



CO WATF,
20mar2009,
Denver



Seasonal Outlook into mid-2009

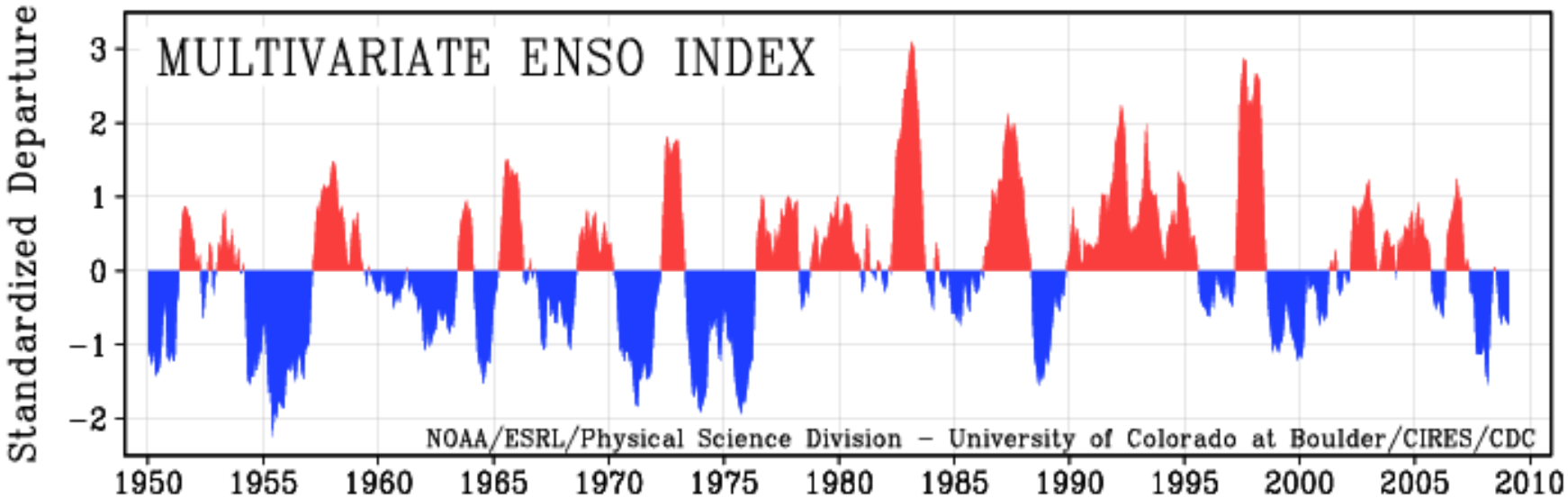
Klaus Wolter

University of Colorado, CIRES & NOAA-ESRL PSD 1, Climate Analysis Branch

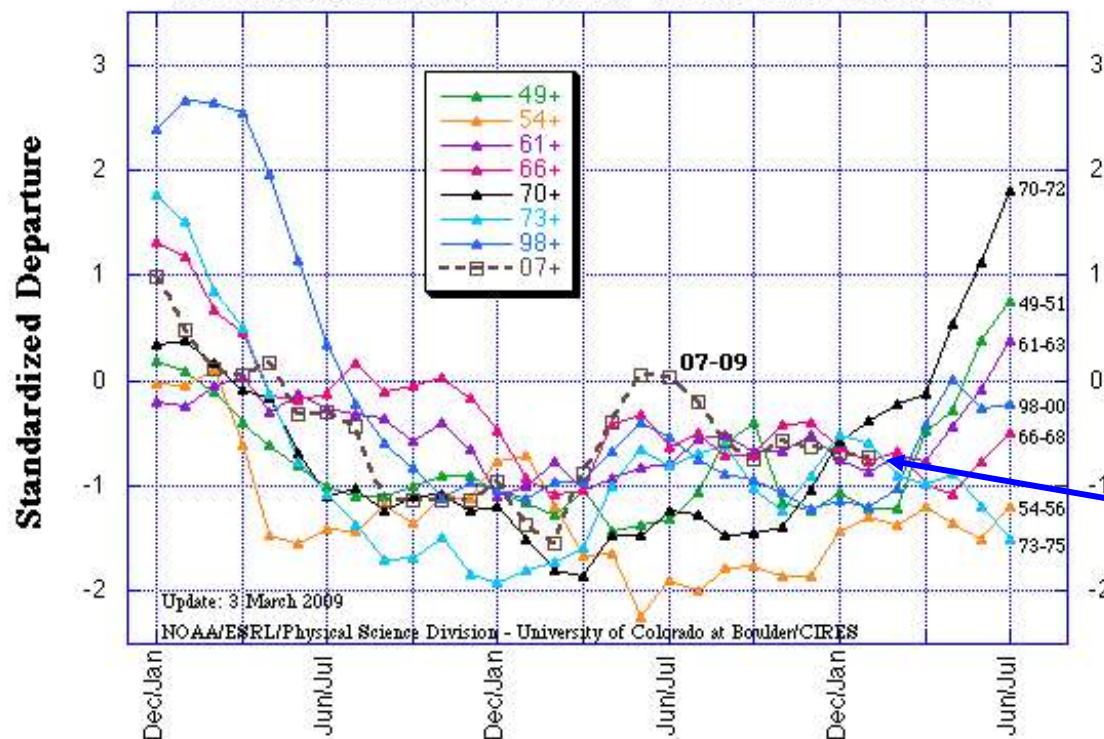
klaus.wolter@noaa.gov

<http://www.cdc.noaa.gov/people/klaus.wolter/SWcasts/>

- **La Niña: Winter #2**
- **This winter so far & expectations for next few weeks**
- **Analog cases**
- **CPC forecasts for April - September 2009**
- **Experimental forecast guidance for April - June 2009**

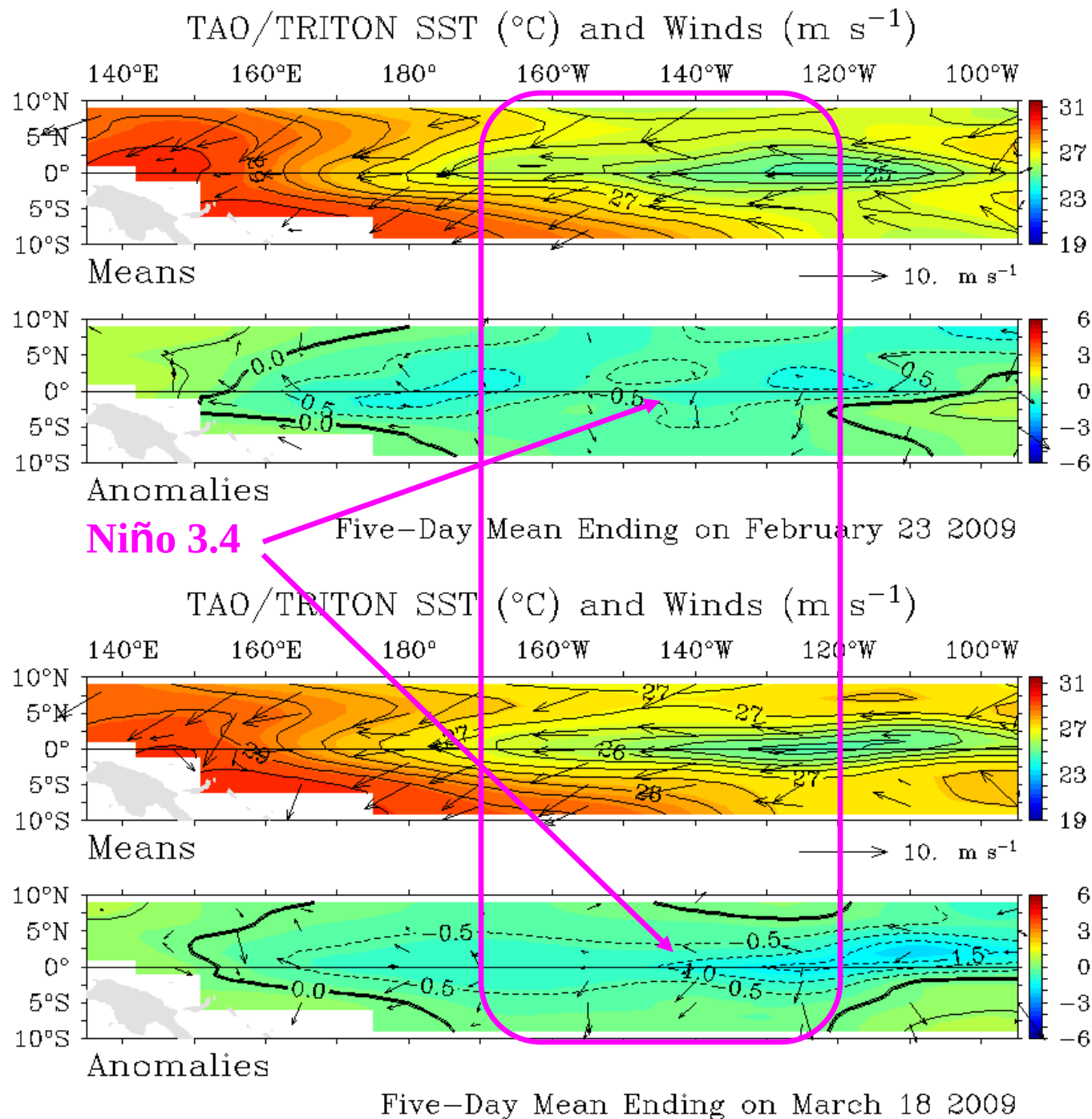


Multivariate ENSO Index (MEI) for 7 long-lasting La Niña events since 1949 vs. recent conditions



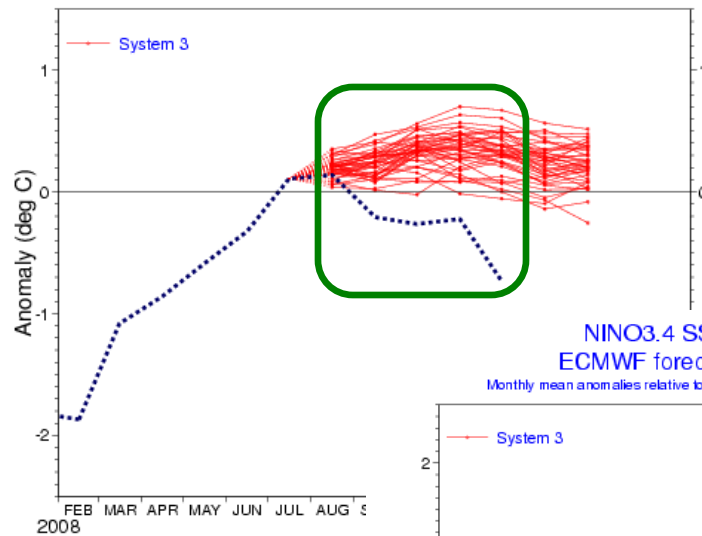
From 3rd strongest La Niña since 1950 (Feb-Mar'08) to above-normal in three months, and back to a weak La Niña!

Current state of ENSO (bottom) compared to four weeks ago (top): the tropical Pacific has continued its weak La Niña event, but the emphasis has shifted to the eastern part of the basin where SST anomalies went from positive to highly negative. Wind anomalies remain relatively weak, keeping 'all options on the table' in terms of future development.



NINO3.4 SST anomaly plume
ECMWF forecast from 1 Aug 2008

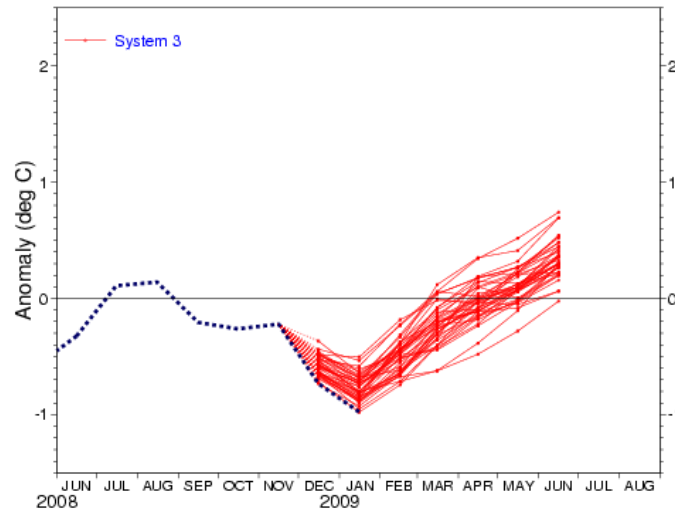
Monthly mean anomalies relative to NCEP adjusted OIv2 1971-2000 climatology



The European model's August forecast (left) anticipated weak El Niño conditions thru rest of 2008, while the observed SST dropped below the forecast range by *September* - highly unusual!

