Winter Climate Patterns and Outlook

Northeast Region
October 2020

Typical La Niña Winter Pattern

NWS/NCEP Climate Prediction Center

The image above shows the typical pattern during La Niña winters. High pressure over the eastern North Pacific leads to increased blocking. The polar and Pacific jet streams tend to split around this area of high pressure and join over the Northwest U.S. The jet stream tends to be wave-like, with the active storm track along the northern states. This increases the likelihood of cooler, stormier conditions. Across the southern U.S., conditions tend to be drier and warmer. It is important to note that this is a schematic diagram representing general patterns and is not created from actual data. For more information, please visit: https://www.climate.gov/news-features/department/enso-blog.
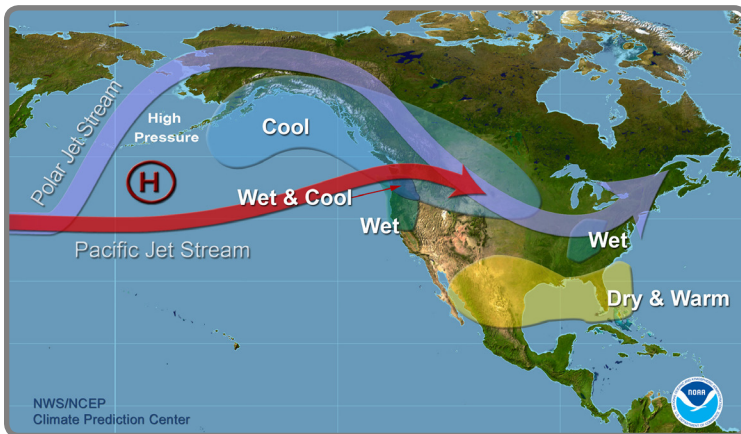
A **La Niña** develops when **sea surface temperatures** are **cooler than average** in the equatorial Pacific for at least several months, altering tropical rainfall patterns and the global atmospheric circulation. This is important to North America because La Niña has an **impact on our weather patterns**, most predominantly in winter.
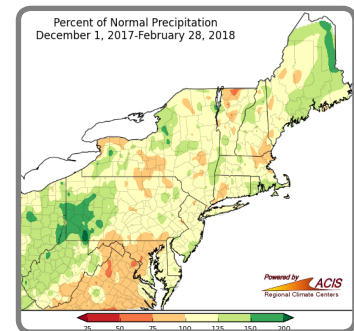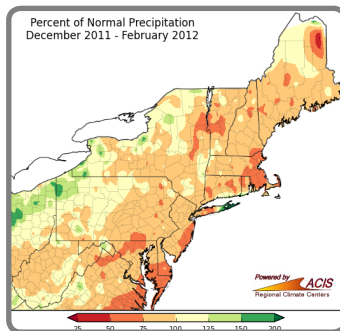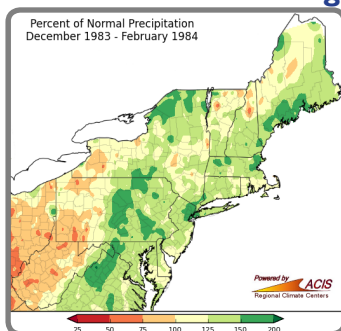
Although each La Niña is different, there are some general patterns that are predictable. The **jet stream flow** tends to be **very wave-like** (see figure to left). An area of high pressure over the eastern North Pacific leads to increased blocking. The jet stream strength is variable, but usually enters North America in the northwestern U.S. This pattern brings **increased storminess** and above-normal precipitation to the **Ohio Valley**, as the jet stream steers storms that direction. There is also an increased frequency of **cold air outbreaks** in the **central U.S.** Conversely, the **South** tends to experienced **below-normal precipitation** and **warmer-than-normal** temperatures.

This La Niña is expected to be **moderate or strong**; however, **other atmospheric and oceanic factors** may also influence the Northeast's weather patterns this winter.

