The Developing La Niña and the Outlook for September, October and November 2010 For Northeast Colorado

Mike Baker
National Weather Service
Boulder, Colorado

Status of
La Niña

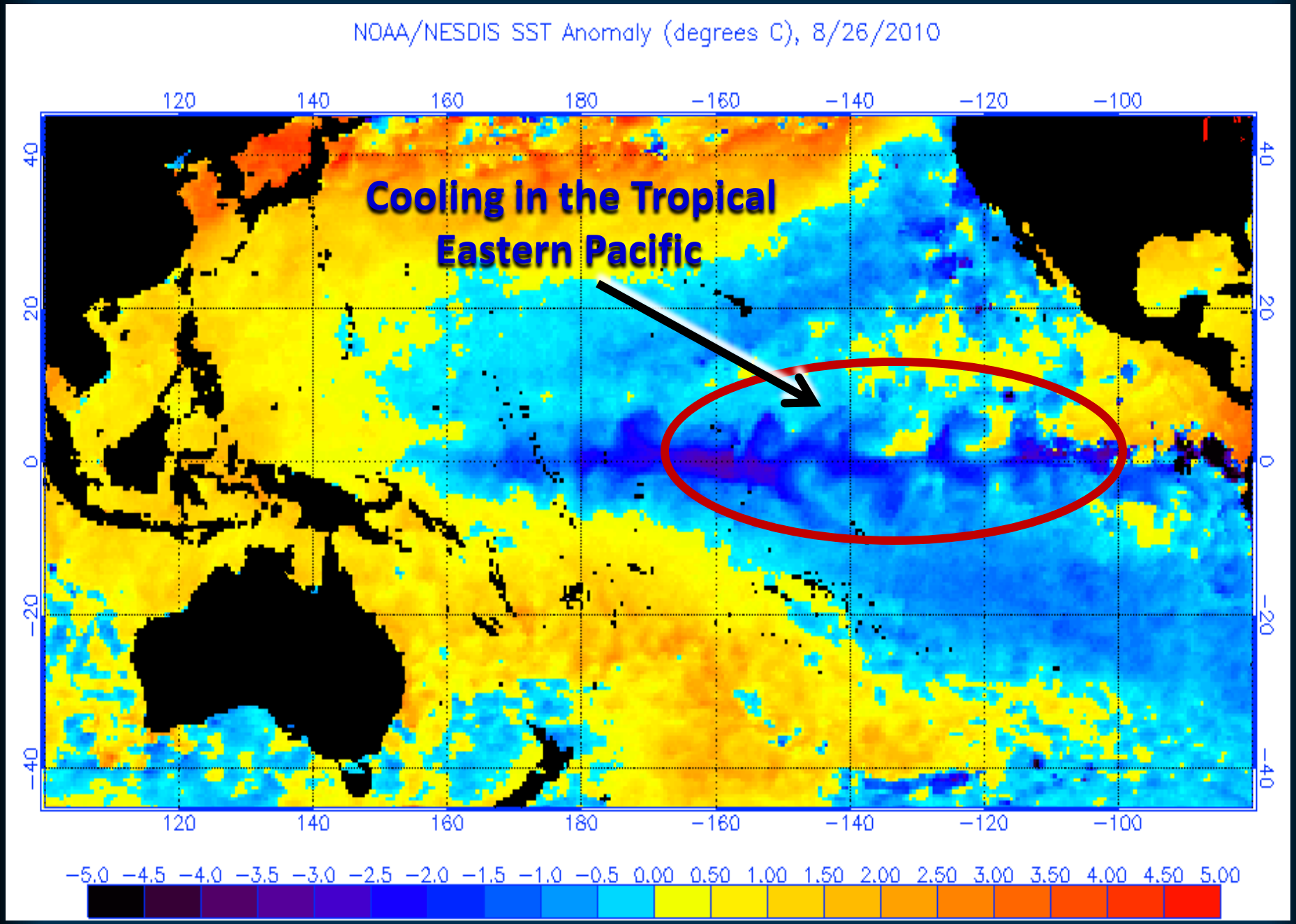
Overview

- La Niña conditions have developed in the eastern tropical Pacific Ocean.
- Sea surface temperatures (SSTs) in the tropical Pacific from near the International date line to the west coast of South America have remained below average for the past few months.
- Recent Equatorial Pacific SST trends and model forecasts indicate La Niña will strengthen in the next few months and continue at least through the Northern Hemisphere winter of 2010-2011.

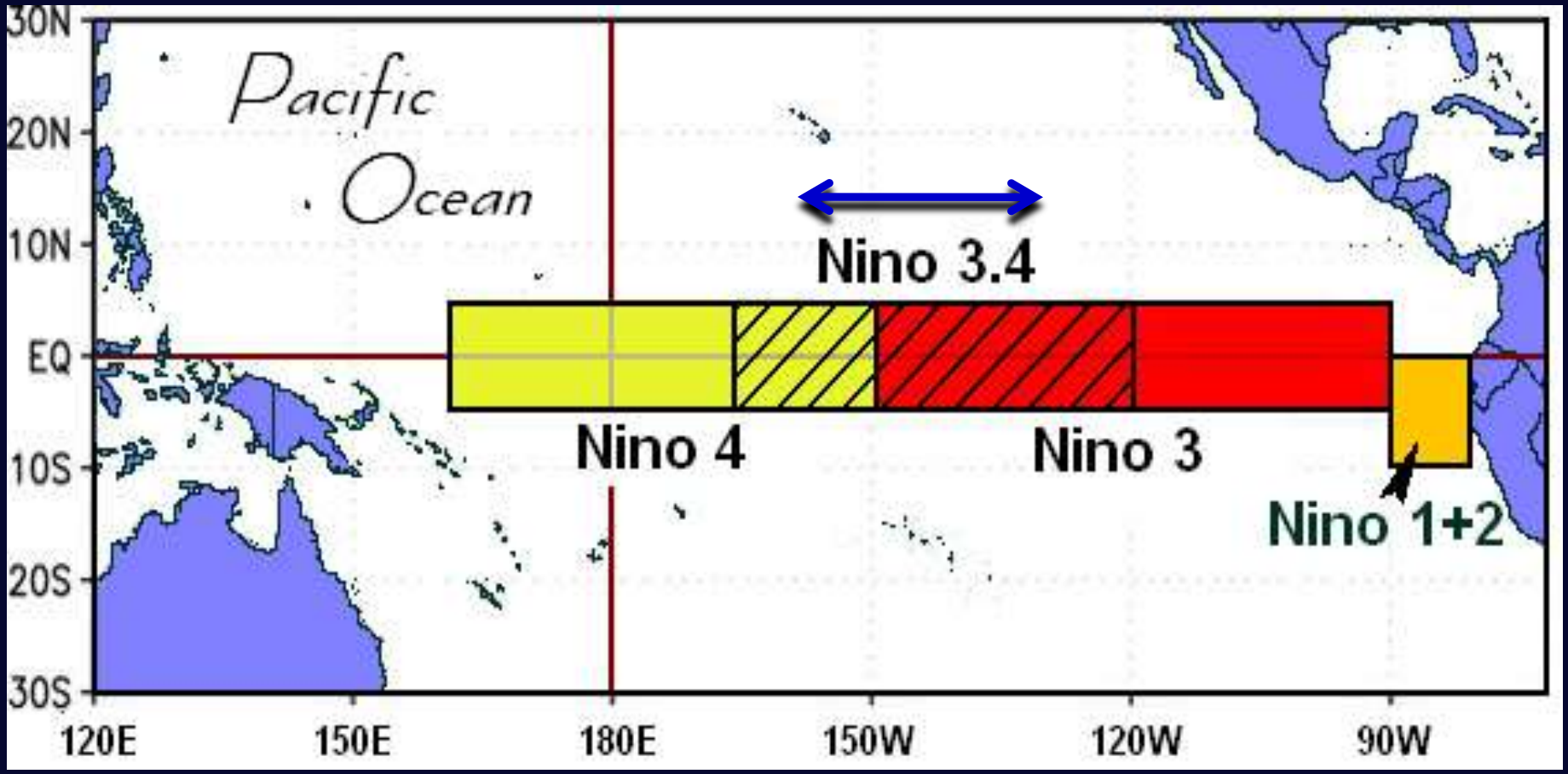
Overview

- However, there is disagreement among the models over the eventual strength of this La Niña. Approximately half of the models (dynamical models) predict a moderate-to-strong La Niña, while the remaining (statistical) models indicate a weaker episode.

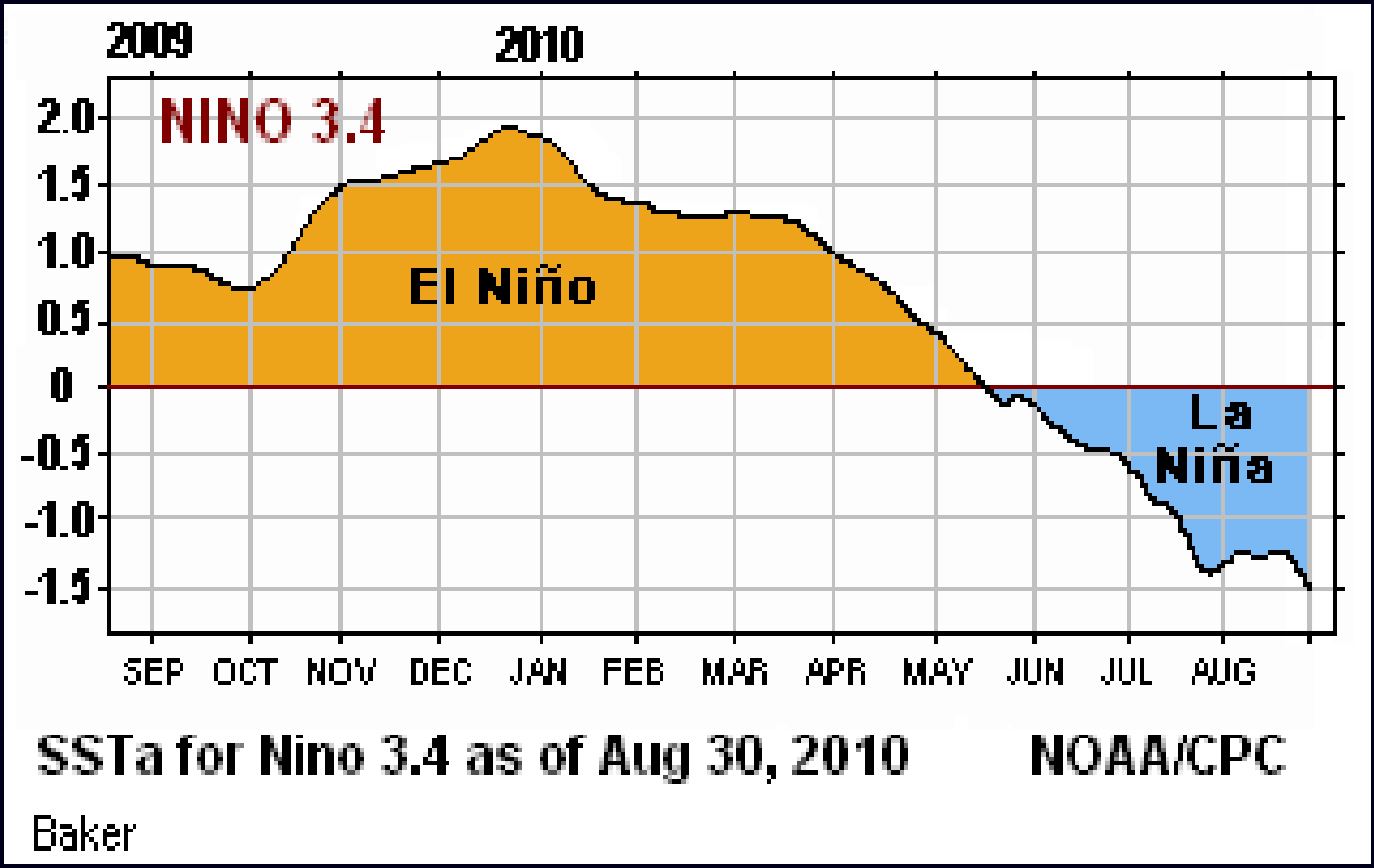
- Given the strong cooling observed in the eastern Pacific over the last few months and the apparent ocean-atmosphere coupling (positive feedback), the dynamical model outcome of a moderate-to-strong episode is favored at this time.


