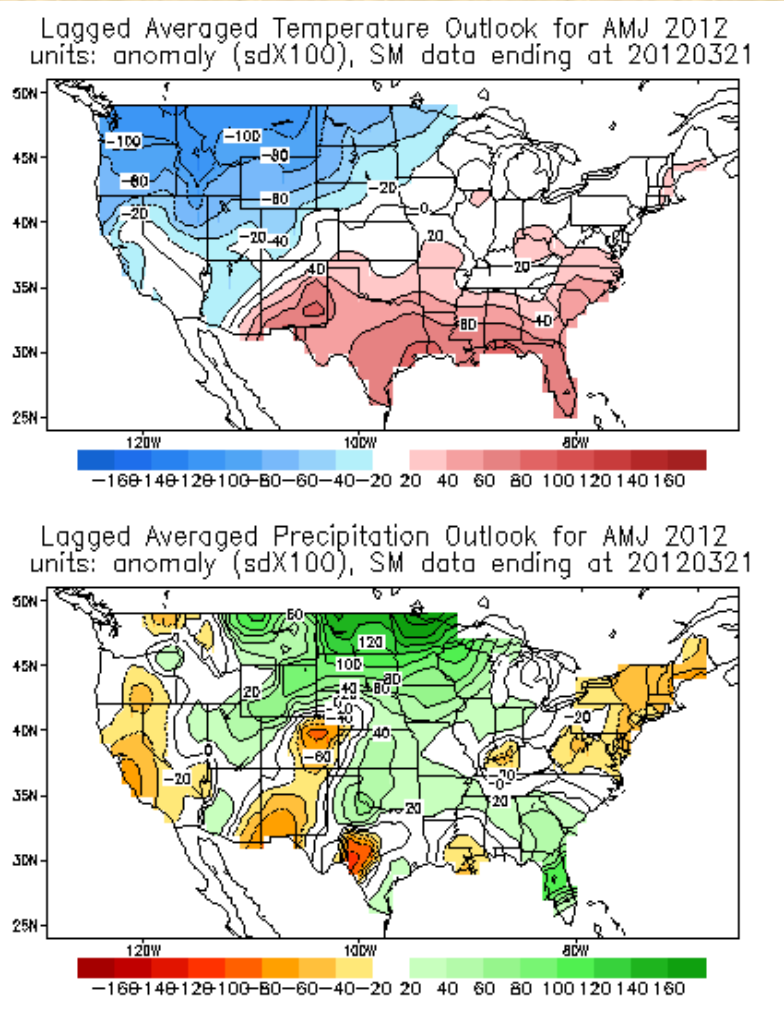
This one could generate a Kelvin wave to jumpstart El Niño!

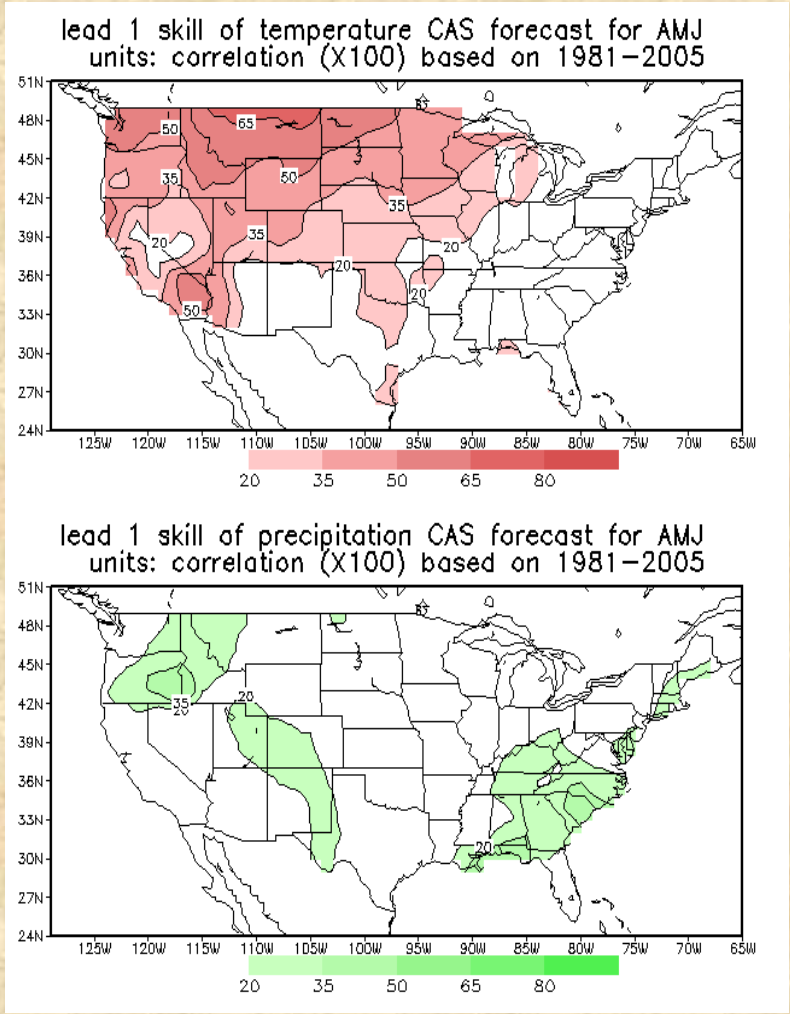
What can we expect more than a week from now?