NINO3.4 SST anomaly plume
ECMWF forecast from 1 Dec 2008

Monthly mean anomalies relative to NCEP adjusted OIv2 1971-2000 climatology



Forecast issue date: 15 Dec 2008

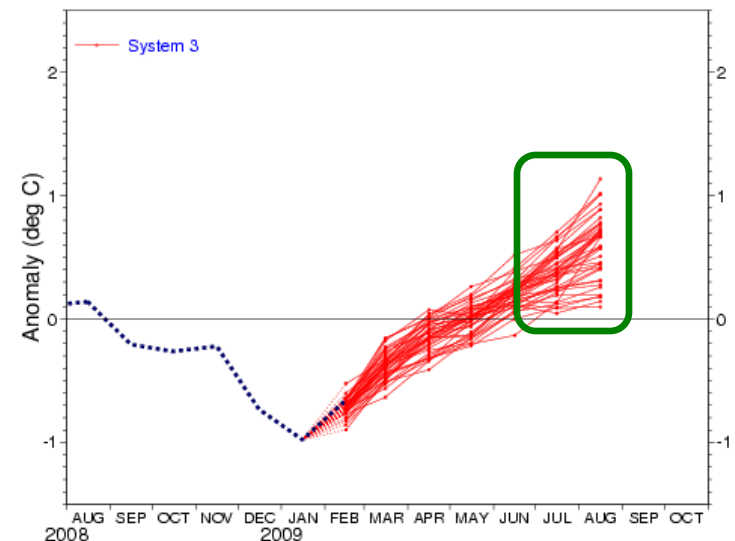
ECMWF

A more serious temperature drop occurred by late '08 (left), peaking near -1°C (moderate La Niña) in January.

NINO3.4 SST anomaly plume

ECMWF forecast from 1 Feb 2009

Monthly mean anomalies relative to NCEP adjusted OIv2 1971-2000 climatology

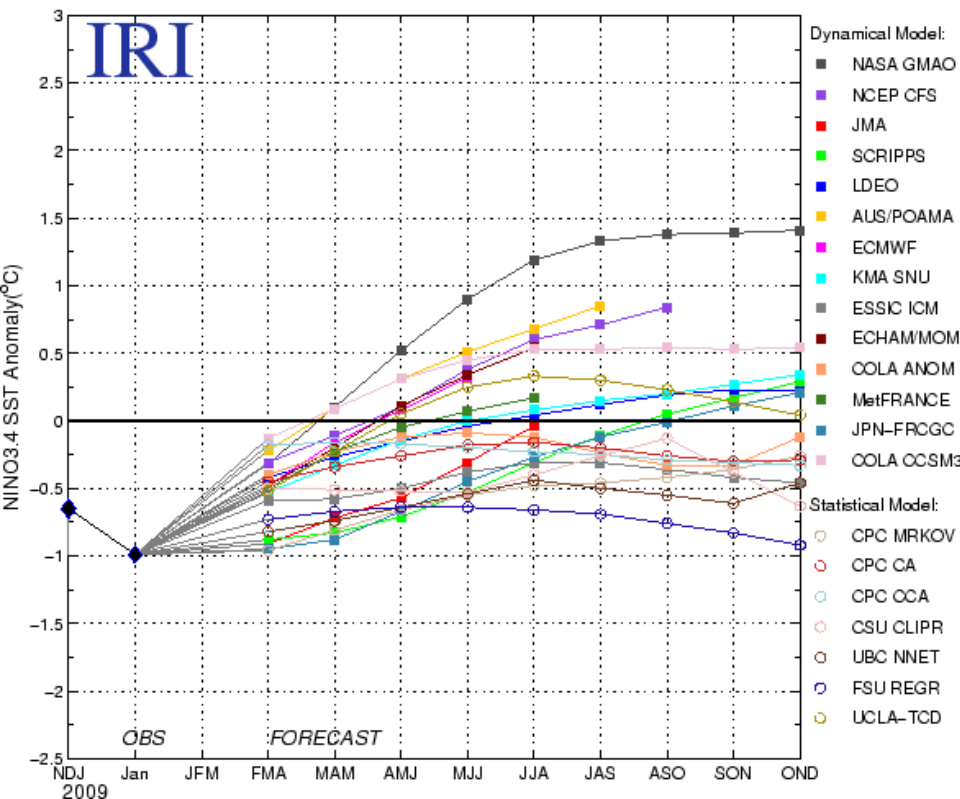


Forecast issue date: 15 Feb 2009

ECMWF

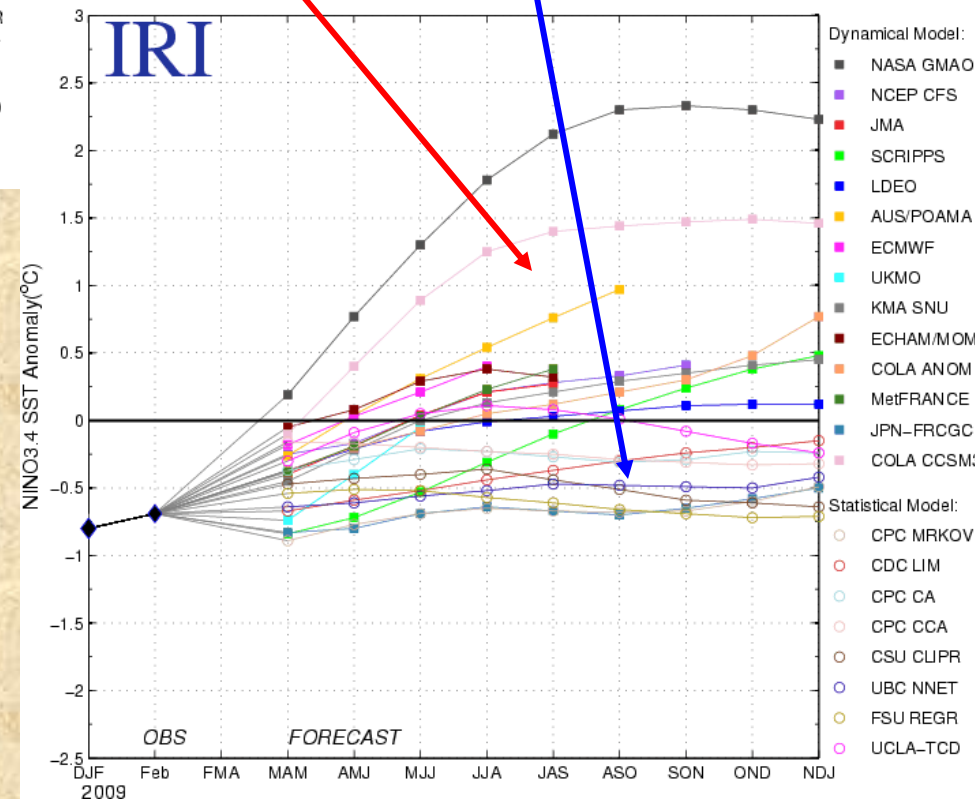
The latest forecast (right) has a pretty clear trend towards at least neutral (if not El Niño) conditions by late spring (summer). The forecast range of less than 1°C thru July is comparatively small.

Model Forecasts of ENSO from Feb 2009



Latest ENSO forecasts from almost two dozen dynamical & statistical forecast models (below) vs. last month (left). Most models show a return towards ENSO-neutral by the spring, with a wide range of possible outcomes ($\pm 1^{\circ}\text{C}$). *There is a near-record gap between dynamical & statistical models!*

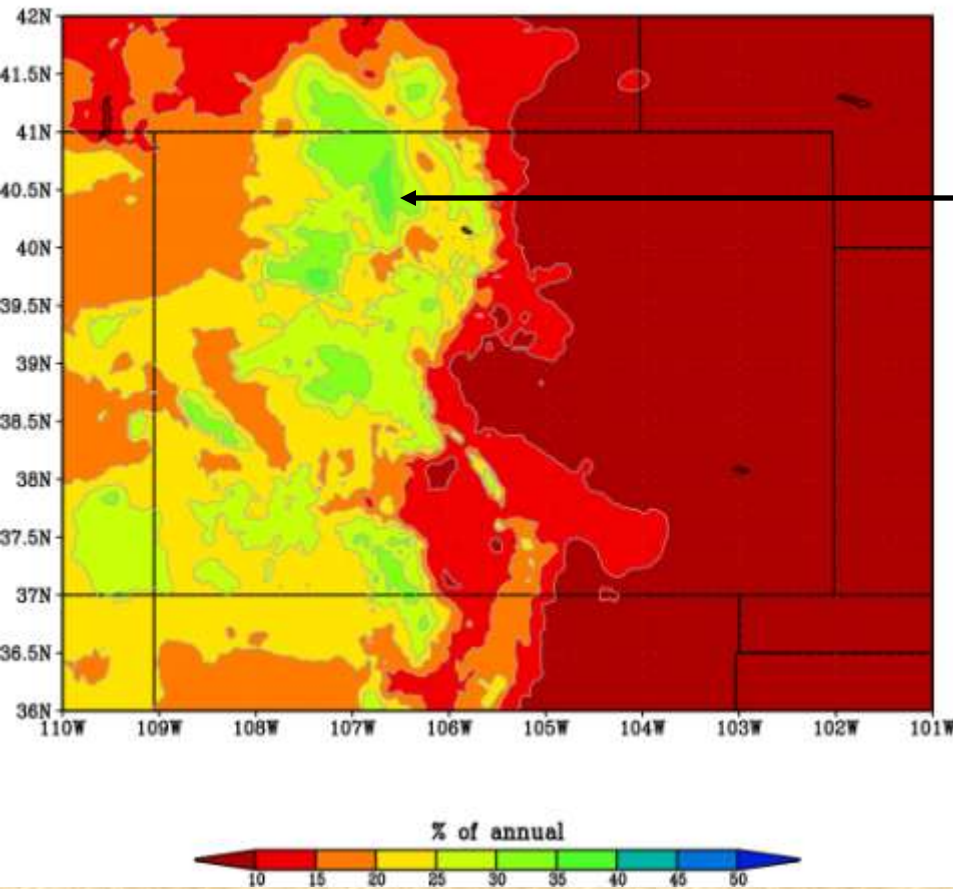
Model Forecasts of ENSO from Mar 2009



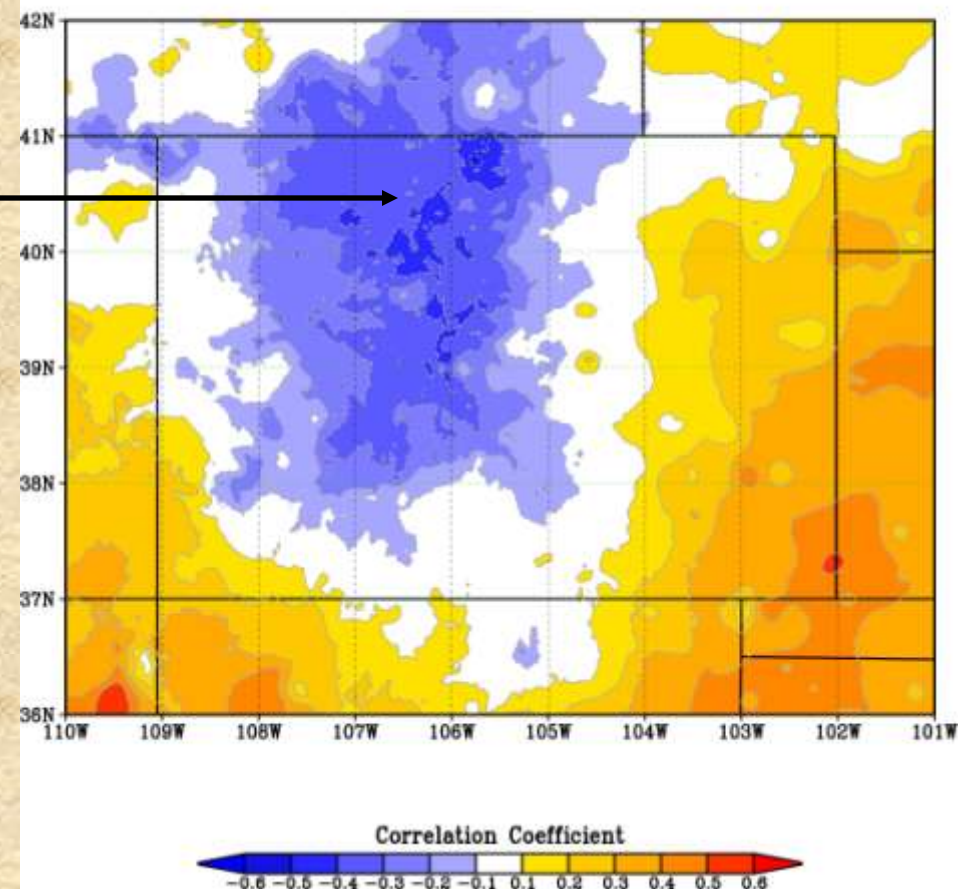
Historically, La Niña events of the recent magnitude have had a tendency to continue for three years+ (54-57; 73-76; 98-01), possibly involving re-emergence in boreal fall.

