La Niña Conditions Continue and the Latest Outlook for the Remainder of the 2010-2011 Winter Season

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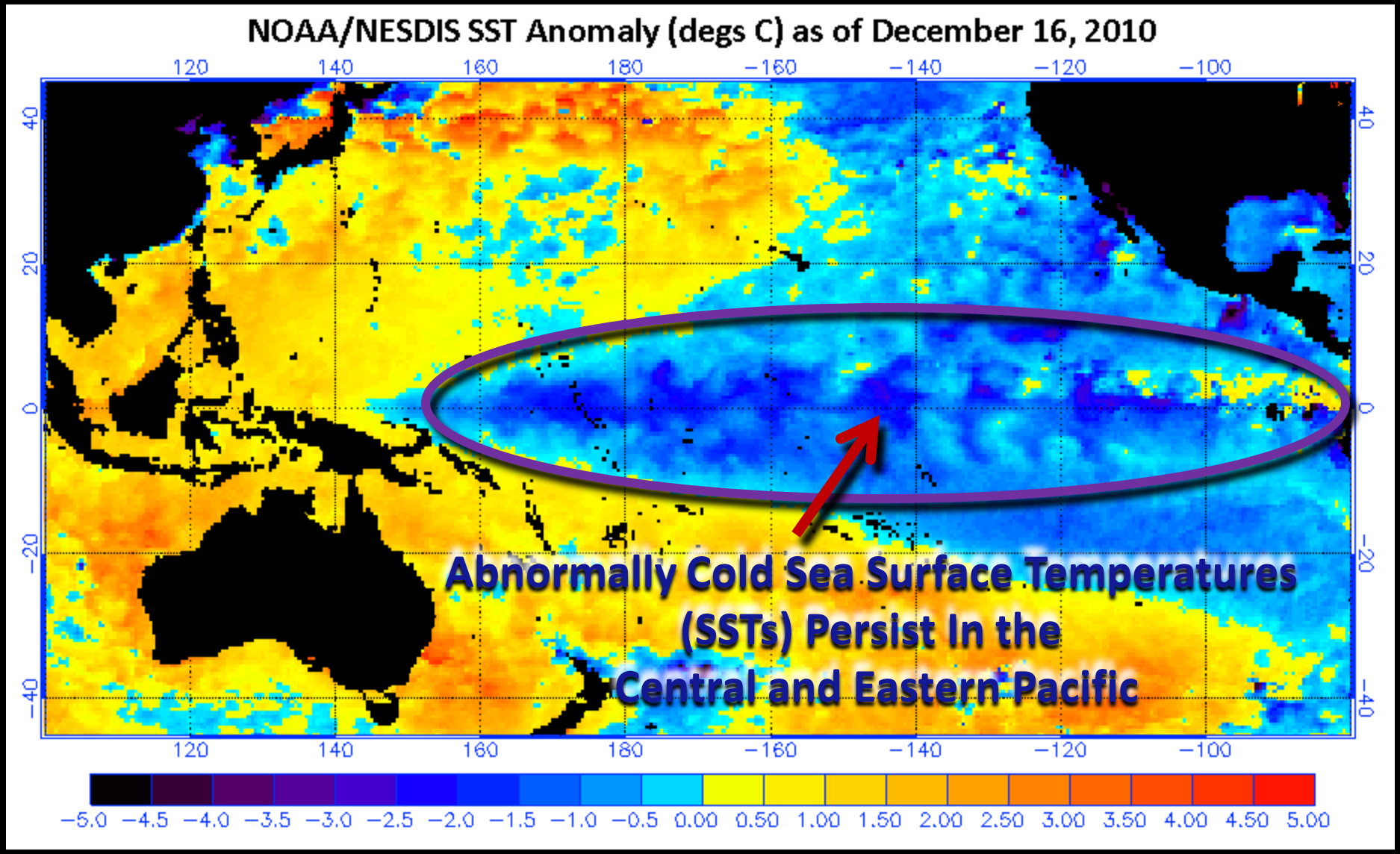
La Niña Overview

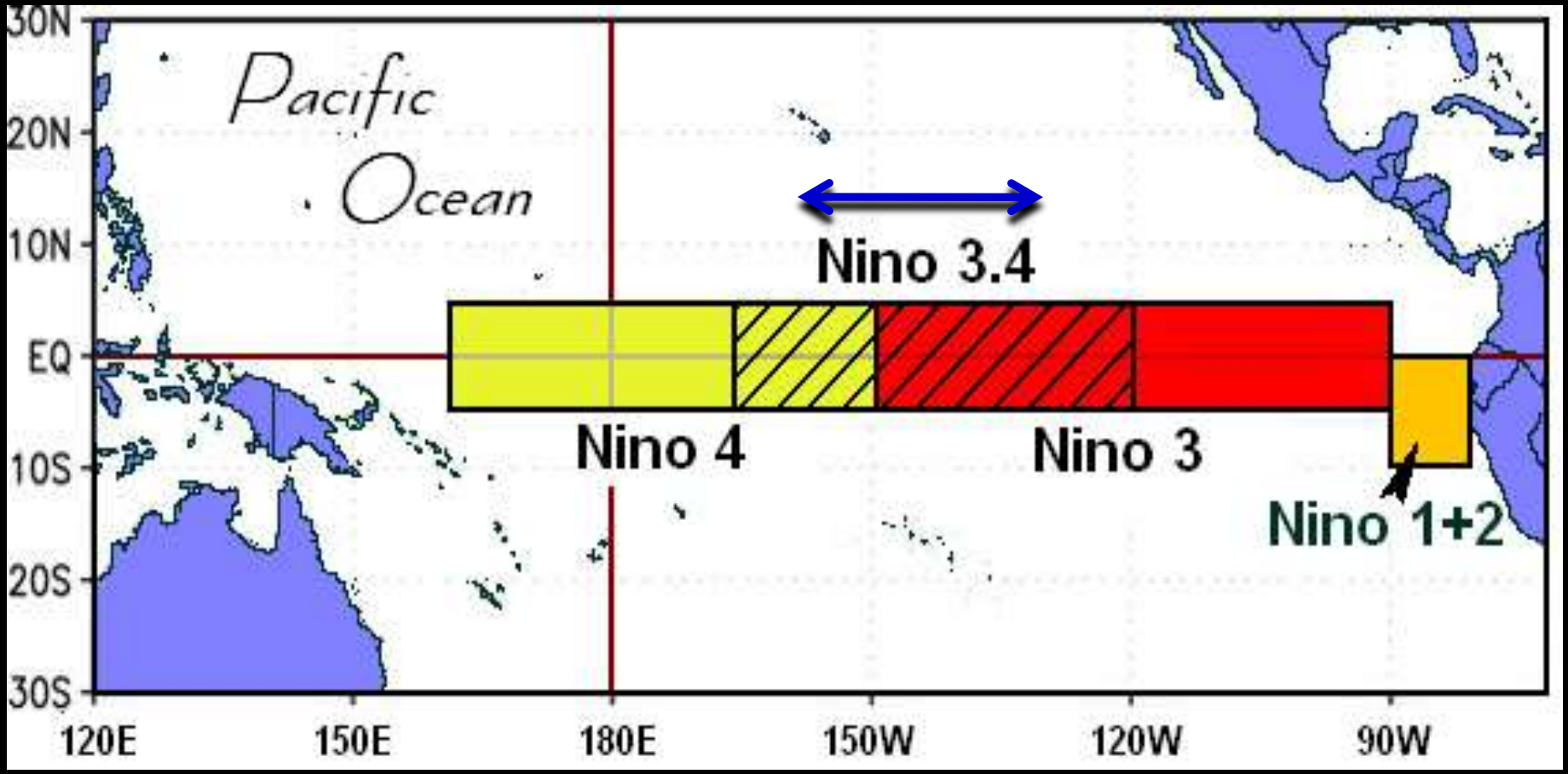
- Moderate to strong La Niña conditions persist in the central and eastern tropical Pacific Ocean.
- For the second straight month, only small changes were evident in the Niño SST indices, which range from -1.3 to –1.7 (moderate to strong intensity) at the end of November.
- Recent Equatorial Pacific SST trends and model forecasts indicate that La Niña will peak during the November-January time frame, then slowly weaken but will most likely persist through at least the Northern Hemisphere spring of 2011.
- Thereafter , the fate of La Niña is more uncertain.


La Niña Conditions
Continue in the Pacific



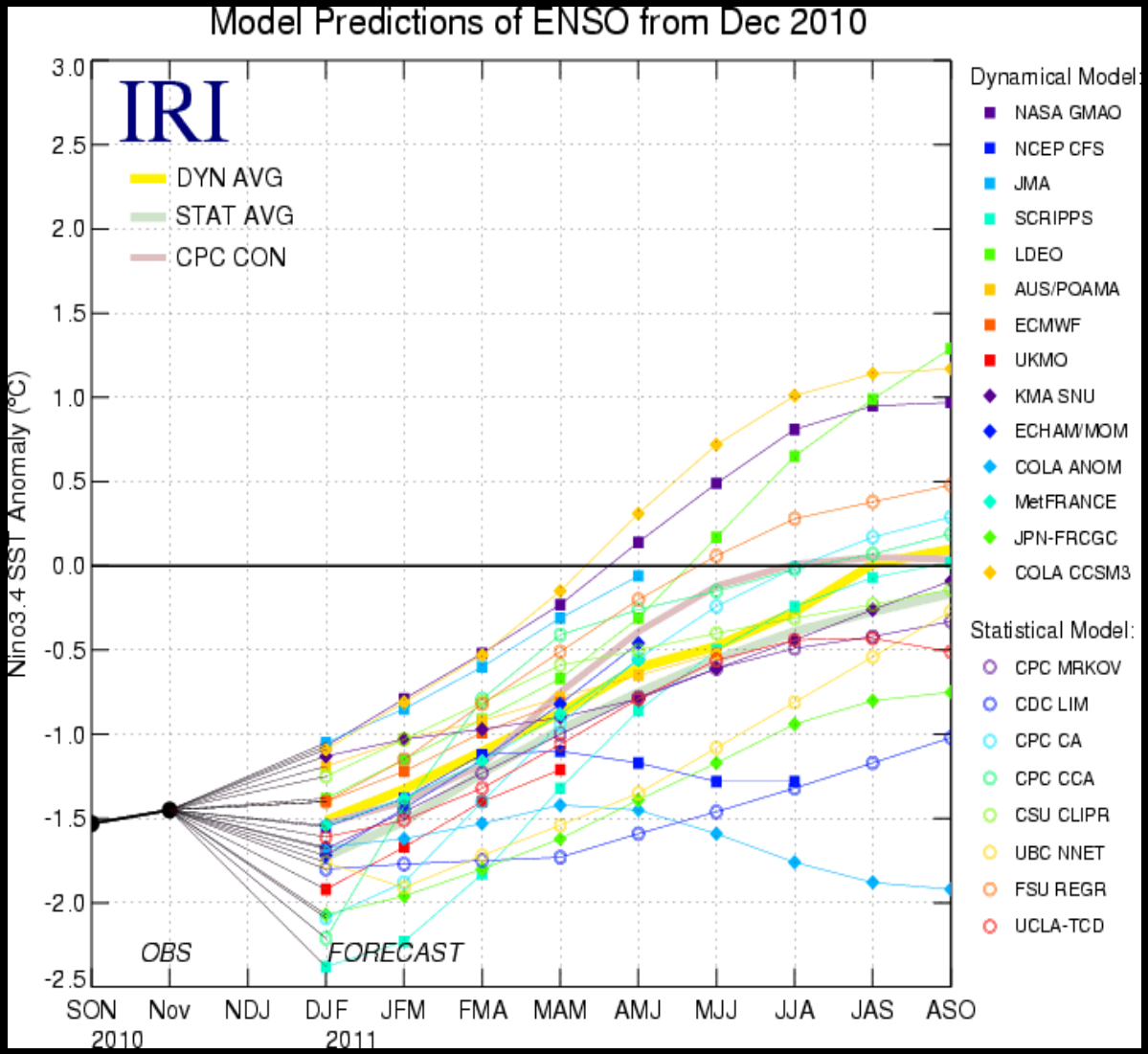
Source: NOAA's National Environmental Satellite, Data, and Information Service (NESDIS)

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.

Pacific Niño 3.4 ENSO Outlook



- A majority of the 23 dynamical and statistical El Niño-Southern Oscillation (ENSO) models continue to indicate the presence of a moderate to strong La Niña episode (-1.5 C or less) during the December-January-February 2010-2011 climate season.

- These same dynamical and statistical models also indicate a La Niña of weak to moderate strength (-0.5 C to -1.0˚C) at least through the Northern Hemisphere spring of 2011.