NOAA/NESDIS SST Anomaly (degrees C), 8/26/2010
120
140
160
180
−160
−140
−120
−100
40
20
0
−20
−40
Cooling in the Tropical Eastern Pacific
−5.0 −4.5 −4.0 −3.5 −3.0 −2.5 −2.0 −1.5 −1.0 −0.5 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00

Niño Regions in the Tropical Pacific Ocean



Nino 3.4 – The principal region in the eastern tropical Pacific used by the Climate Prediction Center (CPC) for monitoring, assessing and predicting ENSO.



Abnormally warm sea surface temperatures (SSTs) during the winter and spring of 2009-2010 were quickly replaced by anomalously cool temperatures in June and July. The large negative anomalies observed this summer are consistent with the development of a La Niña. As of August 30th, the average SSTa for Niño 3.4 Region was -1.5˚C.

Oceanic Niño Index (ONI)

- The **ONI** is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO.
- Defined as the three-month running-mean SST departures in the Niño 3.4 region.
- Used to place current events into a historical perspective
- **NOAA's operational definitions of El Niño and La Niña are keyed to the ONI index.**

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a *positive* ONI greater than or equal to +0.5 C.

La Niña: characterized by a *negative* ONI less than or equal to –0.5 C.

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5°C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

Oceanic Niño Index - ONI

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.6	-1.4	-1	-0.8	-0.6	-0.5	-0.4	-0.4	-0.4	-0.5	-0.6	-0.7
2001	-0.6	-0.5	-0.4	-0.2	-0.1	0.1	0.2	0.2	0.1	0	-0.1	-0.1
2002	-0.1	0.1	0.2	0.4	0.7	0.8	0.9	1	1.1	1.3	1.5	1.4
2003	1.2	0.9	0.5	0.1	-0.1	0.1	0.4	0.5	0.6	0.5	0.6	0.4
2004	0.4	0.3	0.2	0.2	0.3	0.5	0.7	0.8	0.9	0.8	0.8	0.8
2005	0.7	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.2	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.1
2007	0.8	0.4	0.1	-0.1	-0.1	-0.1	-0.1	-0.4	-0.7	-1	-1.1	-1.3
2008	-1.4	-1.4	-1.1	-0.8	-0.6	-0.4	-0.1	0	0	0	-0.3	-0.6
2009	-0.8	-0.7	-0.5	-0.1	0.2	0.6	0.7	0.8	0.9	1.2	1.5	1.8
2010	1.7	1.5	1.2	0.8	0.3	-0.2	?					

Not yet determined

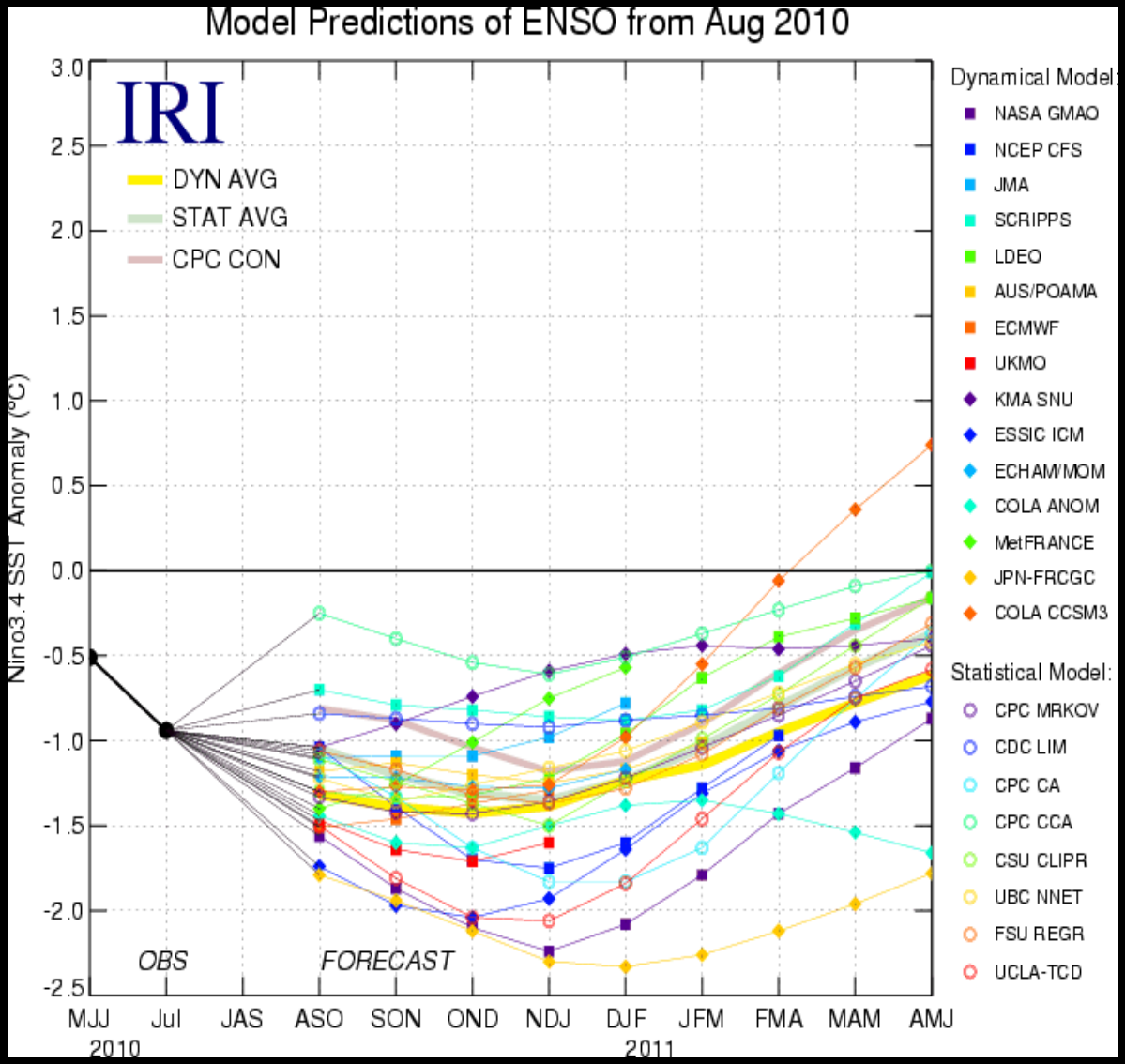
Warm Episodes - El Niños (in RED): ONI 0.5 and above

Cold Episodes - La Niñas (In Blue): ONI of -0.5 and below

Neutral Episodes -non-ENSO (In White): ONI above -0.5 and below 0.5

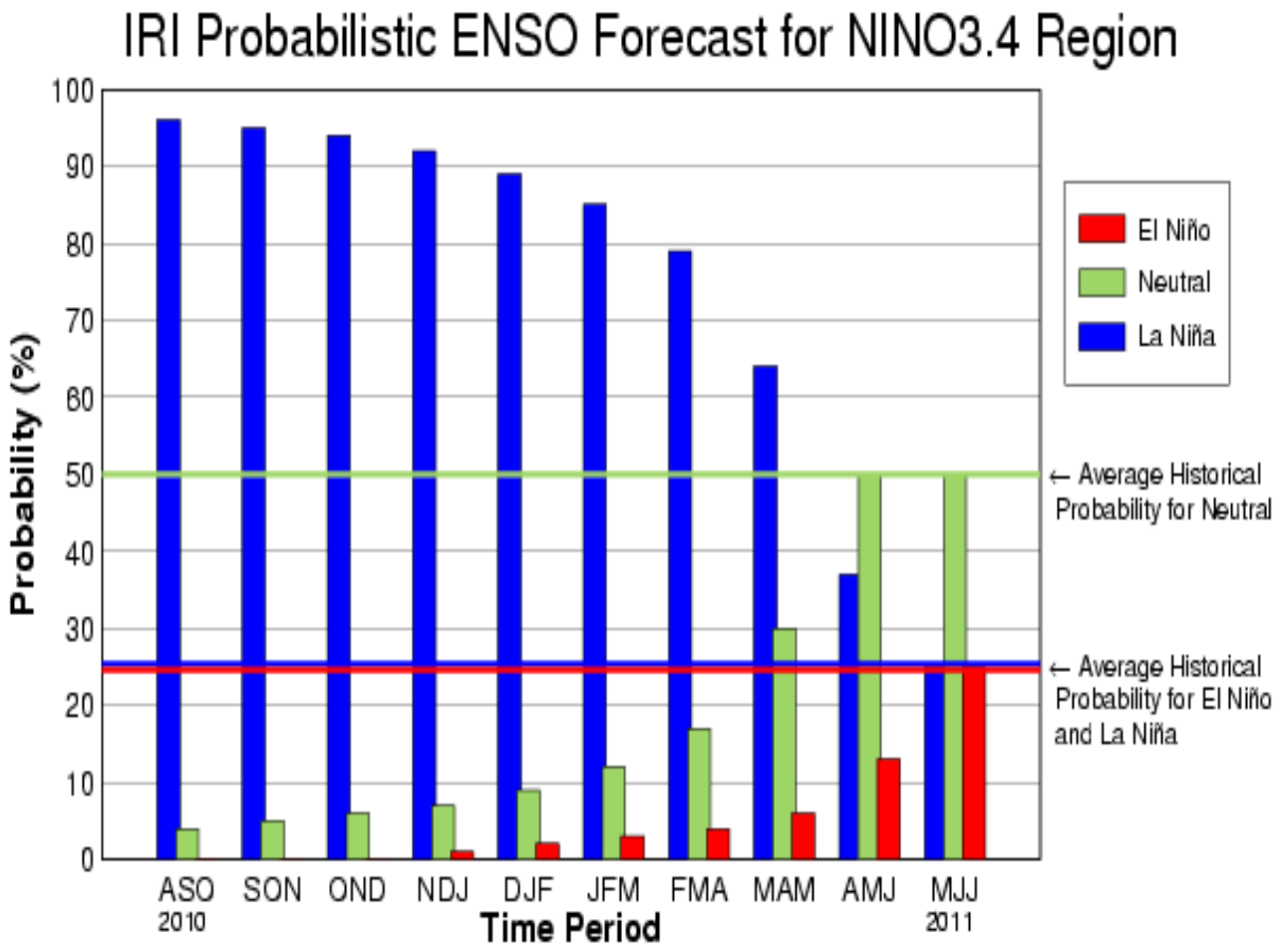
NOAA/CPC Aug 2010 Baker

Pacific Niño 3.4 SST Outlook



• All 23 dynamical and statistical models indicate that La Niña conditions (Niño-3.4 SST anomalies -0.5 C or less) will persist at least through the Northern Hemisphere winter 2010-11. A majority of the models forecast La Niña will strengthen during the next few 3-month climate seasons.

