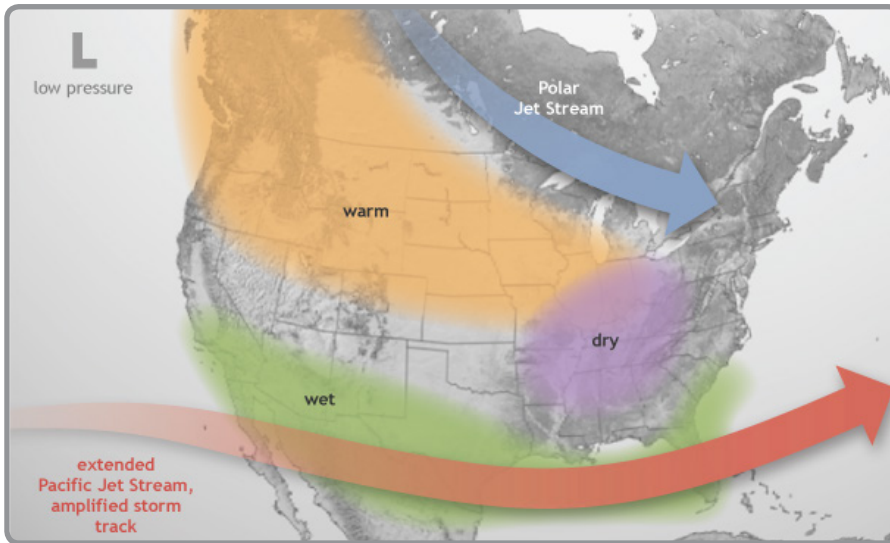


## Typical El Niño Winter Pattern



The image above shows the typical pattern in the winter during El Niño events. The polar jet stream tends to stay to the north of the Missouri Basin region, while the Pacific jet stream remains across the southern U.S. With the Missouri Basin isolated between the storm tracks, warmer and possibly drier conditions can develop during El Niño events.

Image courtesy of the National Oceanic and Atmospheric Administration. For more information please visit: <https://www.climate.gov/news-features/department/enso-blog>

## El Niño in Winter

An El Niño develops when sea surface temperatures are warmer than average in the equatorial Pacific for an extended period of time. This is important to North America because El Niño has an impact on our weather patterns, most predominantly in the winter.

Although each El Niño is different, there are some general patterns that are predictable. For instance, the polar jet stream is typically farther north than usual, while the Pacific jet stream remains across the southern United States (see figure to left).

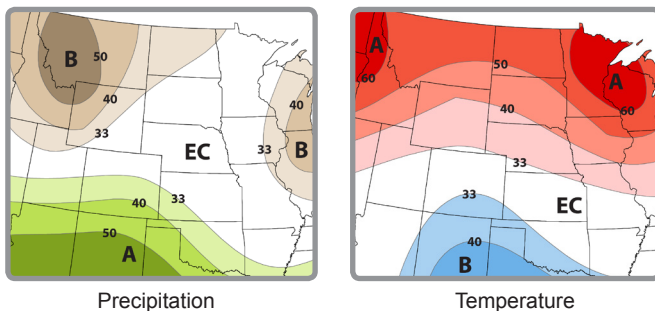
This pattern brings above-normal temperatures to much of the Missouri River Basin region, particularly across the northern tier of the basin. Keep in mind that this does not mean that cold weather will not happen this winter. Extreme cold weather may be milder and less frequent, however.

Snowpack can also be impacted by the typical El Niño winter pattern as well. Snowpack in the northern Rockies and Plains can be reduced and heavy snow events may be less frequent.

## El Niño Outlook

### Winter Temperature and Precipitation Outlooks

Valid for December 2015 - February 2016



EC: Equal chances of above, near or below normal, A: Above normal, B: Below normal

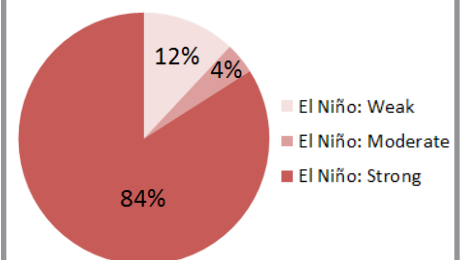
As of August, the winter outlooks for the region show that below-normal precipitation is favored for the headwaters of the Missouri River, while above-normal precipitation is favored for areas of the southern Rockies. This could have implications for many sectors, in both positive ways (increased snowpack to the south could be welcomed by ski resorts) and negative ways (reduced snowpack to the north could impact spring runoff). Meanwhile, the temperature outlook indicates that central and northern areas of the region could have above-normal temperatures, while some southern areas could have below-normal temperatures.

