

El Nino and the Upper Yellowstone River Basin

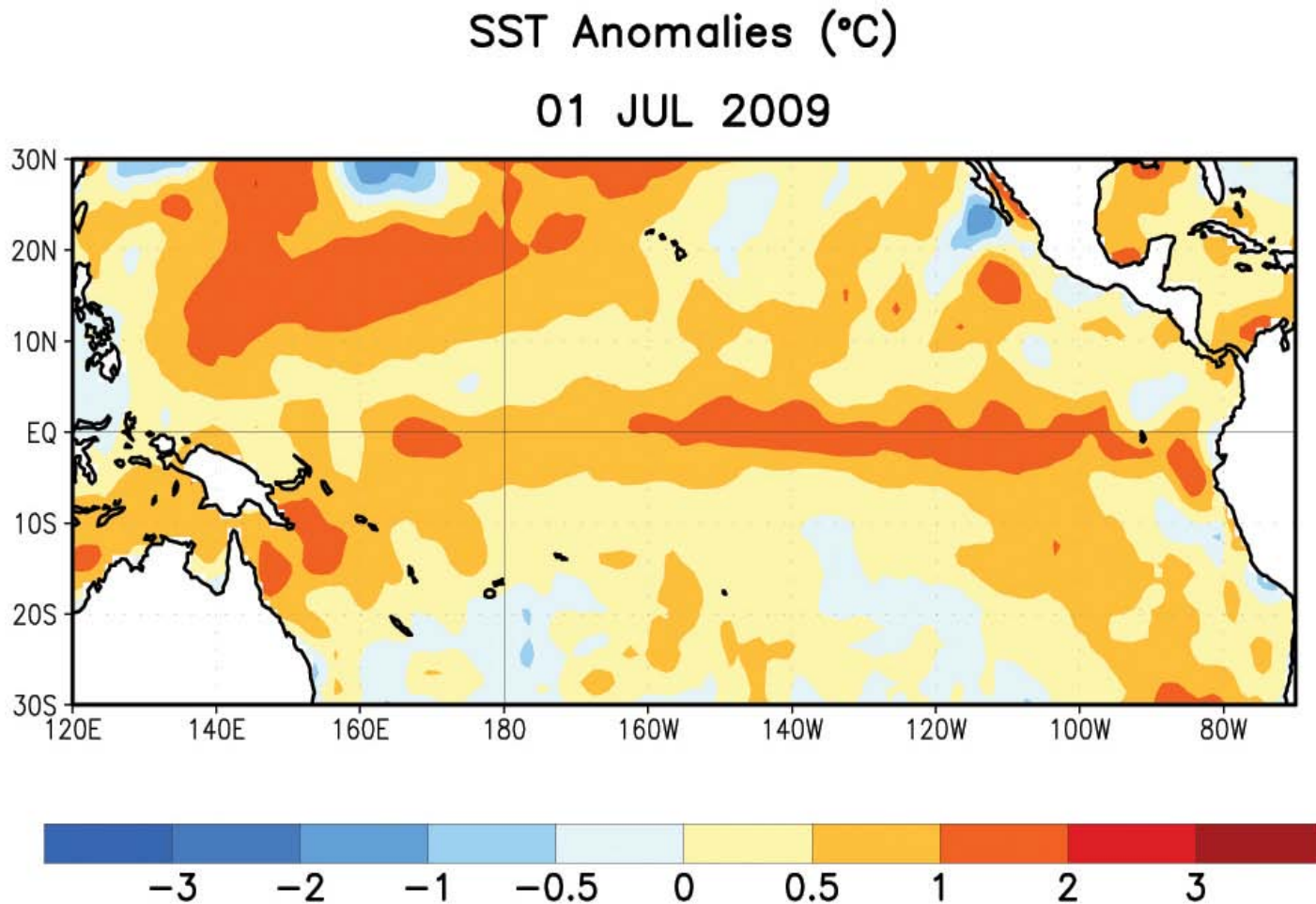
Jesse Aber, M.Sc.

Governor's Drought Advisory
Committee

DNRC Water Resources

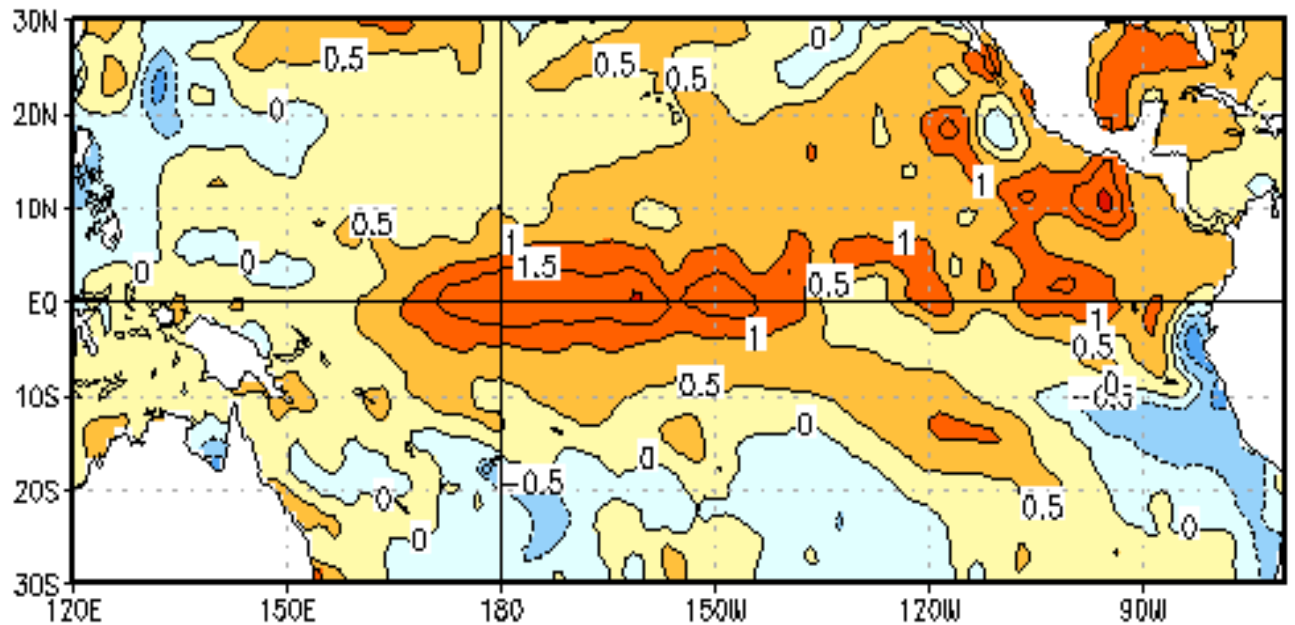
**NOAA's Climate Prediction Center
defines El Nino (La Nina) as a 1-
month or more positive (negative)
sea surface temperature anomaly of
0.5C or greater is observed in the
Niño-3.4 region of the equatorial
Pacific Ocean
(5°N-5°S Lat., 120°W-170°W Lon.)**