European & U.S. models show West Coast trough for the average circulation forecast 7-10 days out (warm and dry from Utah eastward...) – not wet at all!

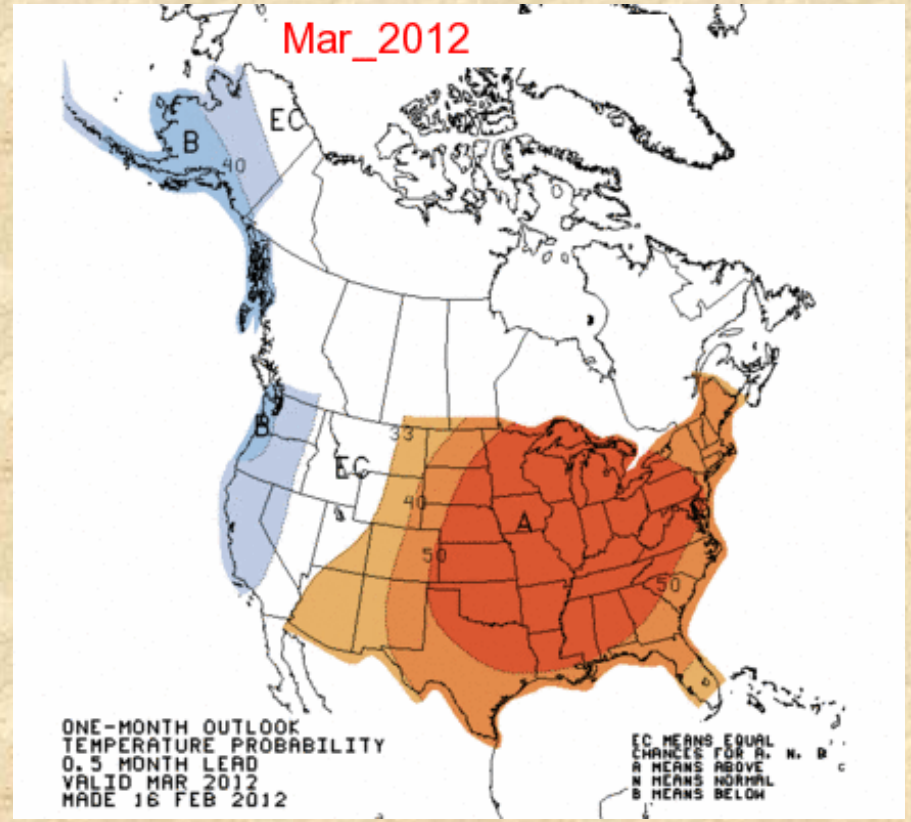
Climate Prediction Center 'Analog' Forecasts