Source: International Research Institute for Climate and Society (IRI)

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	-0.6	-1.0	-1.3	-1.4	?	

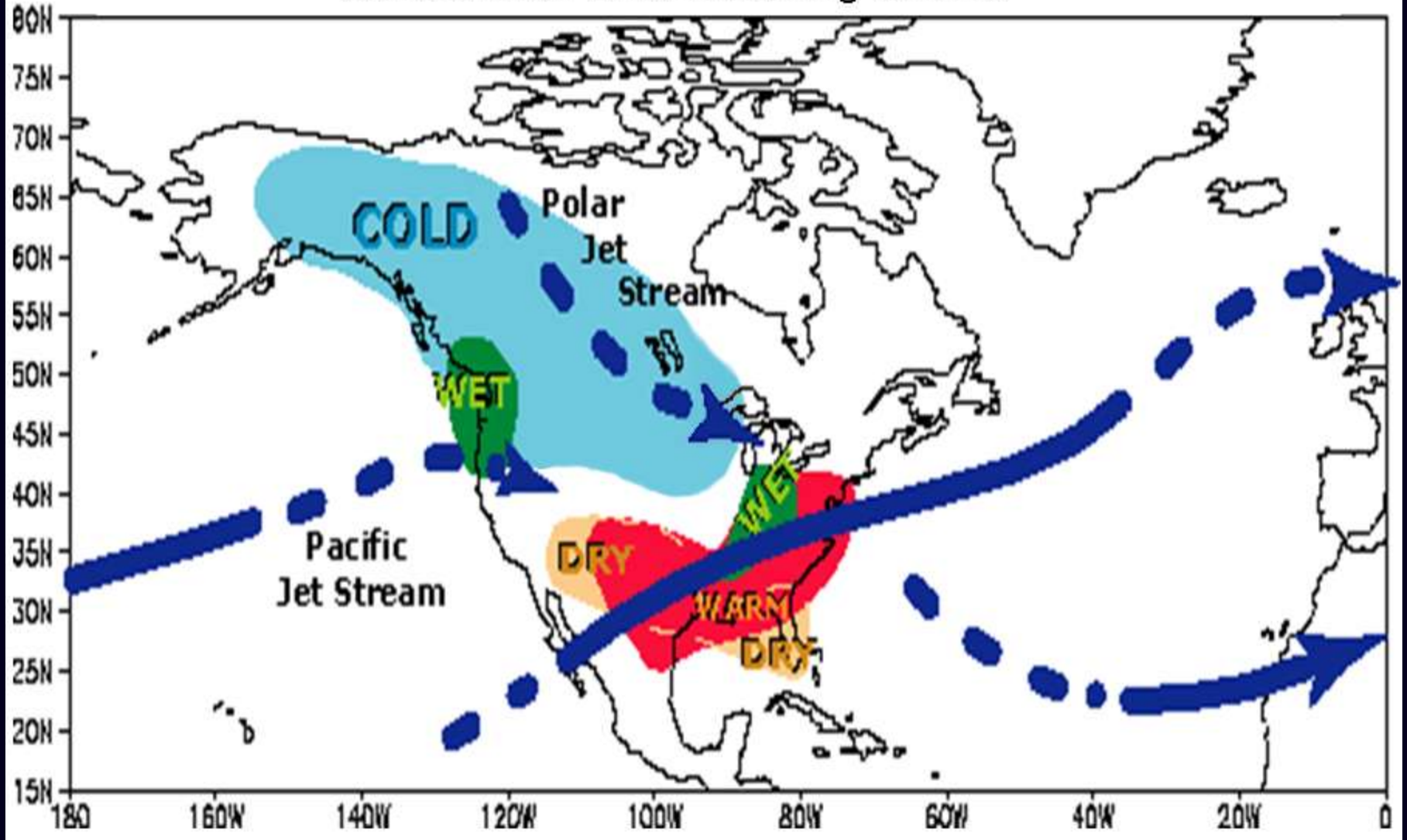
Warm Episodes - El Niños (in RED): ONI 0.5 and above

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 Nov 18 2010 Baker

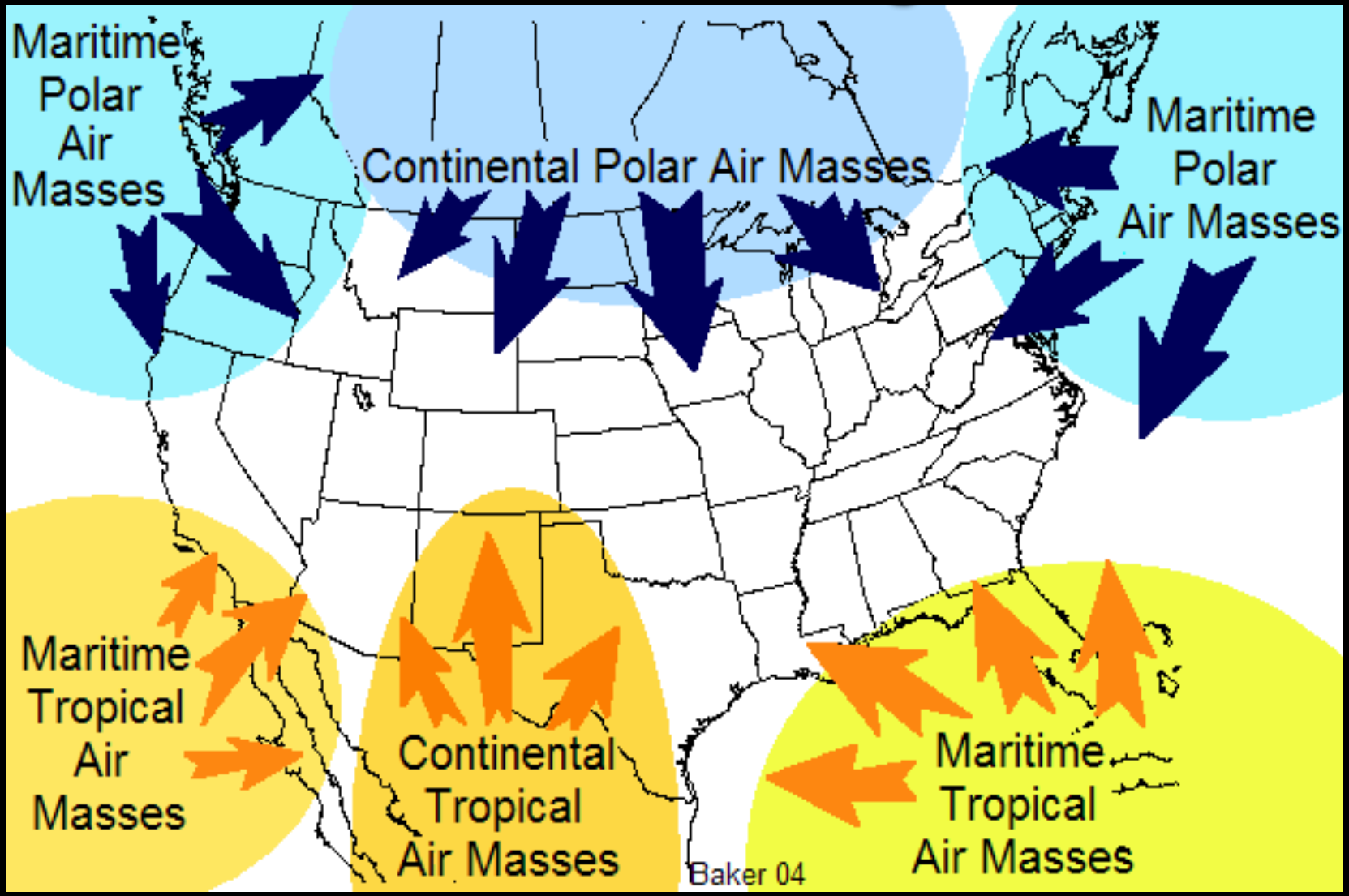
Typical Winter Weather and Jet Stream Patterns Across North America during La Niña



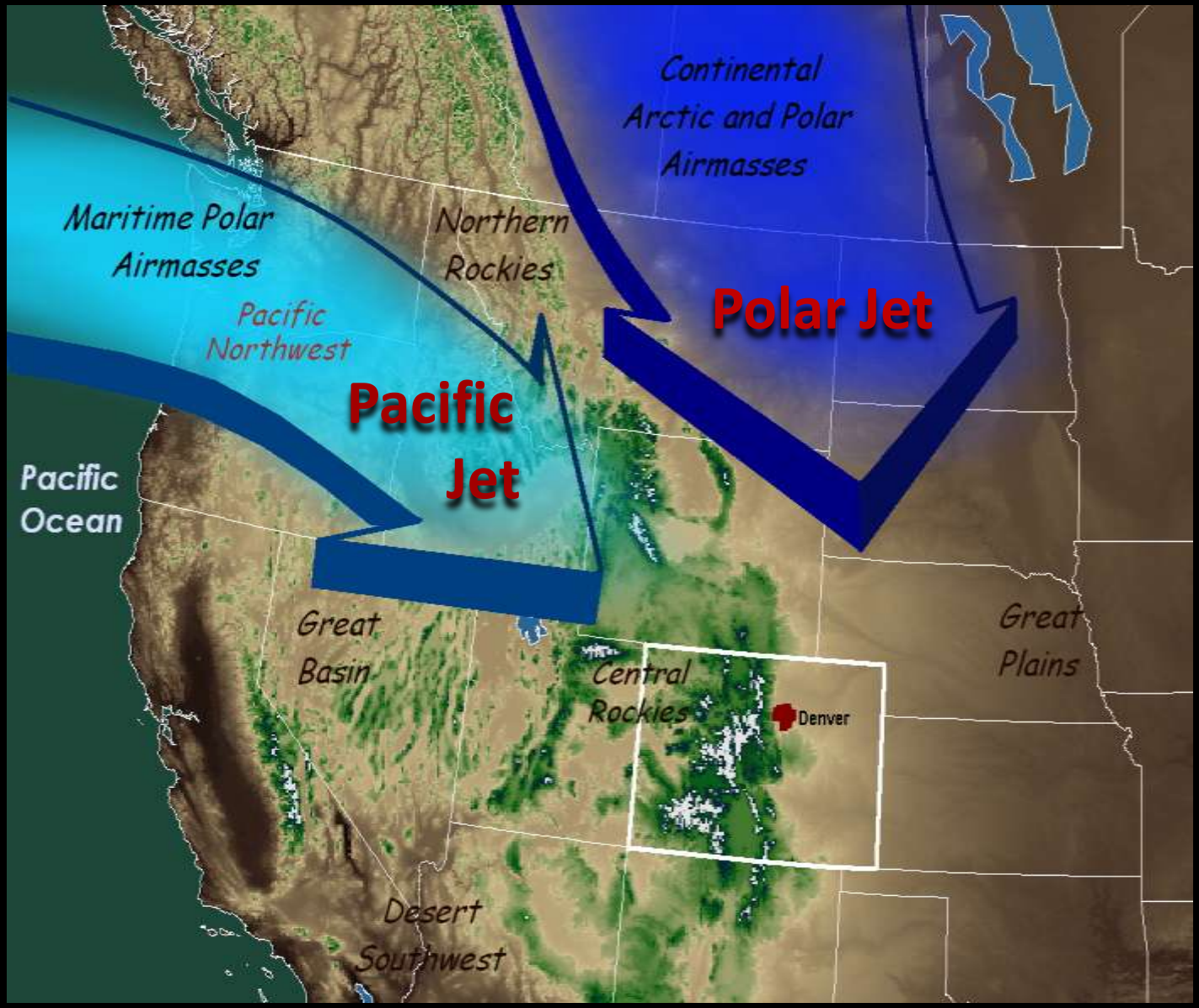
Source: NOAA's Climate Prediction Center

The Potential Influence of La Niña on the Jet Stream and Colorado Weather During the Upcoming Winter and Spring