What are typical La Niña impacts in the winter?

DJF Climatological Precipitation



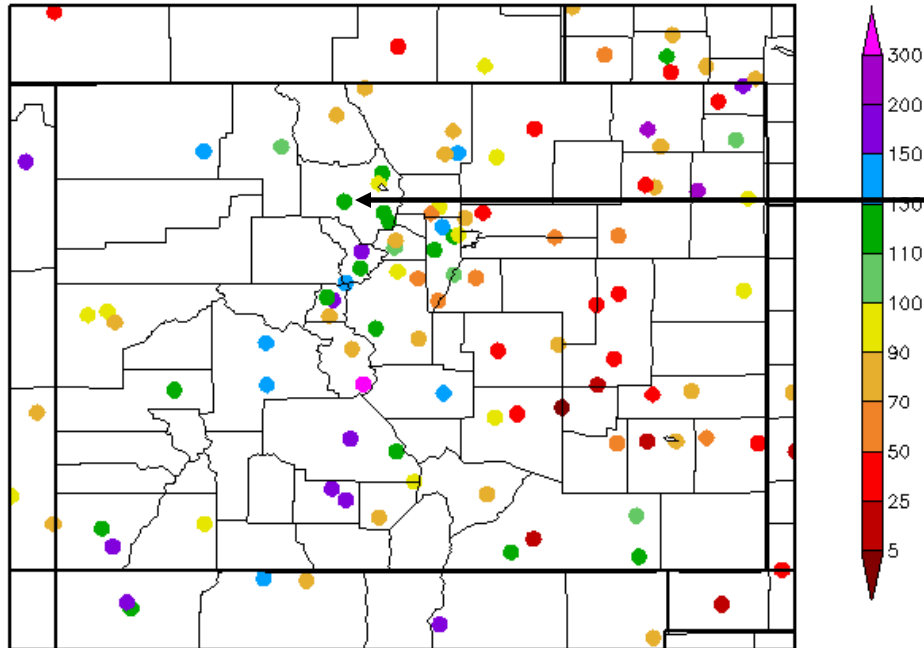
DJF Precipitation versus MEI (1956–2005)



Northwest Colorado benefits the most from average winter seasons (left), even more so during La Niña conditions (negative correlations; right).

What about this winter?

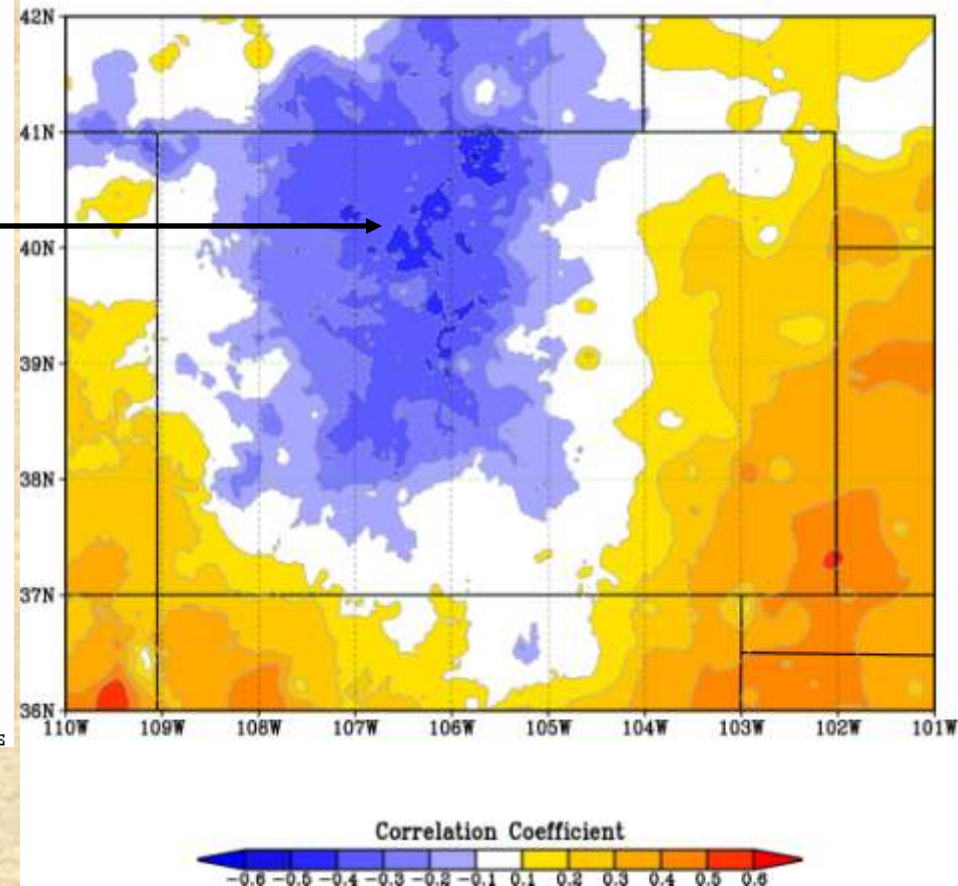
Percent of Normal Precipitation (%)
12/1/2008 – 2/28/2009



3/11/2009 at HPRCC using provisional data.

NOAA Regional Climate Centers

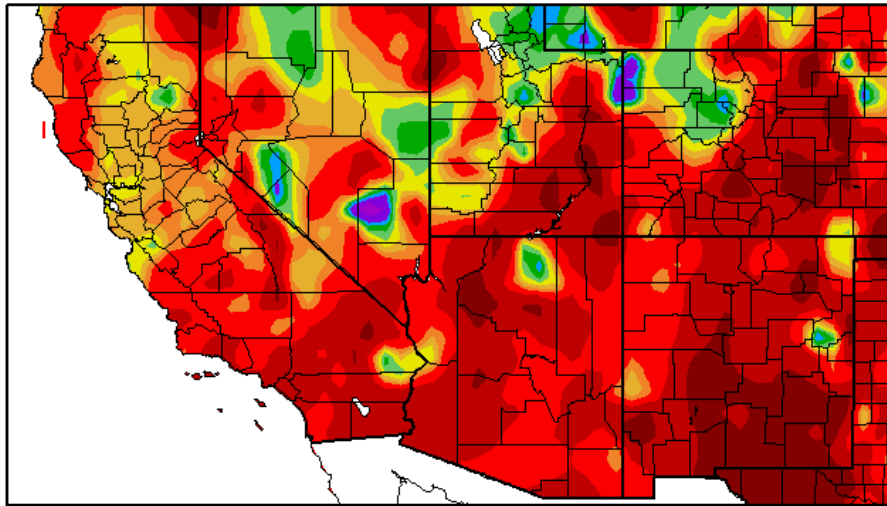
DJF Precipitation versus MEI (1956–2005)



This winter has brought snow amounts pretty close to La Niña-based expectations - above normal in most mountain locations, below normal on most of the eastern plains!

What has happened so far in 2009?

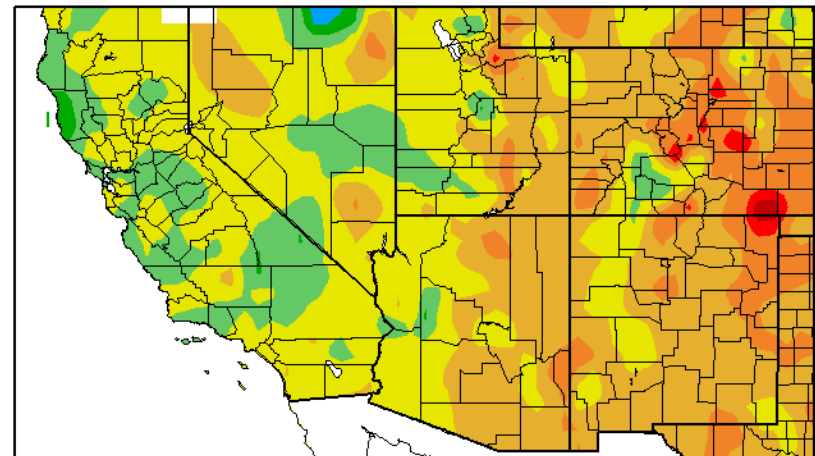
Percent of Normal Precipitation (%)
1/1/2009 – 3/18/2009



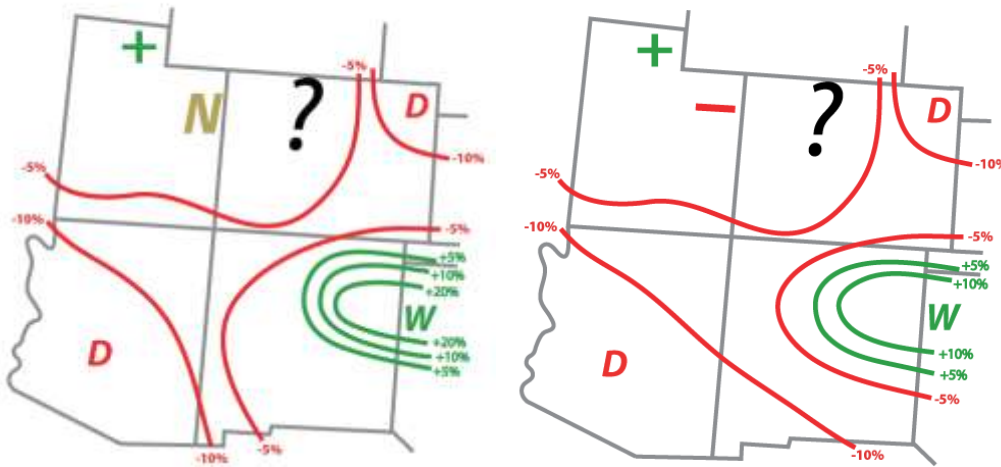
Generated 3/19/2009 at HPRCC using provisional data. NOAA Regional Climate Centers
EXPERIMENTAL PSD PRECIPITATION FORECAST GUIDANCE
JAN - MAR 2009 (issued December 17, 2008) JAN - MAR 2009 (issued January 26, 2009)

Our northern mountains (and northern Utah) have received decent moisture for the year so far (left), while the rest of CO, UT, AZ, and NM have been dry. Except for NM, this is fairly consistent with my forecasts (bottom left). *During the same period, it has not nearly been as cold (below) as last year, with frequent Chinooks to keep us 'warm' in the Front Range and wiping out our snowcover below ~9K.*

