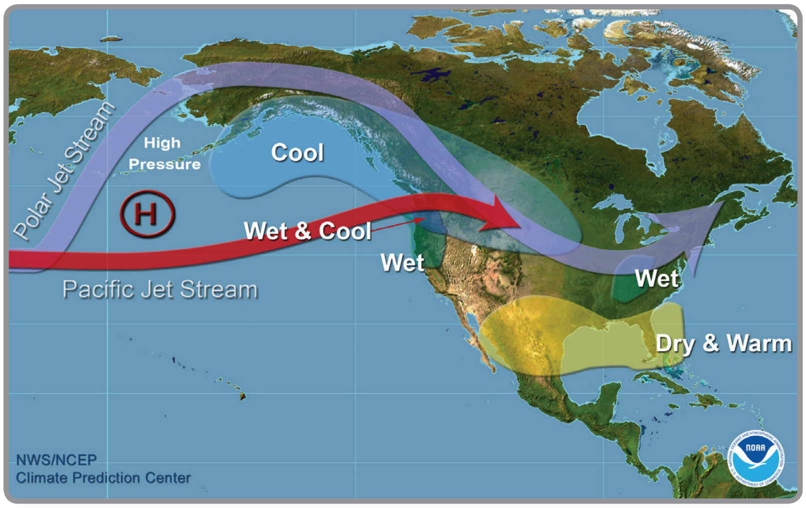
Winter Climate Patterns and Outlook

Northeast Region

November 2017

Typical La Niña Winter Pattern



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 the winter.

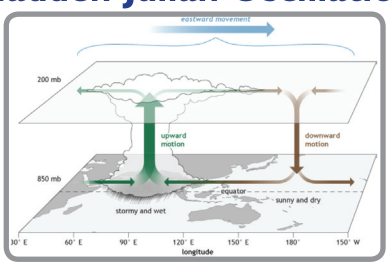
Although each La Niña is different, there are some general patterns that are predictable. The jet stream flow tends to be very wave-like (see figure to left). An area of high pressure over the eastern North Pacific leads to increased blocking. The jet stream strength is variable, but usually enters North 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 experience below-normal precipitation and warmer-than-normal temperatures.

It is more difficult to define conditions in the Northeast because of other atmospheric and oceanic influences. This La Niña is expected to be weak and short-lived, so its impacts may be more variable and other factors may dominate the Northeast's weather patterns this winter.

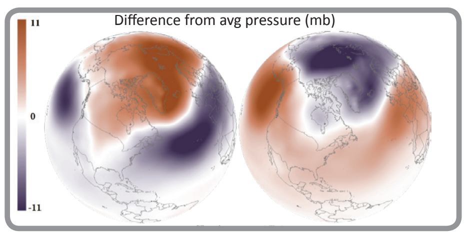
Other Factors

Madden-Julian Oscillation



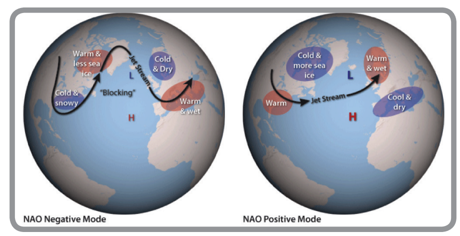
The Madden-Julian Oscillation (MJO) is a tropical disturbance that results in changes in clouds, rainfall, winds, and pressure across much of the global tropics. The disturbance moves eastward with time, traversing the planet in the tropics and returning to its starting point in about 30–60 days. This atmospheric disturbance is distinct from ENSO (El Niño–Southern Oscillation), which once established, is associated with persistent features that last several seasons or longer over the Pacific Ocean basin. There can be multiple MJO events within a season, so the MJO is best described as intraseasonal tropical climate variability (i.e. varies on a week-to-week basis). The MJO 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 MJO influence on the higher latitudes is to understand that it can produce impacts similar to those of ENSO, but typically only for 1–2 weeks before changing.

Arctic Oscillation



The Arctic Oscillation (AO) is an important type of climate variability. With its origin in the Northern Hemisphere, it can substantially impact conditions during winter for many areas, including eastern North America. Atmospheric air pressure conditions oscillate between two common patterns. 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. Flips back and forth between the positive and negative phases of the Arctic Oscillation occur routinely and result in changes in the jet stream, which affects temperature and precipitation. The AO is less predictable far in advance, so there is considerable uncertainty as to how much it will impact a given winter season.

North Atlantic Oscillation



The North Atlantic Oscillation (NAO), often considered a regional subset of the AO, is a prominent pattern of climate variability that can have a strong influence on weather over northeastern North America, Greenland, and Europe. The high latitudes of the North Atlantic Ocean generally experience lower air pressure than surrounding regions, while air pressure over the central North Atlantic Ocean is generally higher than surrounding regions. Phases of the NAO are defined by higher-than-normal air pressure in one of these regions and lower-than-normal air pressure in the other. 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 NAO is less predictable far in advance, so there is considerable uncertainty as to how much it will impact a given winter season.