Figure provided by the International Research Institute (IRI) for Climate and Society (updated 18 August 2010).

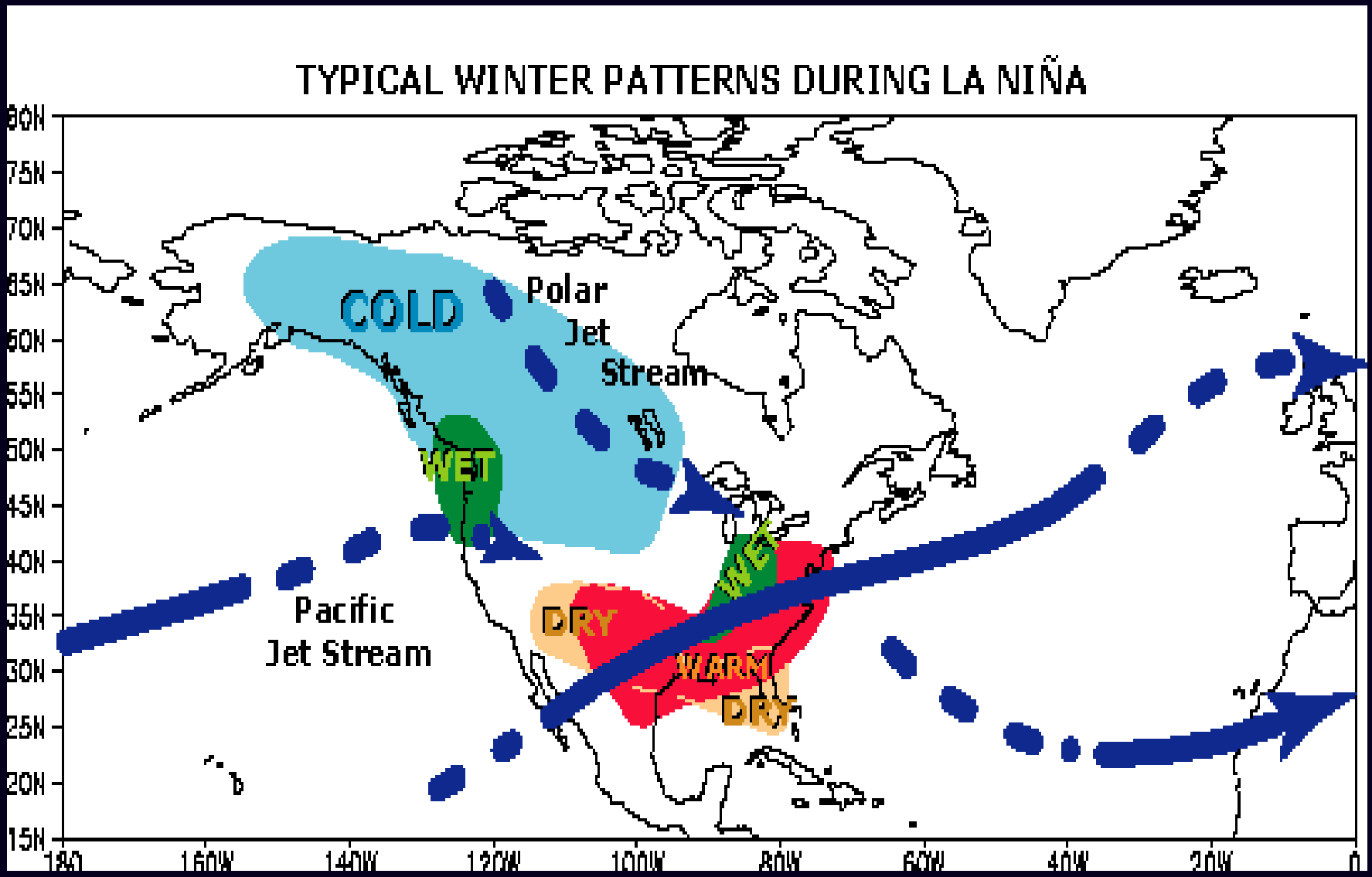


Issued Aug 2010

This table from IRI shows a greater than 90% probability that the current La Niña will persist in the Niño 3.4 Region at least through the 2010-11 December-January-February climate period.

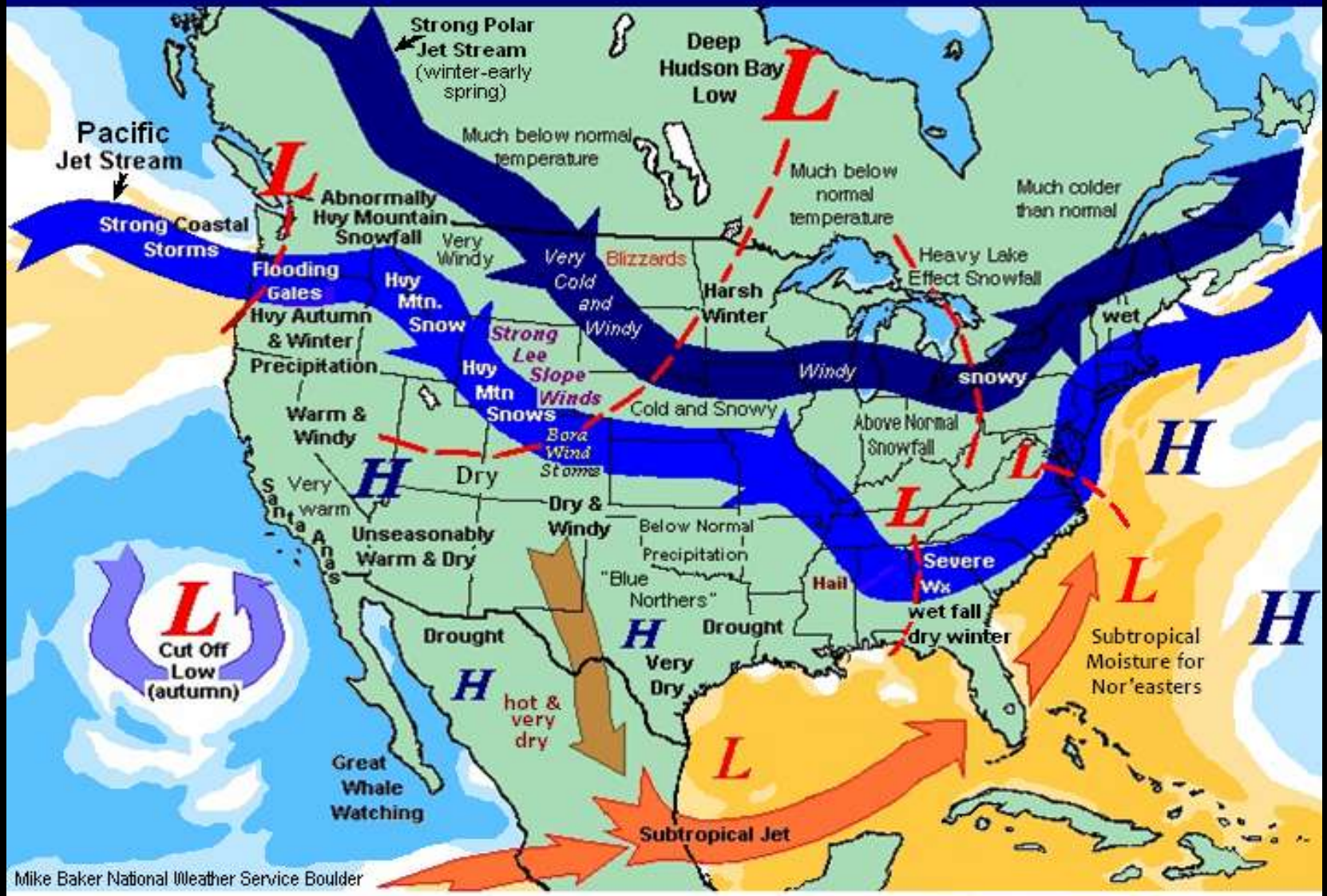
The probability of La Niña, El Niño and non-ENSO or neutral conditions for the next nine 3-month climate periods

Typical North American Temperature, Precipitation and Jet Stream Patterns during La Niña Winters

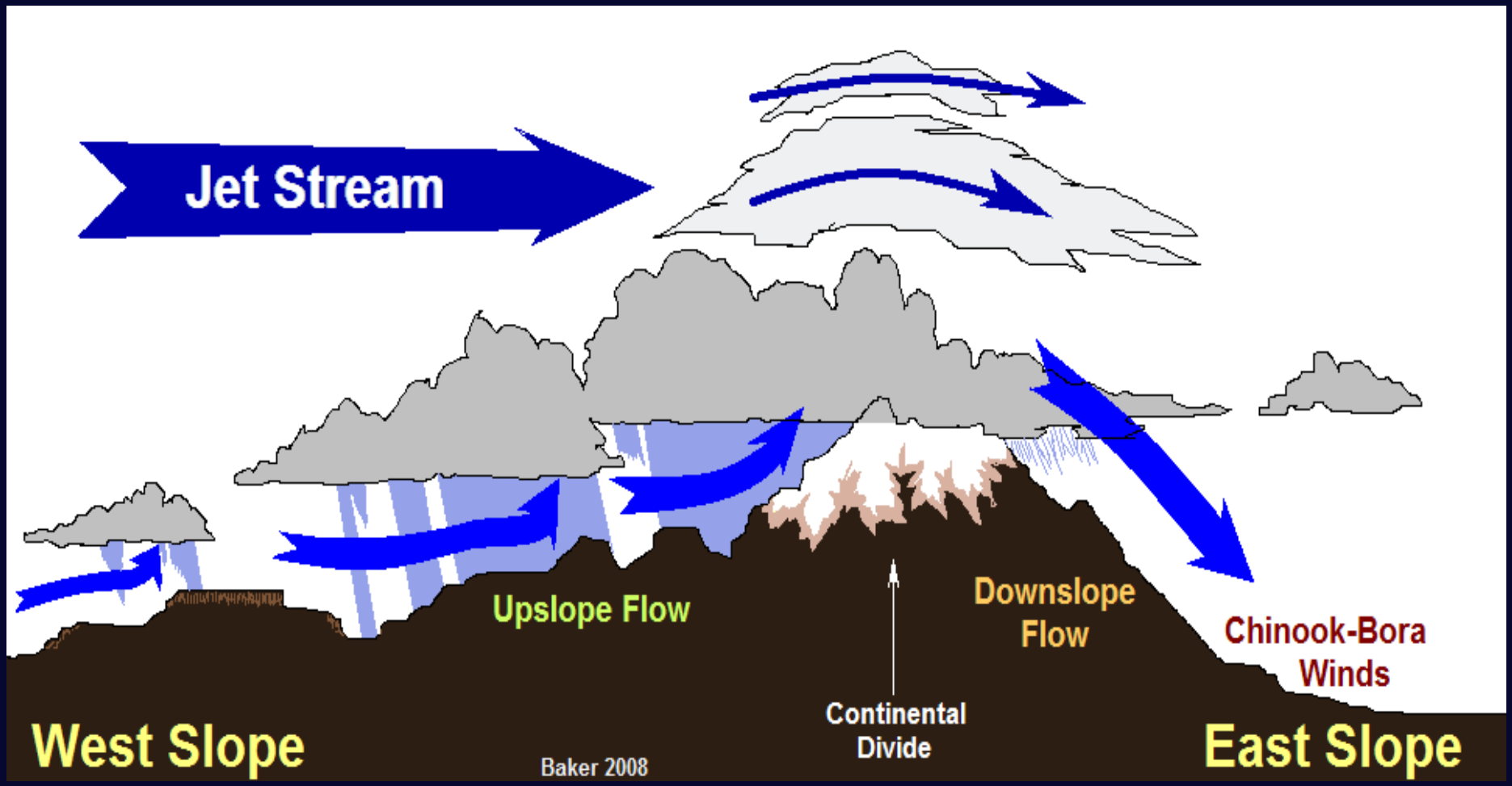


Source: NOAA/Climate Prediction Center

Typical Jet Stream Pattern and Seasonal Weather Conditions Observed Across the U.S. During Moderate to Strong La Niñas