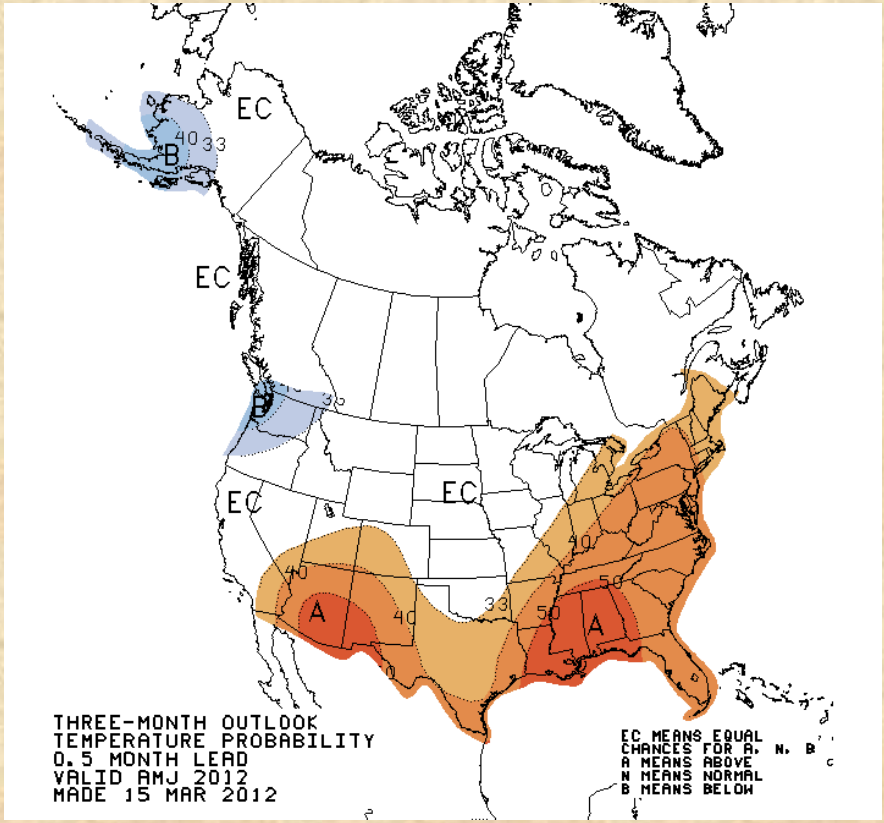


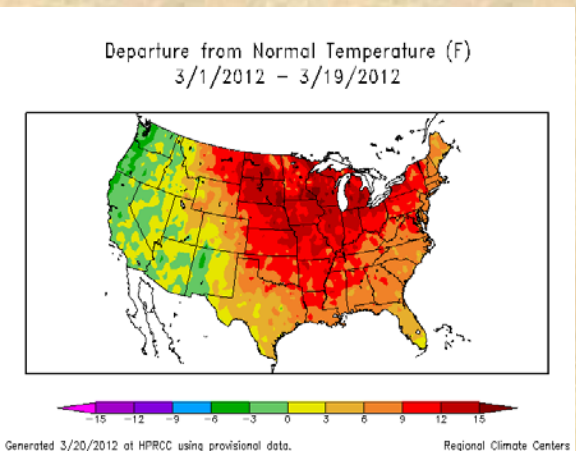


According to the soil-moisture analog forecast, northwest Colorado is favored over eastern Colorado in April-June '12 (left), reversing recent storm track behavior. The temperature forecast is mostly neutral-to-cool for us. Skill at this lead-time (right) is marginal for precipitation, better for temperatures. **Source**: ***http://www.cpc.ncep.noaa.gov/soilmst/cas.shtml***