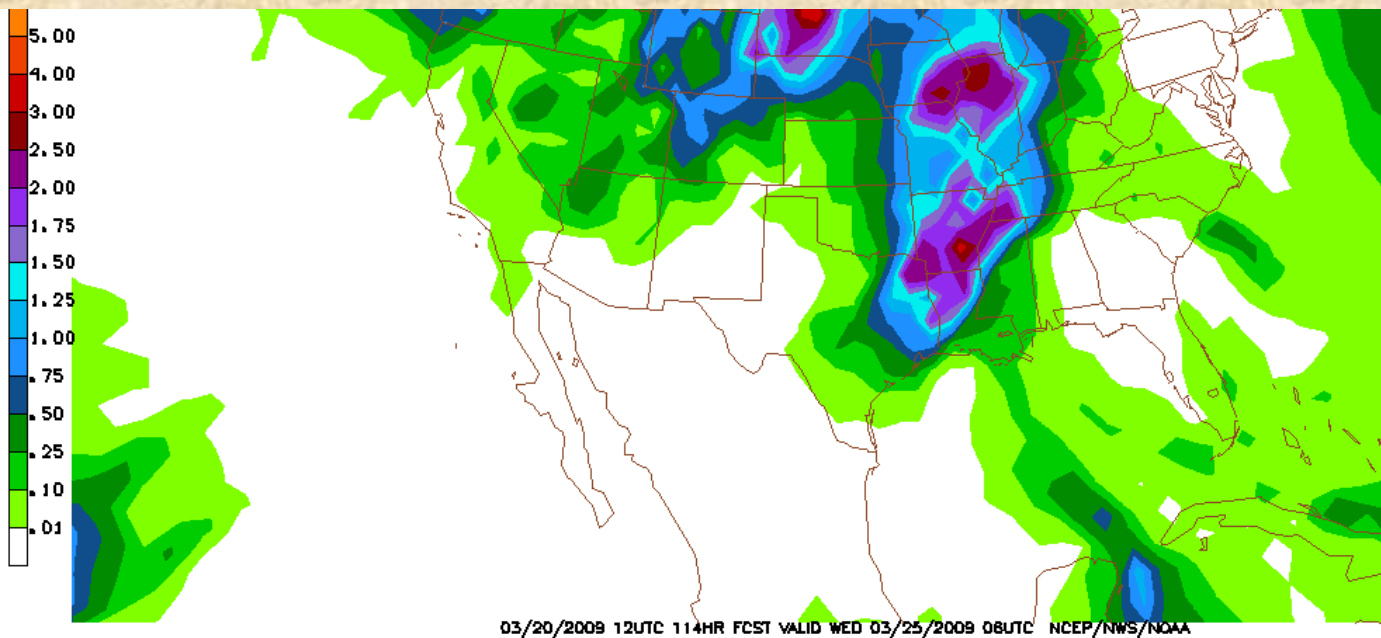
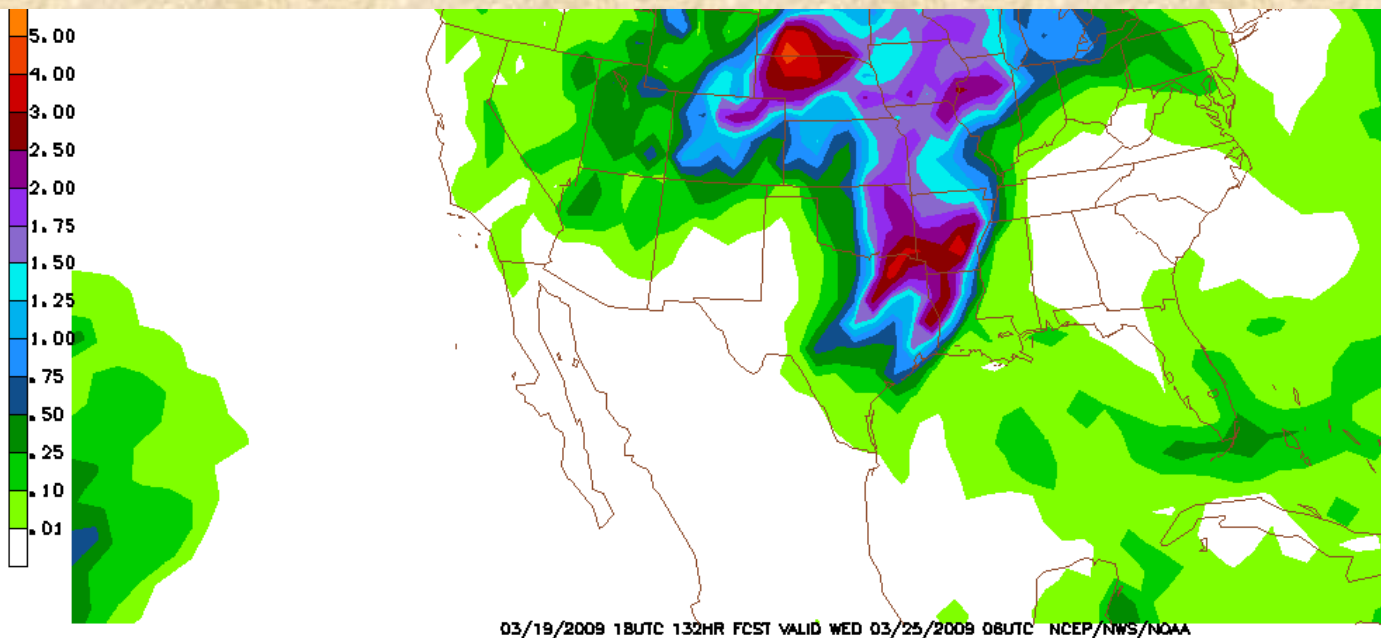
Departure from Normal Temperature (F)
1/1/2009 – 3/18/2009



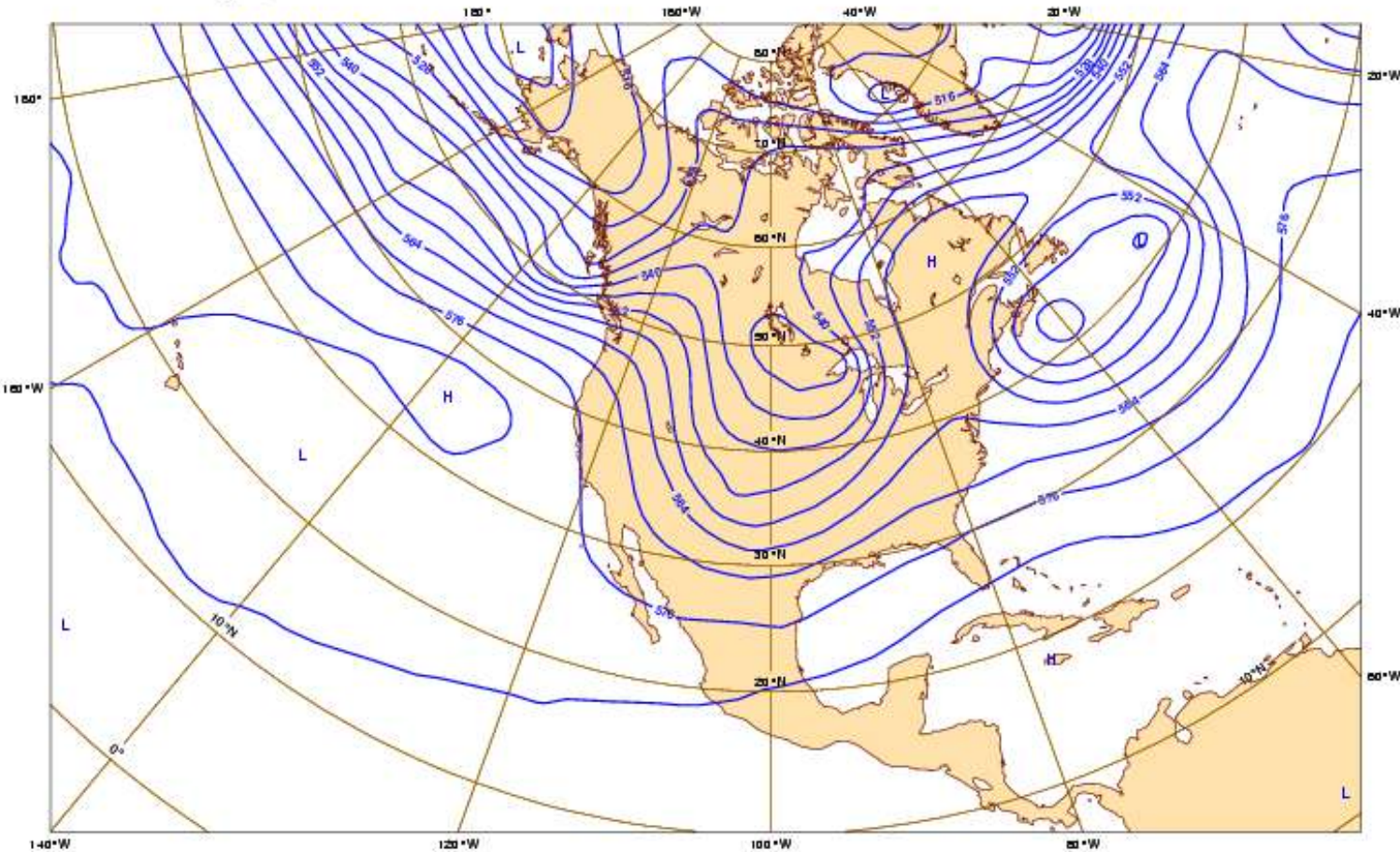
Generated 3/19/2009 at HPRCC using provisional data. NOAA Regional Climate Centers



What can we expect in the near-term?



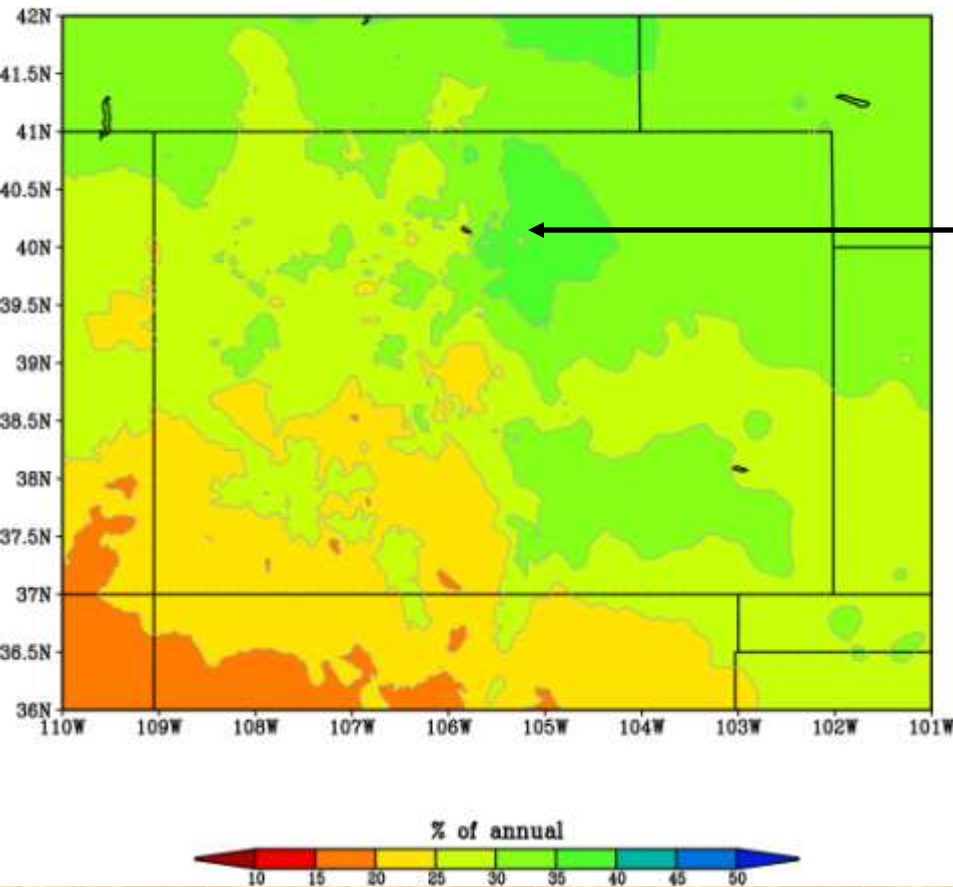
The next storm for Colorado should arrive early next week. Maps (left) show total precipitation thru Tuesday by one of the runs yesterday (top), and the latest run (bottom): there is a potential for a real 'dump' in northern Colorado, but today's forecasts are less gungho than yesterday's. The GFS model shown here is wetter for us than the NAM outcome.



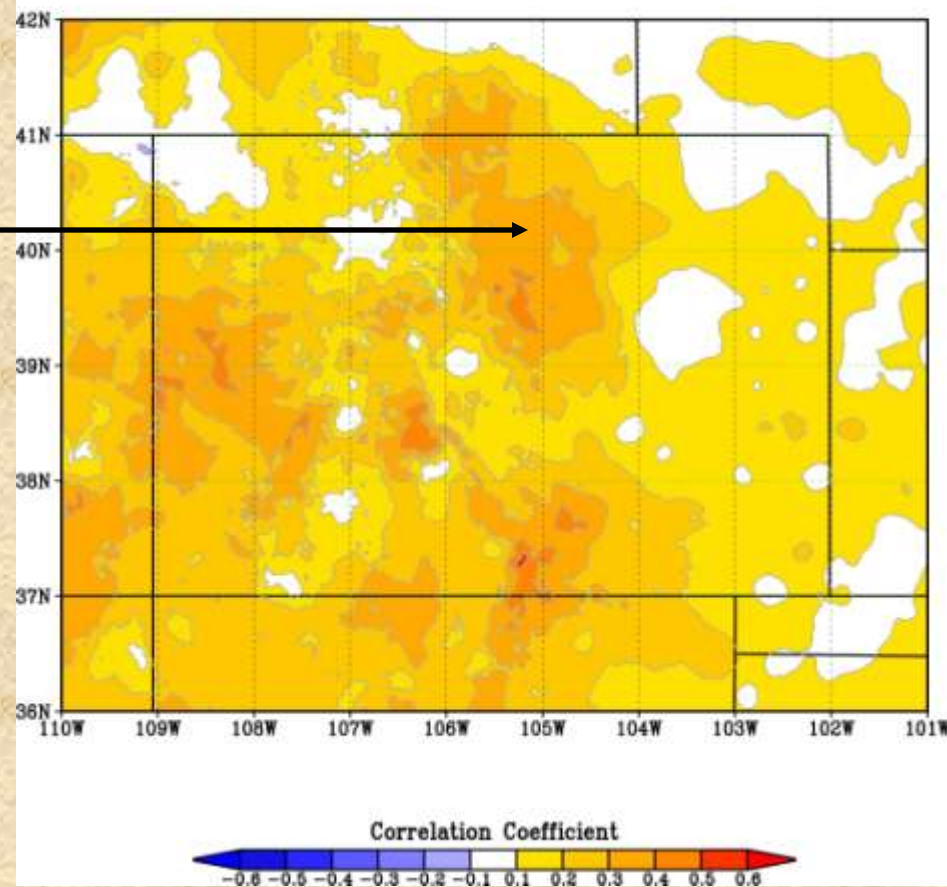
Next week's cool spell will be anchored by troughing aloft over the mid-continent, which should be good for occasional snow, but not enough to get us substantially above the long-term mean.