Warm Equatorial waters propagate to the east from the West Pacific



Sea Surface Anomaly Strengthens Along Equator in Oct-Nov 1.5C

Average SST Anomalies
4 OCT 2009 – 31 OCT 2009

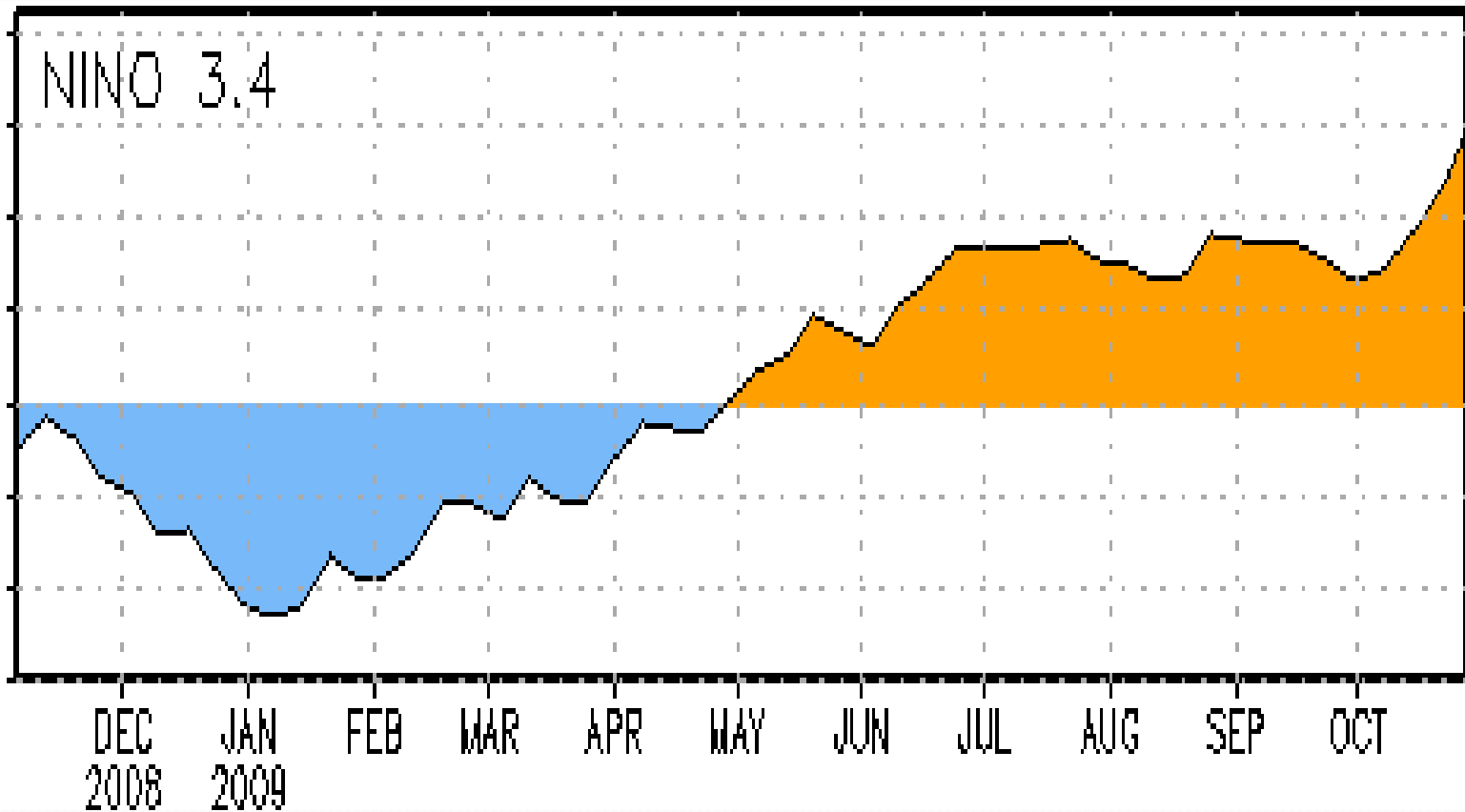


**During the last four weeks,
(10/14 – 11/4) equatorial positive SST
anomalies strengthened across the
central and eastern Pacific Ocean –**

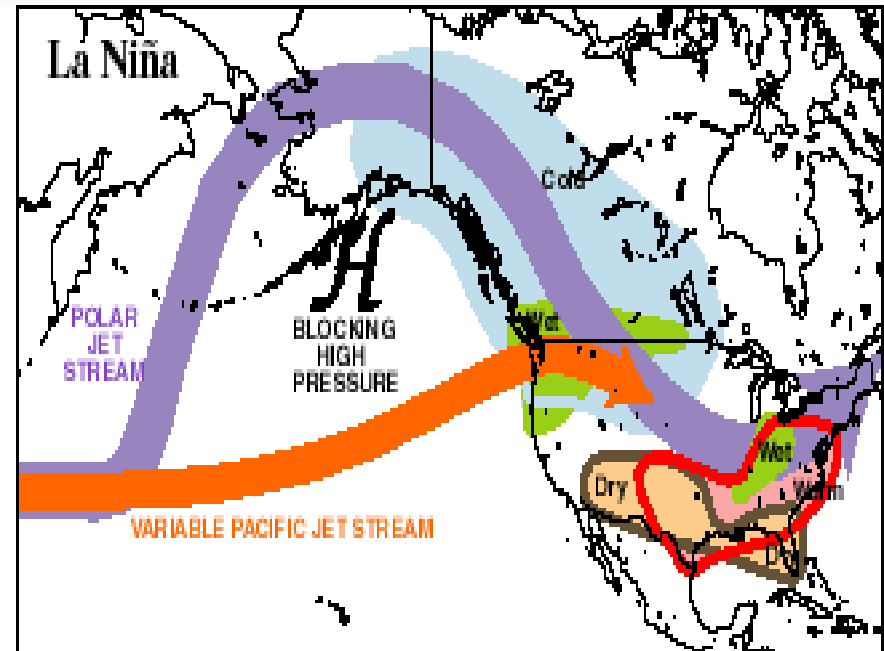
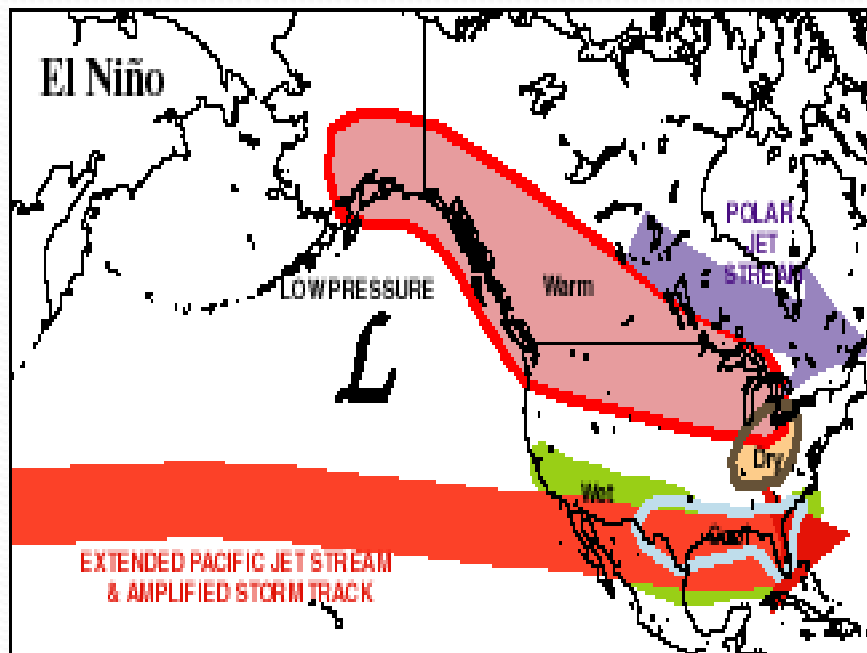
Why?

**Significant weakening of the low-level
easterly winds usually initiates
eastward-propagating oceanic Kelvin
wave(s). – CPC, 11/5**