Climate Prediction Center Temperature Forecasts



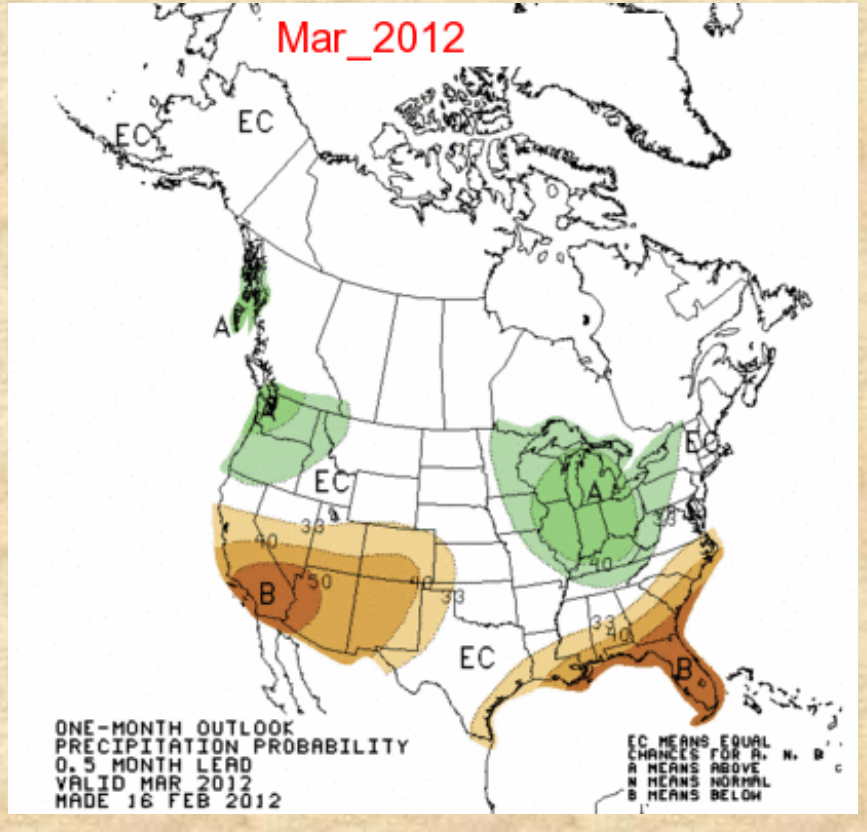


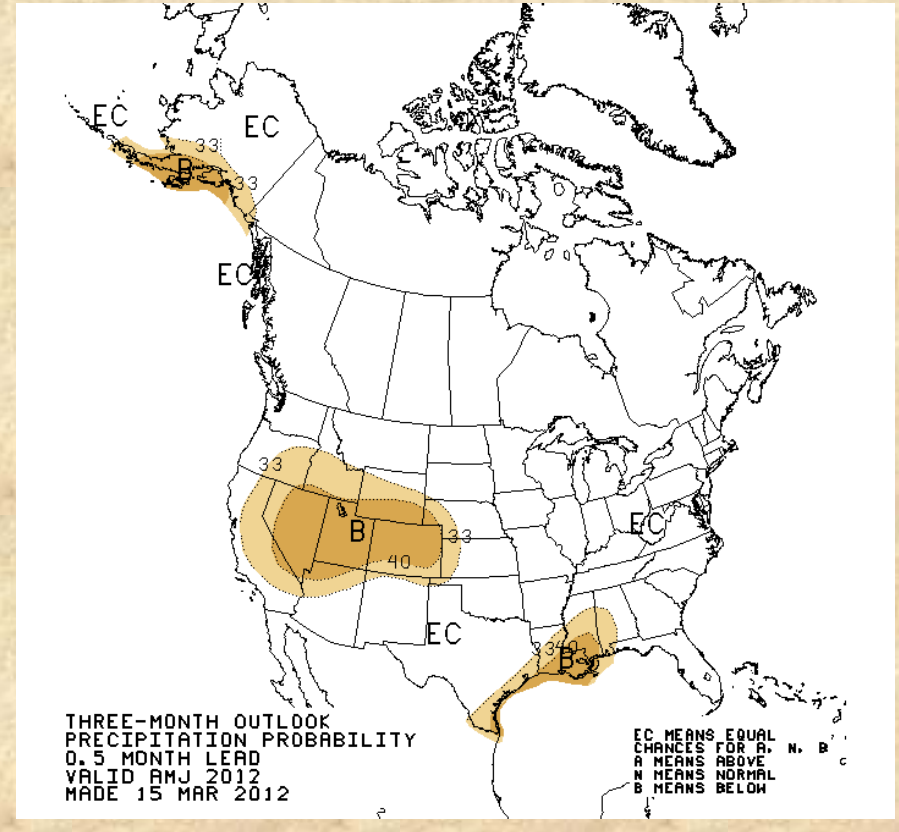


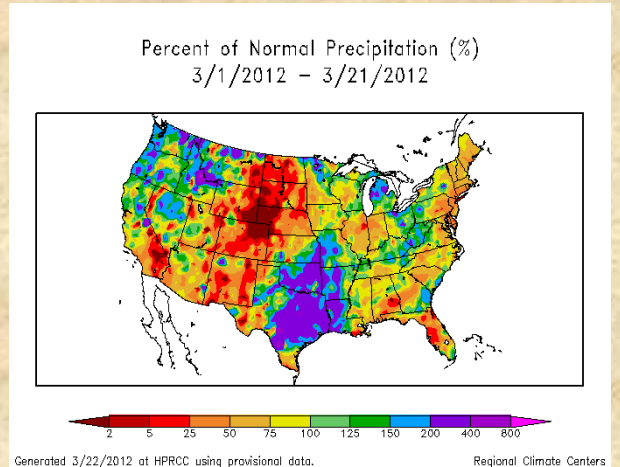
A month ago, CPC made an unusually successful March temperature forecast (left vs. top left), while the latest April-June (right) temperature forecast shows typical La Niña-based expectations, leaving southern Colorado with higher than average chances for a warm spring.

