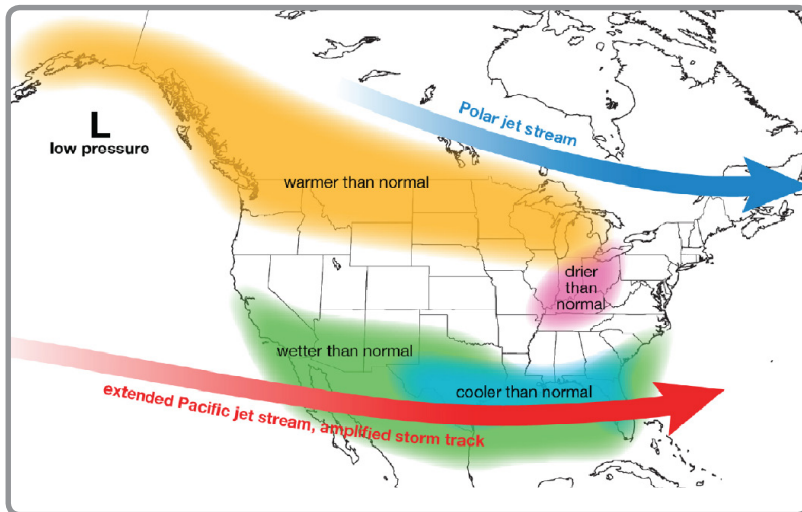


El Niño in Winter



This graphic shows the weather patterns that are typically observed during an El Niño winter. The polar jet stream is displaced unusually far to the north, but a stronger-than-normal subtropical jet stream can bring excessive rainfall to portions of the Southeast U.S. Graphic provided by the Illinois State Water Survey (using data from NOAA).

- An El Niño event occurs when warmer-than-average sea surface temperatures persist across the equatorial Pacific Ocean for periods of 6 to 12 months or longer. A strong El Niño is expected during winter 2015–2016.
- Each El Niño is different, and the impact these events have on weather patterns across the United States can vary significantly. The polar jet stream is usually displaced farther to the north than normal during El Niño, while a stronger-than-normal subtropical jet stream often affects the southern United States (see figure at left).
- A pronounced gradient in precipitation is typically observed across the Southeast during El Niño, with above-normal precipitation in southern and southeastern portions of the region. Average or drier-than-normal conditions are generally found across the interior northwestern portion of the region, which is less influenced by the southerly storm track.
- Cooler-than-average temperatures usually occur across the Gulf Coast region during El Niño, with near-normal temperatures to the north. Daily maximum temperatures are typically below average across the southern portion of the region, while daily minimum temperatures are often near average or even slightly above average.

Winter Temperature and Precipitation Outlooks

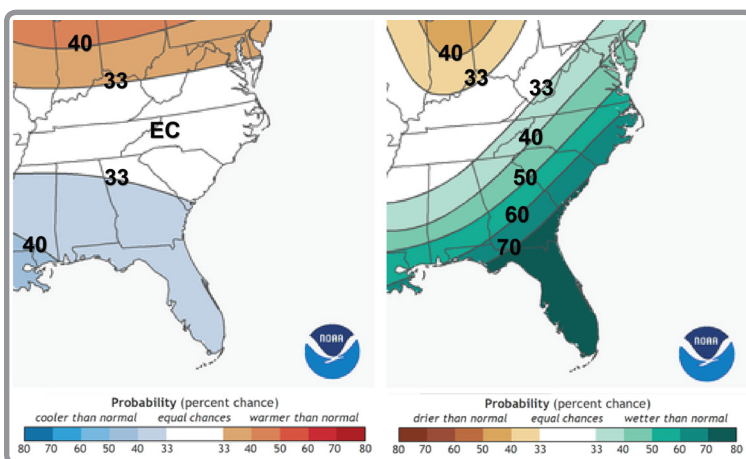
The official NOAA outlook for December–February indicates an increased chance of below-normal temperatures across the southern portion of the region, including much of Alabama, Georgia, and Florida. The Carolinas and Virginia have equal chances of above, below, and near-normal temperatures. The precipitation outlook shows an elevated probability of above-normal precipitation throughout the Southeast, especially in the southern and eastern portions of the region. Indeed, much of Florida and coastal portions of Georgia and South Carolina will see at least a 70% chance that precipitation totals will be in the wettest 33% of historical observations. These predictions have substantial implications for the threat of flooding across the region, particularly in South Carolina and southeast North Carolina where record-breaking rainfall has occurred recently.