La Nina fades, El Nino begins May

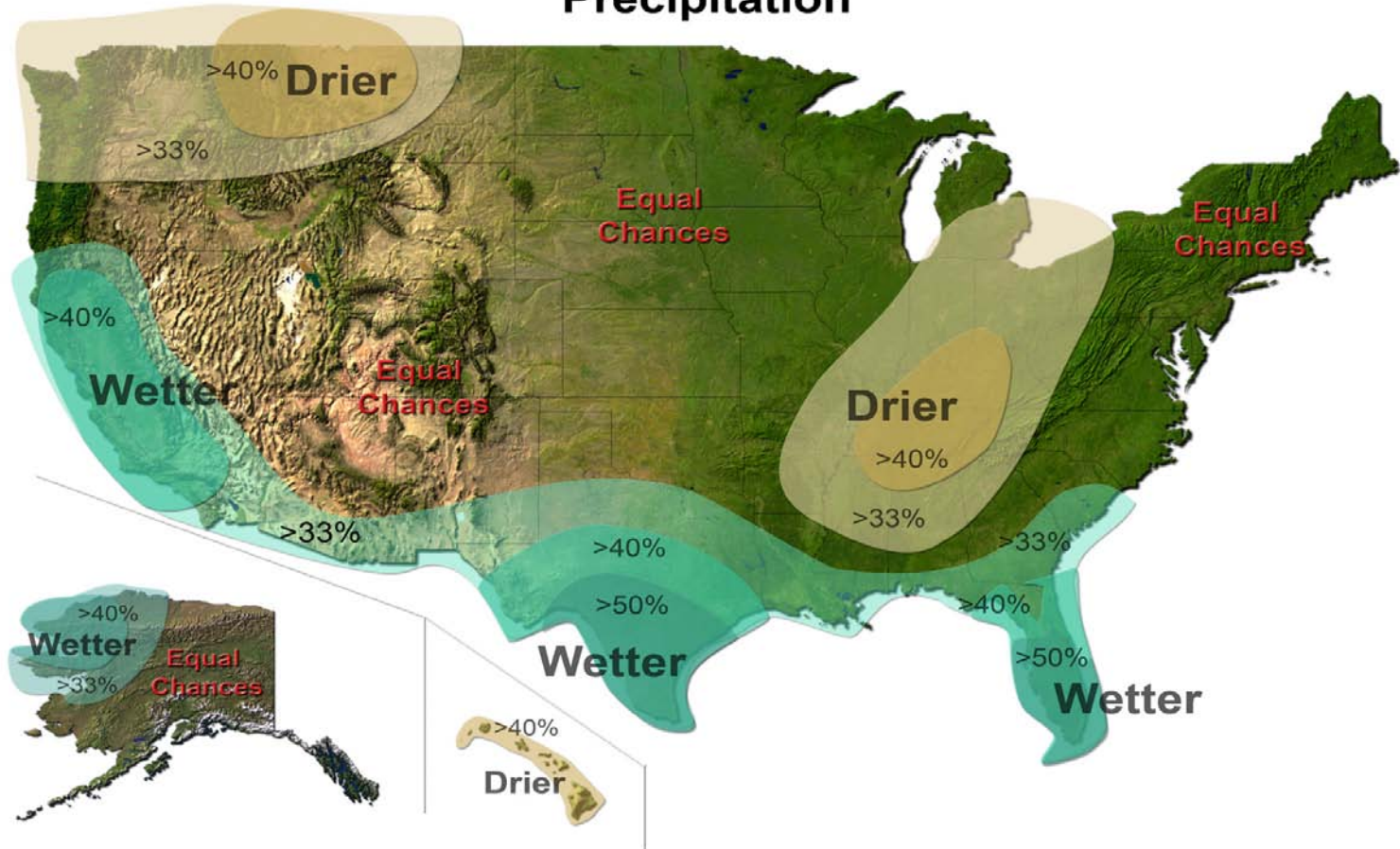


El Niño v. La Niña atmospheric North Pacific pattern shifts



NOAA: Montana Winter Up to 50% chance drier than normal

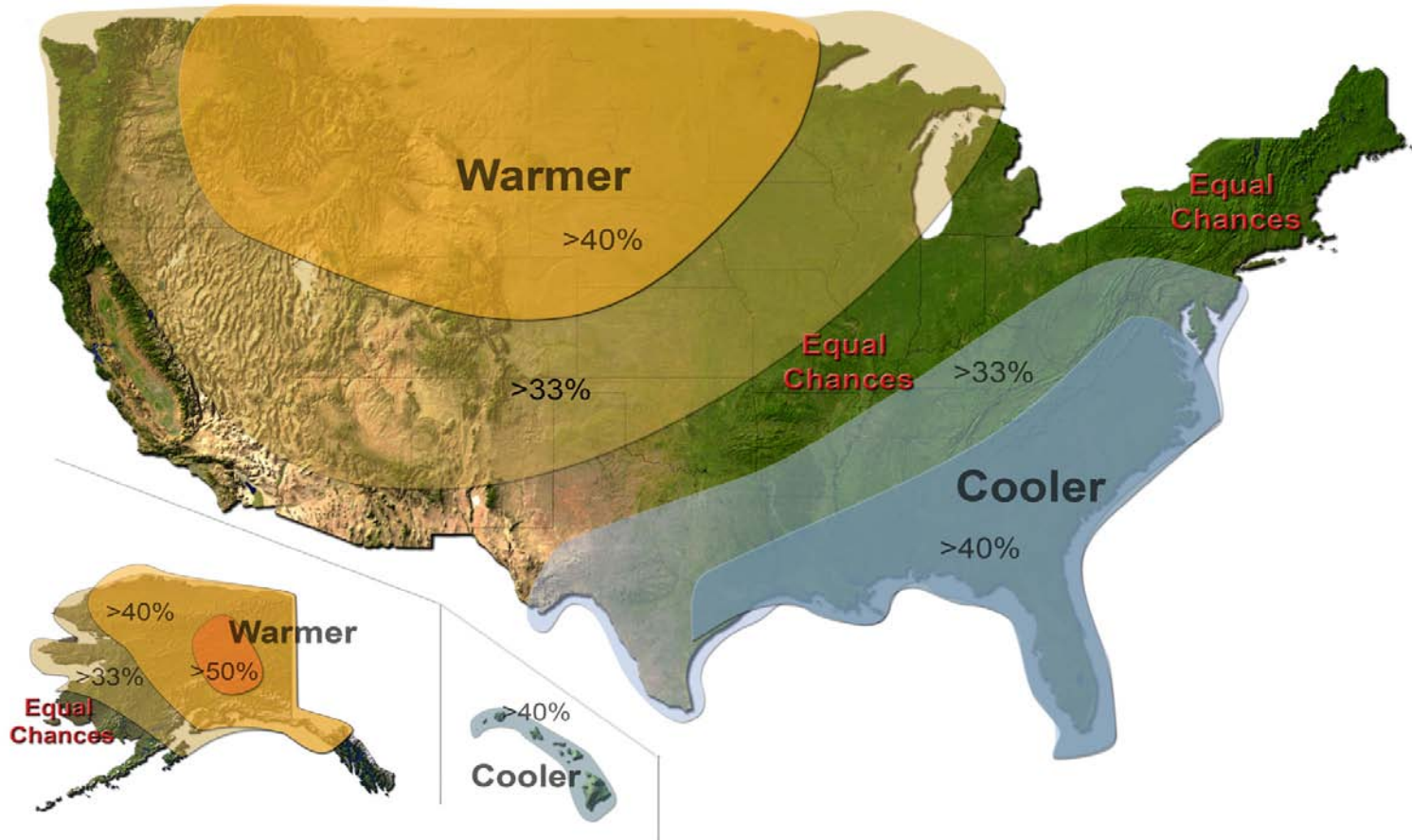
U.S. Winter Outlook Precipitation



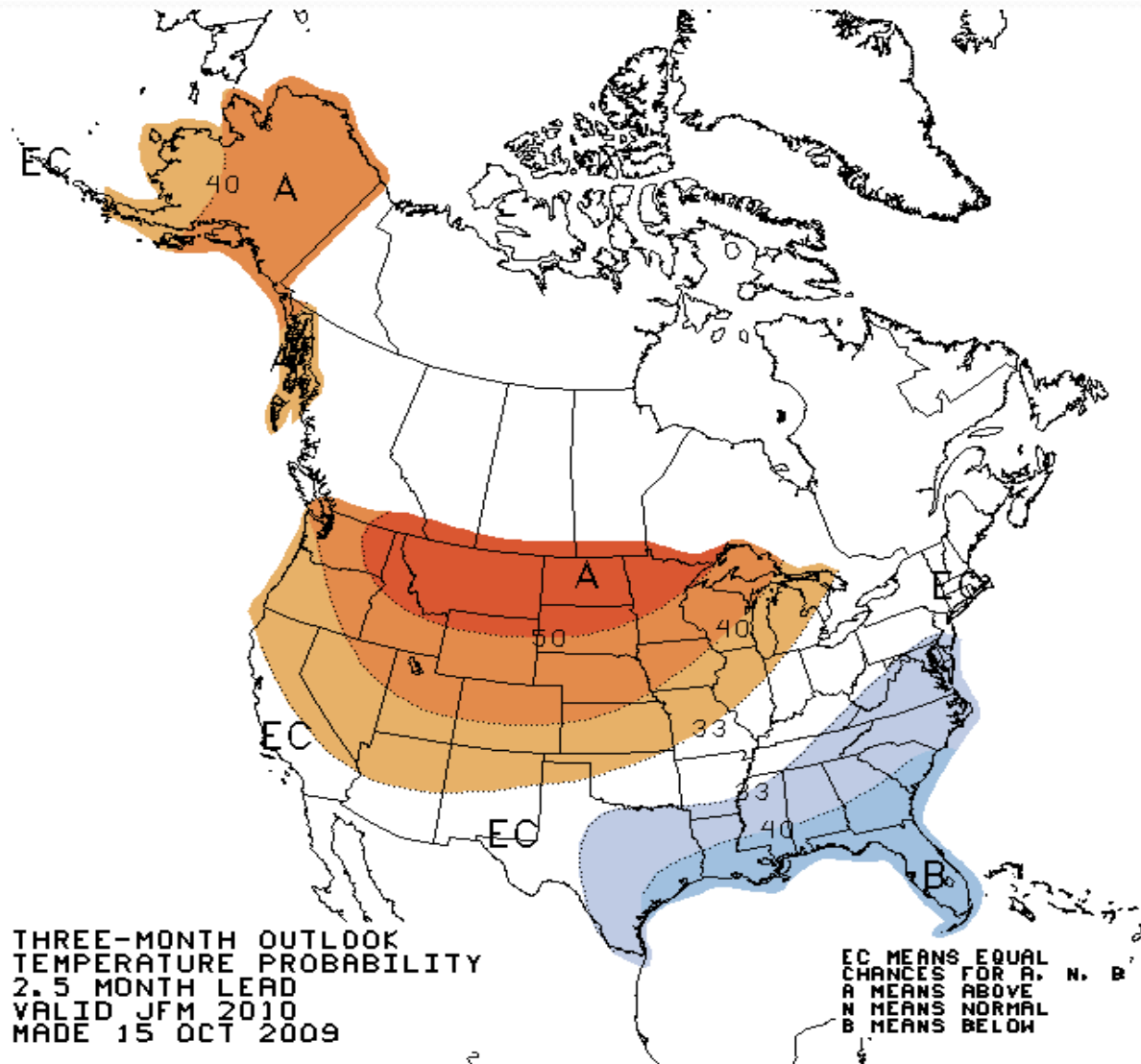
Northern Rockies & N. Great Plains

40 to 50% Chance Warmer

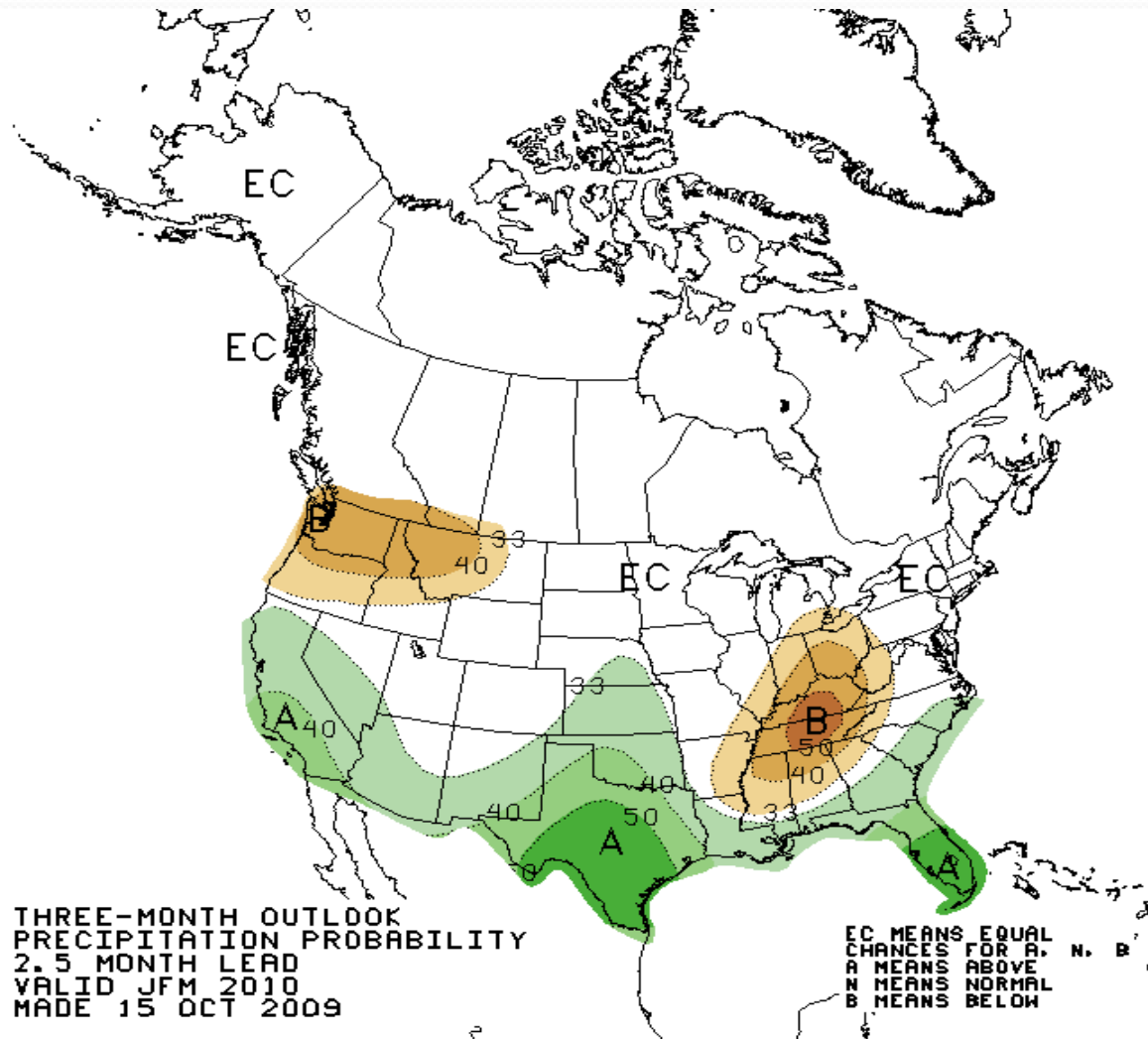
U.S. Winter Outlook Temperature



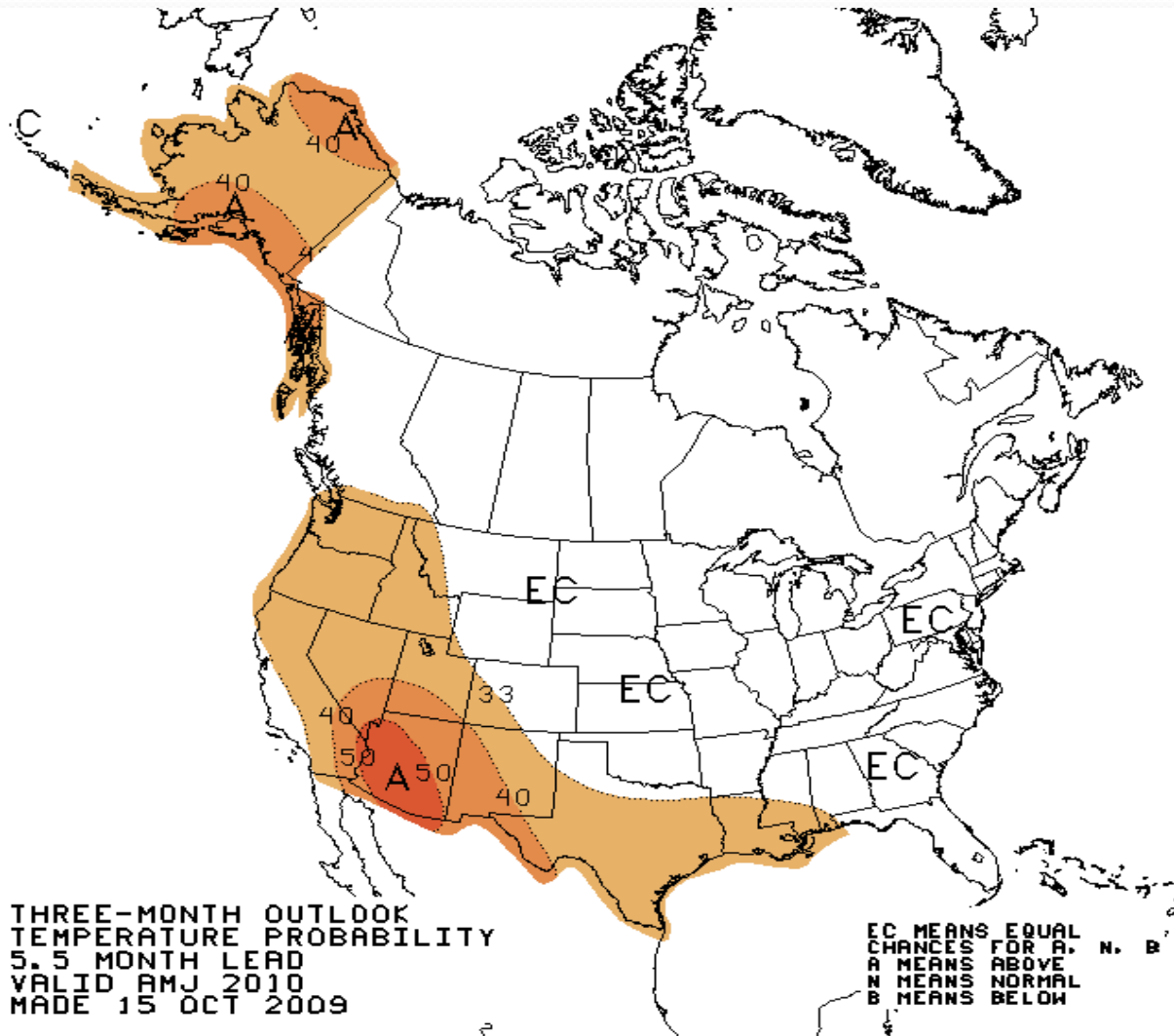
Temperatures – Jan-Feb-Mar 2010



Precipitation Jan-Feb-Mar



Temperature Apr-May-June



Snowpack water content peak for Upper Yellowstone for recent El Nino winters NRCS Snow Survey (mid-April)

- 2004-2005 SWE – 69; Tot. Precip. - 71
- 2006-2007 SWE – 73; Tot. Precip. - 89
- 2002-2003 SWE – 98; Tot. Precip. - 95
- 1997-1998 SWE – 92; Tot. Precip. – 89

Monument Pk. Snotel elv. 8850'

El Nino years – Peak, Date, Melt

<u>Year</u>	<u>SWE %</u>	<u>Peak date</u>	<u>Melt out</u>
1992	92	4/26	6/7
1995	119	5/10	7/7
1987	65	4/12	5/23
1988	91	5/11	6/11
1998	93	4/21	7/2
2003	123	5/13	6/19

Box Canyon Snotel elev. 6670'

El Nino years – Peak, Date, Melt

<u>Year</u>	<u>SWE %</u>	<u>Peak date</u>	<u>Melt out</u>
1992	59	3/27	4/16
1995	69	4/4	5/18
1987	73	3/30	4/23
1988	94	4/11	5/14
1998	80	4/19	5/5
2003	103	4/1	5/14

El Nino Forecast Summary

Based on current observations and dynamical model forecasts, El Niño is expected to continue to strengthen and last through at least the Northern Hemisphere winter '09-'10.