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

Climate Prediction Center Precipitation Forecasts



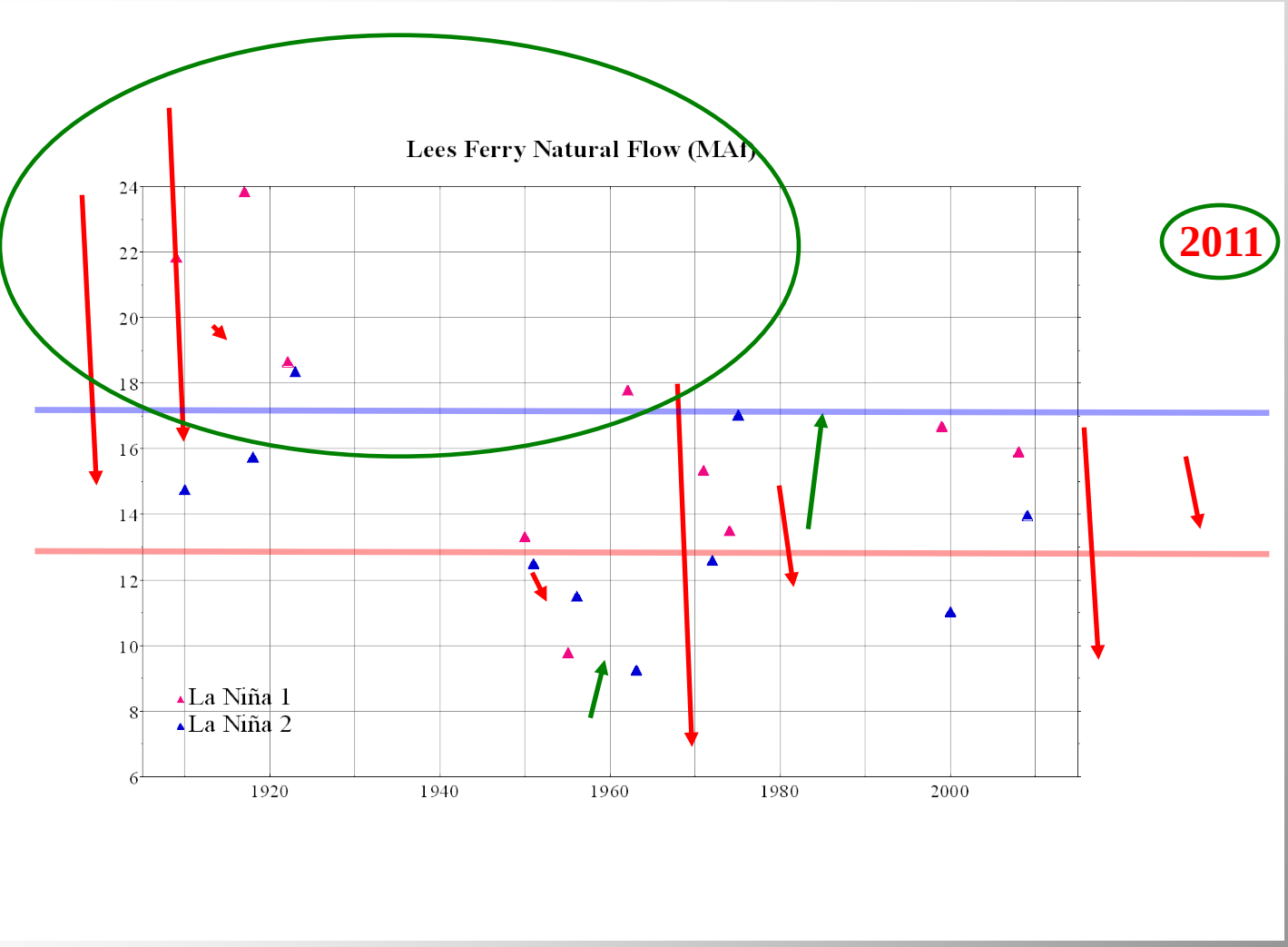




A month ago, CPC also made a fairly successful March precipitation forecast (left vs. top left), while the latest April-June (right) forecast leaves most of Colorado with higher than average chances for a DRY spring (this focus on UT and CO is unusual).

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

What is difference for Year 1 vs. Year 2 Las Niñas?