Past Strong El Niño Events (1950 to present)

According to the Oceanic Niño Index (ONI), the current El Niño is ranked second in intensity for the August–October (ASO) period, relative to other El Niño events. However, if the IRI/CPC forecast verifies, it will surpass the 1997–1998 event as the strongest El Niño on record. Based on an average of 17 dynamical and 8 statistical models, a peak ONI value of +2.5°C is projected to occur during early winter, which would exceed the peak intensity of the 1997–1998 event by 0.2°C.

Event Rank	Year	ONI (°C) for ASO (peak)
1	1997–98	+2.0 (+2.3)
2	2015–16	+1.7 (+2.5)
3	1965–66	+1.6 (+1.8)
4	1987–88	+1.6 (+1.6)
5	1982–83	+1.5 (+2.1)
6	1972–73	+1.5 (+2.0)

Ranking of the top six El Niño events since 1950 based on the Oceanic Niño Index (ONI) value observed during the August–October (ASO) period. The peak ONI value observed during each historical El Niño event and the projected peak ONI value for the current event are listed in parentheses. Data provided by the Climate Prediction Center and the International Research Institute for Climate and Society.



Probabilistic temperature (left) and precipitation (right) outlooks for December 2015 through February 2016. The numbers indicate the percent chance that observed temperature (precipitation) will be in the warmest (wettest) 33% of historical values. Maps provided by NOAA Climate.gov using Climate Prediction Center data.

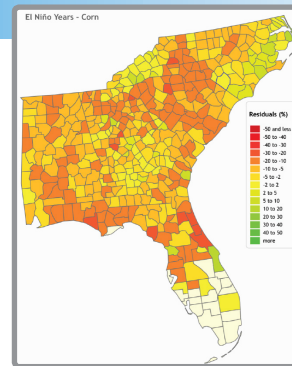
Potential Winter and Spring Impacts

Agriculture:

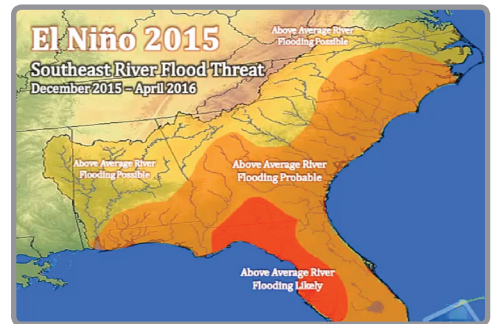
El Niño typically brings a variety of impacts to agricultural interests across the Southeast, some beneficial and others detrimental. Agricultural production across the region could be impacted substantially if current predictions of above-normal precipitation verify. Frequent rainfall can lead to saturated conditions in winter wheat fields, which prevents farmers from tilling and harvesting the crop. However, cattle ranchers typically profit from El Niño events, as moist, cool conditions during the winter aid in the growth of winter forage (e.g., rye). Increased cloudiness during spring (early growing season for row crops) usually results in lower-than-average corn yields across the region. Persistent wetness increases the risk of fungal and bacterial diseases for winter vegetable and fruit production in Florida, particularly among strawberries, tomatoes, and bell peppers. Severe damaging freezes are less likely to occur in Florida during an El Niño, which is a considerable advantage for the citrus and winter vegetable industry.