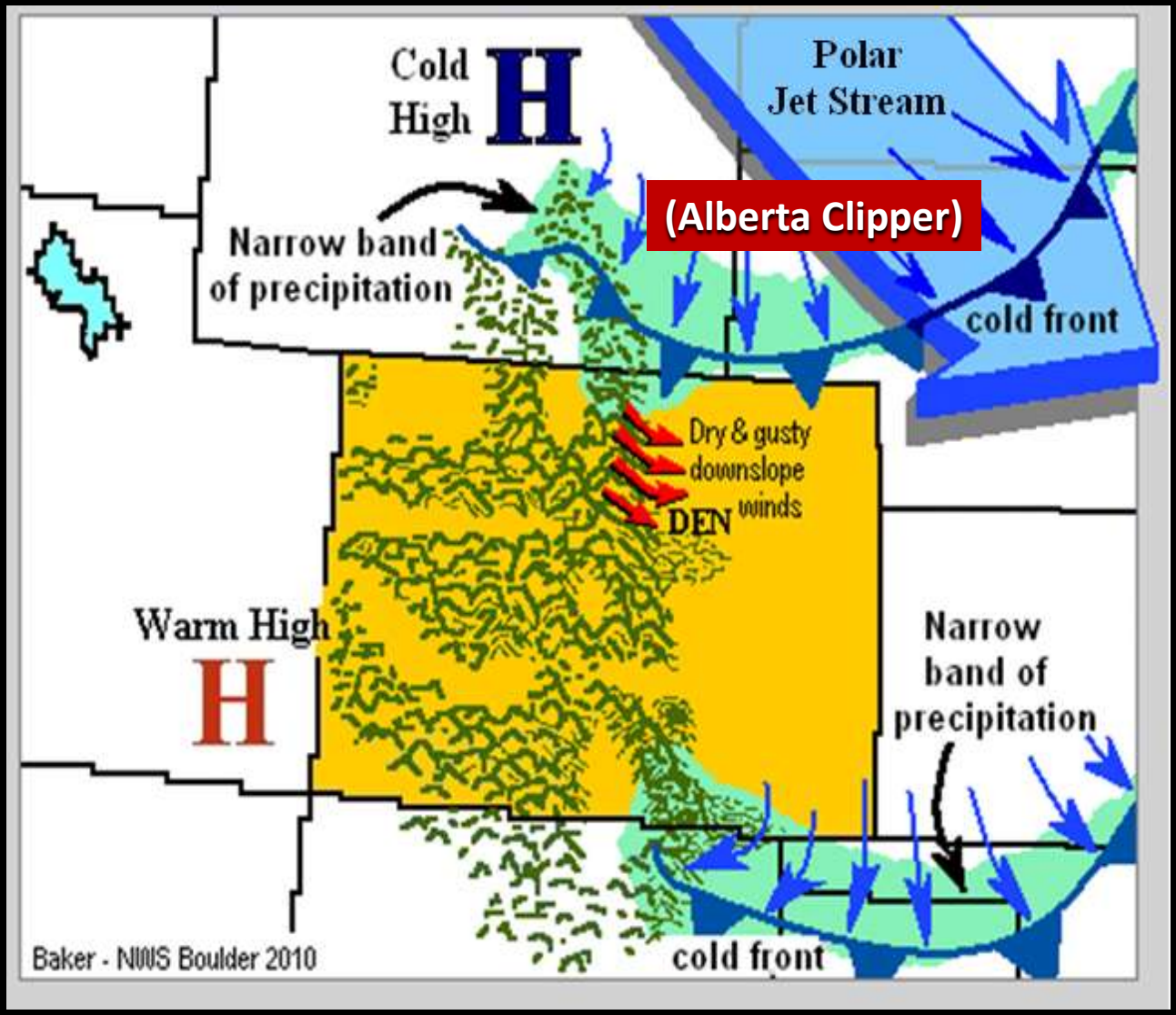
Air Mass Source Regions



Air masses, such as the Maritime Polar (mP) and the Continental Polar (cP) play a significant role in Colorado's weather, particularly during the winter months of the year.



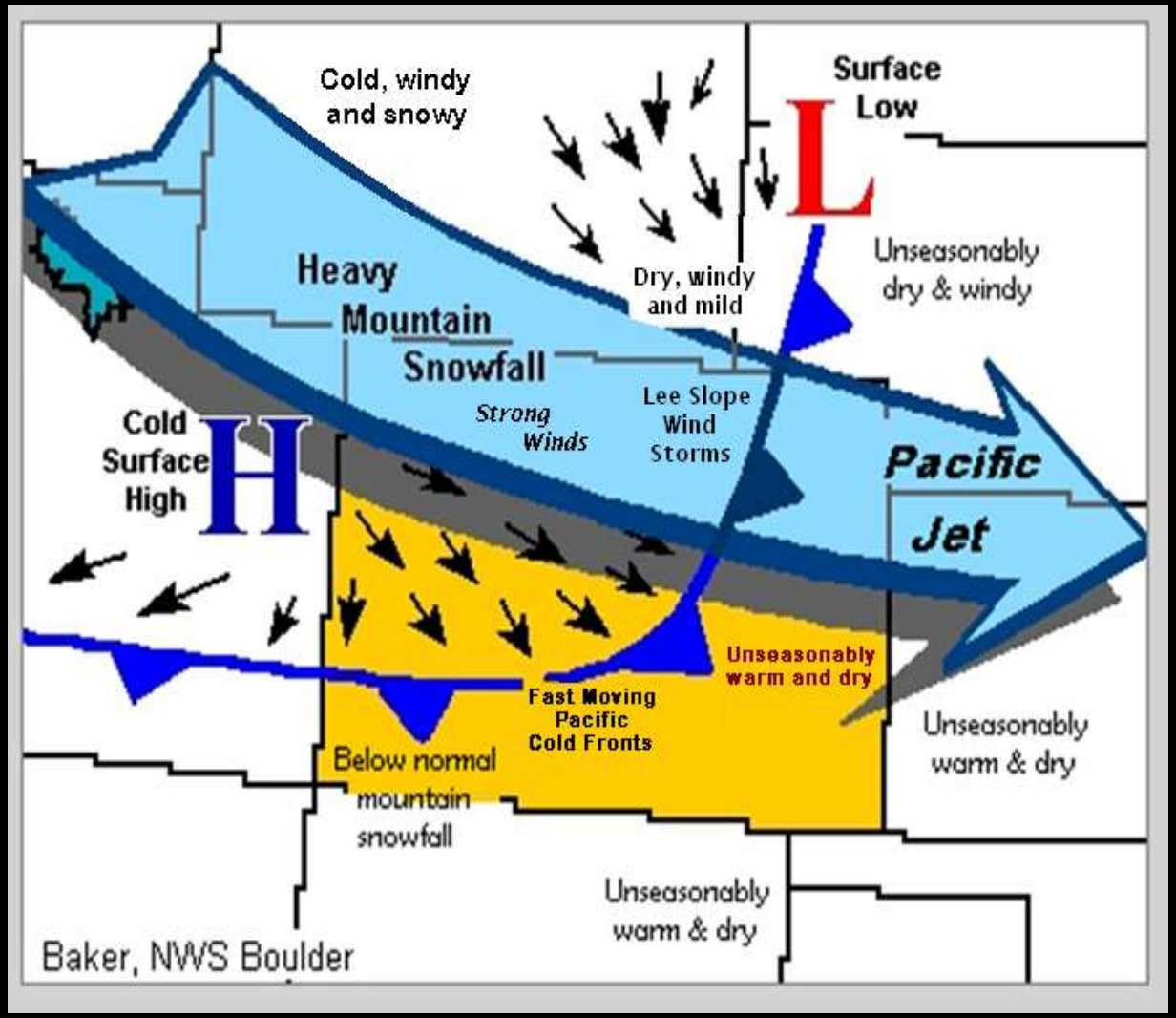
Colorado is more often visited by relatively mild and moist maritime polar air masses than the much drier and colder arctic air masses during the winter season of moderate to strong La Niñas



Warm, dry and windy conditions will often develop in advance of these cold fronts, only to quickly disappear with their passage.

Eastern Colorado typically experiences fewer arctic air mass intrusions, or "back door" cold fronts, during moderate to strong La Niñas. These brushes with the polar jet stream are often brief, usually lasting no longer than a couple days. Rarely does the outer fringe of these shallow air masses affect areas west of the Continental Divide.

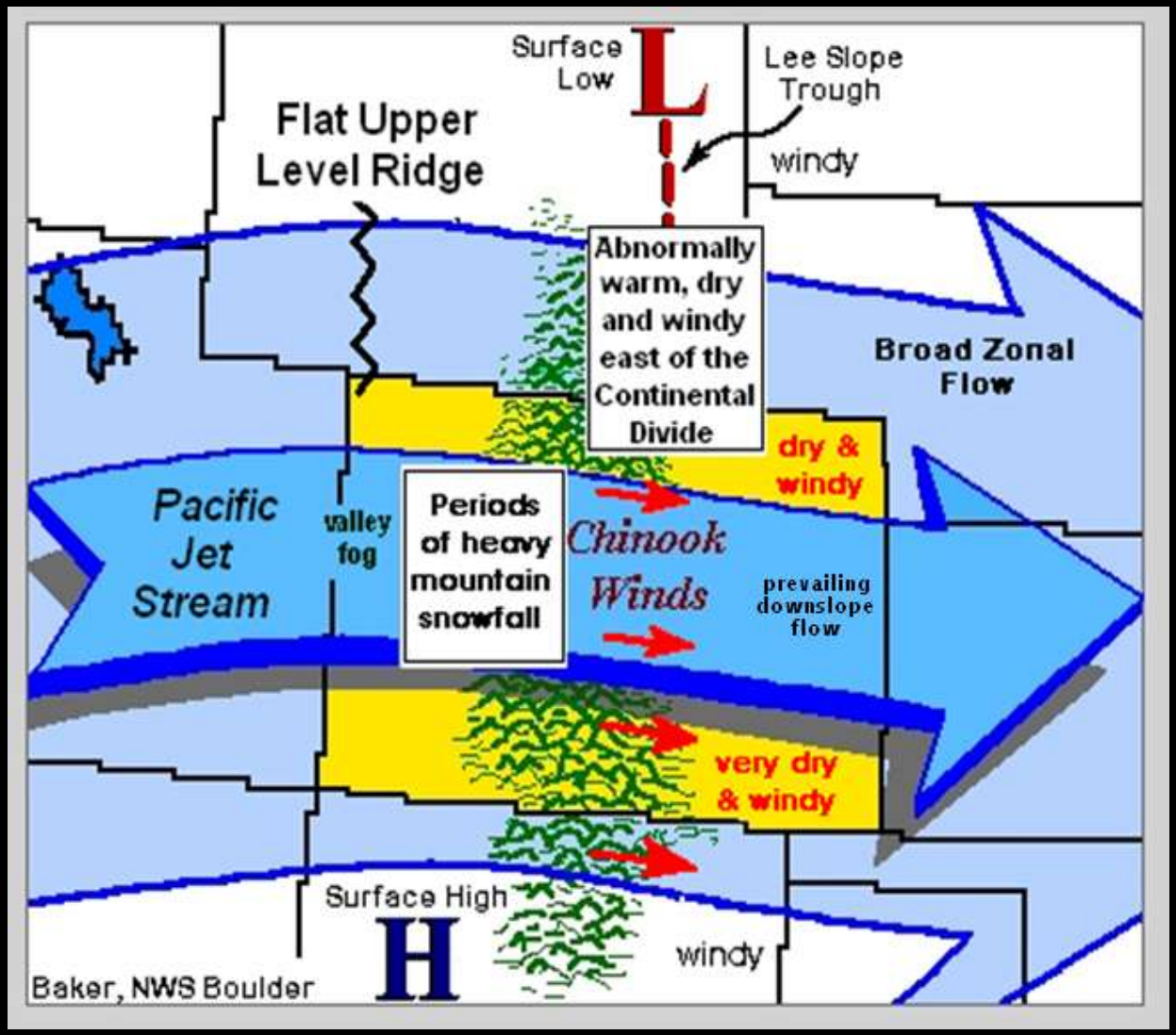
These fast moving cold fronts, sometimes referred to as "Alberta clippers," typically produce little more than a few hours of light to moderate precipitation , strong and gusty northerly winds and, in some cases, a sharp drop in temperature.



The Pacific jet stream will typically assume more of a northwest-to-southeast orientation during late autumn and winter of moderate to strong La Niñas.

A strong Pacific jet stream in this position will increase the chance for heavy precipitation (mountain snowfall) and strong wind across northwest and west central Colorado.