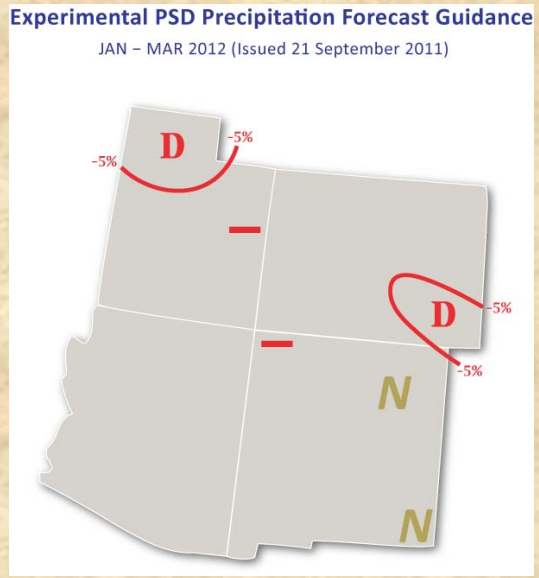
Mean flow for Year 1: 16.75 MAf (= +1.7MAf)

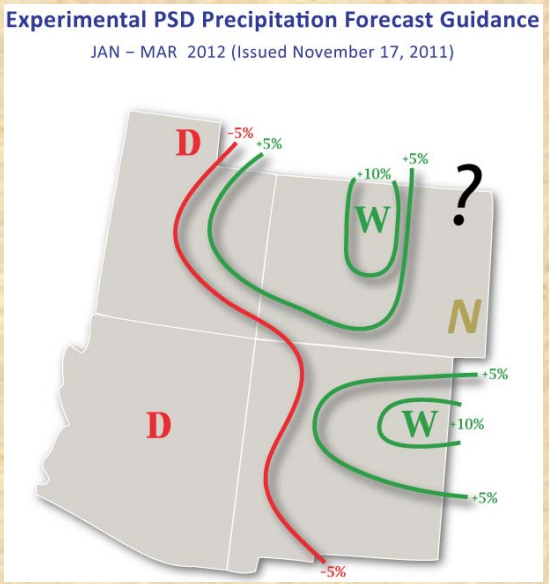
Mean flow for Year 2: 13.64 MAf (= -1.4MAf)

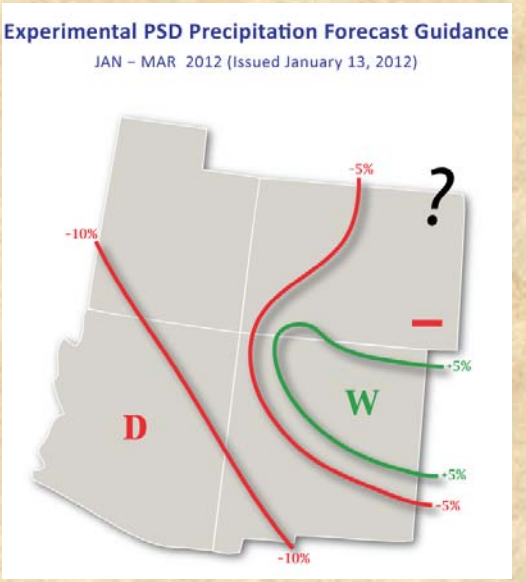
Difference significant, with more than 0.7 standard deviations!

In two-year La Niña events, 2nd year runoff has often been lower than 1st year runoff (8 of 10 cases) for the Colorado River. If we consider only cases above the 1st year mean, then the drop-off increases to 7.1MAF in the median case (or 13.4 MAF in 2012). A separate forecast based on Oct-Dec 2011 precipitation and mid-2011 ENSO behavior yields only 11.2 MAF.

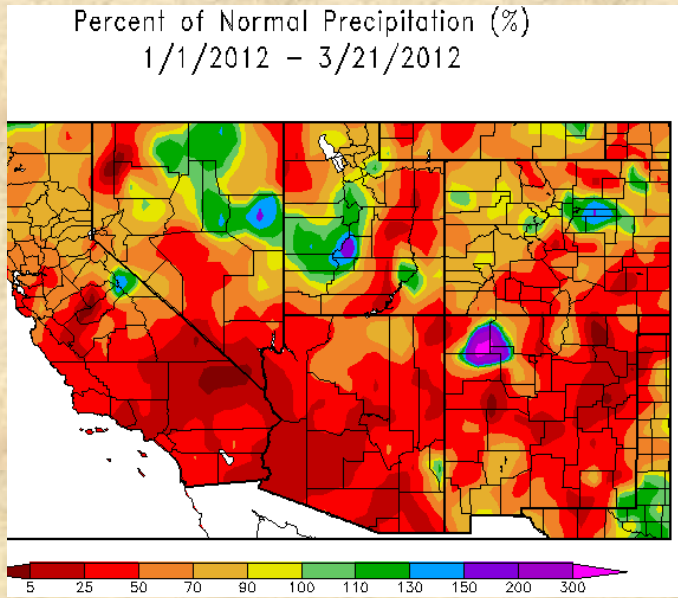
Statistical Forecasts for January-March 2012