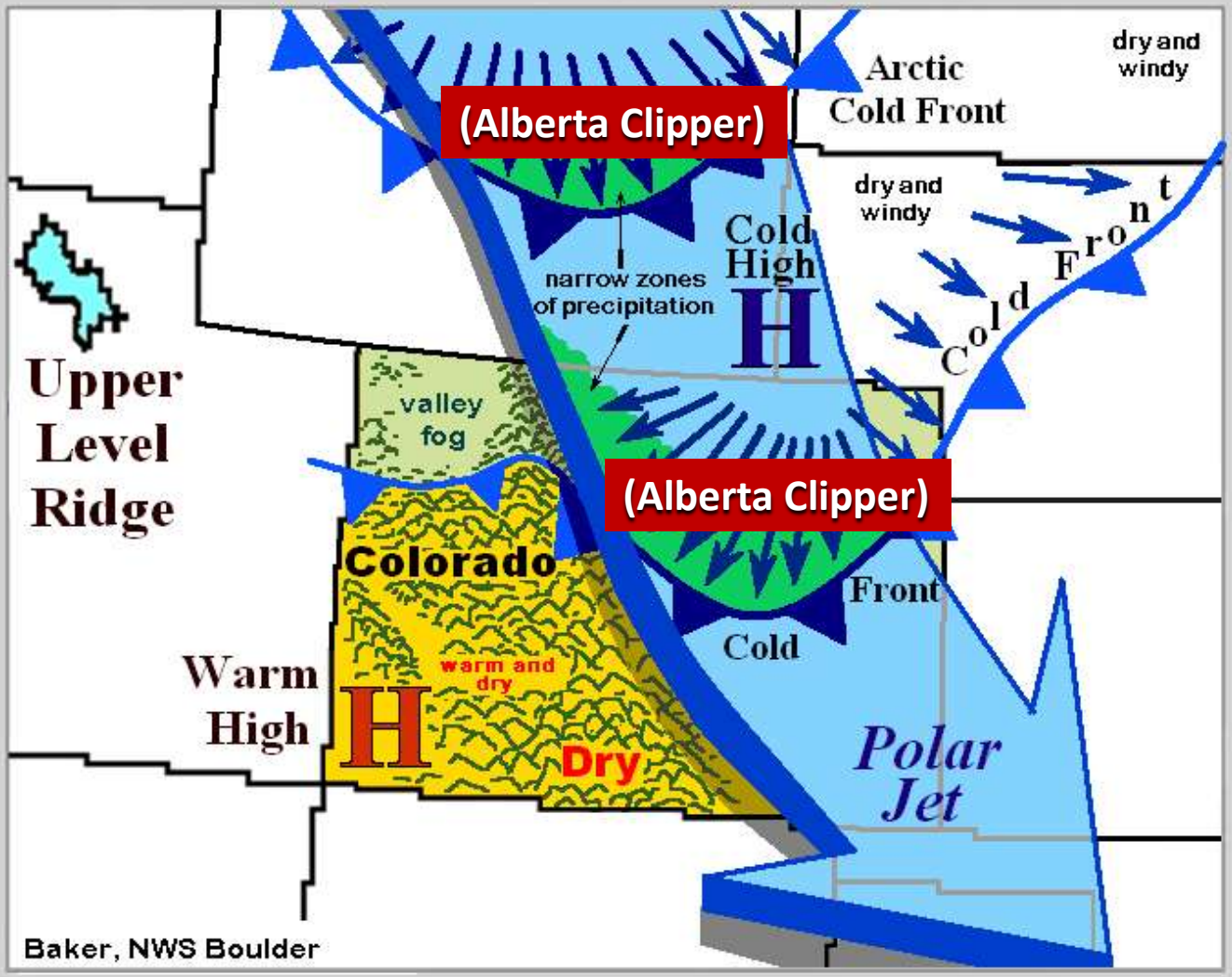


Strong Influence of Mountainous Terrain on Colorado Weather



Windward facing mountain slopes generally see greater precipitation, cooler temperatures and higher humidity values than leeward facing slopes. Downslope winds such as the Chinook can produce abnormally warm and dry conditions, such as along the face of the Colorado Front Range during the late winter and spring of moderate to strong La Niñas.

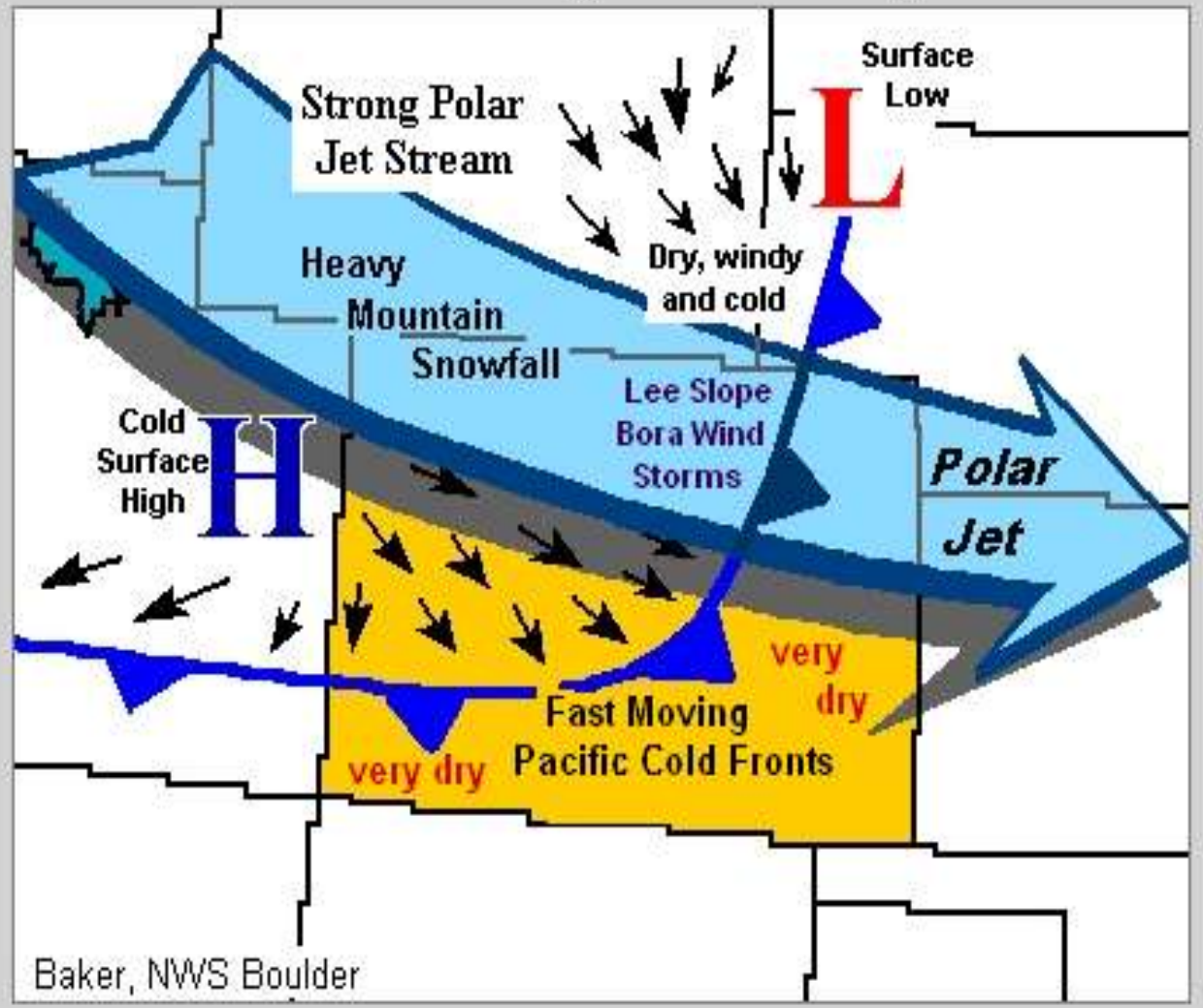
Mean Position of the Polar Jet Stream During Late Summer through Mid-Autumn of Moderate to Strong La Niña Episodes



Eastern Colorado often sees a greater number of cold fronts, occasionally referred to as "Alberta clippers" during the late summer and autumn with the Polar jet stream angled as such across the state during La Niña episodes.

These fast moving frontal systems are often accompanied by narrow bands of precipitation, sometimes with great intensity, strong and gusty northerly winds, and bitter cold air marked by a sudden drop in temperature with passage of the front.