The seasonal outlooks above combine many factors including dynamical models, the effects of long-term trends, soil moisture, and the El Niño Southern Oscillation cycle (ENSO). Because these outlooks combine many inputs, they do not match the typical El Niño conditions exactly. To learn more about these outlooks, or to retrieve the latest temperature, precipitation, and drought outlooks, please visit the Climate Prediction Center at: <http://www.cpc.ncep.noaa.gov>

### El Niño Strength

Winter 2015-16

Potential Intensity, Winter 2015-16



Model data courtesy of the Climate Prediction Center and the International Research Institute for Climate and Society.

El Niño conditions have continued this summer and forecasts indicate that this El Niño will strengthen, peaking as a strong event in late fall or early winter. According to the Climate Prediction Center, there is a greater than 90% chance that these conditions will last through the winter and about an 85% chance that El Niño will continue into the early spring. Research has shown that strong El Niños are often followed by La Niñas, so conditions should continue to be monitored closely, especially if the El Niño weakens next spring, as predicted.

# Potential Winter and Spring Impacts

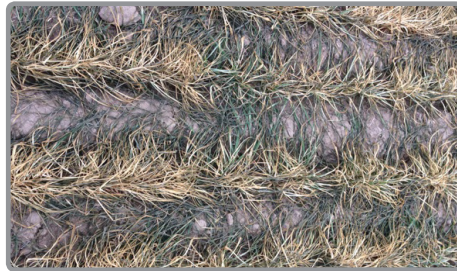
## Missouri River



The Missouri River at Gavins Point, South Dakota. Image courtesy of Natalie Umphlett.

The wet spring resulted in higher than normal river levels in the lower Basin, but with weather conditions in the upper Basin switching from wet to dry to wet again, 2015 runoff above Sioux City, Iowa is expected to be near average at about 25 million acre feet. The Missouri River Mainstem Reservoir System will begin the 2016 runoff season at the base of the Annual Flood Control and Multiple Use Zone, which means that all flood control storage will be available. Some indicators suggest a tilt toward lower than normal mountain snowpack in the upper Basin during a moderate to strong El Niño. Mountain and Plains snowpack will be closely monitored.

## Agriculture



Wheat damaged by cold weather in Kansas - 2014. Image courtesy of Mary Knapp.

El Niño has worldwide impacts to the agricultural sector, and in the Missouri Basin region, there could be mixed impacts. Because El Niño winters typically result in a reduced snowpack in the northern Plains, this could expose winter wheat to harsh temperatures and wind, and also lead to soil moisture concerns. In southern areas, however, good soil moisture conditions could be expected where above-normal precipitation may occur. Additionally, warmer conditions in the northern tier of the basin could be beneficial for livestock producers both in terms of greater gains due to less severe cold weather and for calving in the later winter and spring.

## Ecosystems

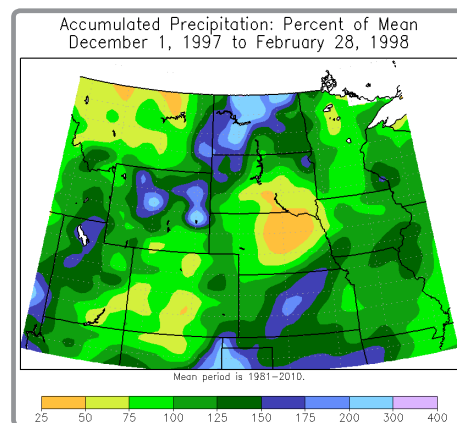
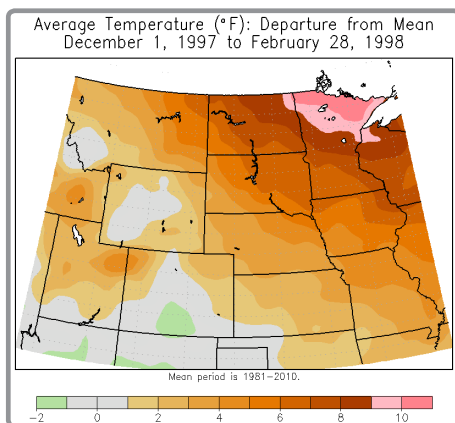


An iconic animal of the Great Plains - the bison. Image courtesy of Natalie Umphlett.