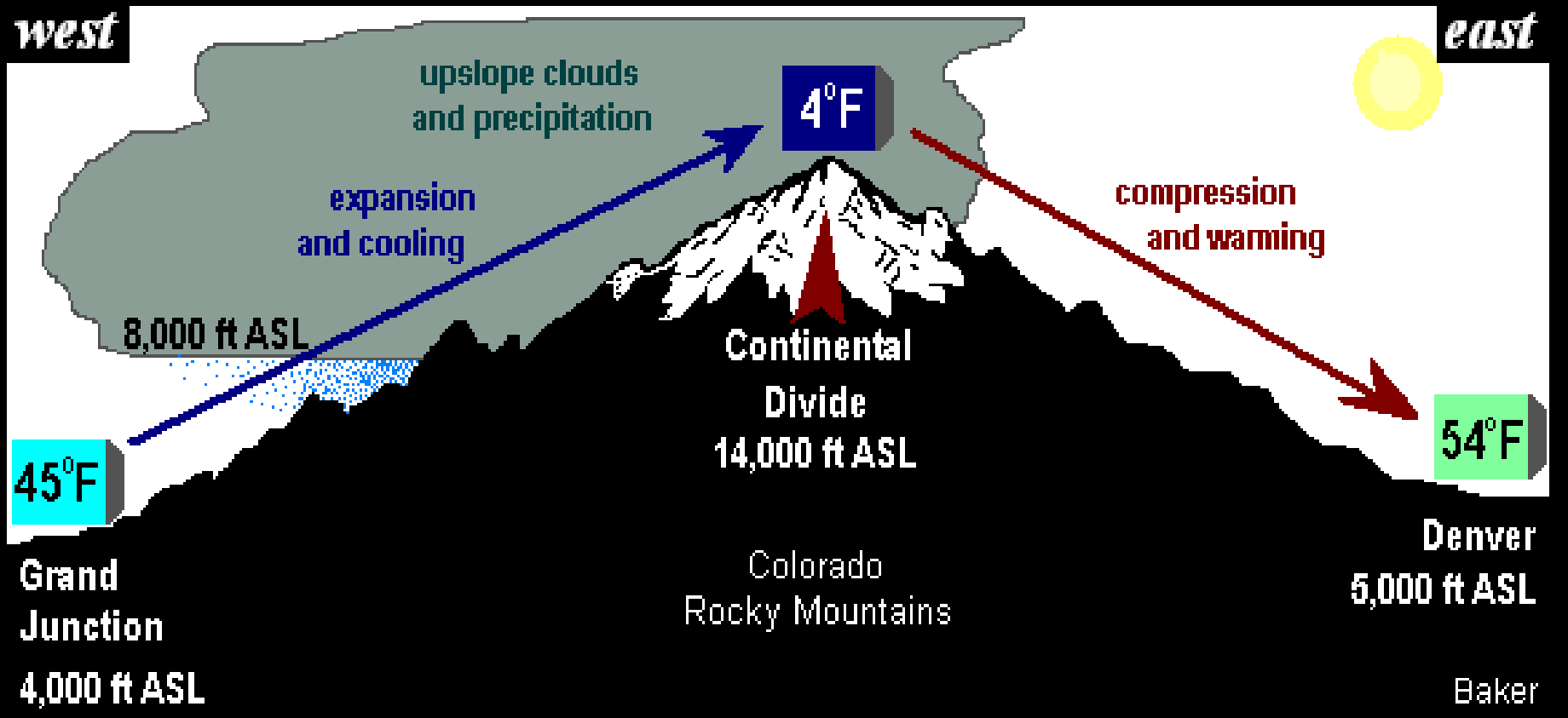
Whereas, east of the Continental Divide the resultant weather is often milder and noticeably much drier. Strong "standup" cold fronts moving down off of the mountains will often produce gusty and potentially damaging down slope (Chinook and Bora) wind events from the Front Range eastward.



A zonal (or westerly) oriented Pacific jet stream also occurs with regularity during the winter and spring of moderate to strong La Niñas.

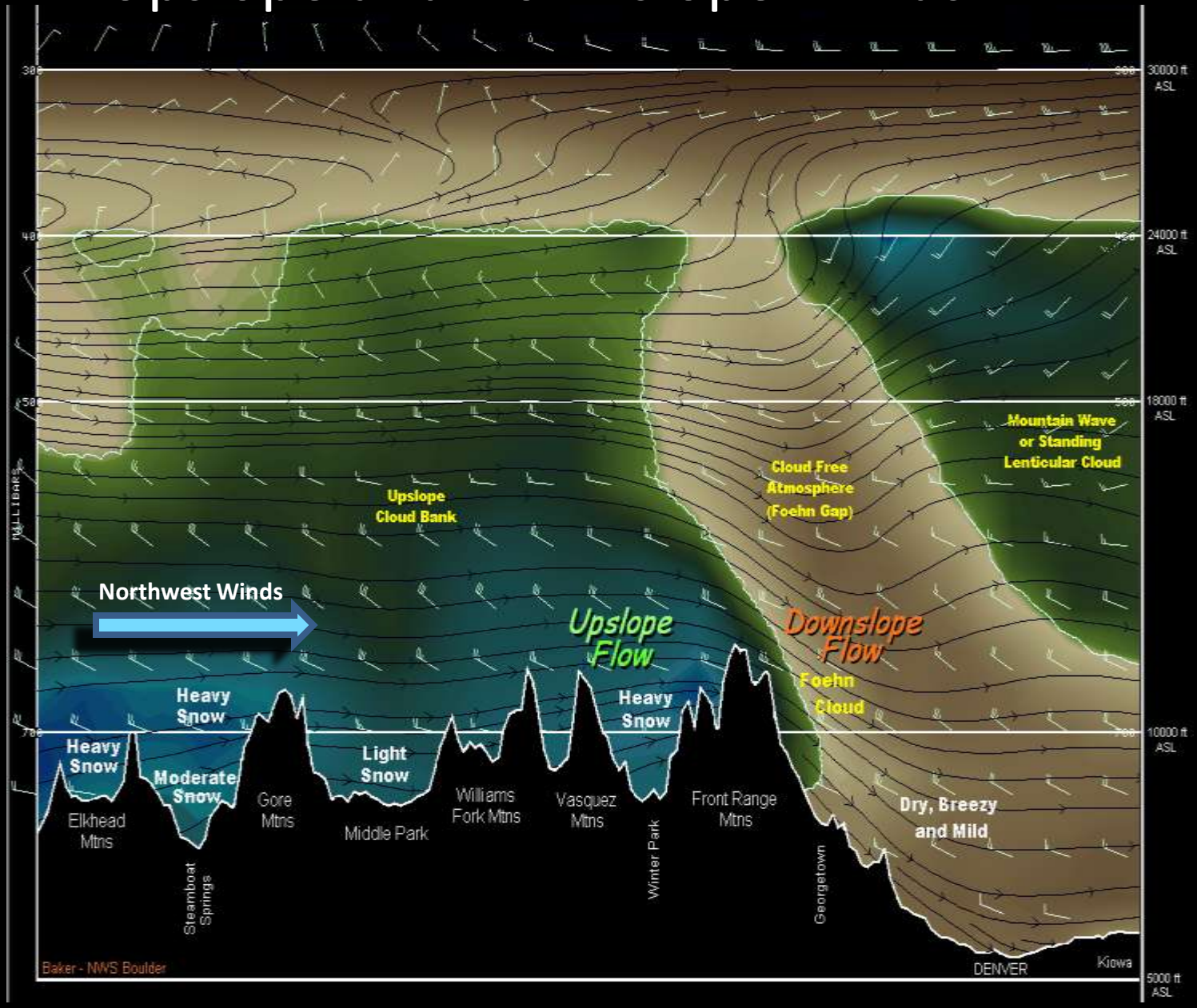
This relatively warm and often moisture laden zonal flow is capable of producing moderate to heavy precipitation (rain and/or snow) and strong wind in mountain and valley areas along and west of the Continental Divide in Colorado.

East of the Continental Divide, weather conditions during the same period are typically much warmer and drier, due in large part to frequent episodes of gusty and potentially damaging downslope winds that form in the lee the Colorado Front Range.



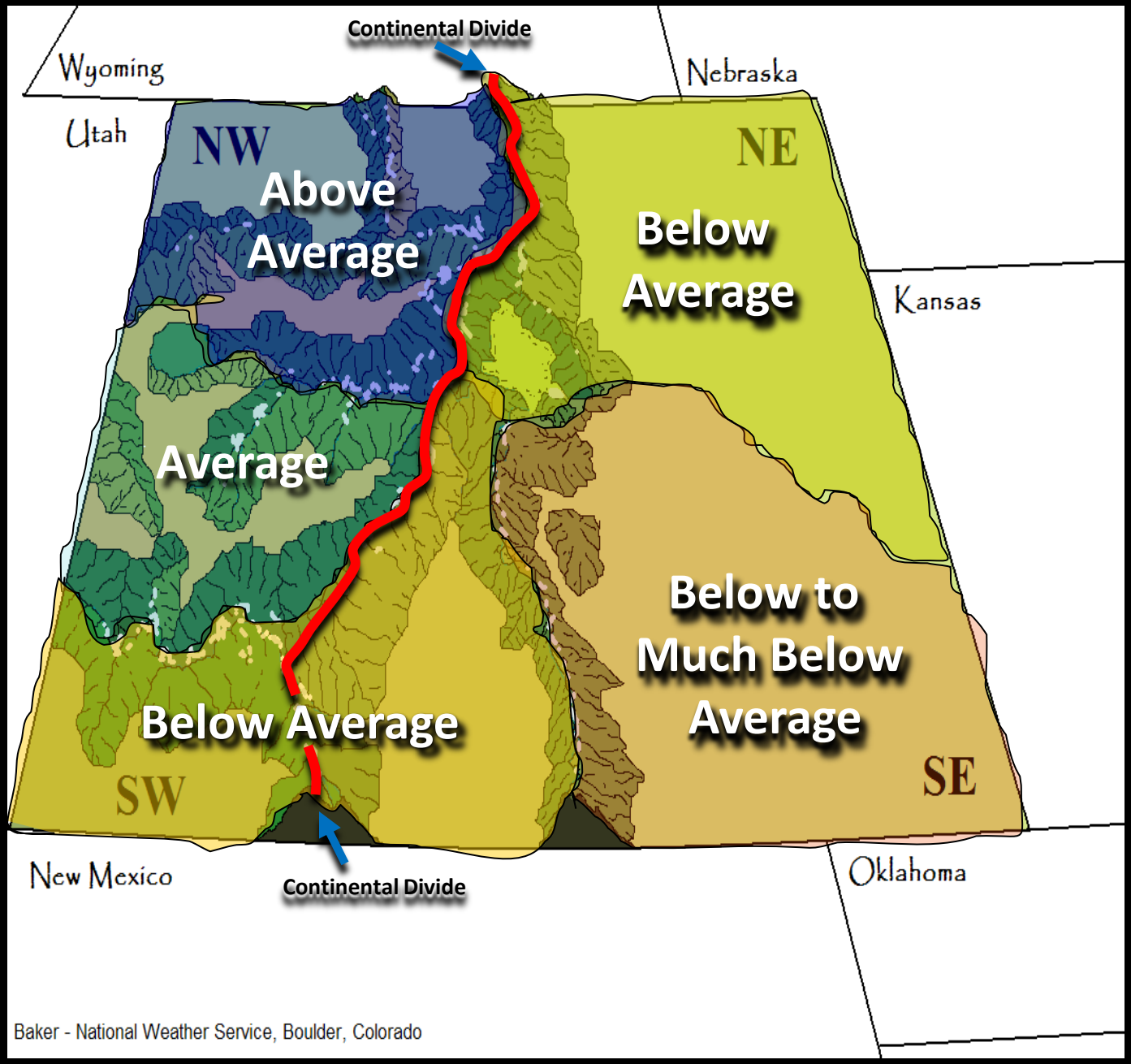
Air transported up the side of a mountain by prevailing winds, in this case a west wind, will expand and cool as it rises in elevation. Once it cools sufficiently clouds form and eventually so does precipitation, which we refer to as upslope or orographic precipitation. As this air continues to rise within the cloud, so does it continue to cool but at a slower rate due to the release of heat during the cloud and precipitation forming processes. After reaching the top of a mountain barrier this moving air (or wind) will quickly begin to warm as it spills down the leeward side of the mountain due to compression. This sinking air has also become much drier along its journey. Notice the difference in temperature between Grand Junction (45F) and Denver (54F) due to this process of expansion, condensation and compression.

Upslope and Downslope Winds



This northwest-to-southeast cross section through the north central mountains of Colorado shows air (the black solid lines with arrows) moving up over the mountains and high valleys and down the east facing slope of the Front Range. Along the way, moisture within this upslope flow condenses out to form clouds and precipitation (the green and blue shading) along and west of the Continental Divide.