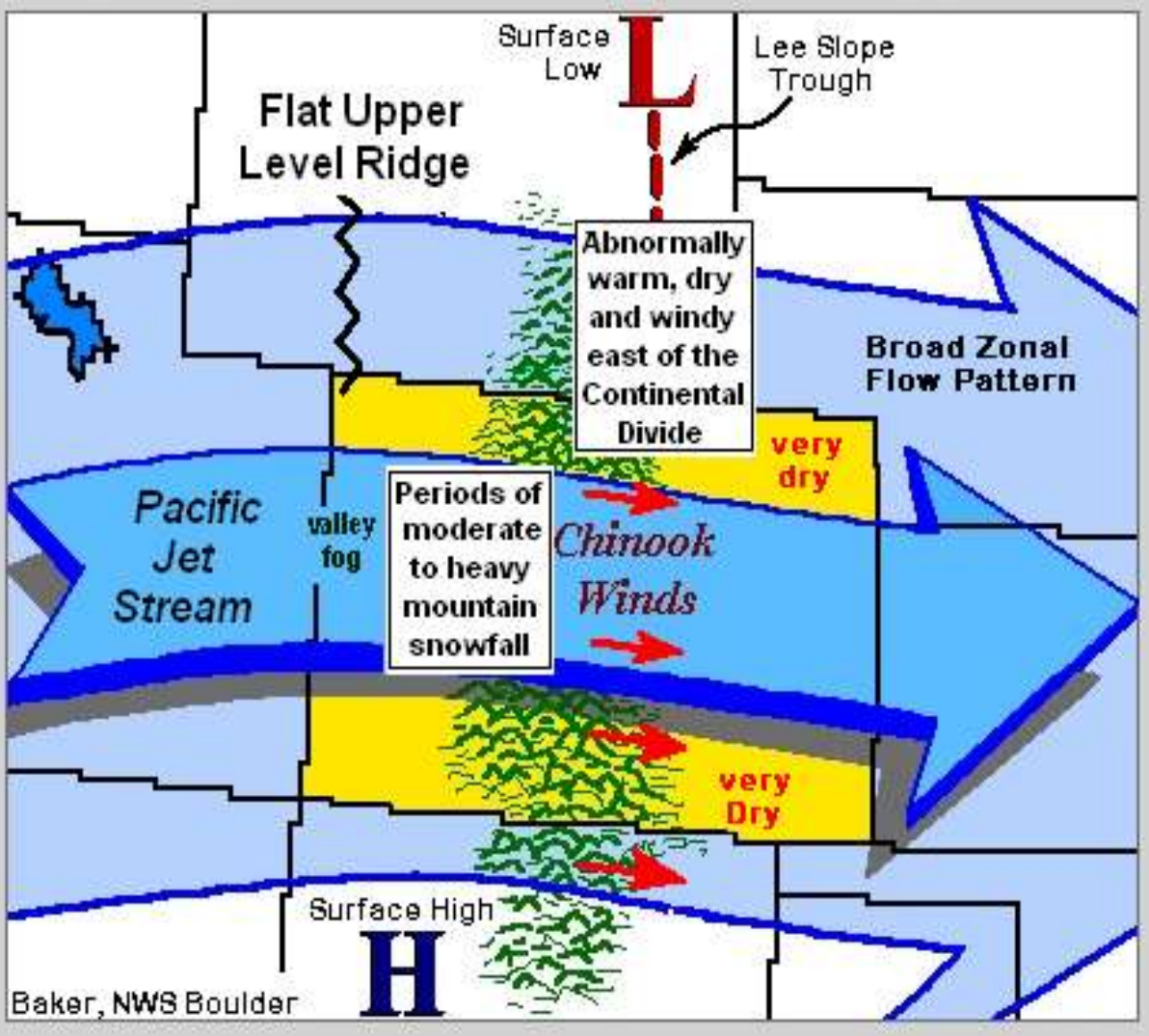
Mean Position of the Polar Jet Stream During Late Autumn through Mid-Winter of Moderate to Strong La Niña Episodes



As the west coast high pressure ridge weakens and flattens, the Polar jet stream acquires more of a west-northwesterly component.

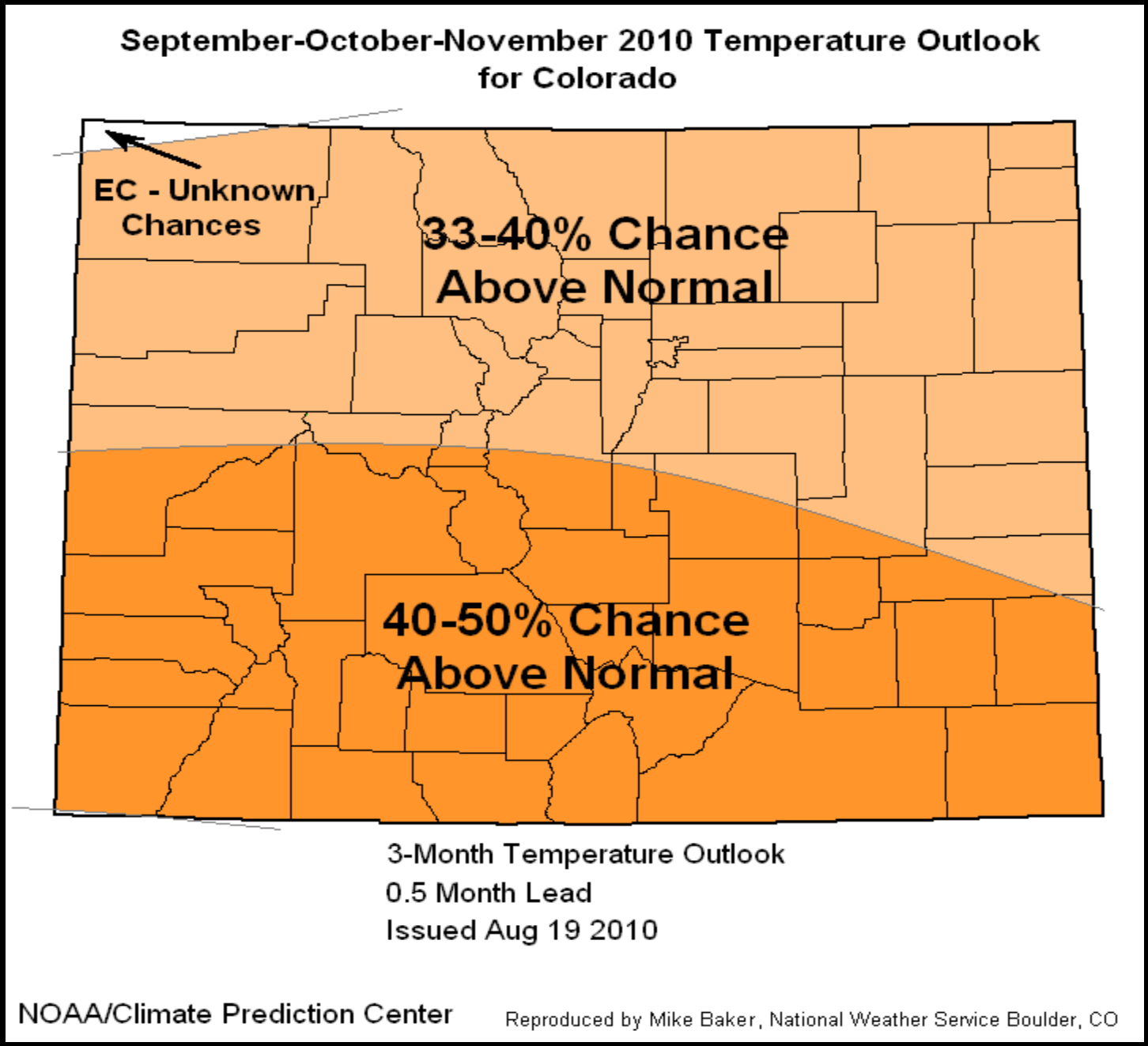
This southward shift in the jet results in an increase, often a significant increase, in precipitation and wind across the northwest plateau and north central mountains of Colorado.

Mean Position of the Polar Jet Stream From Mid-Winter through the Spring During Moderate to Strong La Niña Episodes

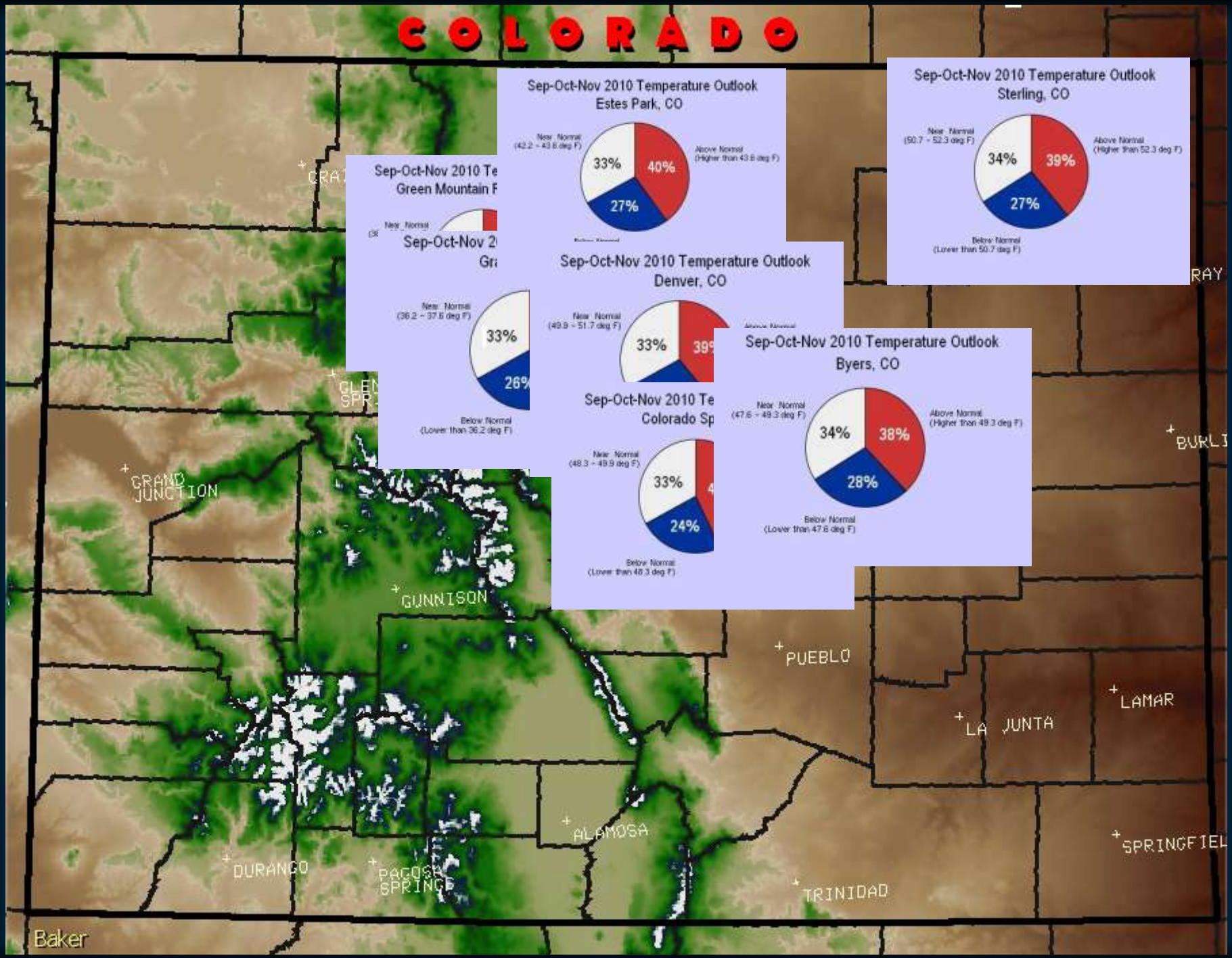


In late winter and spring during the stronger La Niña episodes, the prevailing flow aloft usually becomes predominantly zonal or westerly in direction. This generally warmer and drier flow pattern still manages to produce periods of moderate to heavy snowfall on west facing mountain slopes along and west of the Continental Divide.