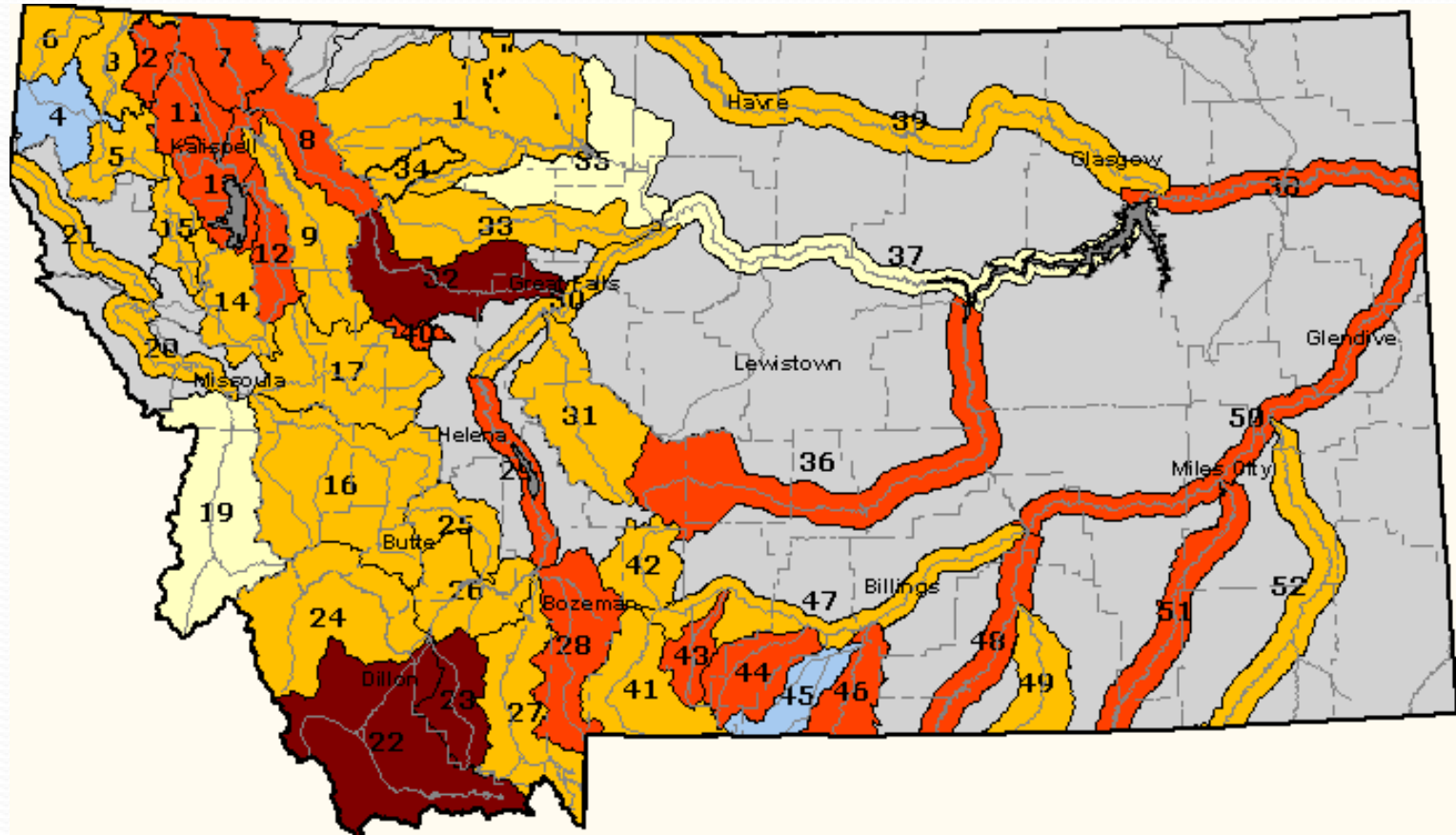
El Nino Animation Site Addresses

<http://www.cpc.noaa.gov/products/precip/CWlink/MJO/enso.shtml#current>

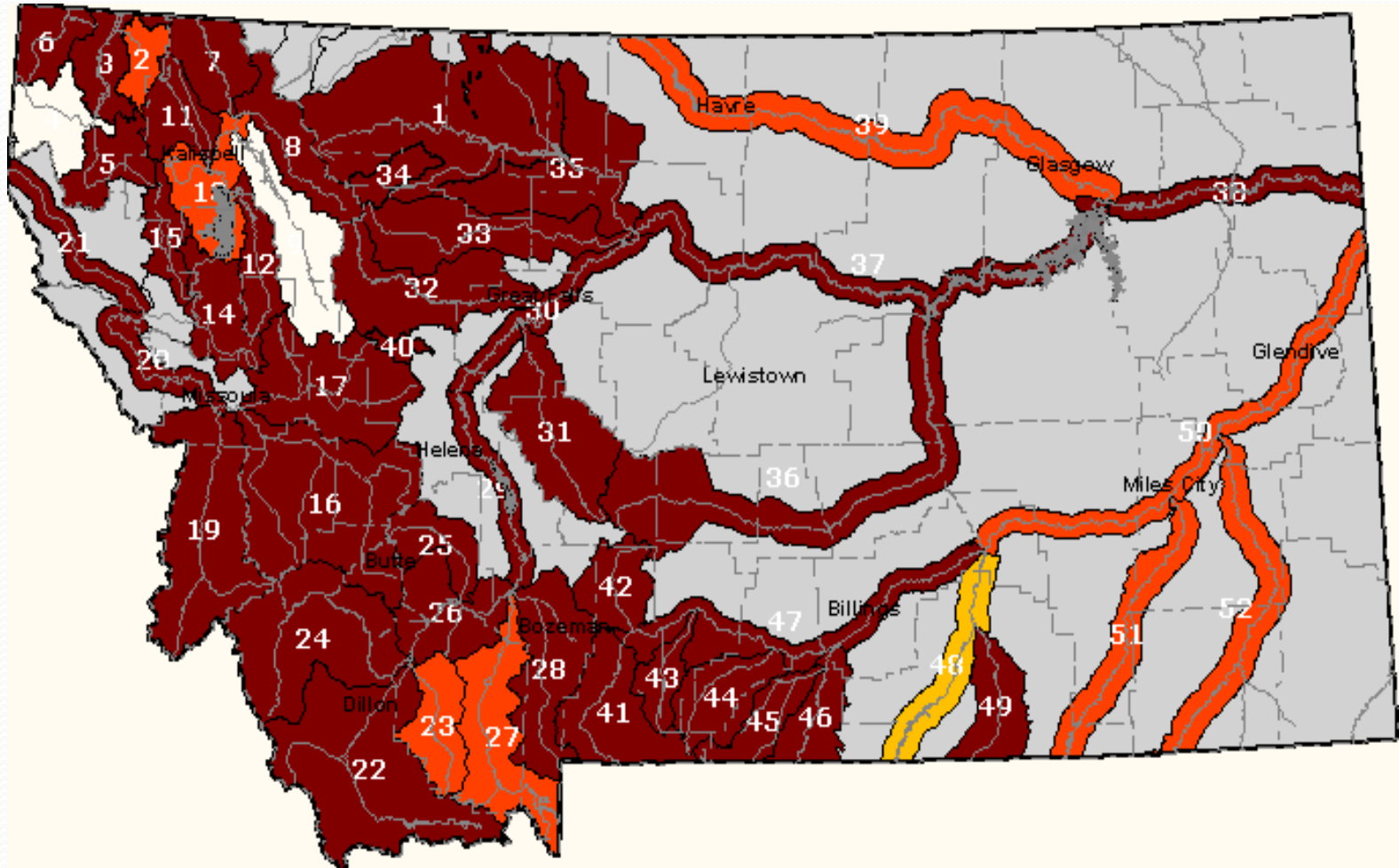
<http://www.cpc.noaa.gov/products/precip/CWlink/MJO/enso.shtml#forecast>

NRCS SWSI Map – April 2003

El Nino with a +1.5, C. anomaly

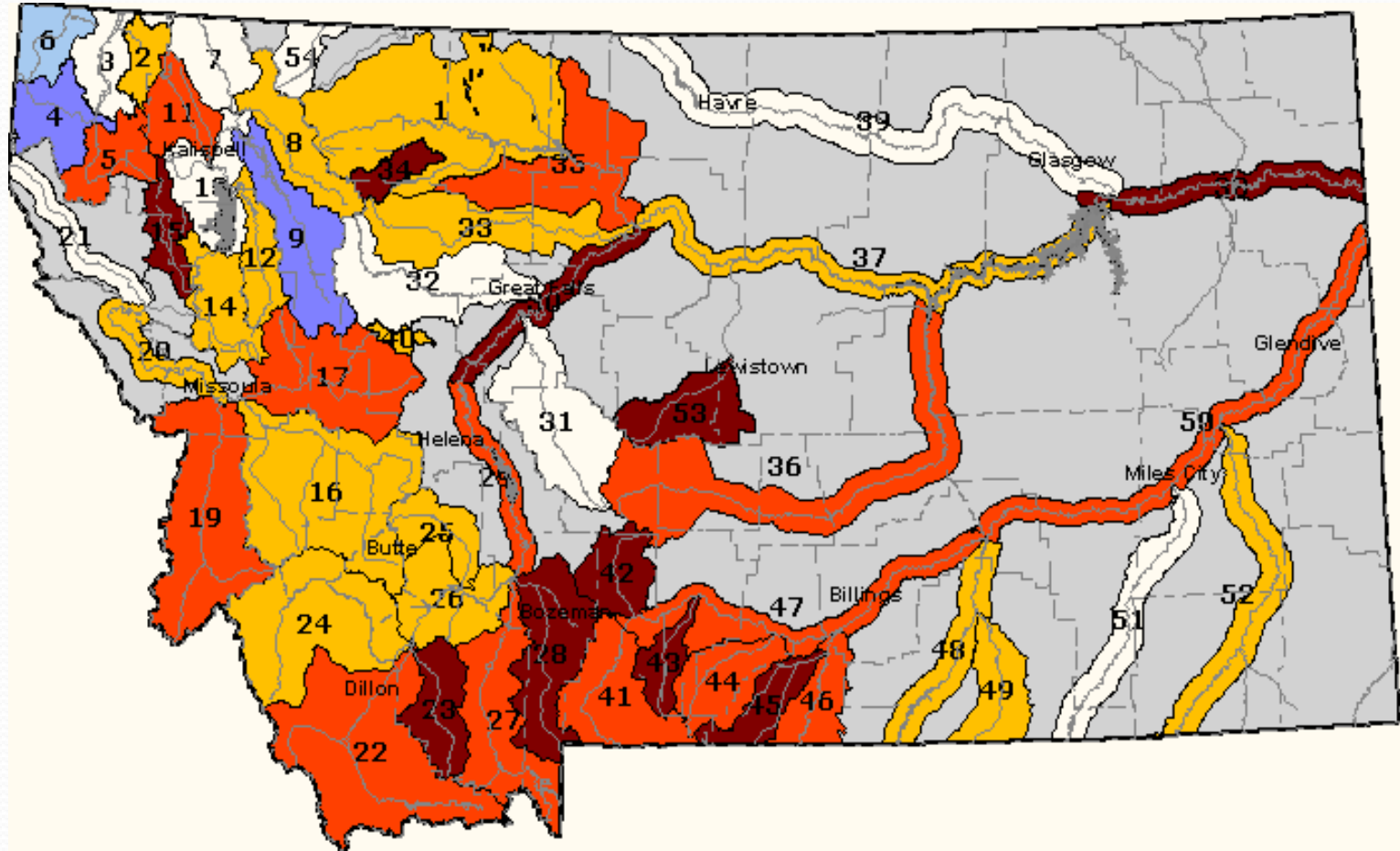


El Nino – April 2005 +0.9 C.