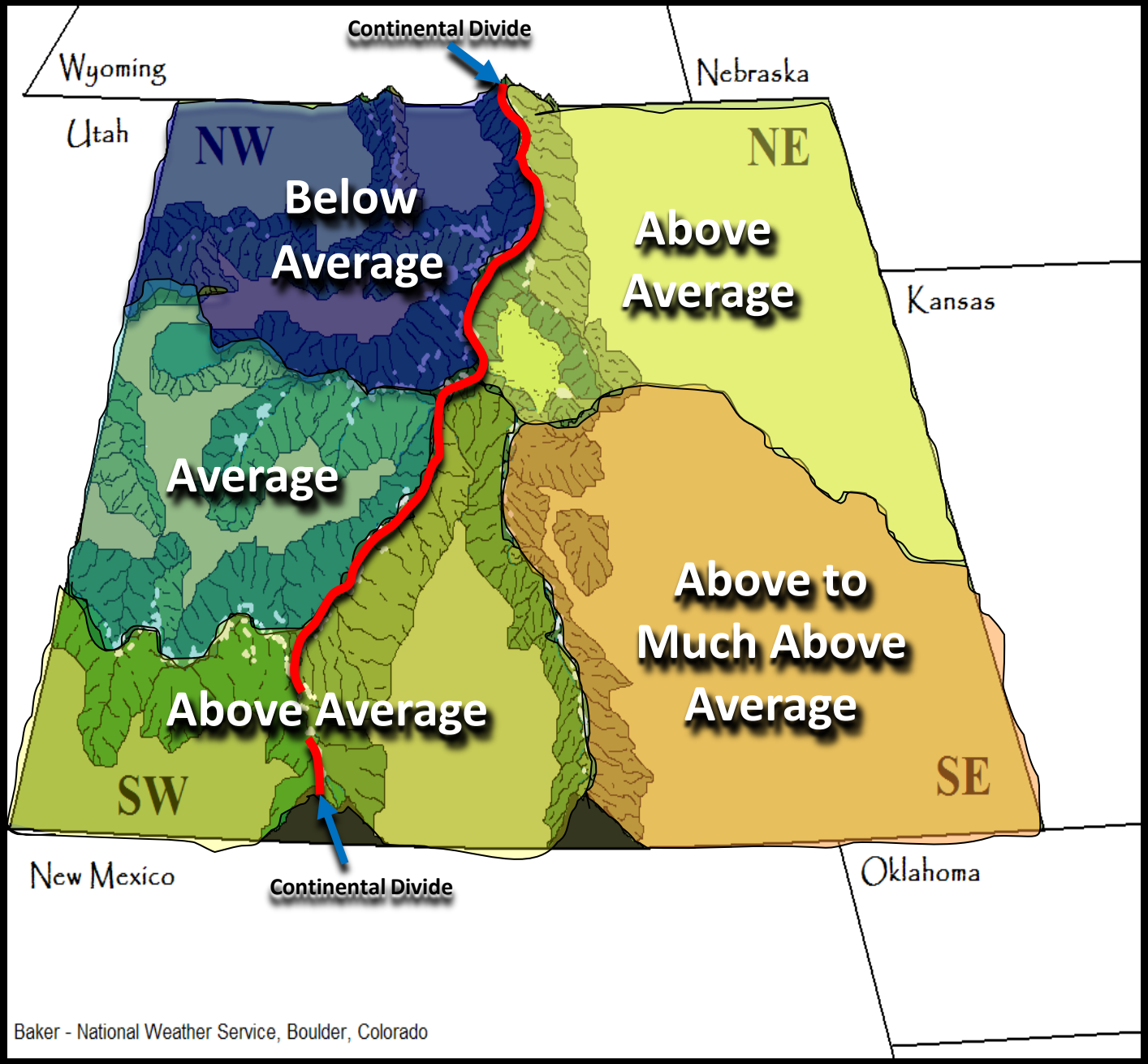
Once this air crests the Continental Divide it immediately begins to warm and dry as it accelerates downslope (e.g., Chinook winds).



Winter Season Precipitation Anomalies Typically Observed During Moderate to Strong La Niña Episodes

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

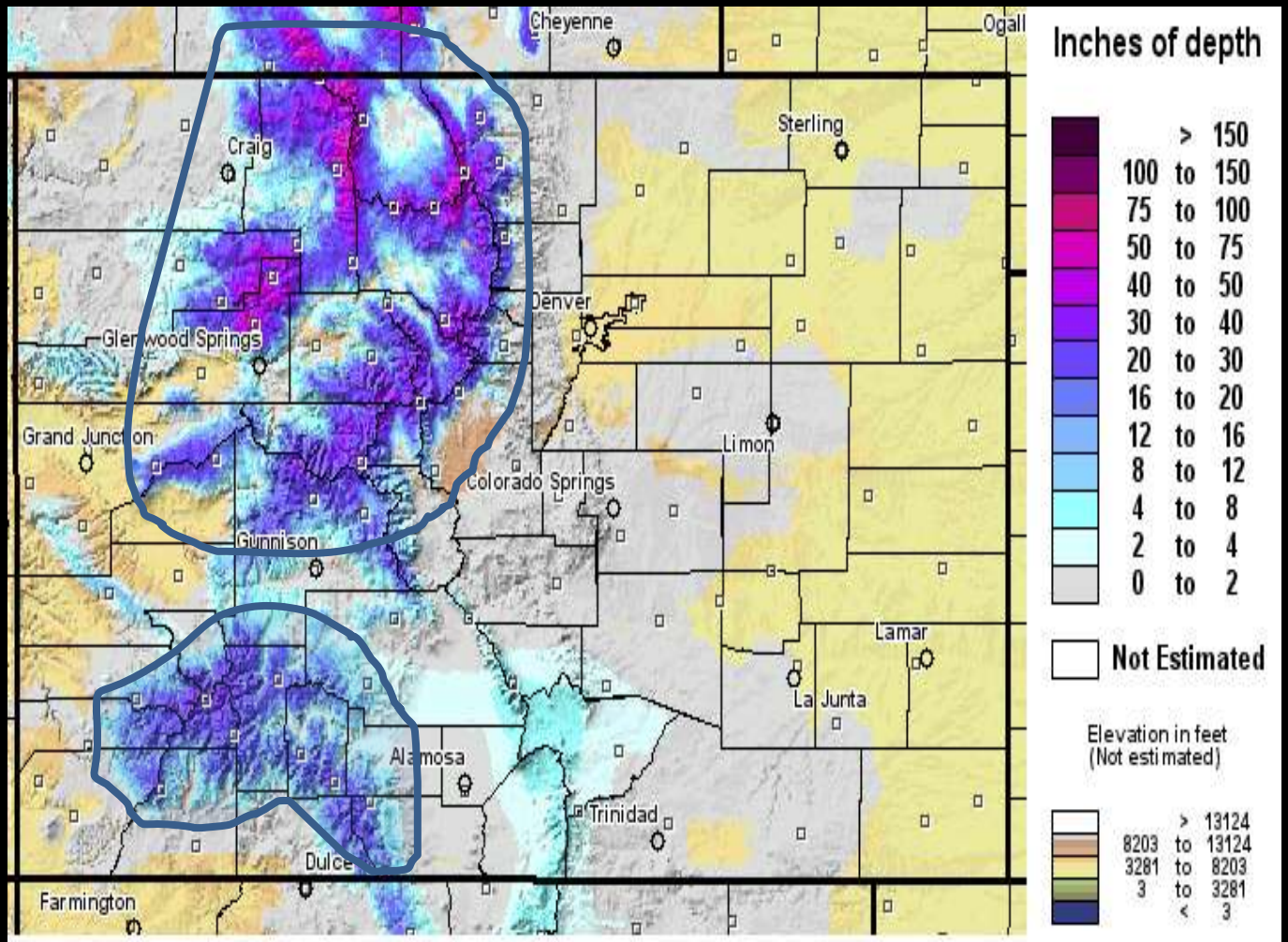
While southwest and eastern Colorado commonly see BELOW to MUCH BELOW AVERAGE precipitation (rain and snow) during the entire cold season of moderate to strong La Niñas.



Winter Season Temperature Anomalies Typically Observed During Moderate to Strong La Niña Episodes

Temperatures across northwest Colorado typically run **BELOW AVERAGE**, particularly when there is an extensive snow cover.

Elsewhere, winter season temperatures run **AVERAGE** to **ABOVE AVERAGE**, except across the southeast quarter of Colorado where temperatures typically run **ABOVE** to **MUCH ABOVE AVERAGE**.



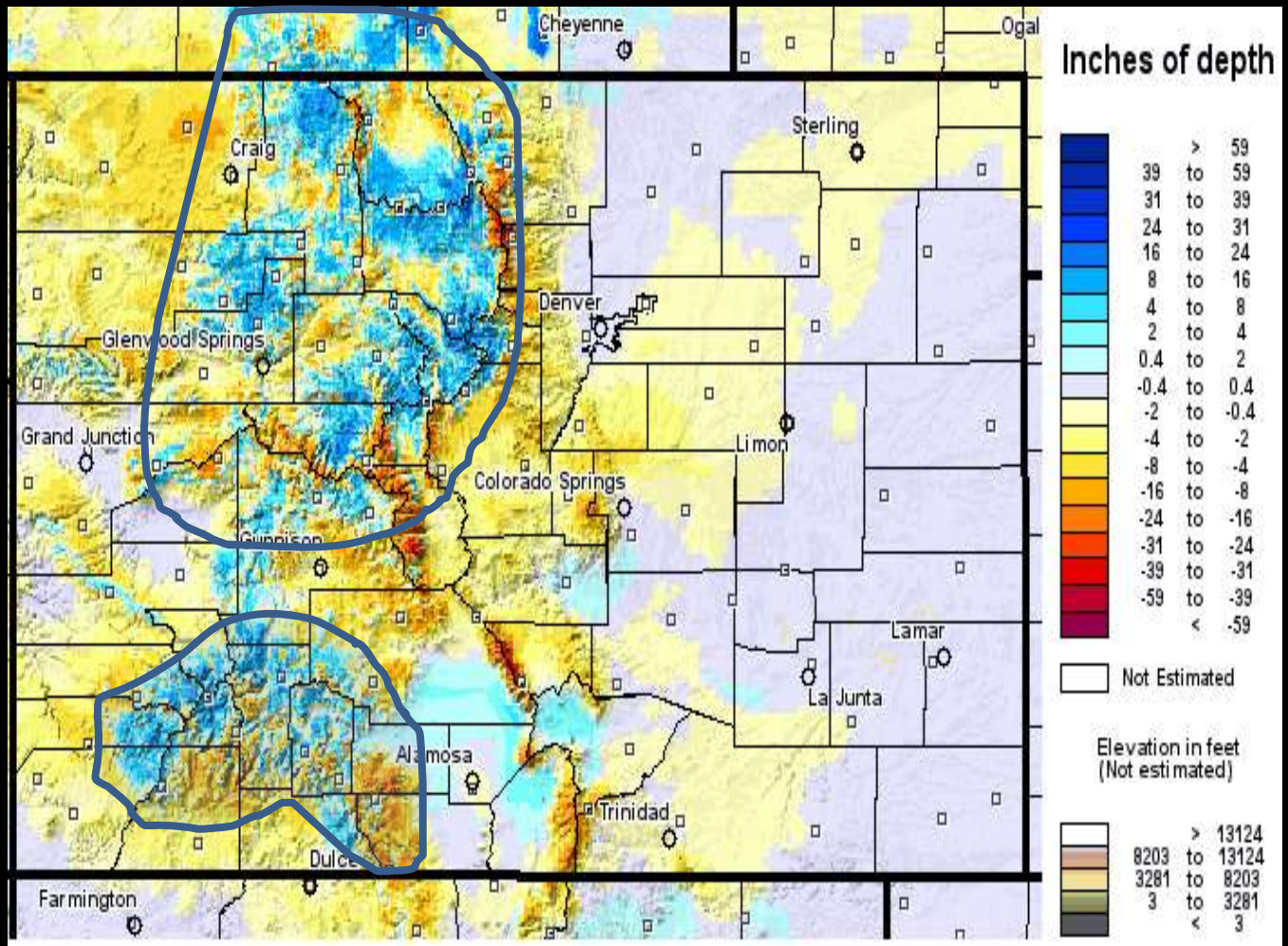
Modeled Total Snow Depth (in Inches) for Colorado as of December 17, 2010

Source: NOAA's National Operational Hydrologic Remote Sensing Center (NOHRSC)

Baker

Snow depth has continued to steadily increase across northwest and west central Colorado, particularly at the high mountain elevations since the first of November.

While areas generally east of the Continental Divide, the south central valleys, and the northwest plateau region remain quite dry, with little if any snow depth as of December 17, as indicated on this model derived map.