What are typical La Niña impacts in the spring?

MAM Climatological Precipitation



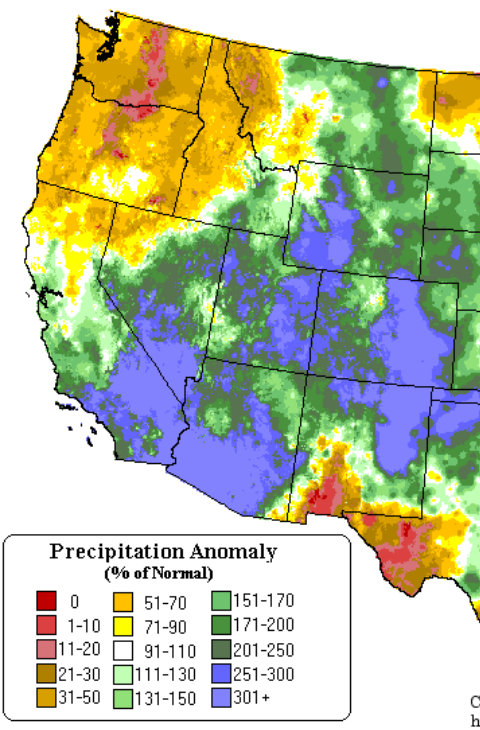
MAM Precipitation versus MEI (1956–2005)



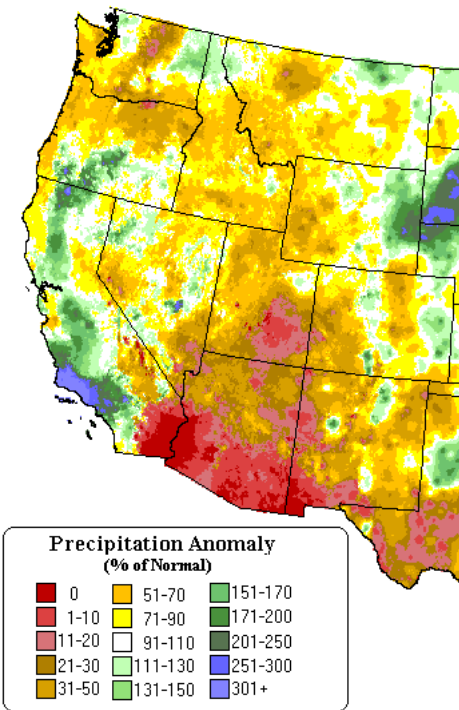
Northeast Colorado benefits the most from average spring seasons (left), but less so during La Niña conditions (positive correlations; right). Best case scenario: a switch from La Niña to El Niño early in year (such as 1957; 1997).

What are typical (weak) La Niña impacts in April?

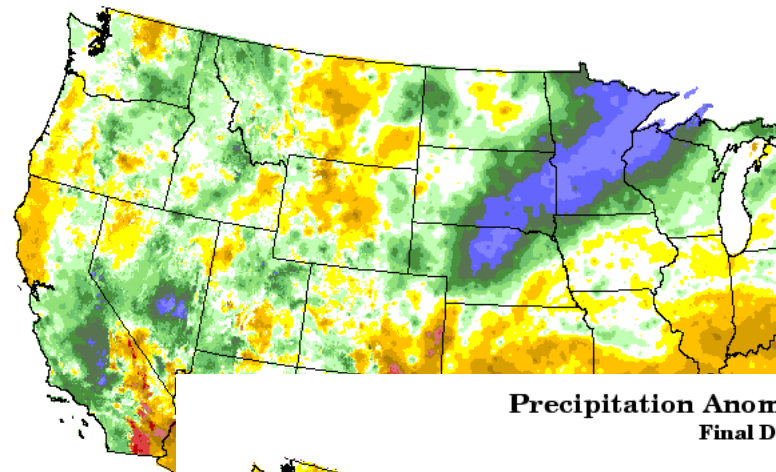
Precipitation Anomaly: Apr 1999



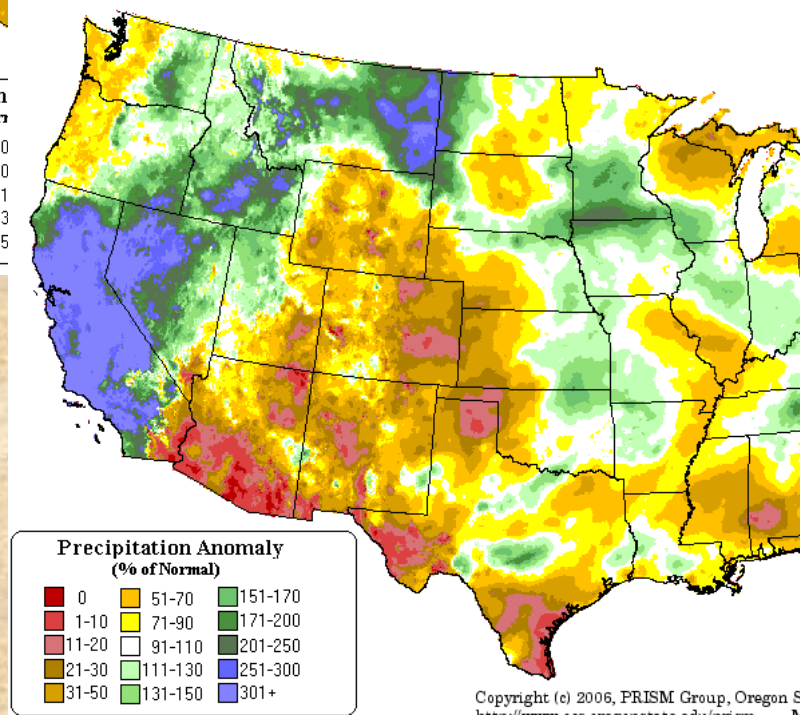
Precipitation Anomaly: Apr 2000



Precipitation Anomaly: Apr 2001
Final Data



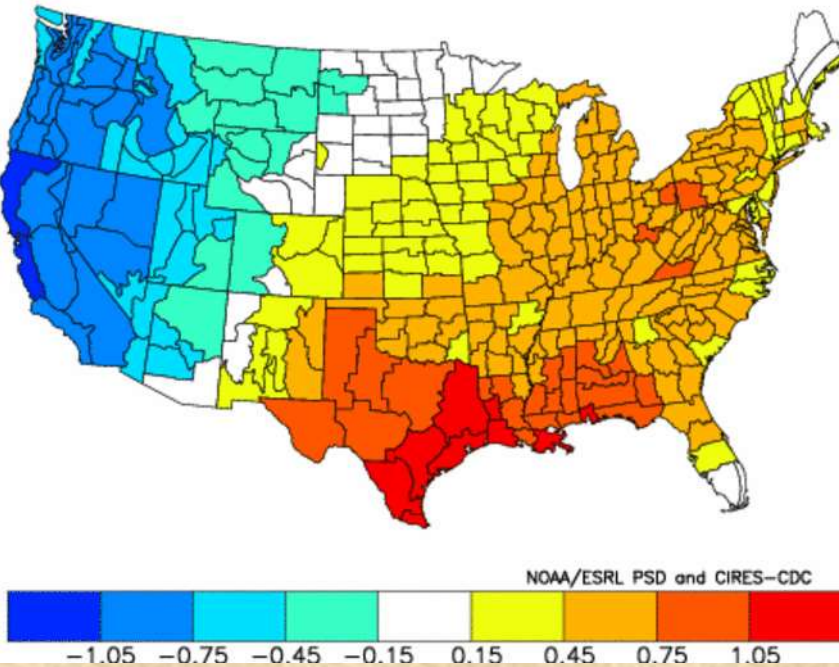
Precipitation Anomaly: Apr 2006
Final Data



Four April La Niña cases confirmed dry tendency for CO in this situation (1999, 2000, '01, and '06). The first case, April '99 was by far the wettest of the four everywhere, but also the strongest La Niña, while April '00 and '06 were particularly dry.

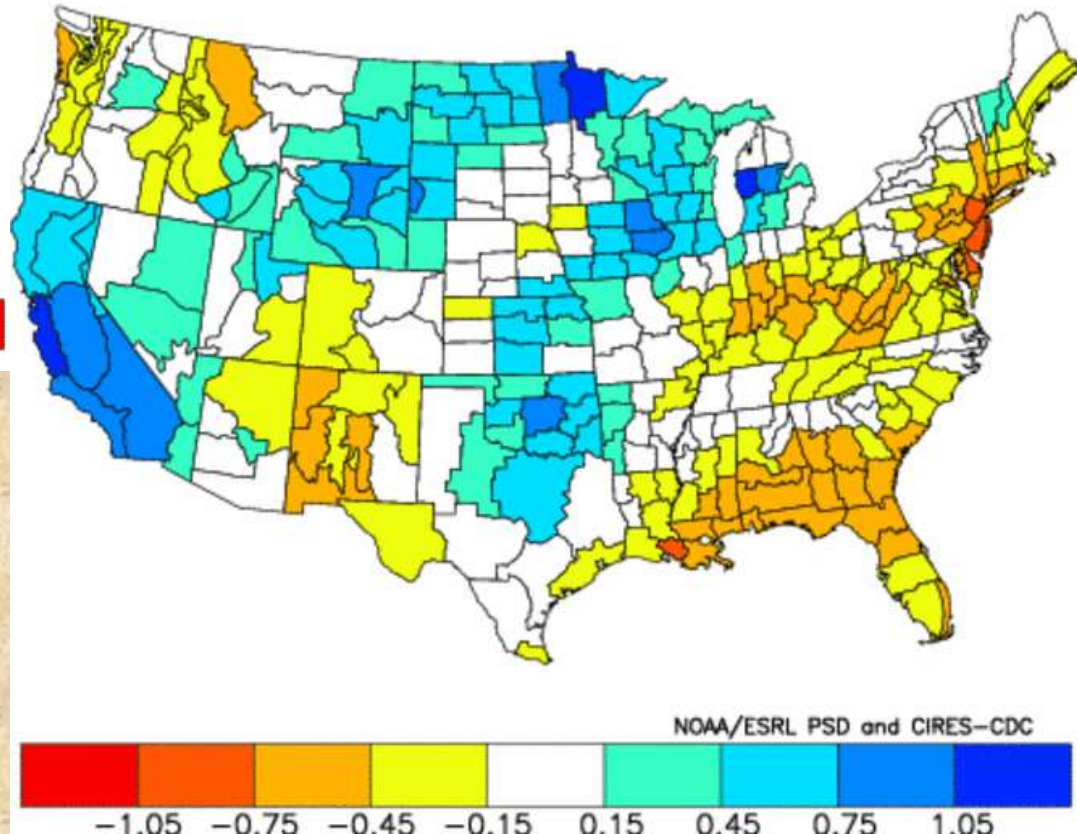
What are typical temp&precip patterns in April after La Niña (going towards ENSO-Neutral during negative PDO?)

Composite Standardized Temperature Anomalies
Apr 1963,1967,1974,1976,1999,2000,2008
Versus 1971–2000 Longterm Average



Significant temperature anomalies (left) over western U.S. (west of UT) for cold, and Gulf Coast (TX to AL) for warmth.