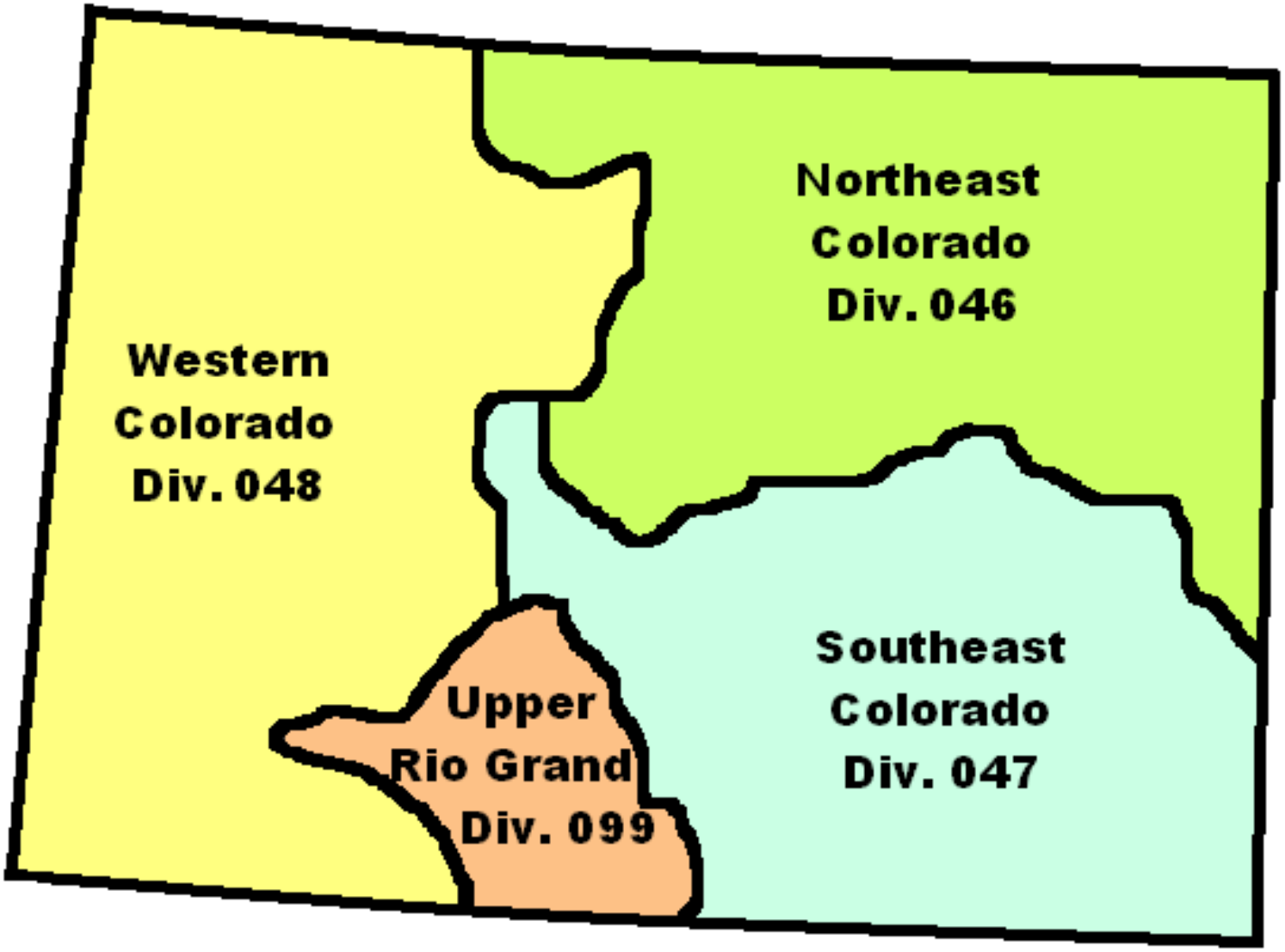
Whereas in areas east of the Divide, the weather is often abnormally warm, windy and quite dry for days, if not for weeks at a time.



Latest Temperature Outlook for Colorado From NOAA's Climate Prediction Center

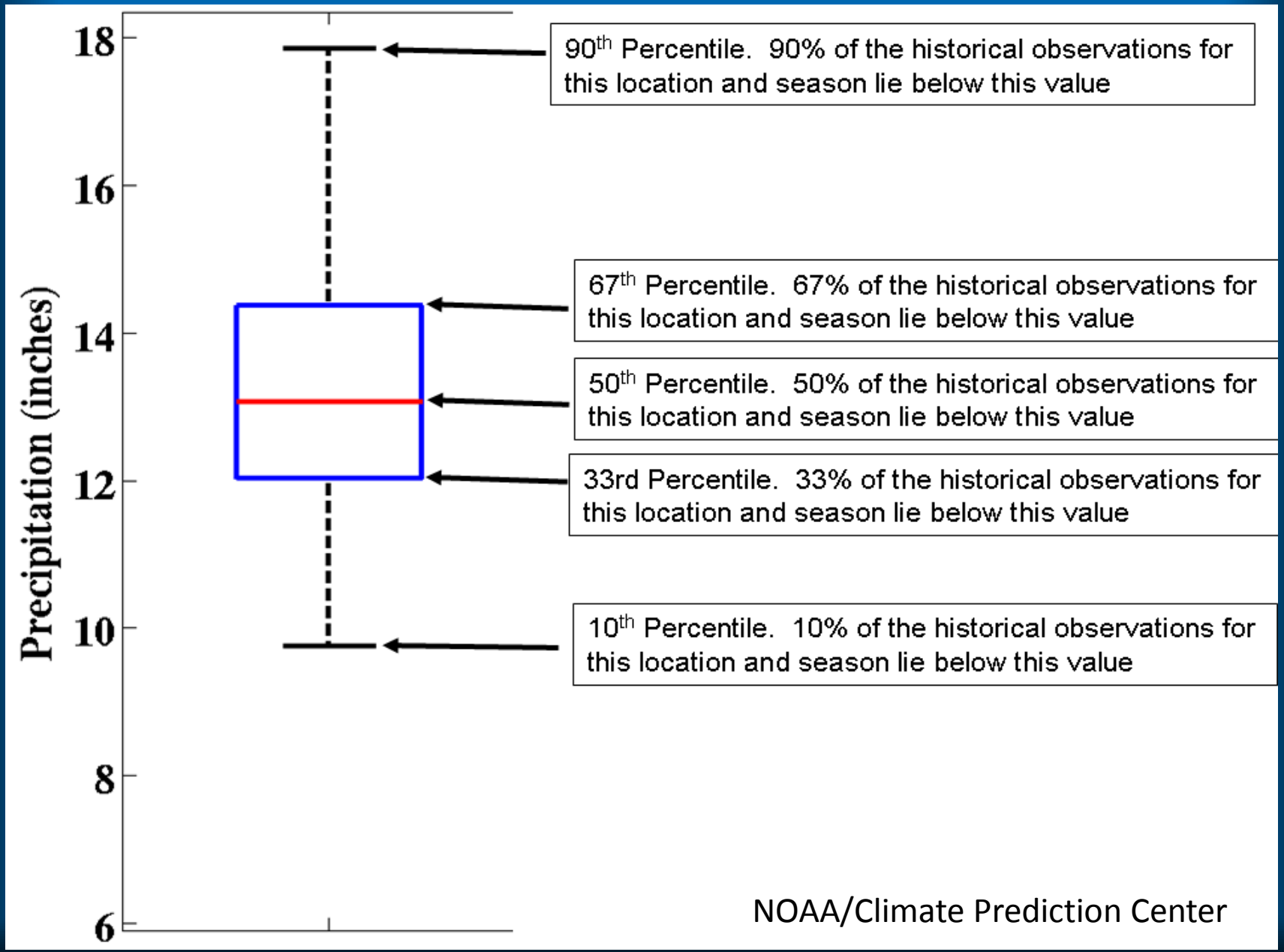

COLORADO
Sep-Oct-Nov 2010 Temperature Outlook
Estes Park, CO
Near Normal (42.2 - 43.8 deg F)
33%
40%
27%
Above Normal (Higher than 43.8 deg F)
Sep-Oct-Nov 2010 Temperature Outlook
Sterling, CO
Near Normal (50.7 - 52.3 deg F)
34%
39%
27%
Above Normal (Higher than 52.3 deg F)
Below Normal (Lower than 50.7 deg F)
Sep-Oct-Nov 2010 Temperature Outlook
Denver, CO
Near Normal (49.9 - 51.7 deg F)
33%
Sep-Oct-Nov 2010 Temperature Outlook
Byers, CO
Near Normal (47.6 - 49.3 deg F)
34%
38%
28%
Above Normal (Higher than 49.3 deg F)
Below Normal (Lower than 47.6 deg F)
Near Normal (36.2 - 37.6 deg F)
33%
26%
Below Normal (Lower than 36.2 deg F)
Near Normal (48.3 - 49.9 deg F)
33%
24%
Below Normal (Lower than 48.3 deg F)
GRAND JUNCTION
GUNNISON
PUEBLO
LAMAR
LA JUNTA
ALAMOSA
DURANGO
TRINIDAD
Baker