Precipitation Implications

Winter Conditions During Past La Niñas

Percent of Normal Precipitation
December 1983 - February 1984

Percent of Normal Precipitation
December 2011 - February 2012

Percent of Normal Precipitation
December 1, 2017-February 28, 2018

With New England and portions of New York and Pennsylvania in a **drought**, this winter's La Niña could have implications for **precipitation patterns** across the Northeast. The maps above illustrate the conditions during the La Niña winters of 1983–84, 2011–12, and 2017–18. During La Niña episodes prior to 1985, much of the Northeast tended to experience **wetter conditions**, as seen during the winter of **1983–84**. After 1985, the La Niña precipitation signal is less clear for most of the Northeast, except in the **Ohio Valley** which tends to be **wetter** and in **southeastern areas** which tend to be **drier**. This typical La Niña precipitation pattern of a wet Ohio Valley and dry southeastern areas was seen during the winter of **2017–18**. However, much of the Northeast was **drier than normal** during the winter of **2011–12**. This shows how **each La Niña is different** and that other factors can affect weather conditions. A few of these factors include **pre-existing global snow cover patterns** or **climate variability** associated with the Arctic Oscillation and the North Atlantic Oscillation. These patterns are less able to be forecasted far in advance compared to La Niña, meaning that it is uncertain how they will affect the upcoming winter season. For more information, see the monthly synoptic discussion from NOAA's National Centers for Environmental Information at https://www.ncdc.noaa.gov/sotc. Another factor is **long-term climate trends**, which can overshadow the La Niña signal. In the Northeast, there is a trend toward wetter conditions. As for snowfall, preliminary research suggests that weaker La Niña events are **snowier over the Northeast** on average, particularly in northern New England and portions of New York. La Niña winters also tend to be **snowier for lake-effect areas**. During strong La Niñas, the **Mid-Atlantic** tends to be **less snowy**.

Other Factors

North Atlantic Oscillation

The North Atlantic Oscillation (NAO), which is often influenced by the Arctic Oscillation, is a prominent **pattern of climate variability** that can have a strong influence on weather in the Northeast. In the **positive phase**, lower-than-average pressure over the Arctic and higher-than-average pressure over the surrounding region tends to keep **cold air locked up** within the polar region. When conditions flip to the **negative phase**, air pressure is higher than average over the Arctic and lower than average over the surrounding regions. This allows **cold, dense air** from the Arctic to **push southward** to locations in the middle latitudes. These patterns affect weather all around the Atlantic by influencing the **intensity and location of the jet stream** and the storm tracks that follow it. During the **positive phase**, the eastern U.S. tends to be **warmer and drier** than average, while during the **negative phase**, **cold and wetter (or snowier) conditions** are observed. The North Atlantic Oscillation is less predictable far in advance, so there is considerable uncertainty as to how much it will impact a given winter season.


Difference from average pressure (millibars)
-11   0   11

NAO Negative Mode   NAO Positive Mode
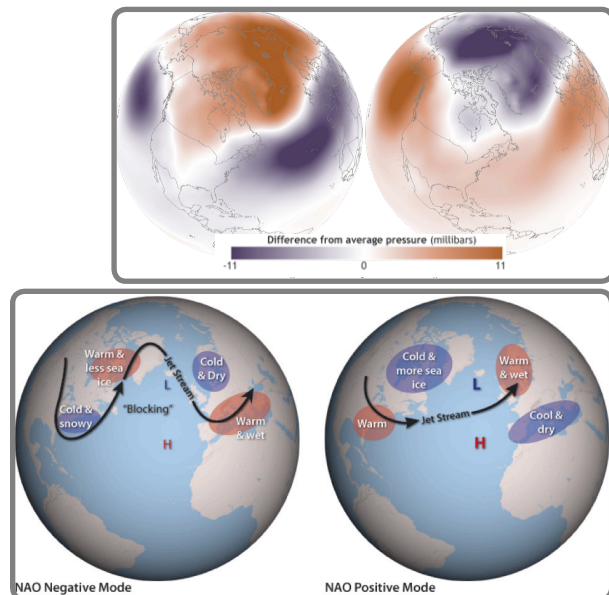
Madden-Julian Oscillation