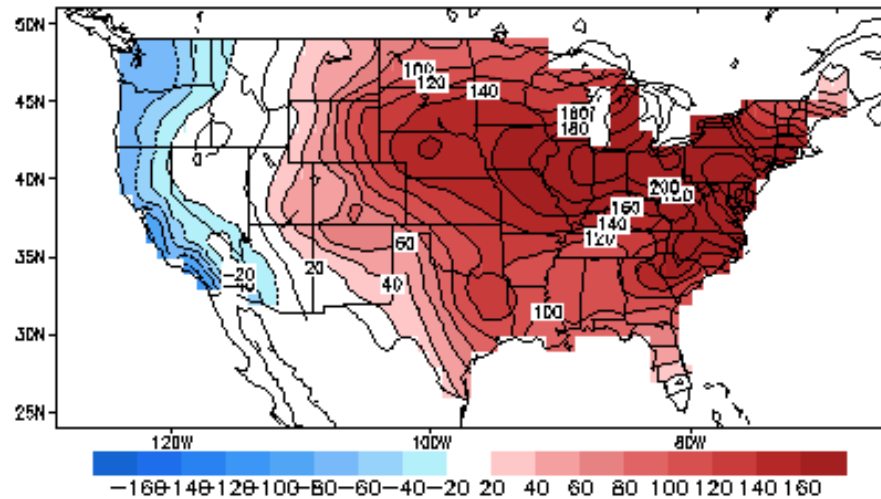
Composite Standardized Precipitation Anomalies
Apr 1963,1967,1974,1976,1999,2000,2008
Versus 1971–2000 Longterm Average



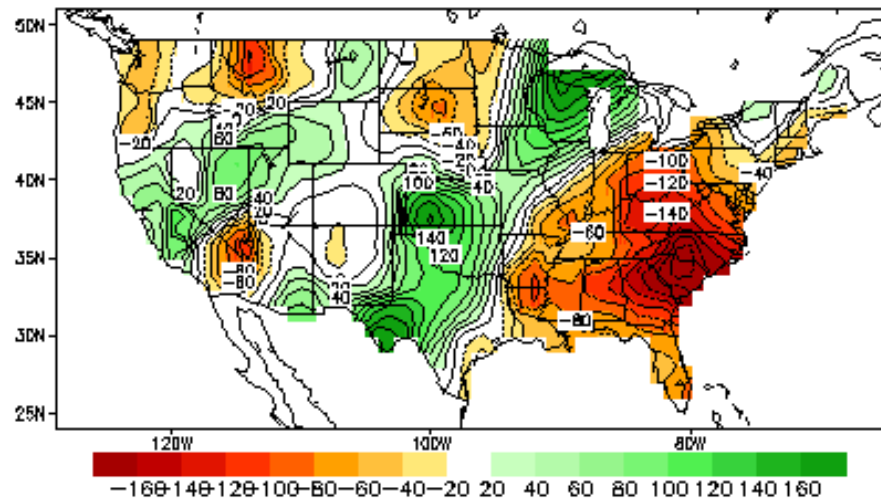
Significant precipitation anomalies (right) over CA, WY, Upper Midwest, and parts of OK for wetness, while significant dry anomalies stick to just a few climate divisions (~New Orleans & MD). Colorado has not shown a clear tendency one way or the other in this situation.

What about 'Constructed Analog' Forecasts?

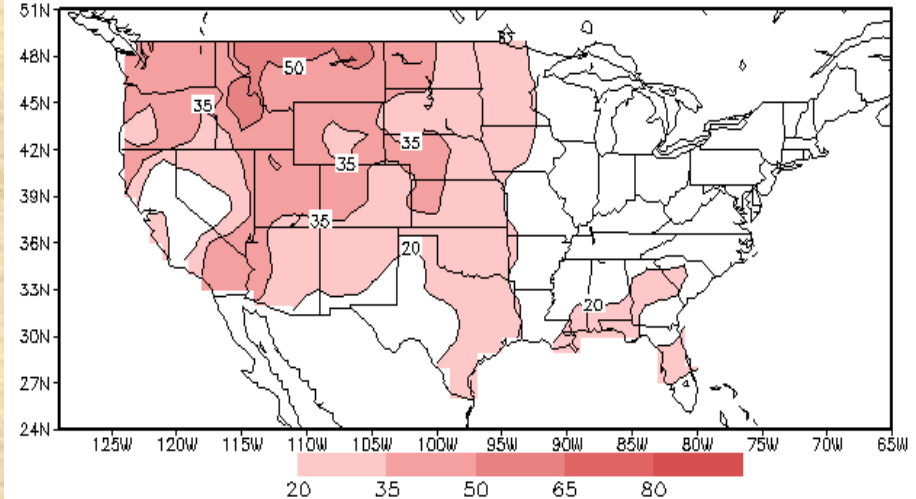
Lagged Averaged Temperature Outlook for APR 2009
units: anomaly (sdX100), SM data ending at 20090318



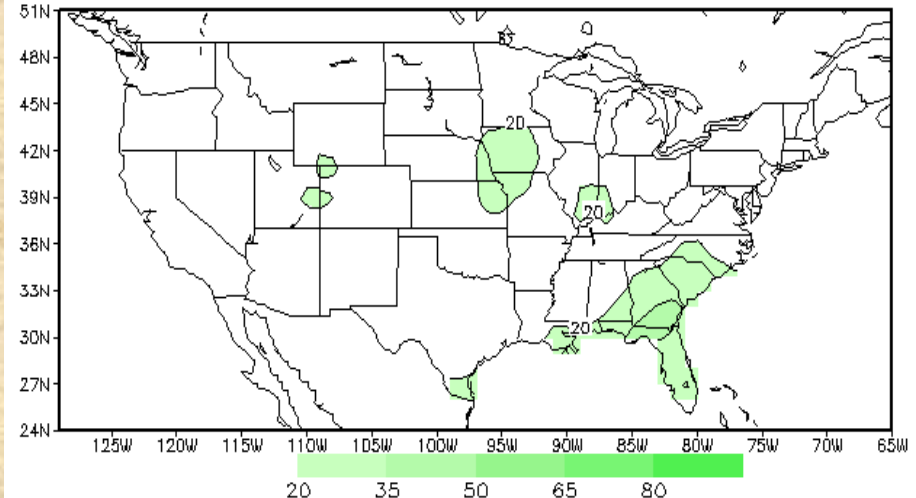
Lagged Averaged Precipitation Outlook for APR 2009
units: anomaly (sdX100), SM data ending at 20090318



lead 1 skill of temperature CAS forecast for Apr
units: correlation (X100) based on 1981-2005



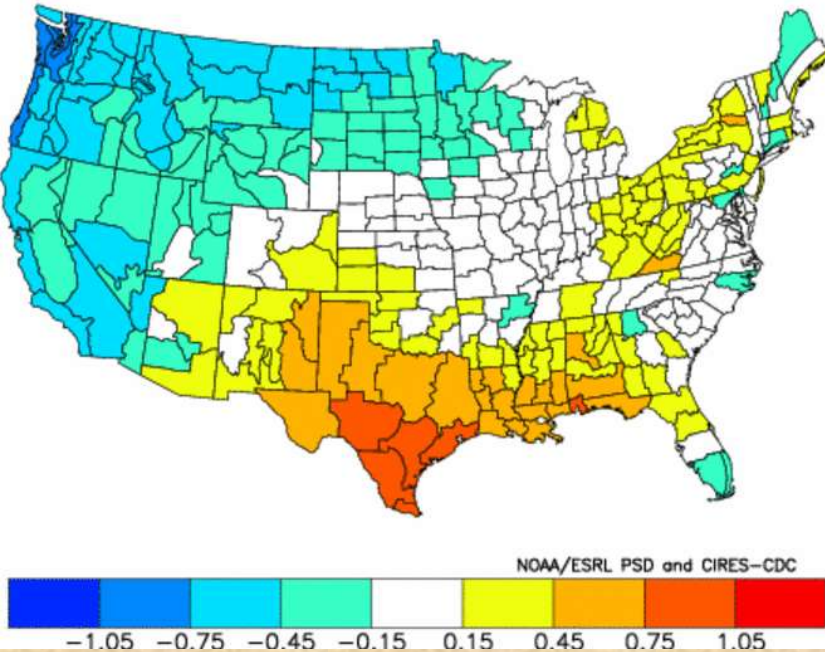
lead 1 skill of precipitation CAS forecast for Apr
units: correlation (X100) based on 1981-2005



April forecasts near 4corners have shown only little skill, while the warm outlook is supported over CO!

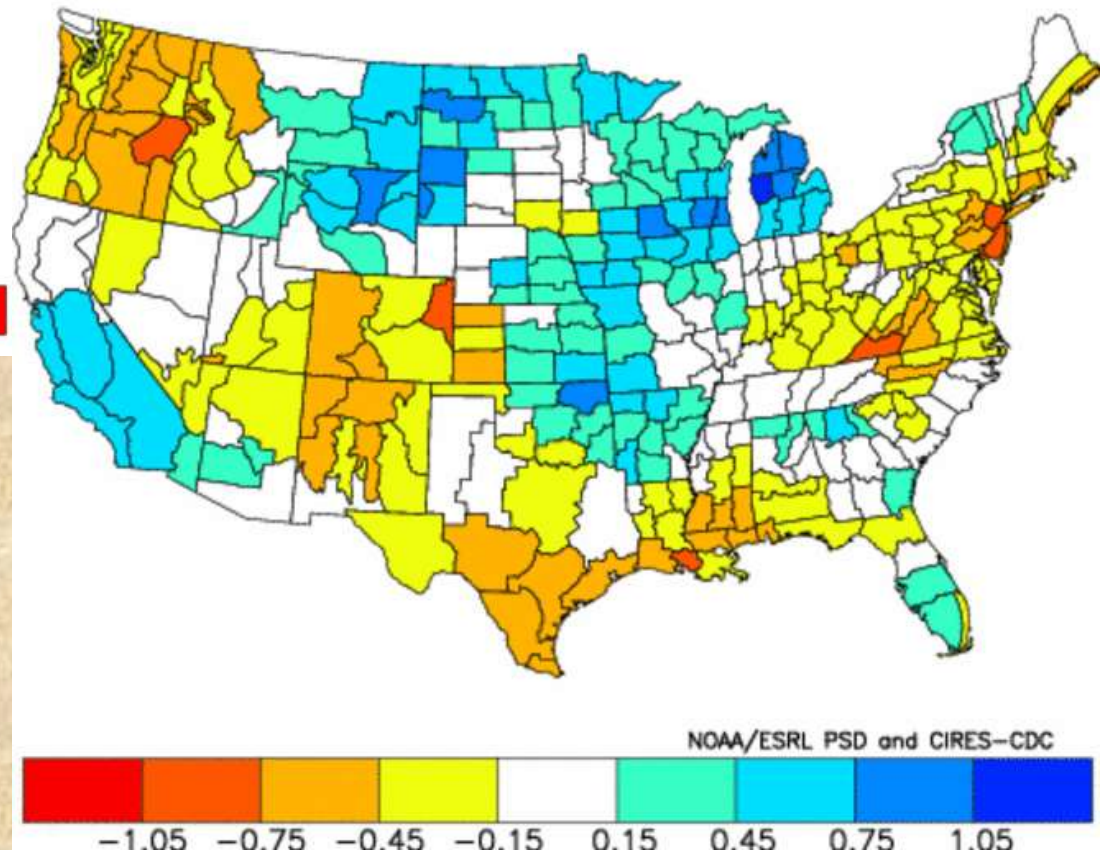
What are typical temp&precip patterns in AMJ after La Niña (going towards ENSO-Neutral during negative PDO?)

Composite Standardized Temperature Anomalies
Apr to Jun 1963,1967,1974,1976,1999,2000,2008
Versus 1971–2000 Longterm Average



Significant temperature anomalies (left) over coastal PNW for cold, and Texas for warmth.

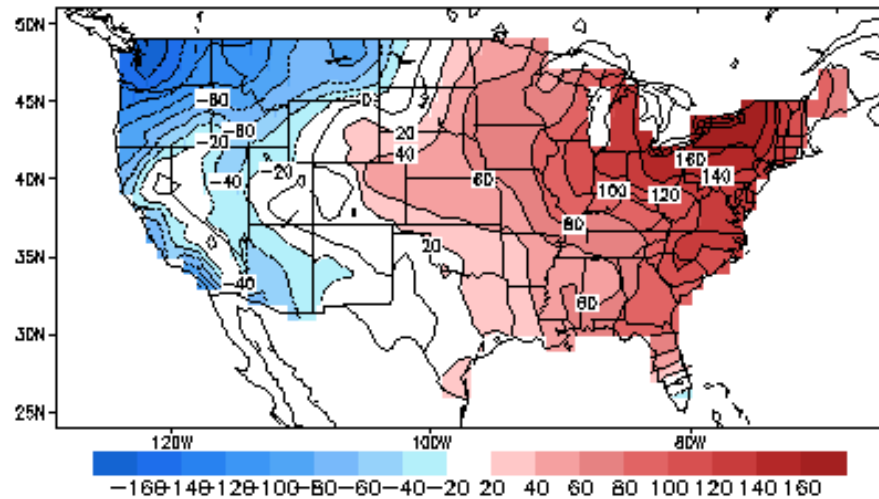
Composite Standardized Precipitation Anomalies
Apr to Jun 1963,1967,1974,1976,1999,2000,2008
Versus 1971–2000 Longterm Average



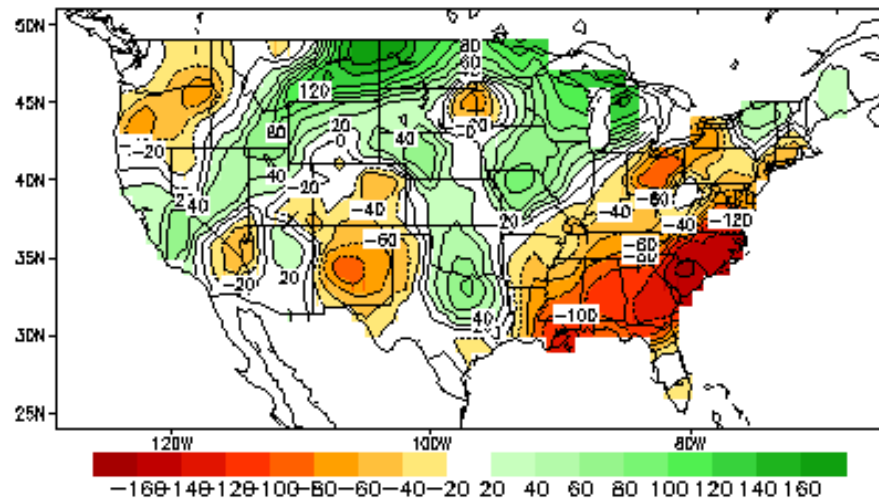
Significant precipitation anomalies (right) over WY, Upper Midwest, and parts of OK for wetness, while significant dry anomalies stick to just a few climate divisions (unfortunately including easternmost Colorado, part of an overall dry composite for our state).