Colorado Climate Divisions

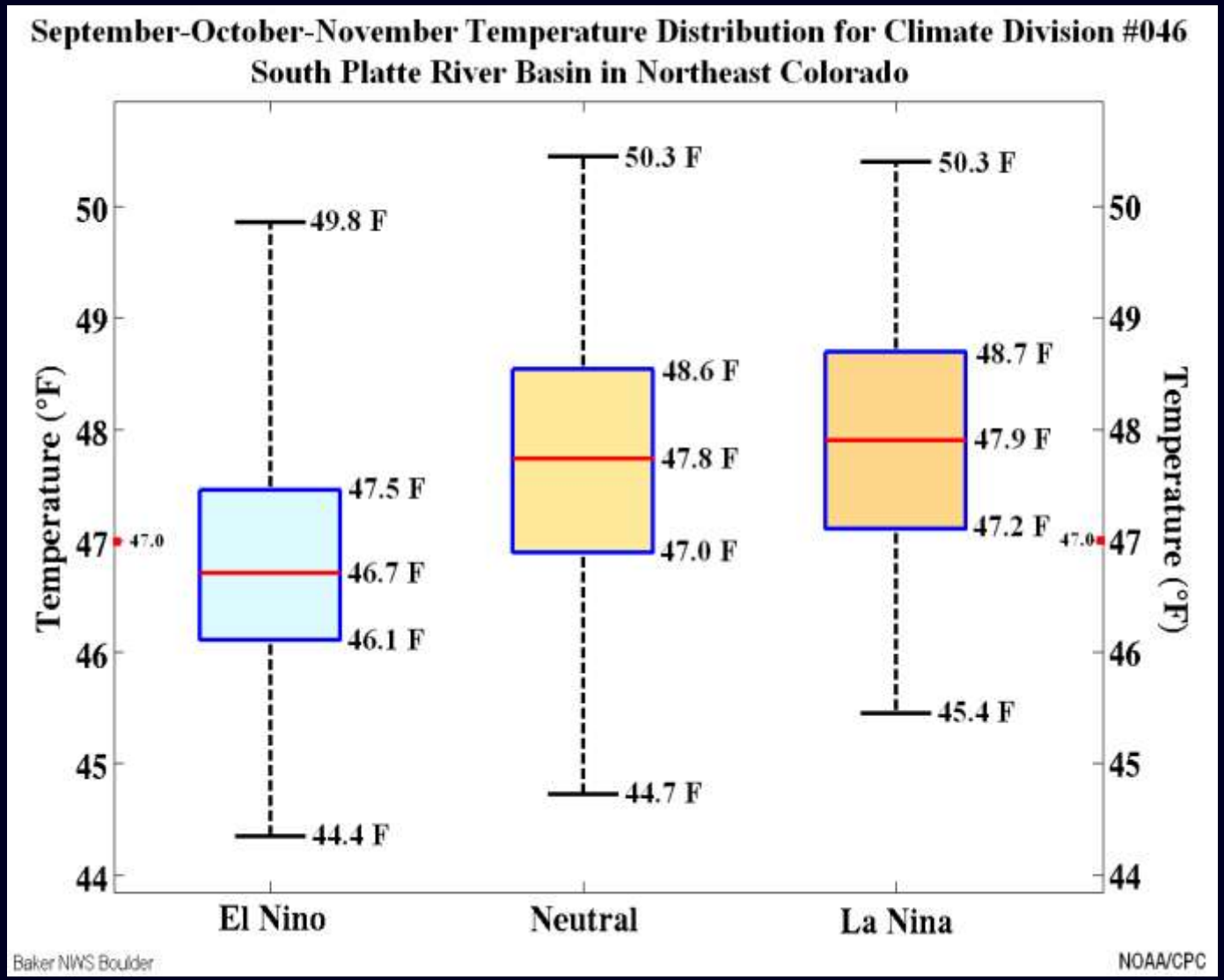


NOAA/Climate Prediction Center

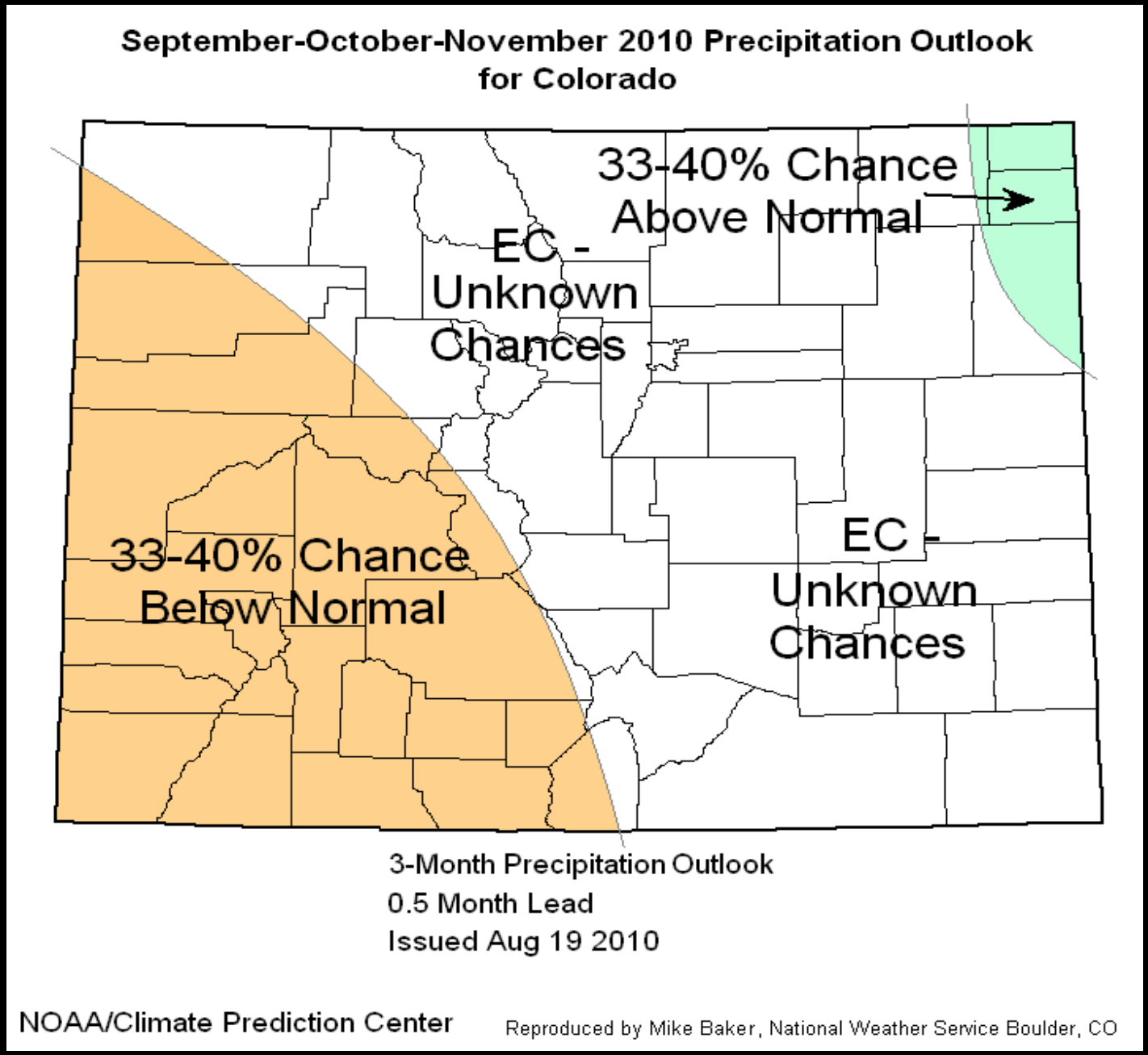
CPC Whisker Plots



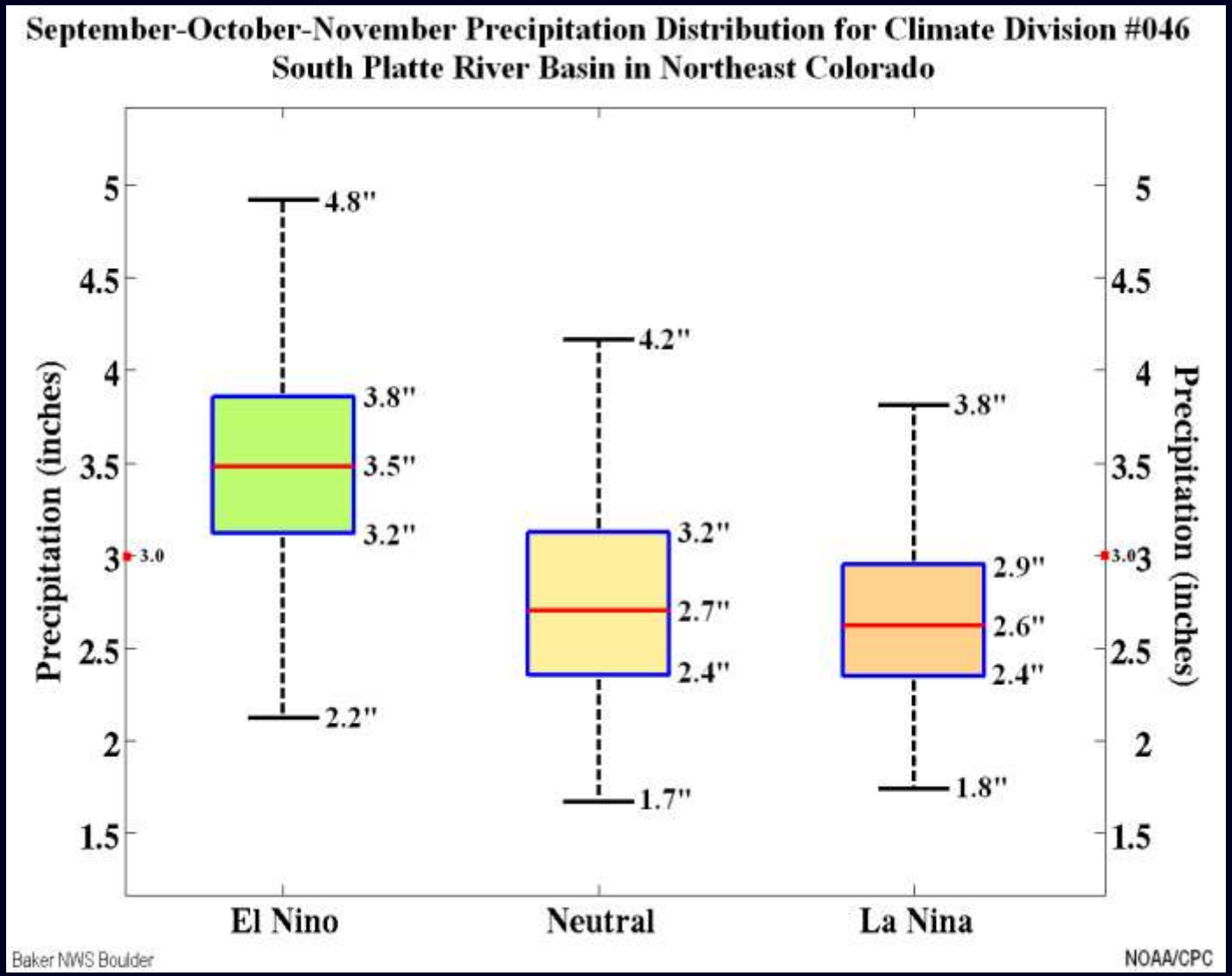
NOAA/Climate Prediction Center



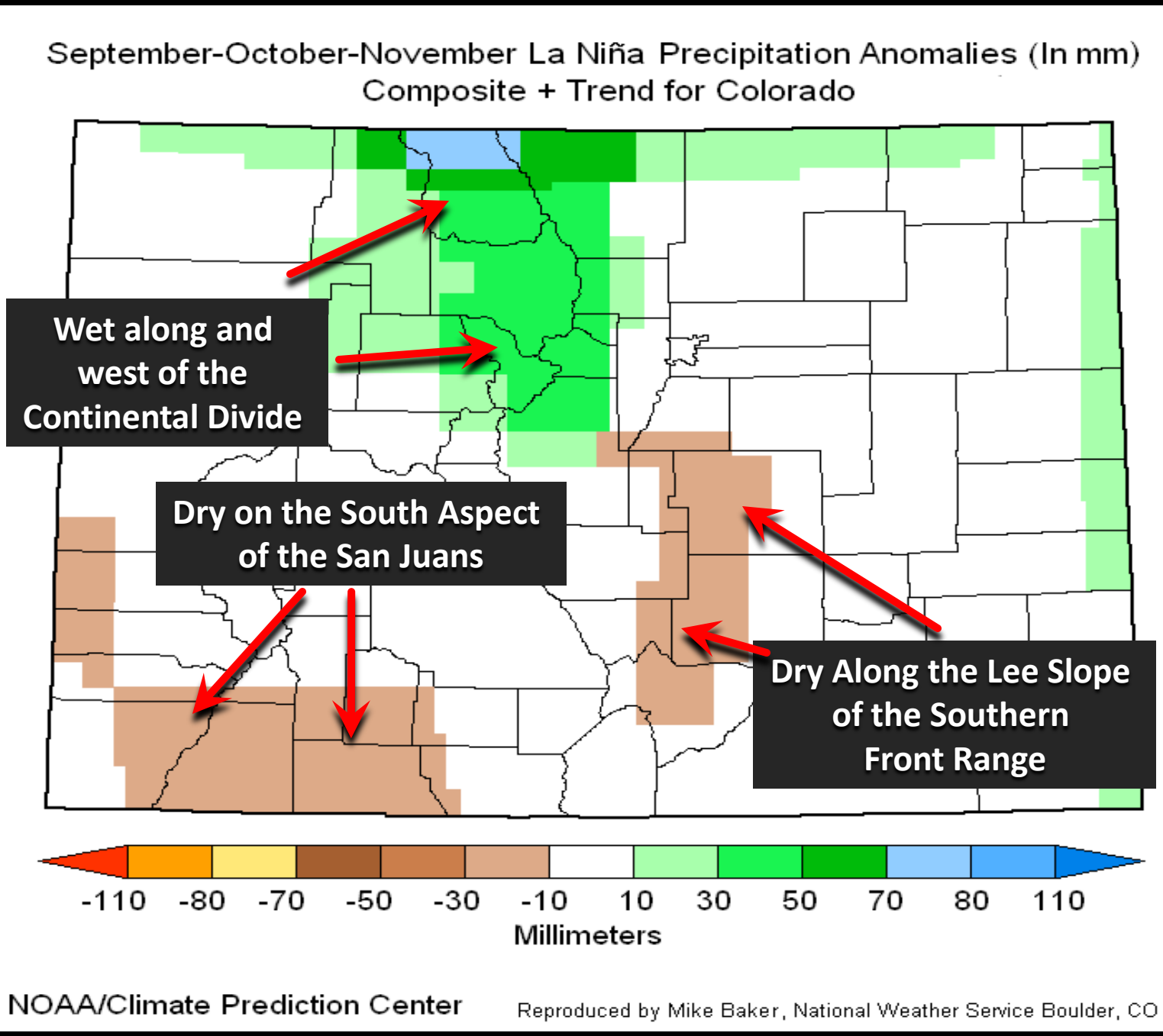
Since 1950, northeast Colorado has climatologically been warmer than average during La Niña episodes, and also warmer than that observed during El Niño episodes. Temperatures during neutral or non-ENSO periods were similar to those during La Niñas.