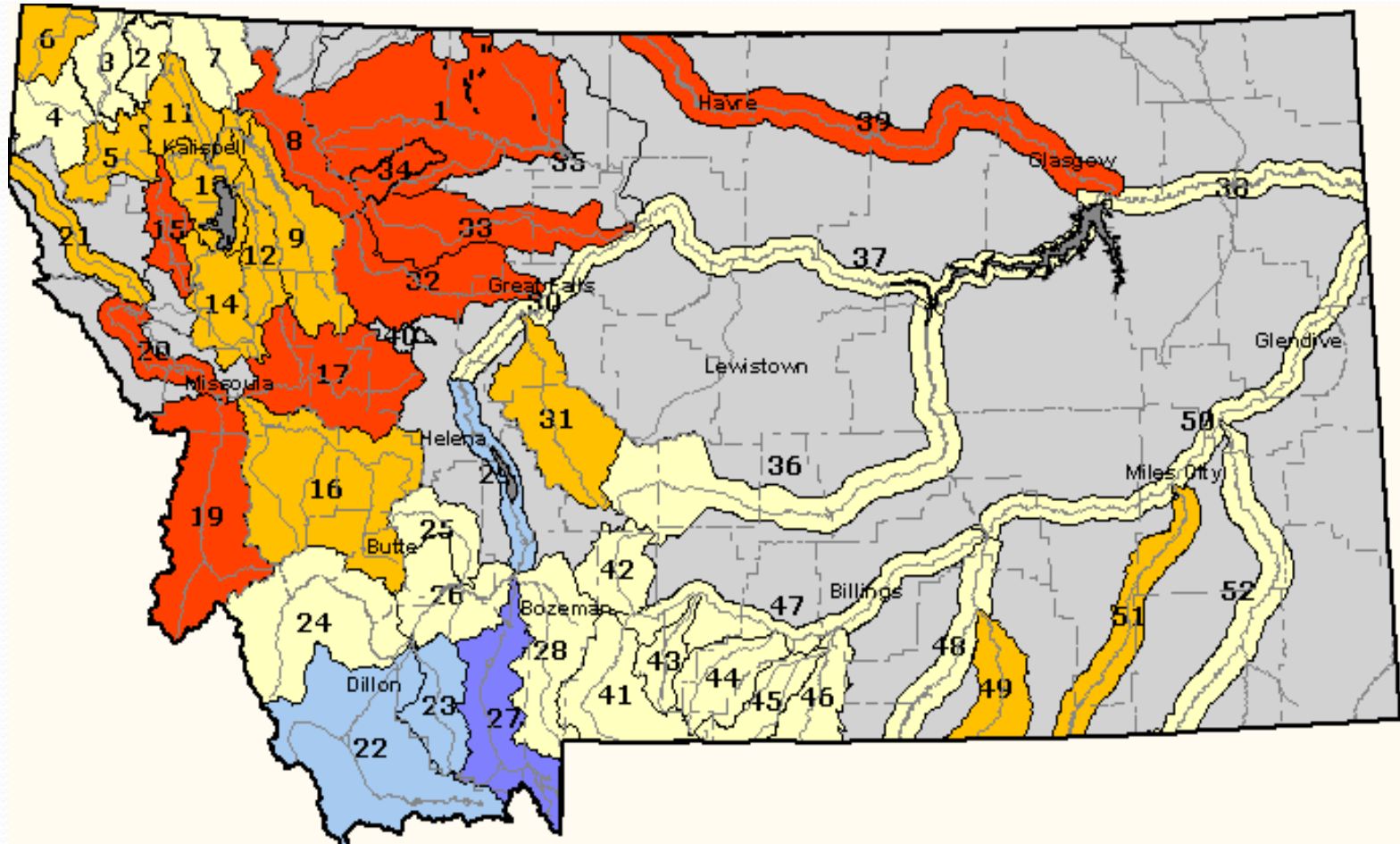


SWSI April 2007 El Nino '06-'07

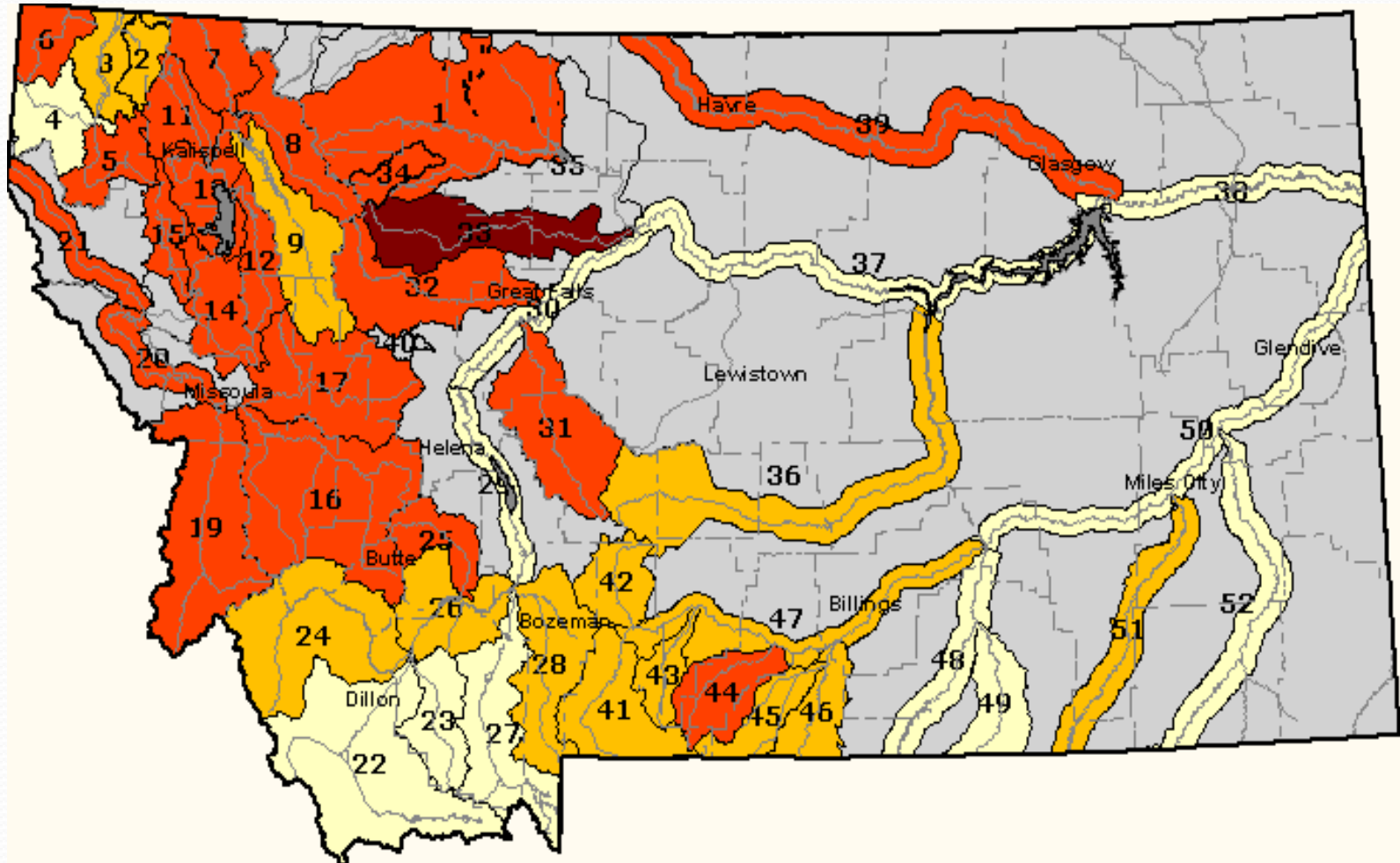
Anomaly strength of +1.1 C.