What about 'Constructed Analog' Forecasts?

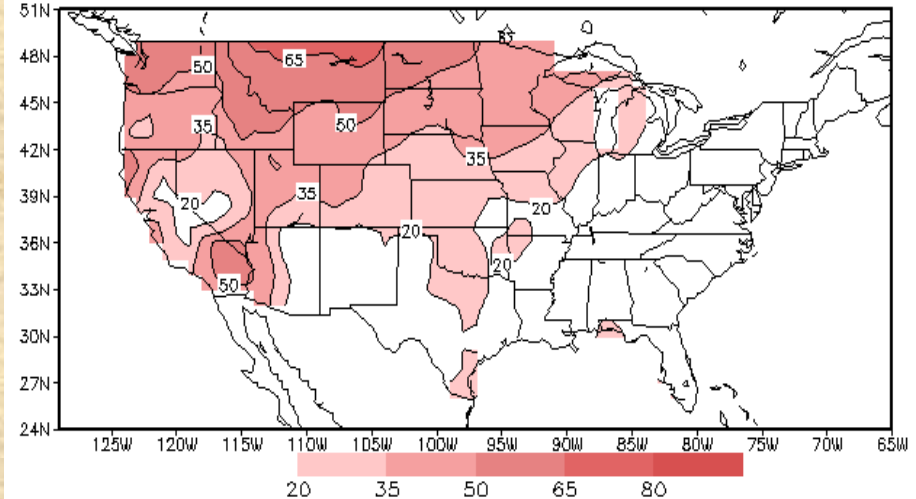
Lagged Averaged Temperature Outlook for AMJ 2009
units: anomaly (sdX100), SM data ending at 20090318



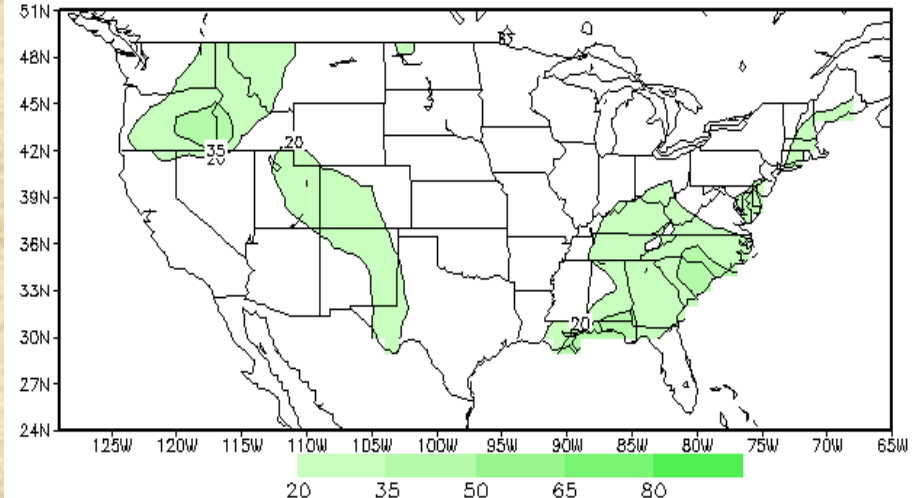
Lagged Averaged Precipitation Outlook for AMJ 2009
units: anomaly (sdX100), SM data ending at 20090318



lead 1 skill of temperature CAS forecast for AMJ
units: correlation (X100) based on 1981-2005



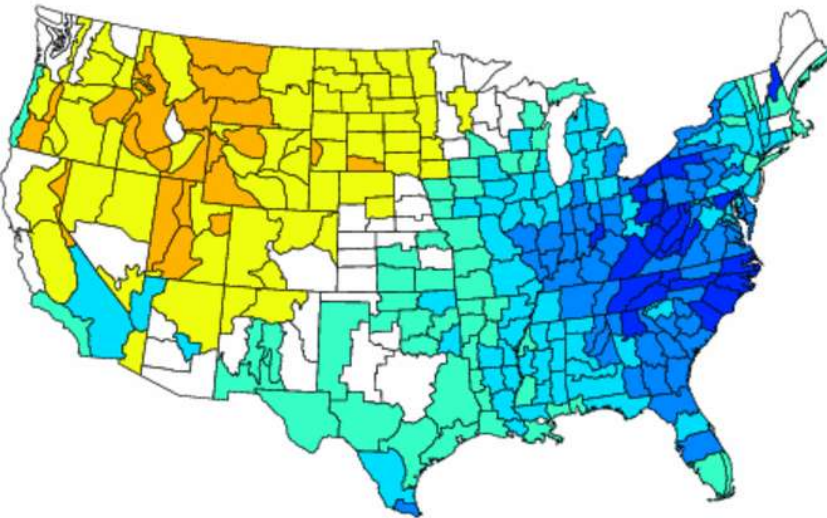
lead 1 skill of precipitation CAS forecast for AMJ
units: correlation (X100) based on 1981-2005



Dry April-June forecasts in CO&NM have skill! Note similarity with my composites!

What are typical temp&precip patterns in JAS after La Niña (going towards ENSO-Neutral during negative PDO?)

Composite Standardized Temperature Anomalies
Jul to Sep 1963,1967,1974,1976,1999,2000,2008
Versus 1971–2000 Longterm Average

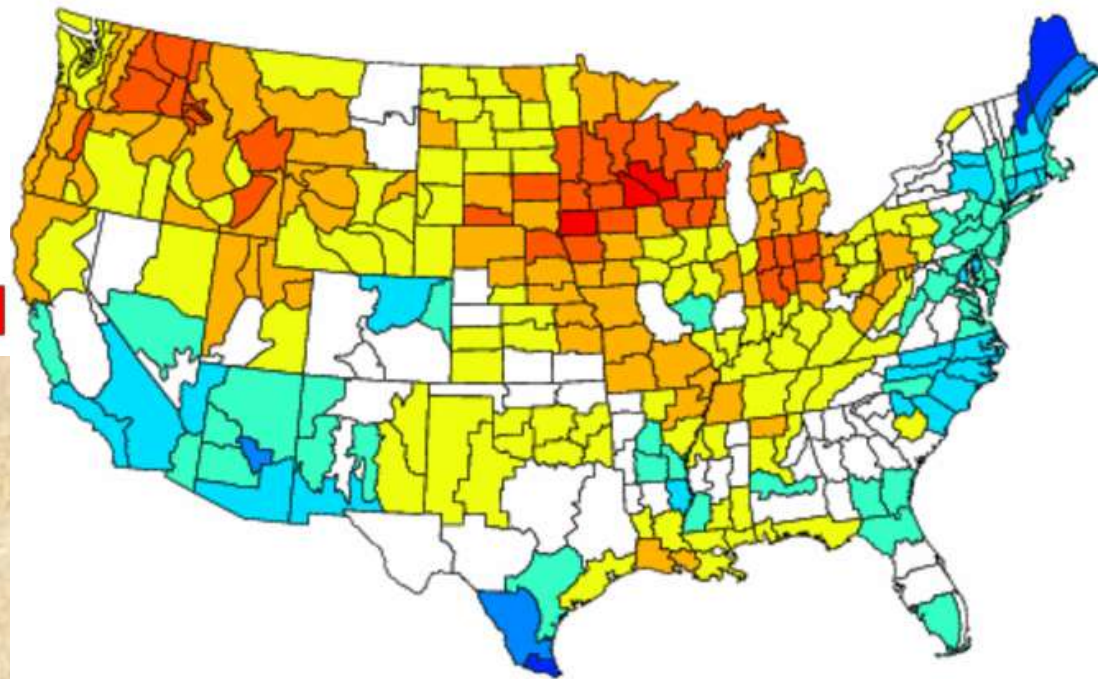


NOAA/ESRL PSD and CIRES-CDC

-1.05 -0.75 -0.45 -0.15 0.15 0.45 0.75 1.05

Significant temperature anomalies (left) over much of eastern states for cold, and nothing for warmth.

Composite Standardized Precipitation Anomalies
Jul to Sep 1963,1967,1974,1976,1999,2000,2008
Versus 1971–2000 Longterm Average

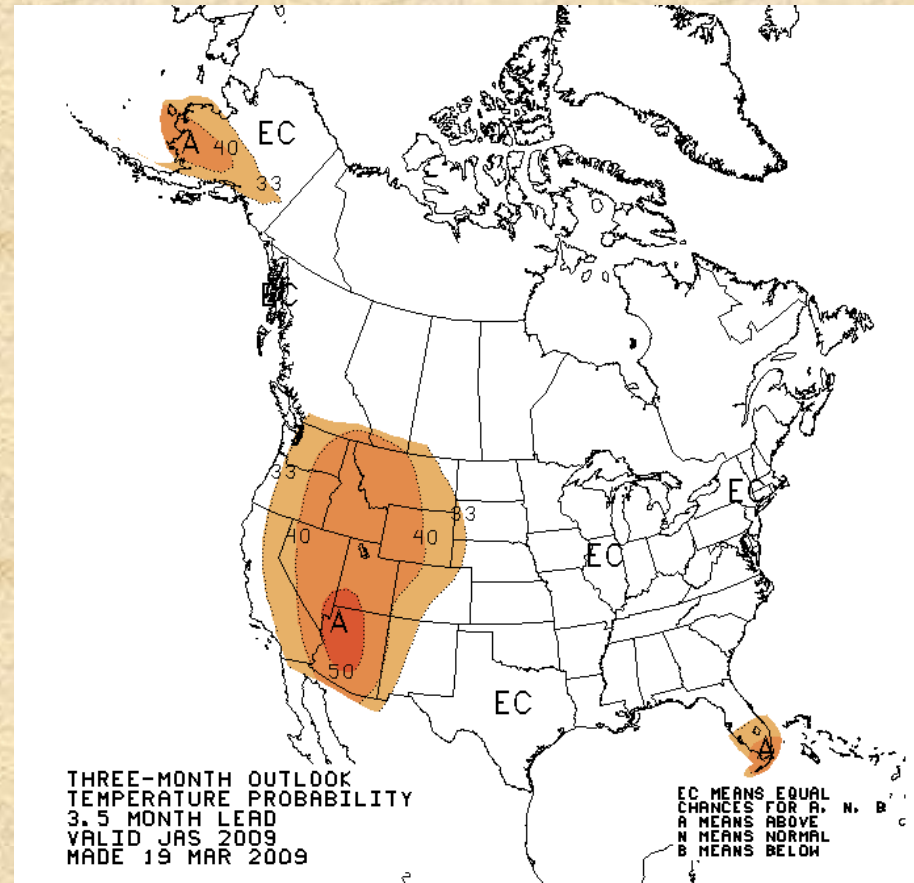
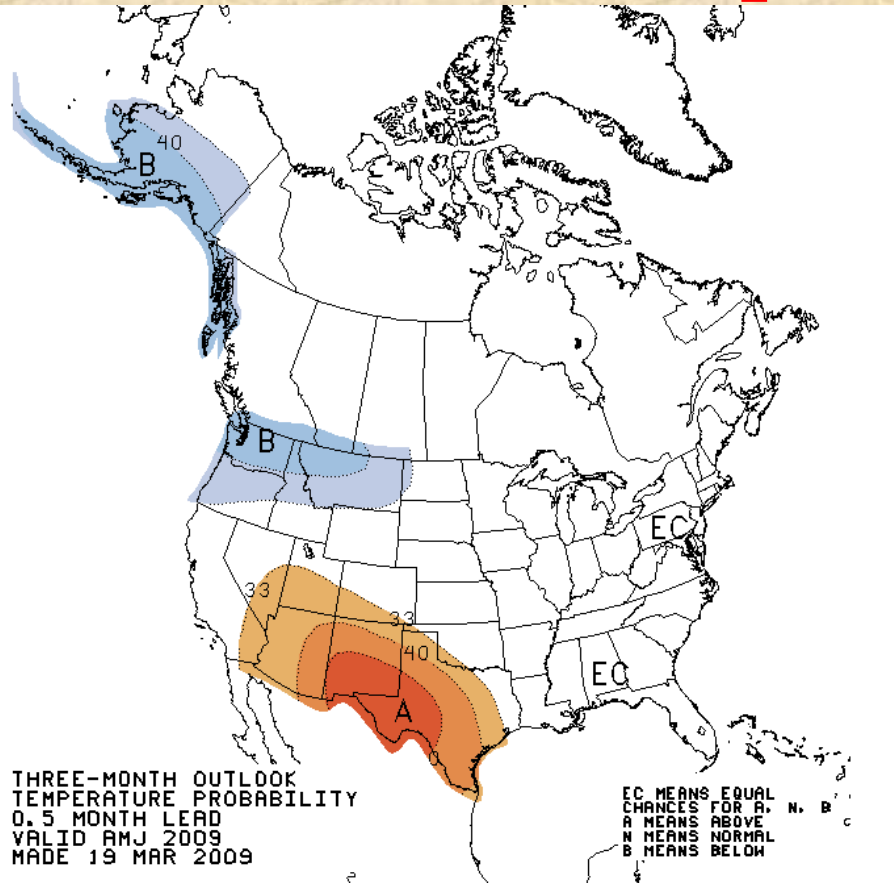


NOAA/ESRL PSD and CIRES-CDC

-1.05 -0.75 -0.45 -0.15 0.15 0.45 0.75 1.05

Significant precipitation anomalies (right) over southcentral AZ, southern TX, and ME for wetness, while significant dry anomalies are found from PNW and Upper Midwest. Colorado's odds are close to even, with a moderate preference for a wet late summer in the South Platte basin.