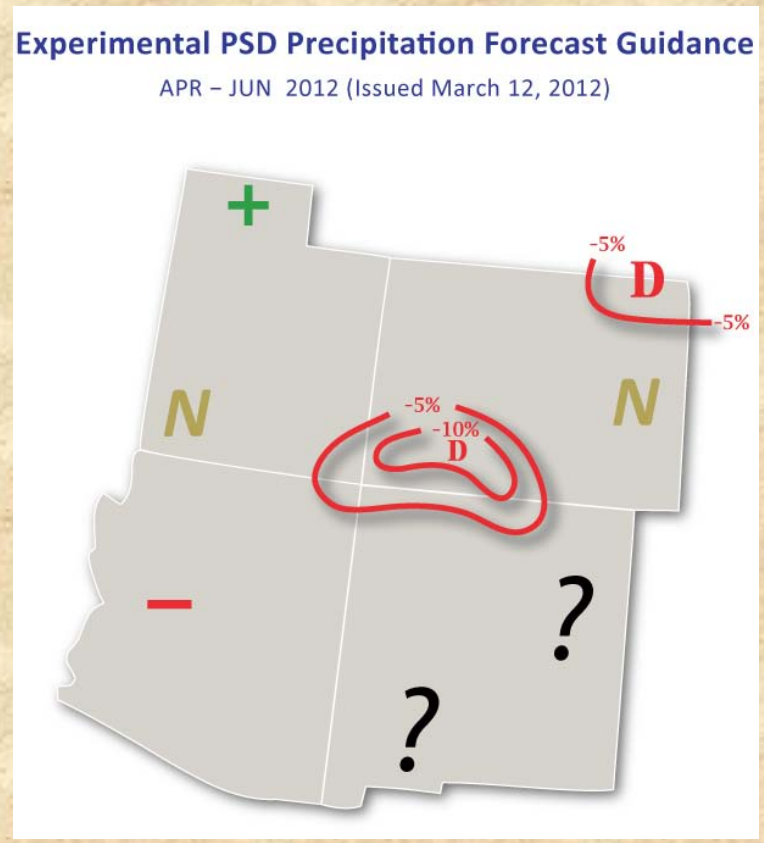


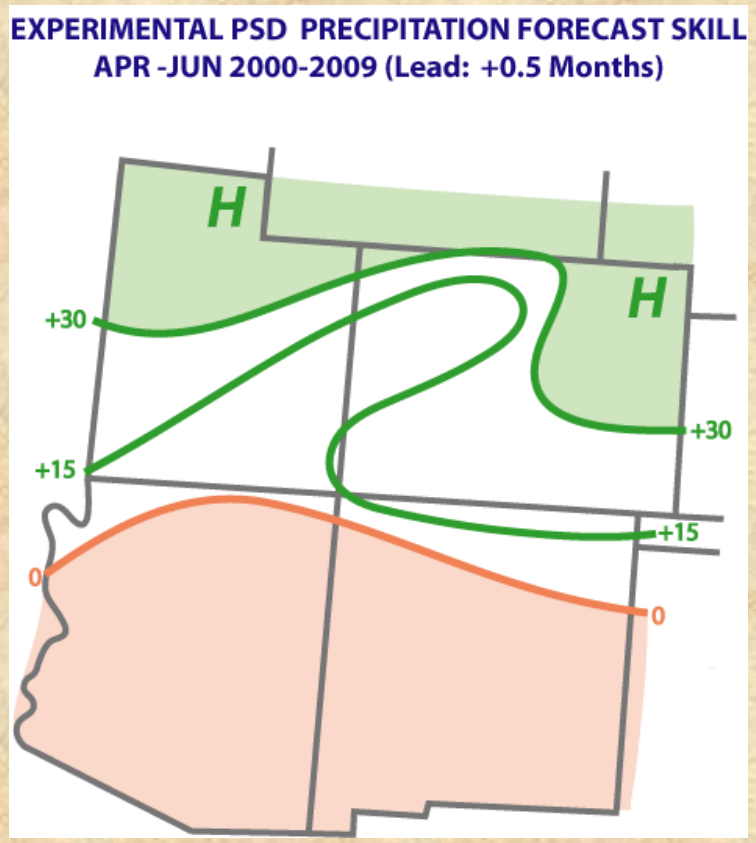


The most recent forecast season (left) and verification so far (right) for January-March 2012 shows the expected dry outcome for most of our state. There was that shining moment of hope in November, but both the September and January forecasts got the dryness right for most of Colorado...