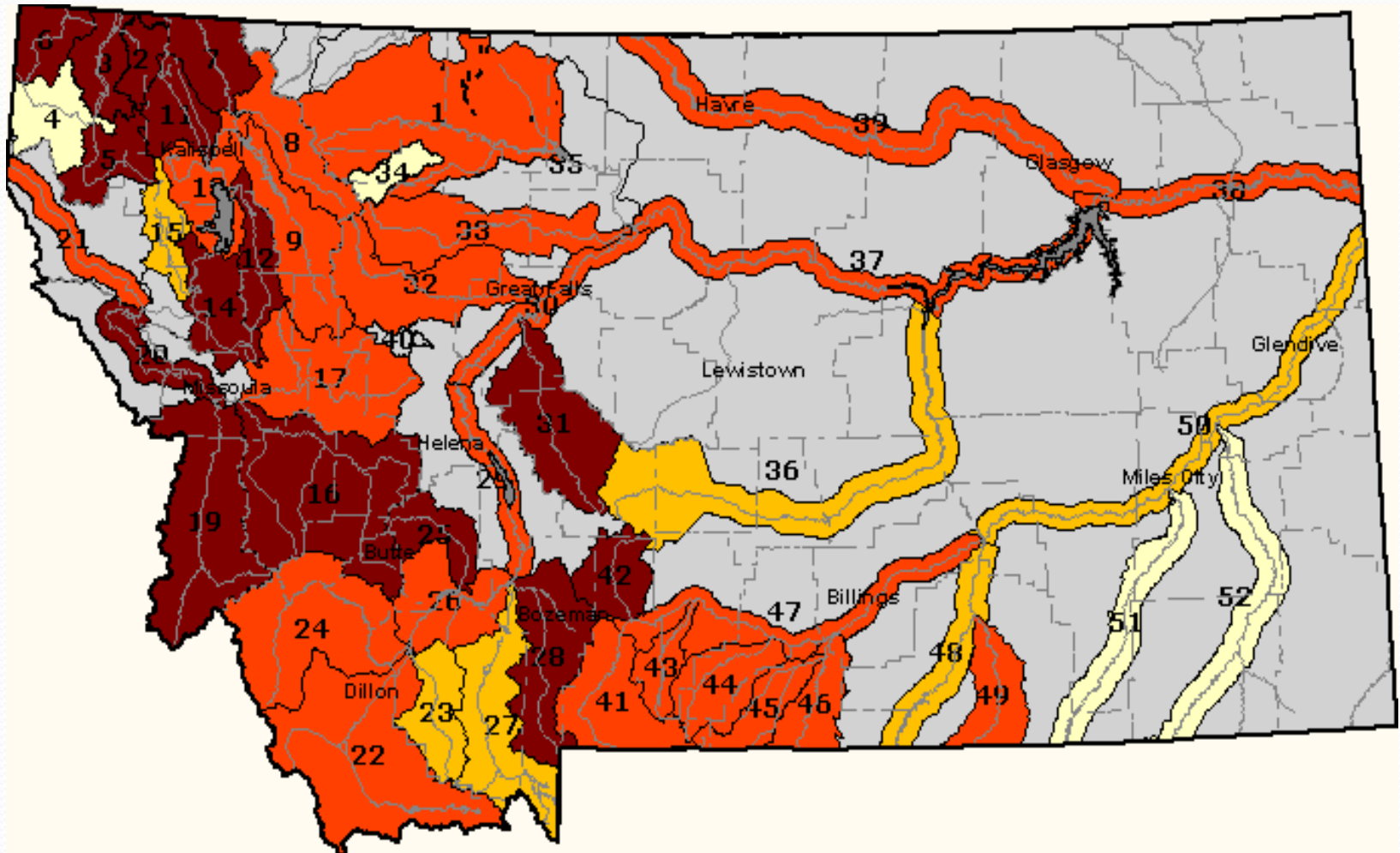
El Nino – April 1995 +1.3 C.



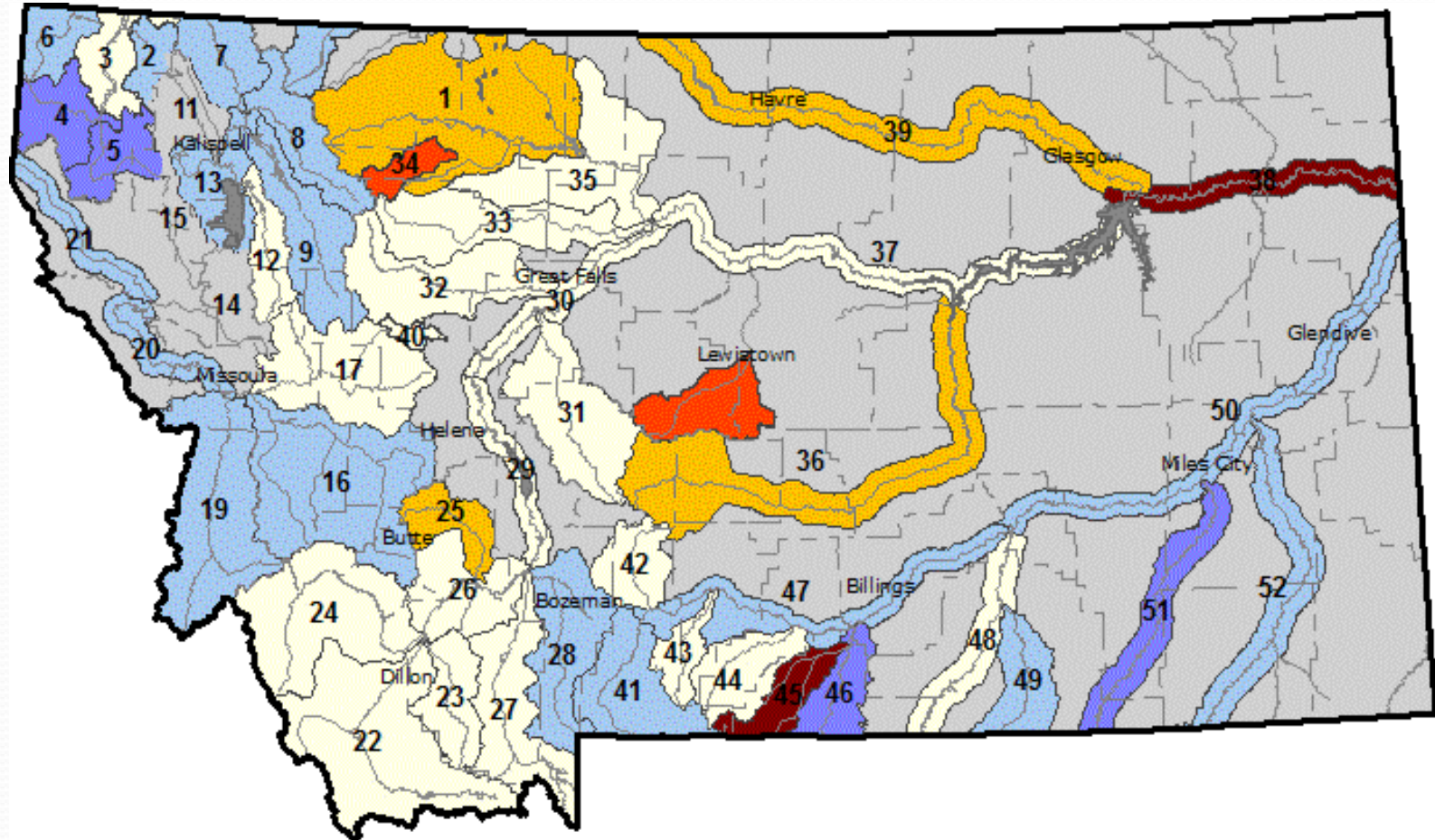
El Nino, April 1998 +2.5 C.



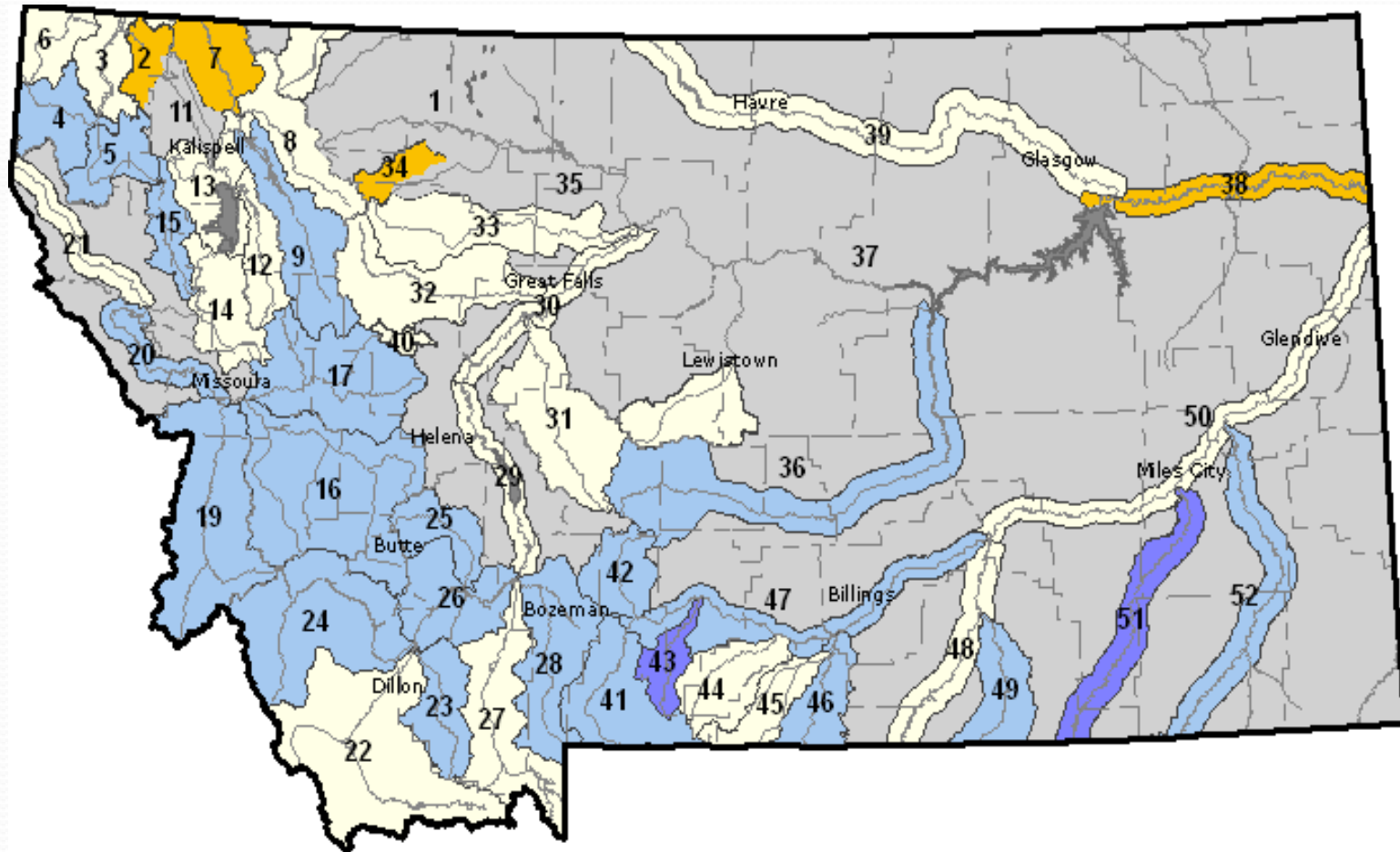
El Nino, April 1992 +1.8 C.