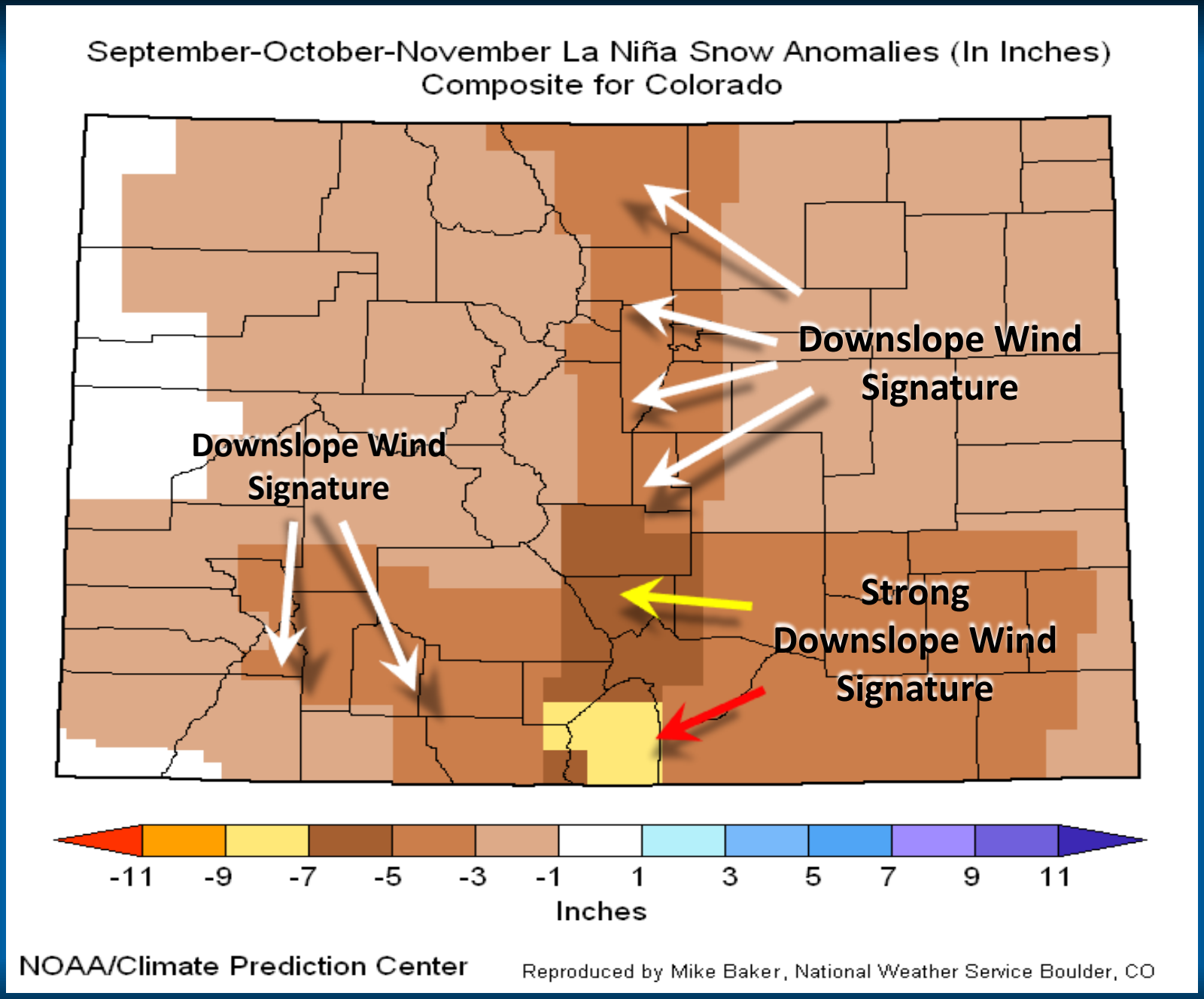


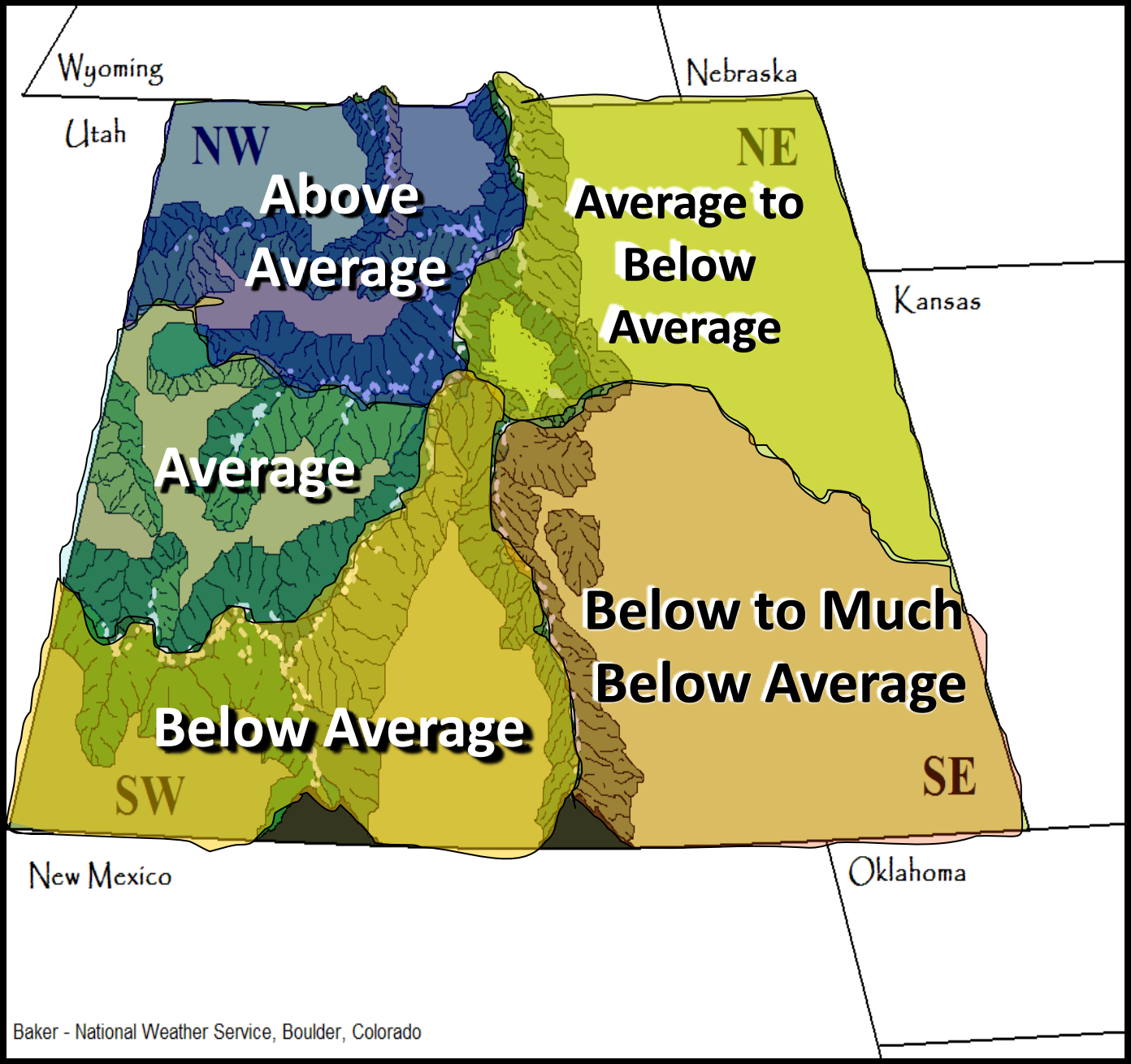
Latest Precipitation Outlook for Colorado From NOAA's Climate Prediction Center



Since 1950, northeast Colorado has climatologically been drier than average during La Niña episodes, and also drier than that observed during El Niño episodes. Precipitation during neutral or non-ENSO periods was similar to that during La Niñas.


September-October-November La Niña Precipitation Anomalies (In mm)
Composite + Trend for Colorado
Wet along and west of the Continental Divide
Dry on the South Aspect of the San Juans
Dry Along the Lee Slope of the Southern Front Range
-110 -80 -70 -50 -30 -10 10 30 50 70 80 110
Millimeters
NOAA/Climate Prediction Center
Reproduced by Mike Baker, National Weather Service Boulder, CO


September-October-November La Niña Snow Anomalies (In Inches)
Composite for Colorado
Downslope Wind Signature
Downslope Wind Signature
Strong Downslope Wind Signature
-11 -9 -7 -5 -3 -1 1 3 5 7 9 11
Inches
NOAA/Climate Prediction Center
Reproduced by Mike Baker, National Weather Service Boulder, CO



Typical Winter Season Precipitation Patterns During La Niñas

West central and northwest Colorado typically receives AVERAGE to ABOVE AVERAGE precipitation (rain and snow) during moderate to strong La Niñas, particularly from mid-winter through mid-spring.

Whereas, southwest and eastern Colorado typically receives BELOW to MUCH BELOW AVERAGE precipitation (rain and snow).

Summary

La Niña conditions are present across the eastern tropical Pacific.

Equatorial SSTs are as much as 1 to 4 degrees Celsius below average from the Date Line eastward to the South American coast.

Recent equatorial Pacific SST trends and model forecasts indicate La Niña will continue at least through the winter of 2010-2011.

The current La Niña is forecast to produce above average temperatures and below average precipitation across most of Colorado…specifically southern and eastern portions of the state at least through the upcoming winter season.

Meanwhile the northwest and north central sections of Colorado are expected to see above average precipitation (snowfall) and below average temperature. These conditions are more likely to exist during the latter half of the winter season and perhaps into the spring of 2011 should the present La Niña episode continue.