For northern areas of the Missouri Basin region, higher temperatures combined with a lower snowpack could be a recipe for increased fire danger this winter and spring. These conditions could also result in earlier peak stream flows; reduced runoff into wetlands, streams, and rivers in the spring; reduced spring vegetation growth (depending on spring precipitation); and generally warmer stream temperatures. Any reduction to spring runoff or vegetation growth could have negative impacts to wildlife, however these impacts may not be apparent until later in the spring or summer and will be dependent on springtime precipitation.

## Comparisons and Limitations

### Winter Conditions During Past El Niños



Departure from mean temperature (left) and percent of mean precipitation (right) during the El Niño winter of 1997-98. Maps courtesy of the Midwestern Regional Climate Center.

The maps above illustrate the winter conditions of the record breaking El Niño of 1997-98. Much of the basin was warmer than average. Precipitation signals varied across the basin, but the mountain snowpack peaked near normal. While the current El Niño is on track to be one of the strongest on record, please note that each El Niño is different. Other factors can be considered such as antecedent conditions or the Arctic Oscillation, which trumped the El Niño during the winter of 2009-10. Right now, there is a warm pool of water off the Pacific Northwest coast that should be monitored, although it does not seem likely to affect the current El Niño at this time.

While past El Niño events can help inform forecasters about certain conditions, there are some limitations. For instance, in the Missouri Basin region, El Niño is *not* known to impact:

- Potential for ice storms or blizzards.
- First freeze in the fall (early or late).
- Track or intensity of any single weather system.
- Last freeze in the spring (early or late).

## Missouri Basin Partners

High Plains Regional Climate Center  
[www.hprcc.unl.edu](http://www.hprcc.unl.edu)

International Research Institute for Climate and Society  
<http://iri.columbia.edu>

National Drought Mitigation Center  
[www.drought.unl.edu](http://www.drought.unl.edu)

National Integrated Drought Information System  
[www.drought.gov](http://www.drought.gov)

National Oceanic and Atmospheric Administration  
National Weather Service - Central Region

[www.crh.noaa.gov/crh](http://www.crh.noaa.gov/crh)

National Centers for Environmental Information

[www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

Missouri River Basin Forecast Center

[www.crh.noaa.gov/mbrfc](http://www.crh.noaa.gov/mbrfc)

Climate Prediction Center

[www.cpc.ncep.noaa.gov](http://www.cpc.ncep.noaa.gov)

Plains & Prairie Potholes Landscape Conservation Cooperative

[www.plainsandprairiepotholeslcc.org](http://www.plainsandprairiepotholeslcc.org)

State Climatologists

[www.stateclimate.org](http://www.stateclimate.org)

U.S. Army Corps of Engineers - Missouri River Basin Water Management Division

[www.usace.army.mil](http://www.usace.army.mil)

U.S. Department of Agriculture

Natural Resources Conservation Service

[www.nrcs.usda.gov](http://www.nrcs.usda.gov)

NRCS National Water & Climate Center

[www.wcc.nrcs.usda.gov](http://www.wcc.nrcs.usda.gov)

Regional Climate Hubs

[www.usda.gov/oce/climate\\_change/regional\\_hubs.htm](http://www.usda.gov/oce/climate_change/regional_hubs.htm)

U.S. Department of Interior

Bureau of Reclamation

[www.usbr.gov](http://www.usbr.gov)

North Central Climate Science Center

[www.doi.gov/csc/northcentral/index.cfm](http://www.doi.gov/csc/northcentral/index.cfm)

U.S. Geological Survey, Water Mission Area

[www.usgs.gov/water](http://www.usgs.gov/water)