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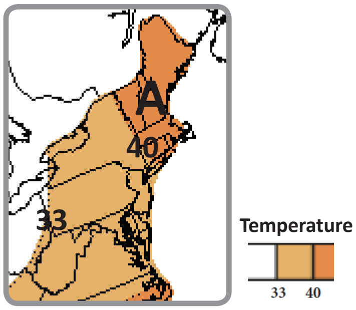
Outlooks

Winter Temperature and Precipitation Outlooks



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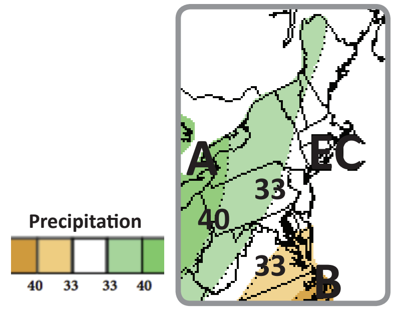
A: Above-normal
B: Below-normal
EC: Equal chances of above-, near, or below-normal
Number: Probability of above- or below-normal



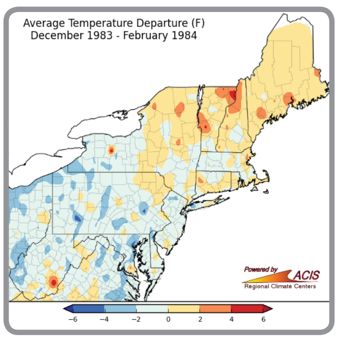
The Climate Prediction Center's temperature outlook for winter 2017–18 indicates that the Northeast is more likely to experience above-normal temperatures. This is primarily linked to long-term climate trends. The Climate Prediction Center's ENSO temperature composites do not show a clear signal for temperatures during a La Niña winter.

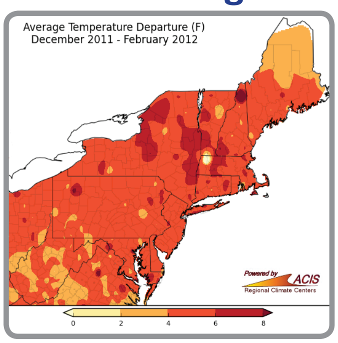
For precipitation, the Climate Prediction Center's ENSO composites show that during winter, the Ohio Valley, including West Virginia and western Pennsylvania, tend to be wetter than normal, while New Jersey, Delaware, and eastern Maryland tend to be drier than normal. The winter 2017–18 precipitation outlook resembles La Niña precipitation anomaly patterns for the region; however, probabilities on the map are more conservative due to the uncertainty associated with the strength and longevity of this La Niña event. The above-normal precipitation that is favored for the Ohio Valley extends into West Virginia, western Pennsylvania, and portions of New York, while below-normal precipitation is favored for southeastern Maryland. 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 above 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 MJO, AO, and NAO.

Comparisons and Limitations

Winter Conditions During Past La Niñas

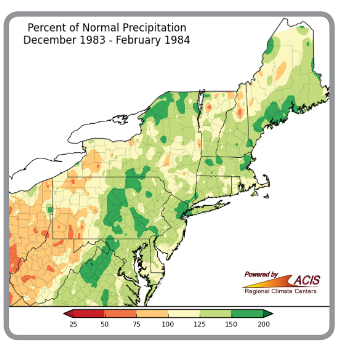


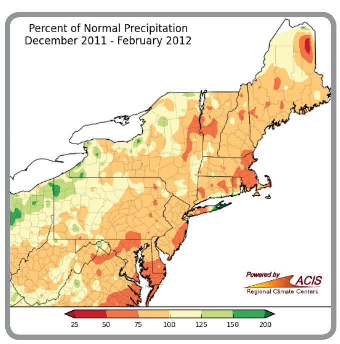


The maps to the left and below illustrate the conditions during the La Niña winters of 1983–84 and 2011–12. A large portion of the Northeast was colder and wetter than normal in 1983–84 compared to 2011–12 when a majority of the region was warmer and drier than normal.

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. The problem associated with these patterns is that they 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.

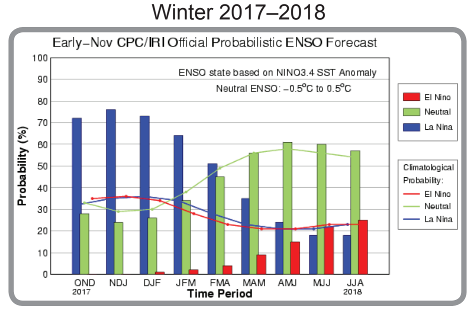
Another factor is long-term climate trends. During La Niña episodes prior to 1985, much of the Northeast tended to experience colder, wetter conditions. After 1985, the La Niña signal tends to be overshadowed by long-term climate trends, with a large part of the Northeast trending towards warmer conditions. For instance, due mainly to long-term climate trends, the winter 2017–18 temperature outlook indicates an increased chance of above-normal temperatures for the Northeast. As for precipitation, after 1985, the precipitation signal is less clear for most of the Northeast, except in southeastern areas where there is a tilt towards drier conditions.





La Niña Forecast

Winter 2017–2018



Atmospheric and oceanic observations through October 2017 and the mean of the IRI forecast plume values favor weak La Niña conditions through winter 2017–18, transitioning to ENSO-neutral conditions during spring 2018.

Eastern Region Partners

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