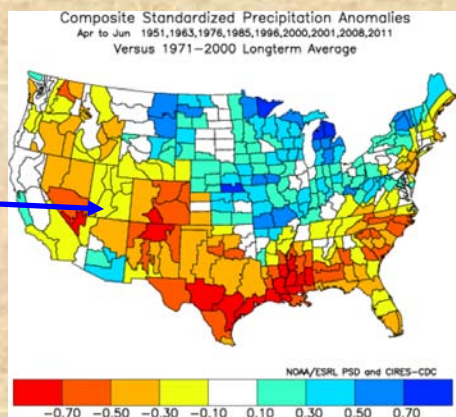
Statistical Forecast for April-June 2012





My forecast for April-June 2012 (left) is fairly confident that SW CO will see below-normal moisture, with a smaller tilt in the odds for dryness over NE CO. The eastern plains have a slight preference for near-normal spring moisture. The forecast map looks similar to the 9 La Niña-neutral ENSO transition composite shown earlier.

Historical skill over the last decade of experimental forecasts has been better for UT and CO than for AZ and NM (right).



Notes on flooding risks in 2012

Time of year and amount of flooding in the Front Range [1864-1976]

May 1-10	1	
May 11-20	3.5	
May 21-30	**5.5**	
May 31-Jun 9	**9**	**Combination of big spring storms with snowmelt**
Jun 10-19	**6**	
Jun 20-29	2	
Jun 30-Jul 9	2	
Jul 10- 19	**6**	
Jul 20-29	**6.5**	
July 30-Aug 8	**8.5**	**Classic monsoonal peak with localized thunderstorms**
Aug 9-18	1	
Aug 19-28	1	
Aug 29-Sep 7	2	
Sep 8-Sep 17	2	

Source: http://www.esrl.noaa.gov/psd/boulder/Boulder.flood.html

Notes on flooding risks in 2012

SNOWMELT-RELATED:

- ***Poor snowpack decreases snowmelt-related flooding potential around our state***
- ***Currently increasing dust load may increase speed of snowmelt (tentative), would affect southern mountains more than north, and is still less than in 2009 and 2010***
- ***La Niña springs tend to be warmer than average, increasing risk of 5+day 'heatwaves' that can trigger 'melt-surges'***

FLASHFLOOD-RELATED:

- ***Some of the most prominent examples of flashflooding occurred during El Niño onset years ('65, '76, '97), while others did not ('99) – I believe the odds for that scenario are higher than last year, but still <<50% (stay tuned!)***
- ***Recent wildfires in Front Range (4 mile!) in particular have lowered the threshold for flashflooding and mudslides – it will take several years to overcome this (Jamestown fire of October 2003 kept us busy for at least five years).***

Executive Summary (22 March 2012)

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- **La Niña ended up weaker than last year, and did not leave all the typical footprints. For Colorado, an overall drier season was correctly anticipated based on typical 2nd year La Niña outcomes. While it is pretty certain that we will see a further weakening of La Niña this spring, a full transition to El Niño is not likely (but possible).**
- **A La Niña-related wet spell in our mountains from mid-January through February was insufficient to offset dry March weather (which is also typical for La Niña). While April can be fairly wet during La Niña conditions, I do not see any major storms on the horizon.**
- **My forecast for late spring (April-June) shows a tilt towards dryness covering much of our state, except for the eastern plains which 'lean' towards near-normal moisture. If we see a rapid transition towards El Niño within the next three months, our prospects for a wet spring would be much better.**
- **Given the mostly dry forecast for spring, and below-average snowpack, I expect runoff to commence earlier than normal. Dust storms have recently picked up and may accelerate meltout from here on out. While I do not predict a sudden switch to El Niño, the odds for it are indeed higher than last year which translates into a better chance for flashfloods.**
- **Bottomline: While this La Niña did not deliver all of the expected impacts, it did give us more windstorms and our current warm&dry March. Unfortunately, La Niña also means more dry conditions for most of us through June. Our best chance for increased moisture would come with a sudden transition to El Niño – I put the odds for that around 20%.**


Just a month ago...