The Madden-Julian Oscillation (MJO) is a tropical disturbance that results in **changes in clouds, rainfall, winds, and pressure** across much of the global tropics. The Madden-Julian Oscillation can be an important factor during the winter months as it often results in **changes in the jet stream**. This can impact the storm track, which affects precipitation including snowfall, and often can lead to **cold air outbreaks**. One way to view the Madden-Julian Oscillation influence on the higher latitudes is to understand that it **can produce impacts similar to those of El Niño-Southern Oscillation** (ENSO), but typically only for 1–2 weeks before changing.

Winter Outlooks

Temperature and Precipitation

33% 40% 50% 60% 70%
Probability of Above

33% 40% 50% 60% 70%
Probability of Above
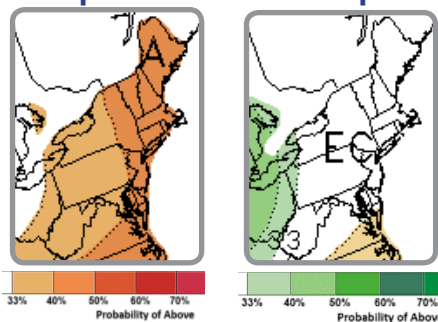
The Climate Prediction Center's temperature outlook for **winter 2020–21** indicates that the **Northeast** is more likely to experience **above-normal temperatures**. This is primarily linked to long-term climate trends. The Climate Prediction Center's El Niño-Southern Oscillation (ENSO) composites do not show a clear signal for temperatures during a La Niña winter.

For precipitation, the ENSO composites show that during a La Niña winter, the Ohio Valley, including parts of **West Virginia** and **Pennsylvania**, tend to be **wetter than normal**. The winter 2020–21 precipitation outlook resembles La Niña precipitation anomaly patterns for the region. **Equal chances** were forecast in areas where climate signals are not as strong or historically reliable. These areas have a 33.3% chance each of above-, near-, or below-normal seasonal total precipitation. During La Niña winters, **northern New England** and portions of **New York** can be **snowier than usual**, while the **Mid-Atlantic** tends to be **less snowy**.

The **seasonal outlooks combine many factors** including dynamical models and the effects of long-term trends, in addition to past La Niña patterns. Therefore, they **may not match typical La Niña conditions** exactly. Also, other factors can affect winter conditions, such as pre-existing global snow cover patterns or climate variability such as the Madden-Julian Oscillation, Arctic Oscillation, and North Atlantic Oscillation.

La Niña Forecast
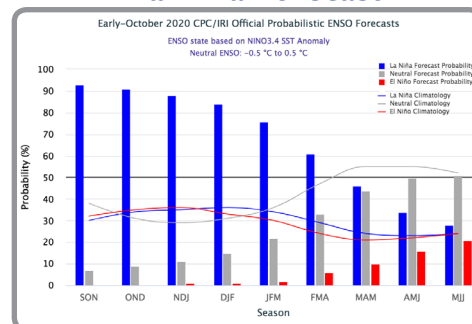
During September, La Niña conditions were observed in the equatorial Pacific Ocean. NOAA's Climate Prediction Center indicates there is a 85% chance **La Niña** conditions will **continue through winter** 2020–21 and around a 60% chance of it continuing through February–April 2021.

Northeast Partners

National Oceanic and Atmospheric Administration offices including:

NESDIS/National Centers for Environmental Information

NWS, Eastern Region

NWS, Climate Prediction Center

And:

Northeast Regional Climate Center