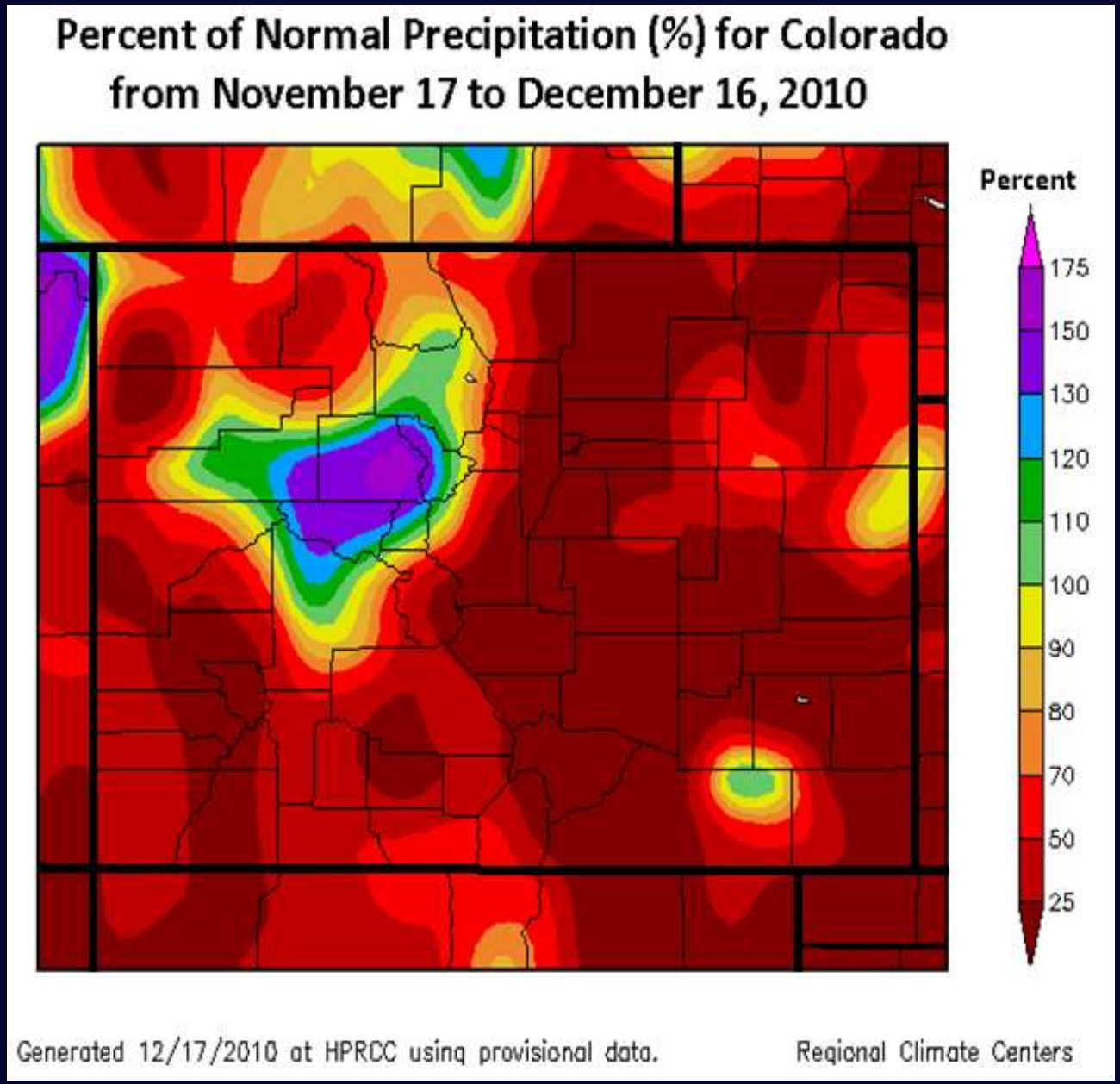
Modeled Snow Depth Departure from Normal (In Inches) for Colorado as of December 17, 2010

Source: NOAA's National Operational Hydrologic Remote Sensing Center (NOHRSC)

Baker

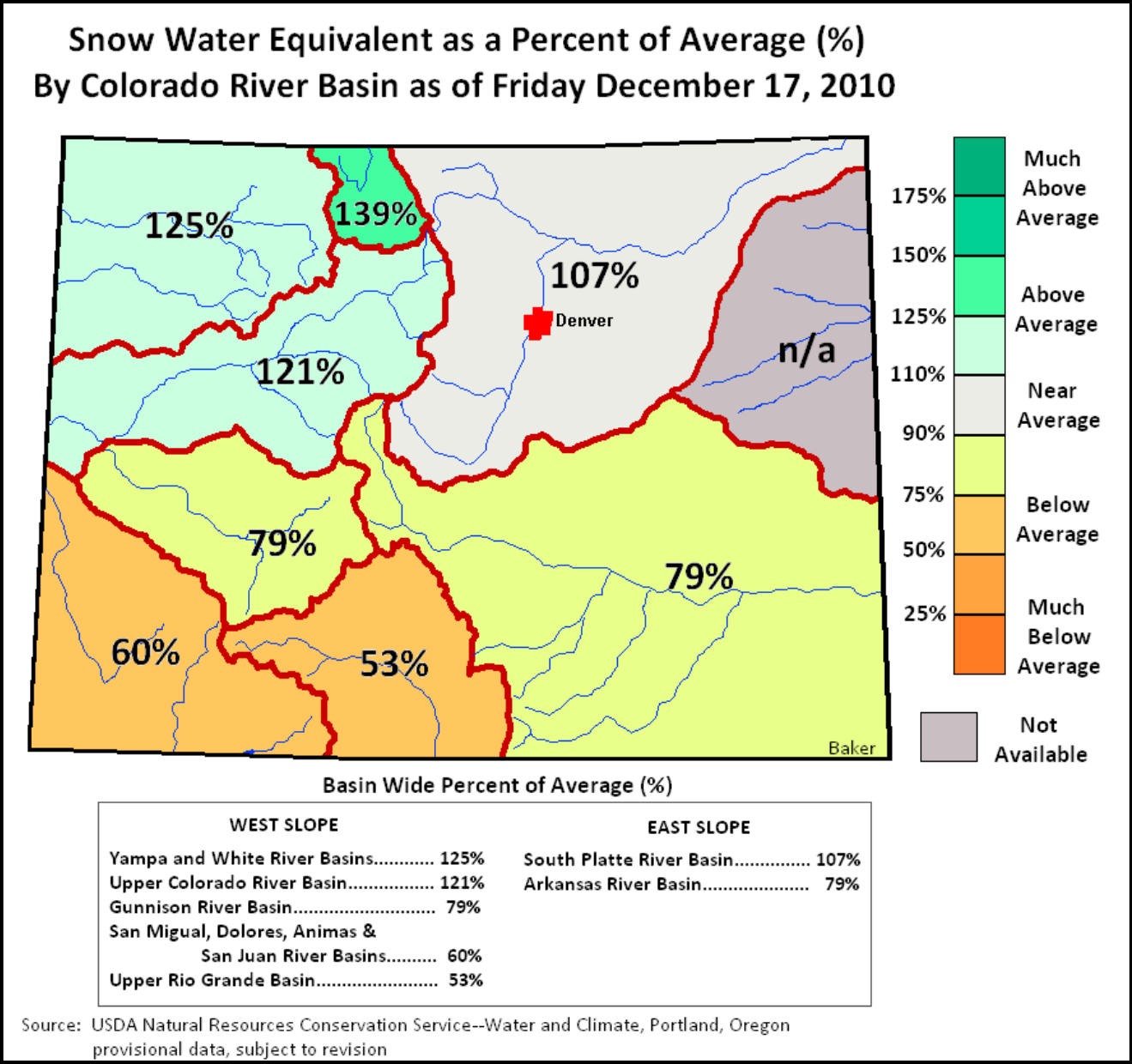
As of December 17th snow depths were averaging above normal in the mountain ranges of northern and central Colorado, west of the Continental Divide and on north and north-west facing slopes of the San Juan Mountains in southwest Colorado.

Note the snow depth departures above timberline in the Front Range Mountains, on the nearby plains, and the state's northwest plateau region.



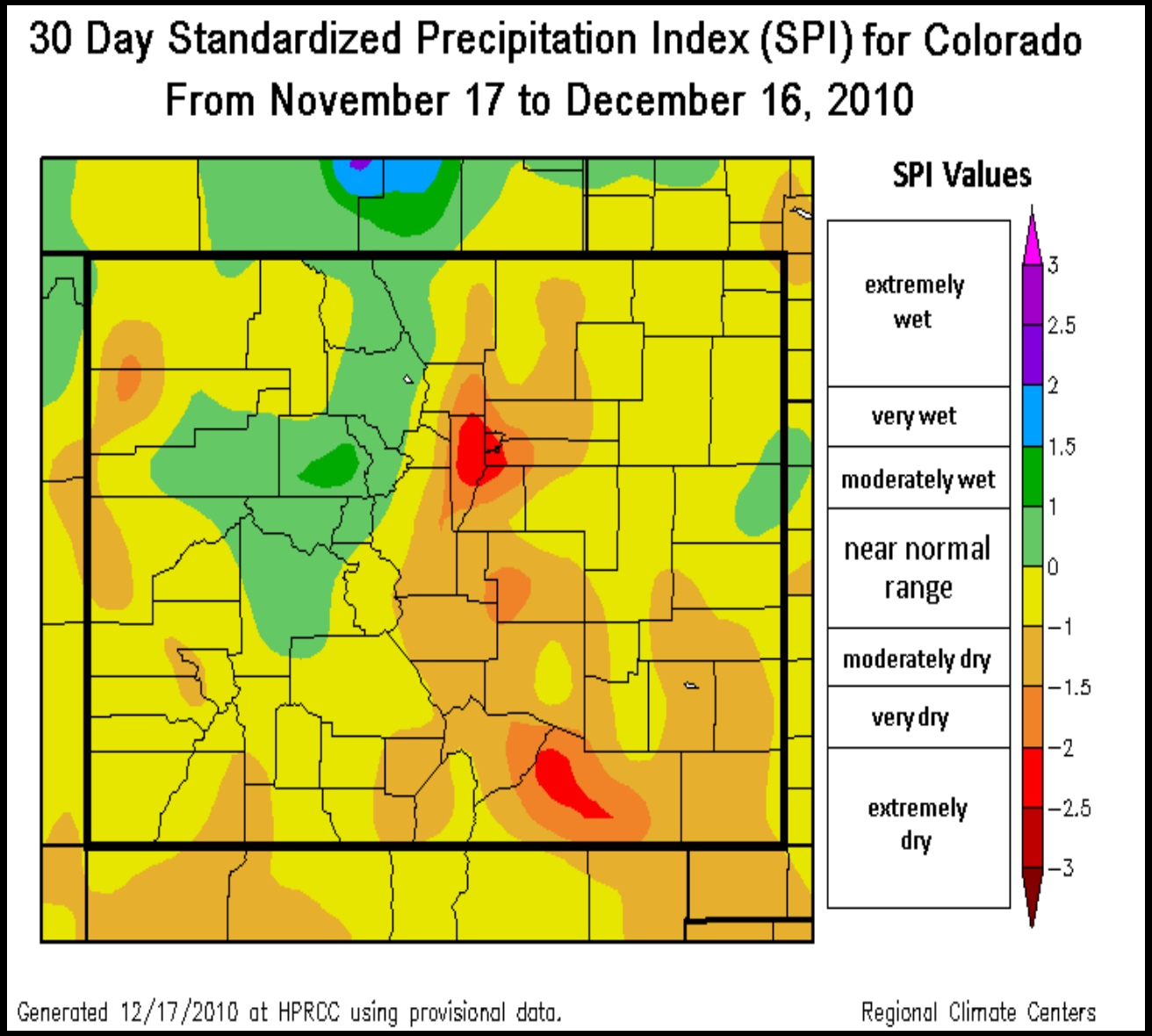
Precipitation during the 30 day period ending December 16th has been 130 to 175 percent of normal in Eagle, Pitkin and Summit Counties in west central Colorado. Surrounding areas were not as wet (snowy), although recent precipitation was a respectable 100 to 130 percent of normal in Rio Blanco, Gunnison, Lake and Grand counties.

During the same period precipitation was quite meager across the rest of the state with totals generally less than 25 percent of normal east of the mountains and portions of the southwest.