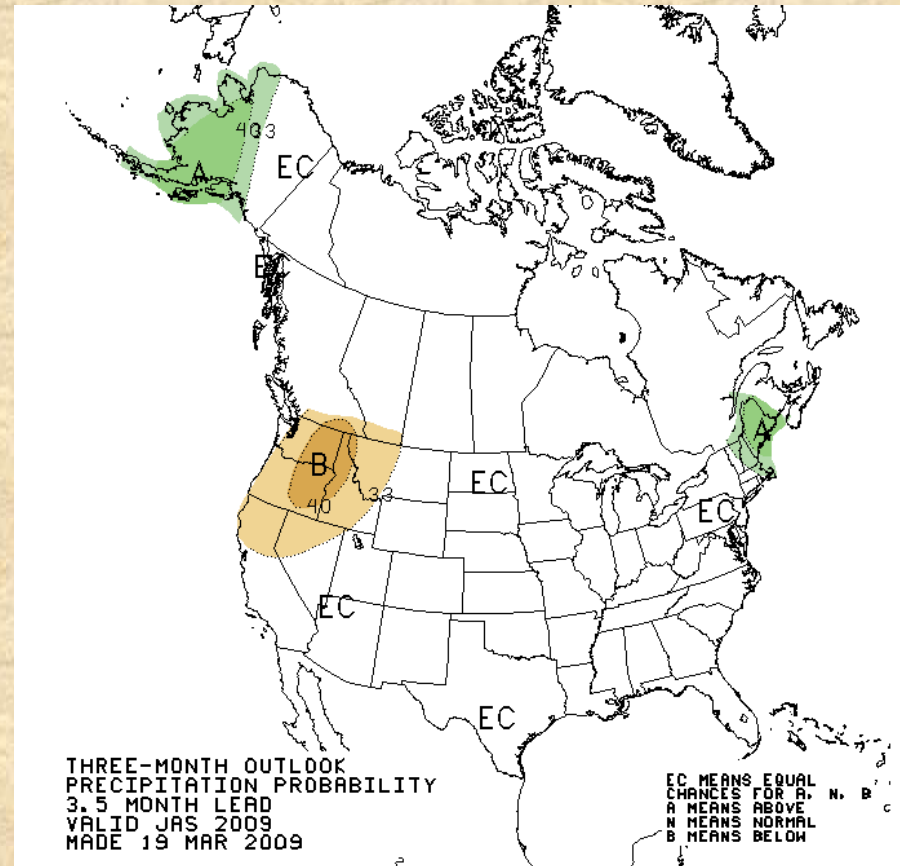
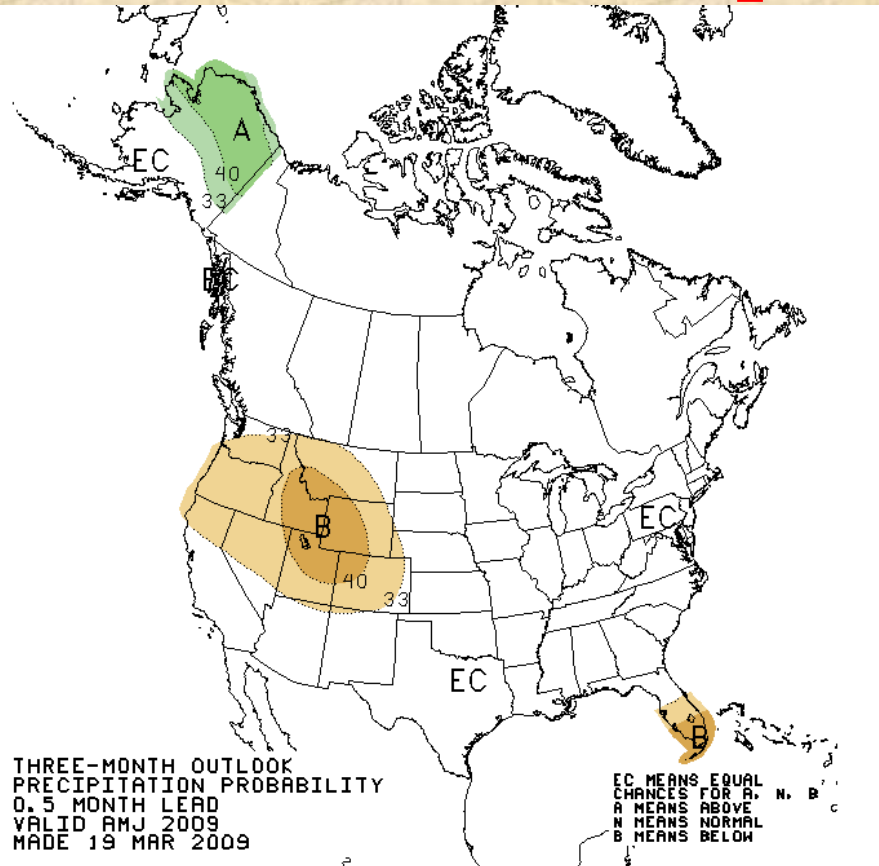
CPC Temperature Forecasts



According to CPC's latest official forecasts from March, April-June (left) and July-September (right) temperature forecasts anticipate warmer-than-average conditions in parts of Colorado, consistent with the long-term trend and lingering La Niña influences in the first season. The summer outlook matches my composites for that season.

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

CPC Precipitation Forecasts



According to CPC's latest official forecasts from March, April-June (left) and July-September (right) precipitation forecasts start out on the dry side for us (mostly due to La Niña), and end up 'EC' (equal chances) in the summer (no clear-cut signal).

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

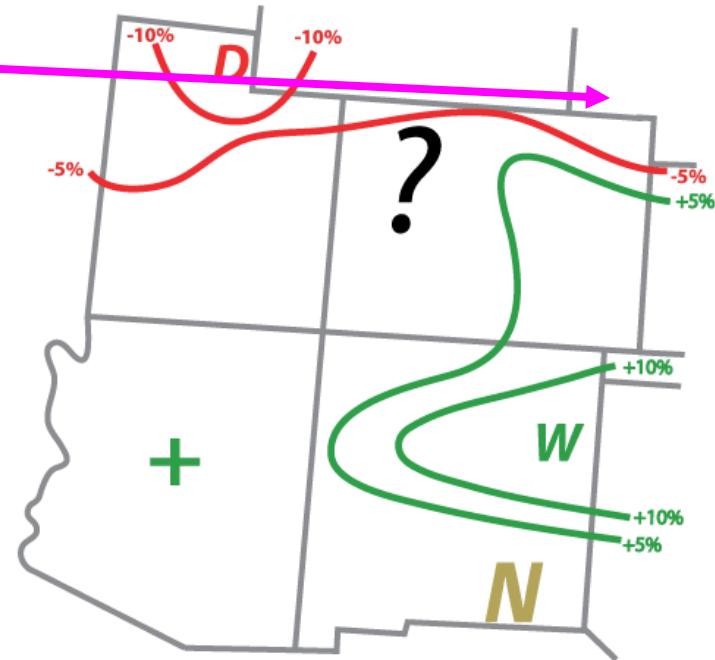
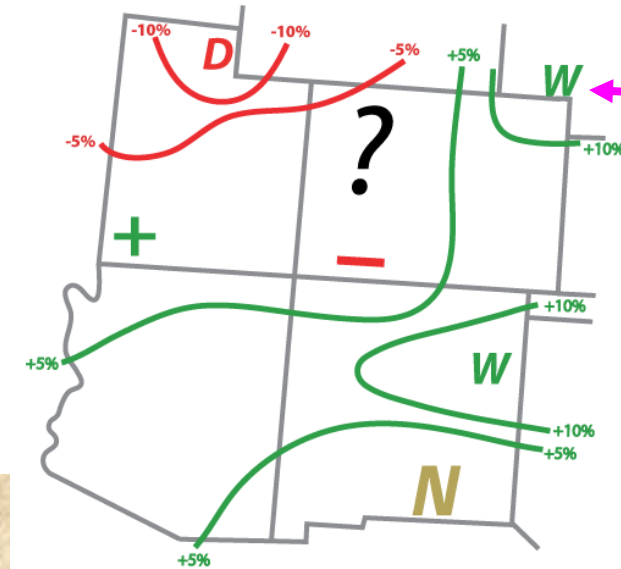
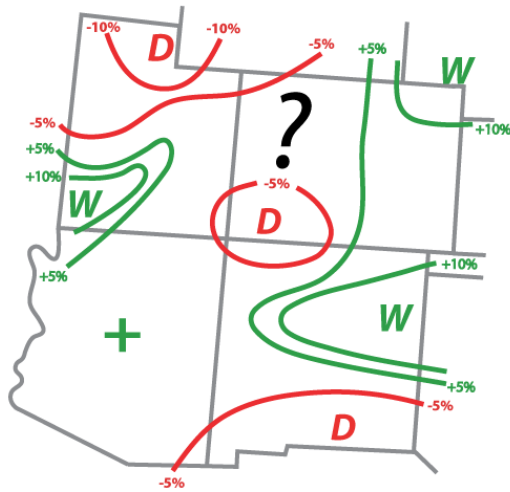
Experimental CDC “Forecast Guidance”

EXPERIMENTAL PSD PRECIPITATION FORECAST GUIDANCE EXPERIMENTAL PSD PRECIPITATION FORECAST GUIDANCE EXPERIMENTAL PSD PRECIPITATION FORECAST GUIDANCE

APR - JUN 2009 (issued January 21, 2009)

APR - JUN 2009 (issued February 13, 2009)

APR - JUN 2009 (issued March 10, 2009)



My late spring forecasts issued this year (most recent one on right) are fairly consistent with each other, anticipating a wet spring over much of Colorado's eastern plains, an undecided outcome west of the divide, and a dry spring to the north (big drop in tilt since last month over NE CO). *Unfortunately, skill levels for both maps are lowest over wet regions/highest for the dry regions, which are also most consistent with lingering La Niña. The only "wet" forecast supported by at least some skill in the last decade is the one for our eastern plains.*

Source: <http://www.cdc.noaa.gov/people/klaus.wolter/SWcasts/>

Executive Summary (lite)

1. During December 2008, weak-to-moderate La Niña conditions returned and influenced our weather right thru the winter. Continued but weakening La Niña conditions are currently anticipated for the next few months. Beyond the middle of 2009, there is very large uncertainty as to whether La Niña continues or whether we see a switch to El Niño.
2. Winter has brought above-normal moisture to the mountains of the interior southwestern U.S., raising our snowpack above the long-term average from late December through mid-March. However, this active stormtrack 'lost steam' over the last few weeks. Nevertheless, the next two weeks promise a return to somewhat cooler and wetter weather going into April, giving us at least a chance of still reaching near-normal peak snowpack values.
3. My experimental forecast guidance for the late spring season (April-June 2009) reflects both lingering La Niña impacts (a dry forecast from northern Utah into northern Colorado), as well as the possibility of a return to near-normal ENSO conditions which would allow for a wetter-than-average season from Arizona to northeastern New Mexico and northward into southeastern Colorado. Unfortunately, most of the wetter-than-average forecasts are not backed by good verification skill in the last decade, while the drier-than-average forecasts have indeed been more reliable for the regions thus labeled.
4. Bottomline: La Niña has returned for an encore performance, consistent with its proven tendency to last longer than one year. While this has helped our mountains with above-average moisture during the winter months, spring looks less favorable. Nevertheless, even La Niña springs allow for occasional wet spells, in particular during April, while the season as a whole is more likely to end up on the dry side for much of the southwestern U.S.

Source: <http://www.cdc.noaa.gov/people/klaus.wolter/SWcasts/>