La Nina – April 2008, -1.4 C



SWSI – La Nina, April 2009



Upper Yellowstone Outlook

Conclusions – El Nino 2009-10

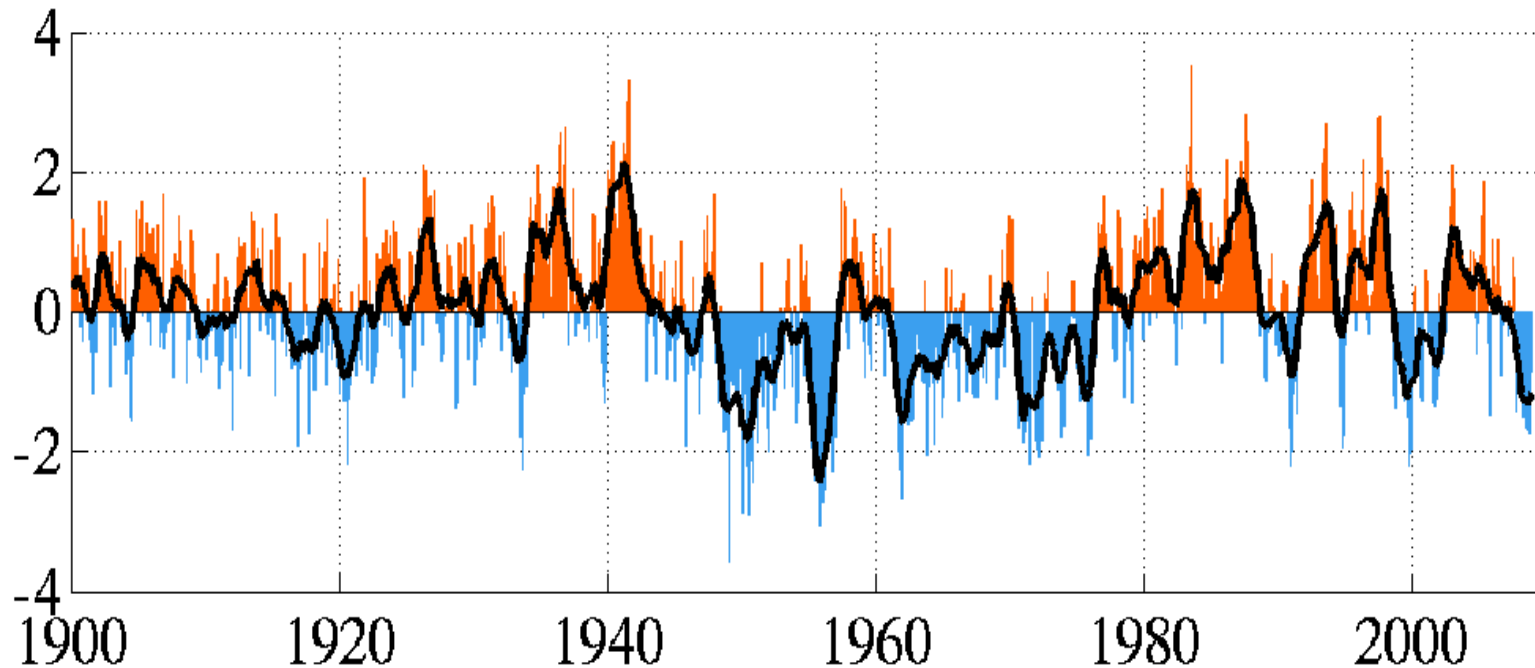
- For 5 El Nino events 1992-2007, UYB had one Extremely Dry SWSI, 2005, which had the lowest intensity value (+0.90) by April;
- Two other El Ninos ranked Moderately Dry, 1992 (+1.8) and 2007 (+1.1); and
- Two El Ninos showed April SWSIs for the UYB as Slightly Dry, 2003 (+1.5) and 1998 (+2.5).
- One El Nino, 1995 (+1.3) had a Near Average water supply outlook by April.
- There does not appear to be a correlation between El Nino intensity value and April SWSI water supply outlook.

UYB El Nino conclusions (cont.)

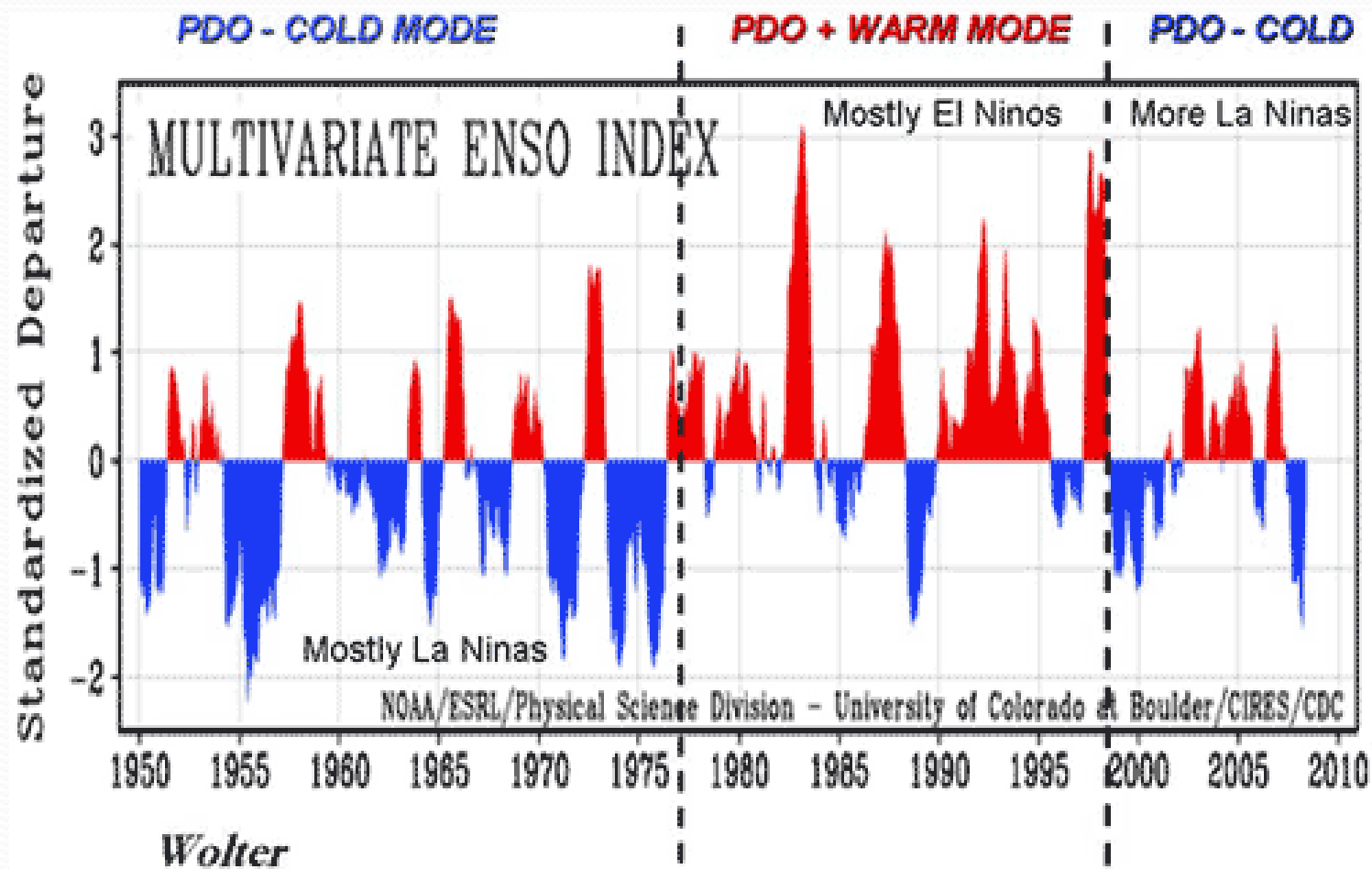
- Upper Yellowstone River Basin mountain snowpack elevations are higher than most in the state, mitigating the vulnerability of warmer than normal temperatures presented by El Nino events;
- Probability of mountain precip falling as rain, not snow in early weeks of water year; and chances of early spring first pulse of runoff from warm spells reduced by virtue of elevation of UYB snowfields; and
- Higher elevation Snotel sites within the UYB, such as Monument Peak (elev. 8850) have higher SWE, later peak SWEs, and later melt-out dates.

One other potentially mitigating factor – PDO cool phase

monthly values for the PDO index: 1900-2008



Cool Phase of PDO weakens El Nino intensity & frequency



The End
Thanks!

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