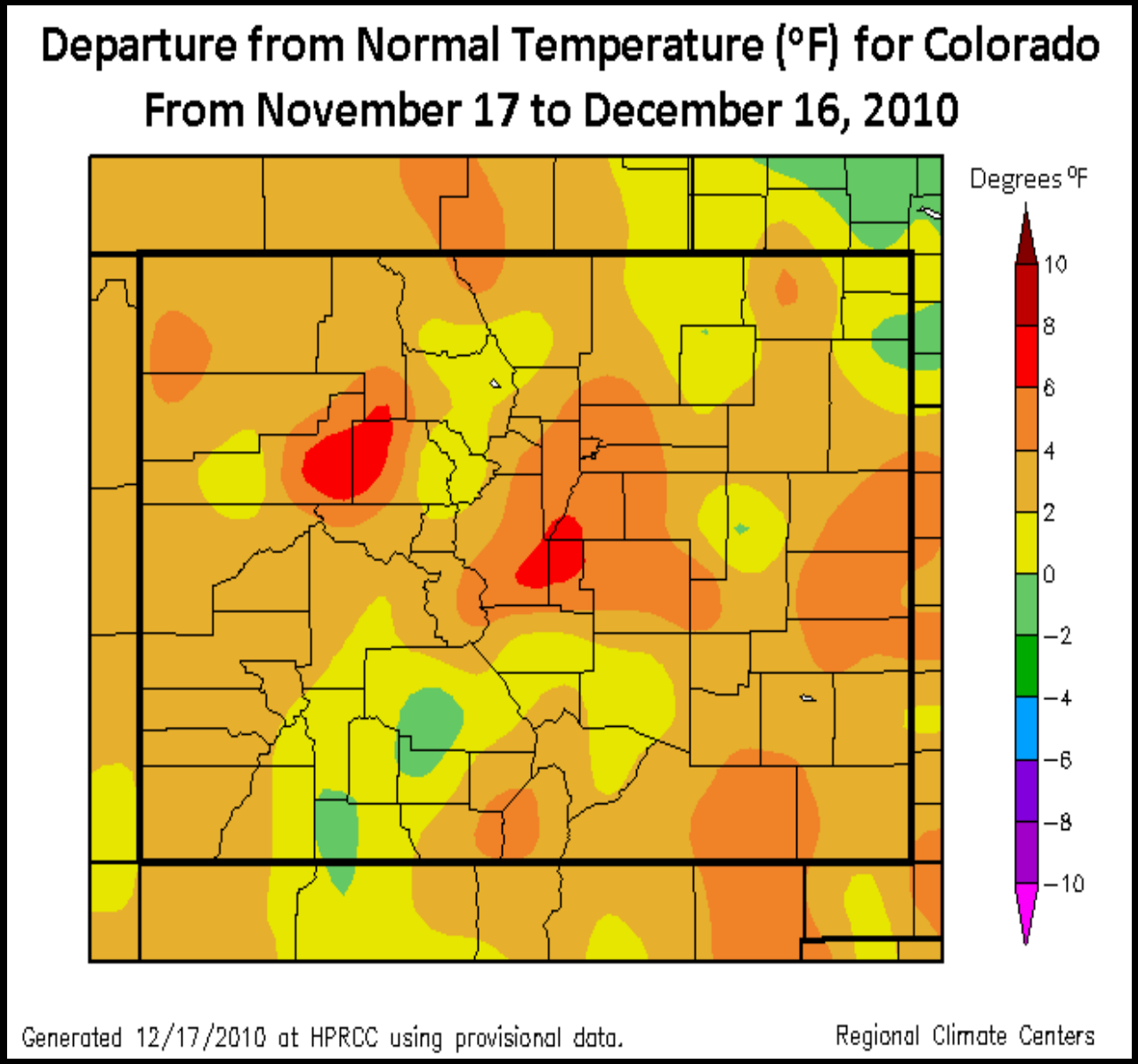
Snow water equivalents have also been running above average in the river basins of northwest Colorado; a pattern that is often observed during La Niñas of moderate to strong intensity.

River basins in southwest, south central and southeast Colorado on the other hand have snow water equivalents below to much below average for this time of year.



The **Standardized Precipitation Index (SPI)** was developed to monitor potential short-term agricultural and long-term hydrological drought conditions. The SPI is a probability index that considers only precipitation.

During the 30 day period ending December 16th the SPI indicated wetter than normal conditions across northwest and west central Colorado, and dry to very dry conditions in the far northwest, lower valleys in the southwest and the foothills and plains of eastern Colorado.



Temperatures across Colorado during the 30 day period ending December 16th were generally above normal.

The greatest departures from normal were observed in the lee of the Front Range, on the southeast plains and portions of the Colorado River basin in west central Colorado.

Potential Impacts of a Moderate to Strong La Niña on the Colorado Front Range

Above Average Temperatures

Abnormally Dry Conditions and Potential Drought

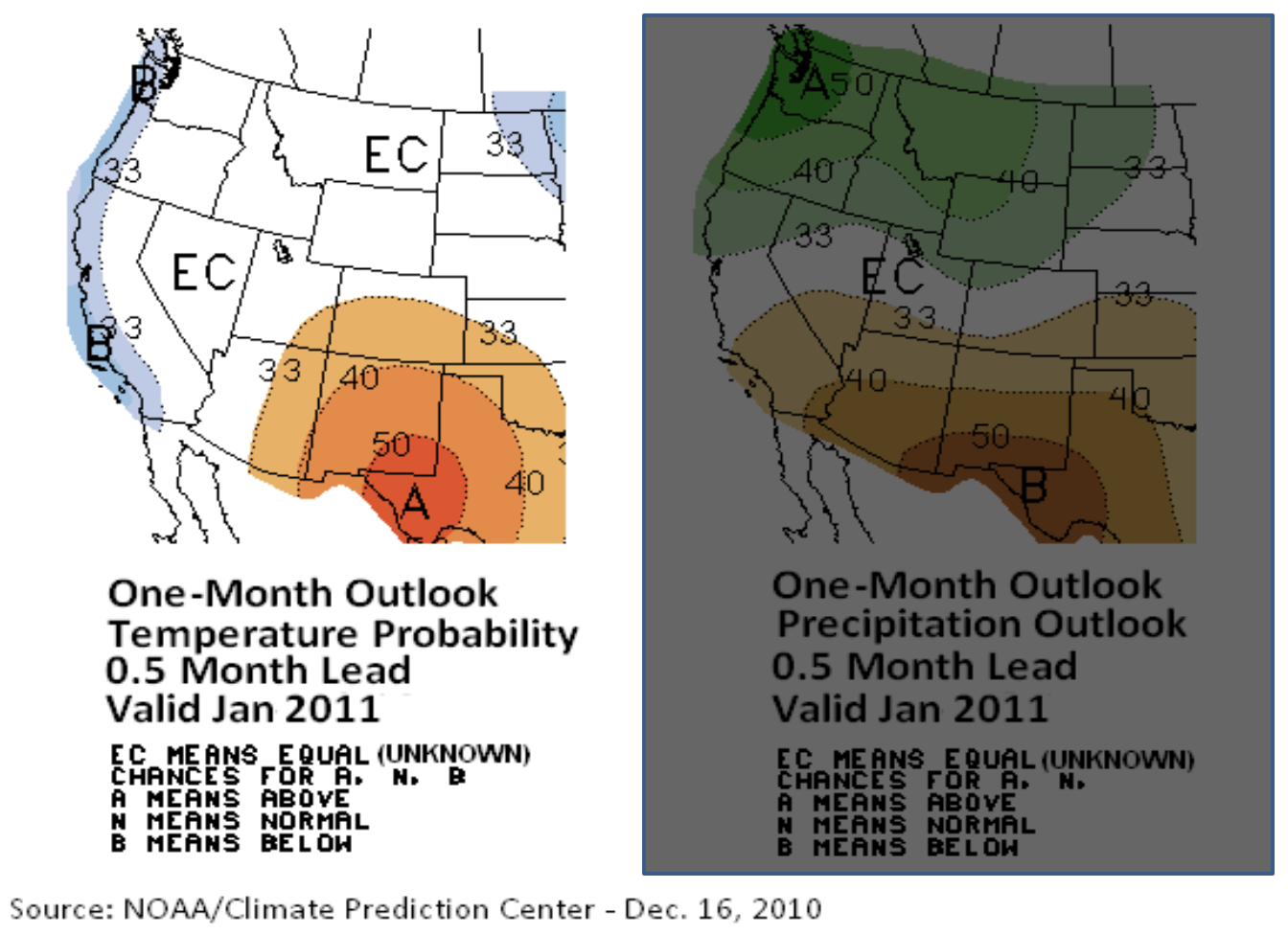
Significantly Reduced Runoff into Lakes and Reservoirs

Elevated Risk of Significant Wildland Fires

Damaging Downslope Wind Storms

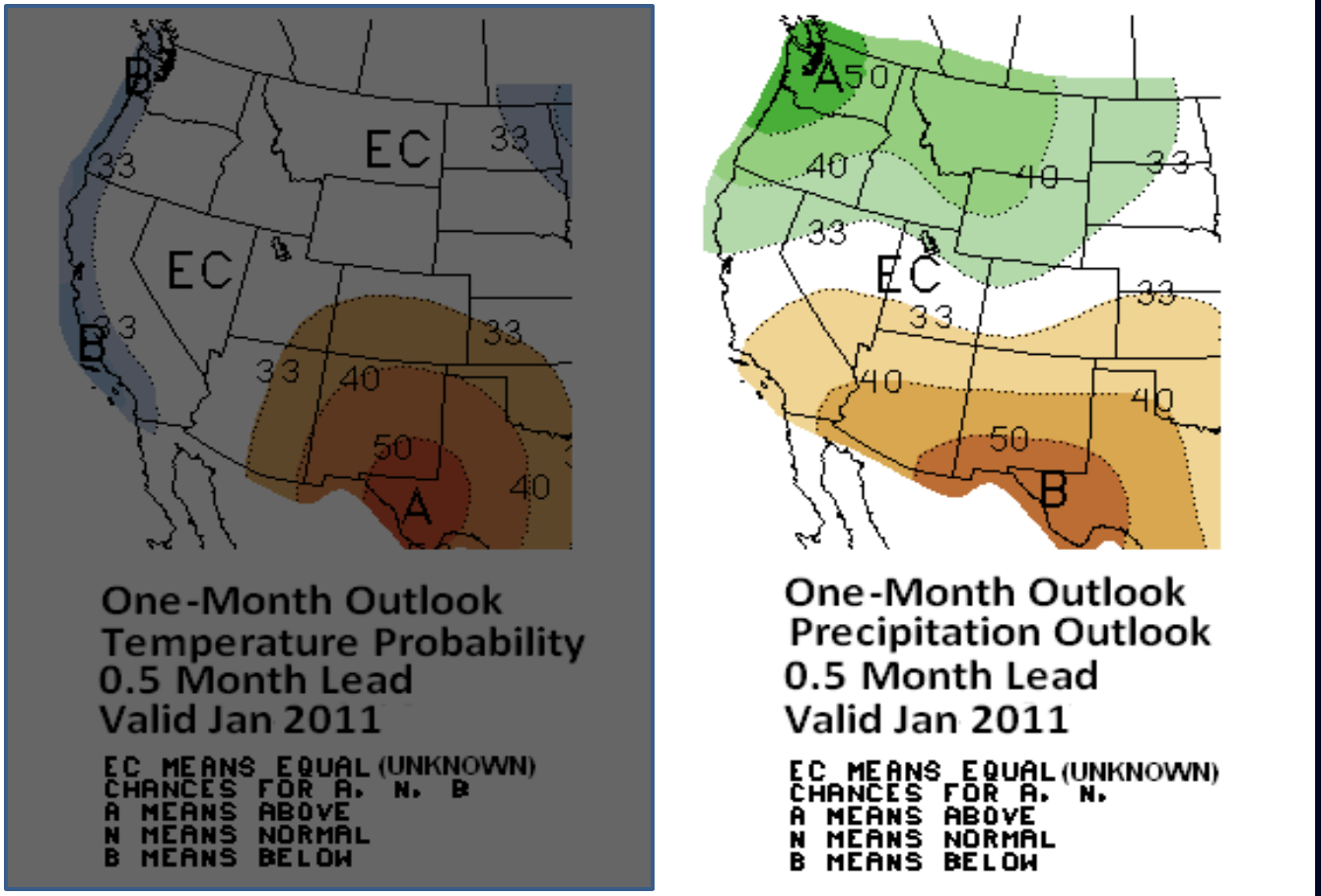
Temperature and Precipitation Outlooks for January-February-March of 2011 Issued by NOAA's Climate Prediction Center

January 2011 Temperature Outlook



The **temperature outlook** for January 2011 is for a 33-40% probability of above average temperature across the southern two-thirds of Colorado, and equal (or undeterminable) chance for above, below or near average temperatures across the northern one-third of the state.

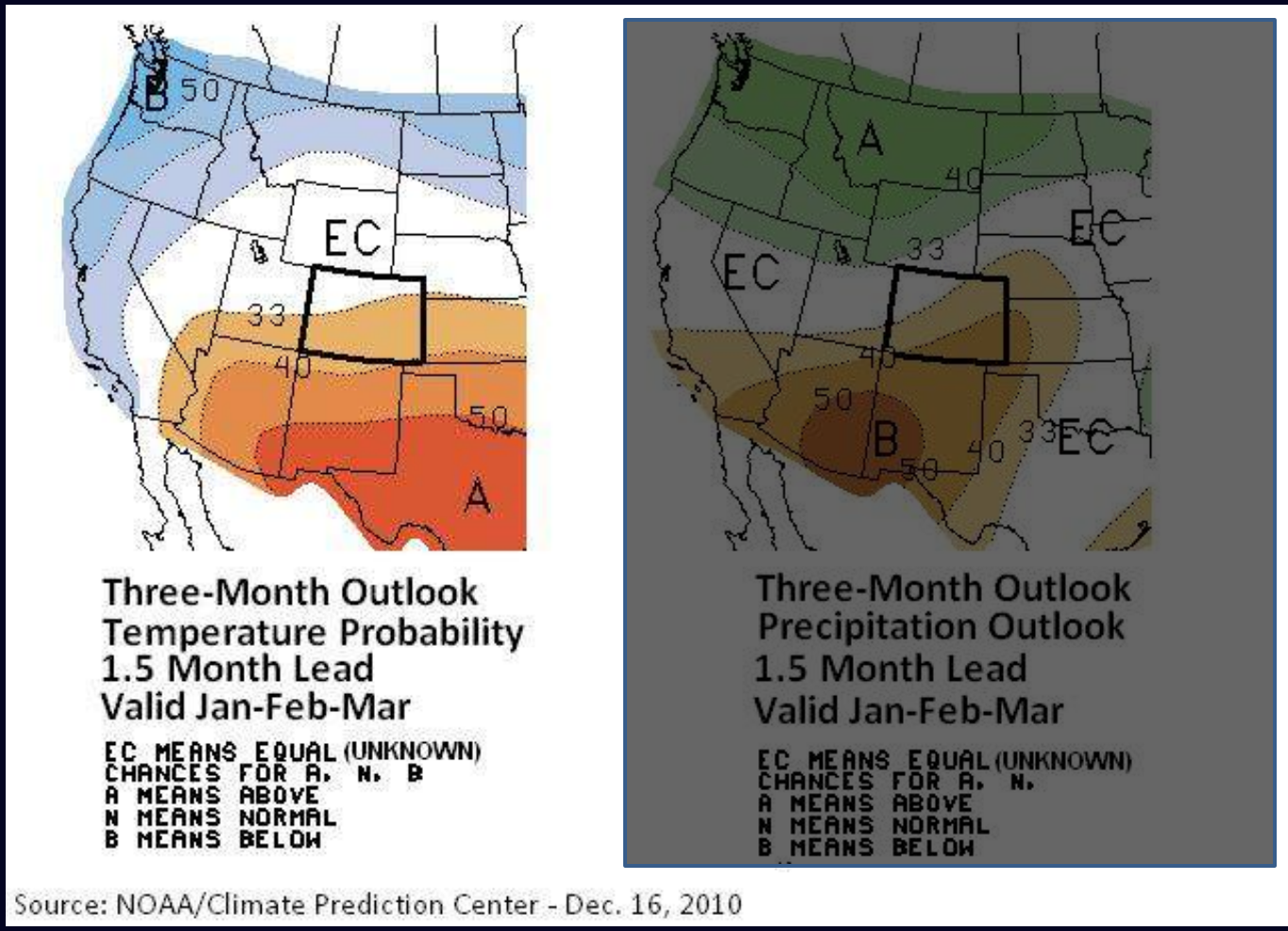
January 2011 Precipitation Outlook



Source: NOAA/Climate Prediction Center - Dec. 16, 2010

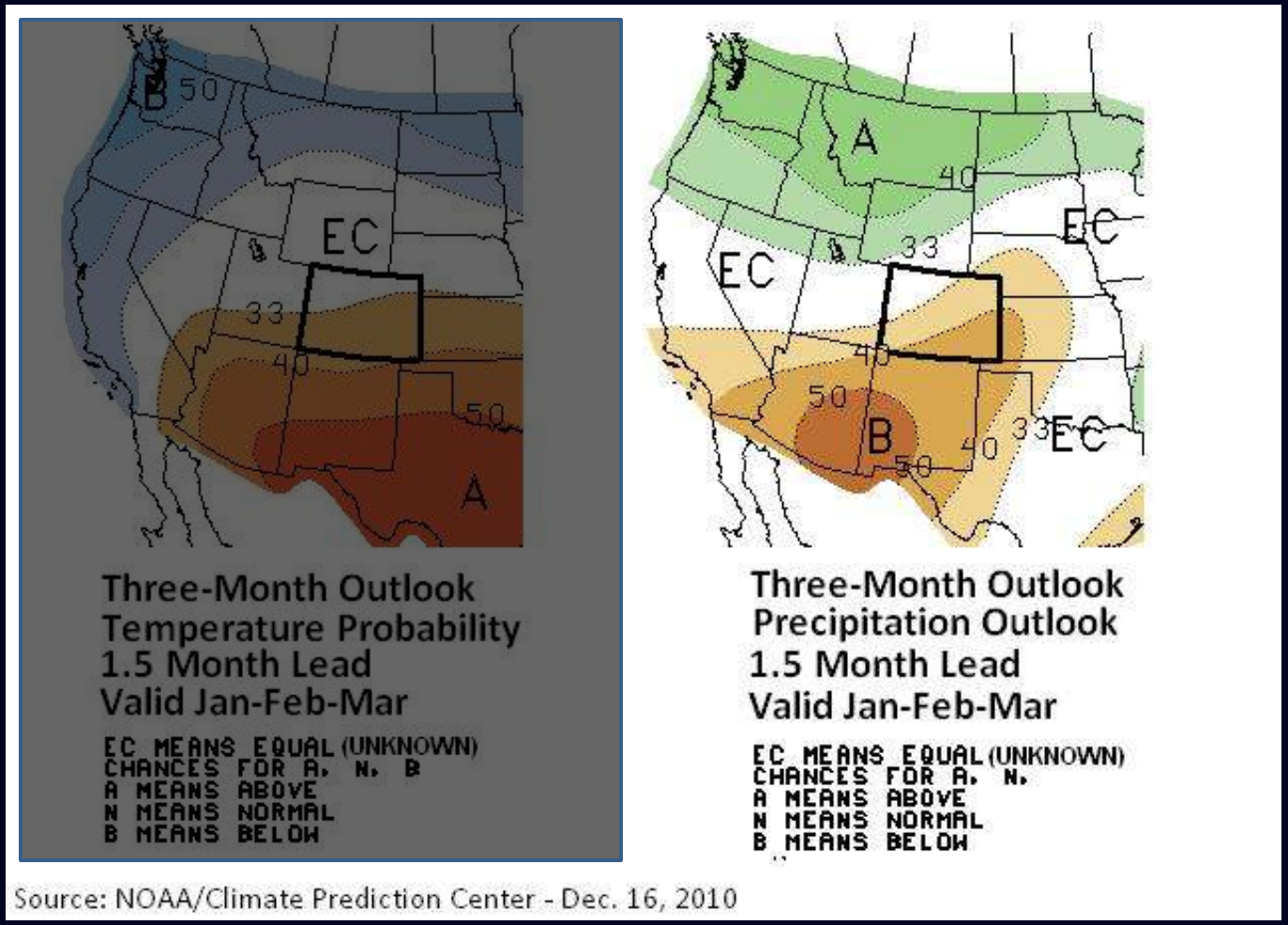
The **precipitation outlook** for January 2011 is for a 33-40% probability of above average precipitation across the northwest corner of the state, a 33-40% chance of below average precipitation across the southeast corner of Colorado, and an equal (or undeterminable) chance for above, below or near average precipitation across the remainder of the state.

Jan-Feb-Mar 2011 Temperature Outlook



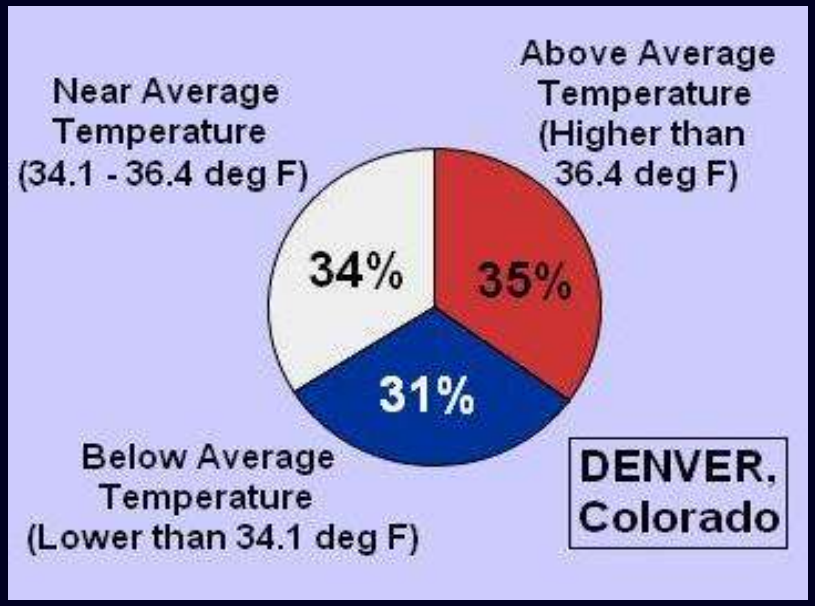
The **temperature outlook** for January, February and March of 2011 is for a 33-40% probability of above average temperature across the southeastern two-thirds of Colorado, and equal (or undeterminable) chances for above, below or near average temperatures across the northern one-third of Colorado.

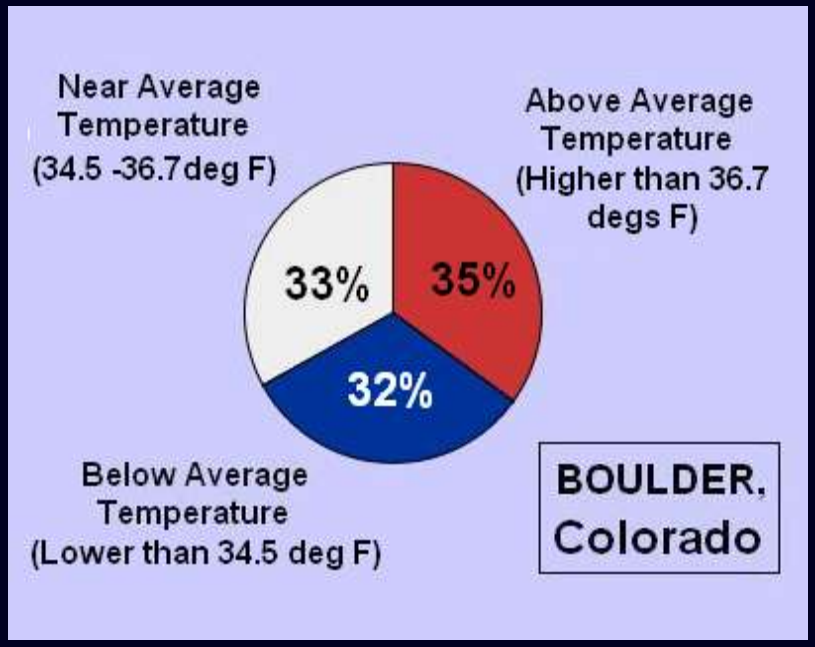
Jan-Feb-Mar 2011 Precipitation Outlook



Source: NOAA/Climate Prediction Center - Dec. 16, 2010

The **precipitation outlook** for January – March, 2011, is for a 40-50% probability of below average precipitation across the southeast one-third of the state, a 33-40% chance of below average precipitation across the central one-third of Colorado, and an equal (or undeterminable) chance for above, below or near average precipitation across the northwest corner of Colorado.





January-February-March 2011 Temperature Outlook for Denver and Boulder, Colorado Provided by NOAA's Climate Prediction Center

The outlook is for equal (or undeterminable) chances for above, below or near average temperature for both locations, with perhaps a slight bias towards above normal temperatures.

Conclusion

La Niña conditions are likely to persist in the central and eastern Pacific Ocean at least through the North American spring of 2011.

For the second straight month (ending November 30), only small changes were evident in the Niño SST indices, which range from -1.3 to –1.7 (moderate to strong strength).

The January-March 2011 temperature outlook for northeast Colorado is for a 33-40% probability of above average temperature across southern two-thirds of this part of the state which includes the greater Denver Metro Area, and equal (or undeterminable) chances for above, below or near average temperatures across the northern one-third of the area which includes the mountains and high valleys of north central Colorado.

The precipitation outlook for northeast Colorado for the same three month period is for a 33-40% probability of below average precipitation across the southeast one-third of the area, and equal (or undeterminable) chance for above, below or near average precipitation for mountain and valley areas roughly north of interstate 70 across north central Colorado.

Overall, little change in the present weather pattern is expected, with cool, windy and snowy conditions for the mountains and high valleys generally west of the Continental Divide, and a continuation of the unseasonably warm , dry and sometimes very windy conditions in areas east of the Continental Divide. However, do not rule out a few bitter cold and snowy outbreaks east of the mountains during January and February.