Flooding:

The strong association between El Niño and above-normal winter precipitation across much of the Southeast can lead to spring flooding. Indeed, the Southeast River Forecast Center (SERFC) is currently predicting that above-average river flooding is likely along the Florida Gulf Coast and south-central Georgia, and it is probable across the remainder of Florida, southeastern Alabama, central and southern Georgia, and coastal portions of the Carolinas. According to the SERFC, the monthly frequencies of river flooding from December through June are greater than normal across the region during moderate and strong El Niños. The greatest flood threat is collocated with the climatological position of the subtropical jet stream during an El Niño, which favors increased precipitation from central Florida to southern Georgia. However, parts of the Carolinas and Virginia have already recorded 150% to as much as 500% of normal precipitation since the beginning of September, which places these areas at an elevated risk for additional flooding.

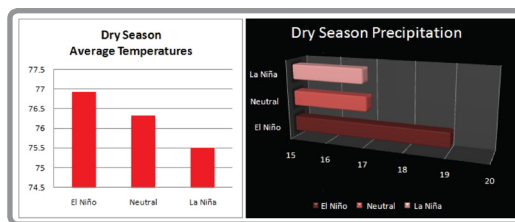


Average expected corn yield across the Southeast region during El Niño years. County-level values are shown as residual percentages, which are defined as departures from the overall trend in annual corn yield. Graphic provided by the Southeast Climate Consortium's AgroClimate toolkit.



Winter and spring river flooding threat for the Southeast region based on the latest Water Resources Outlook (October 20, 2015). Graphic provided by the Southeast River Forecast Center.

Highlight: El Niño and the Caribbean

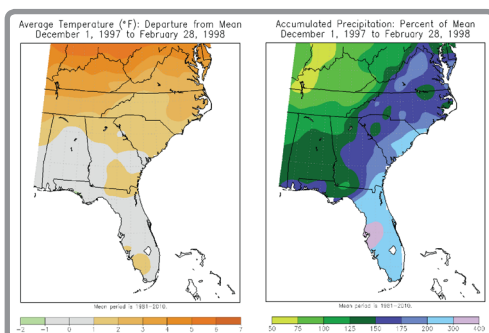


Average temperature (°F) and precipitation (inches) during the dry season (December–April) for 16 observing stations across Puerto Rico and the U.S. Virgin Islands. Results are stratified by ENSO phase. Graphics provided by National Weather Service San Juan.

nearly 16 inches below the normal year-to-date total. During the dry season, the average precipitation in San Juan for the five strongest El Niño events on record was 19.67 inches, which is nearly 2 inches greater than the climatological average for this location.

Winter Conditions during Past El Niños

While every El Niño is different, there is some commonality in the climate patterns over the Southeast United States, especially across Florida and the coastal areas. The record-breaking El Niño episode of 1997–1998 was associated with warmer conditions across the region than the typical El Niño, with



Departure from mean temperature (left) and percent of mean precipitation (right) during the El Niño winter of 1997–1998. The climatological baseline period is 1981–2010. Maps provided by the Midwestern Regional Climate Center's cli-MATE tool

When an El Niño occurs, temperatures tend to be warmer than normal and rainfall is much greater than normal during the dry season (December–May) across Puerto Rico and the U.S. Virgin Islands. The increased probability for above-normal precipitation this winter could ameliorate the severe-to-extreme drought conditions that are currently present in eastern Puerto Rico. San Juan, for example, has observed its third driest year on record (1899–2015) with only 29.12 inches of rainfall through the end of October. This is

warmer-than-average temperatures over the Carolinas and Virginia and near-normal temperatures farther south. Above-normal precipitation was observed over the entire region during the winter of 1997–1998, with record-breaking totals across portions of Florida and coastal areas of Georgia and South Carolina. This is a cause for concern because much of this area, particularly central Florida and coastal South Carolina, has already received excessive rainfall amounts (and consequent flooding) this fall.

While past El Niño events can help inform forecasters about general weather patterns, there are some limitations. For example, El Niño is associated with an active storm track across the region, but many storm systems still track well to the north. Florida typically observes a higher frequency of tornadoes during El Niño winters, but this pattern is not found in the rest of the region. Finally, the potential for winter storms across the northern portion of the region depends largely on other climate cycles, such as the Arctic and North Atlantic Oscillations (AO and NAO).

Southeast Region Partners

- Southeast Regional Climate Center (sercc.com)
- National Oceanic and Atmospheric Administration (noaa.gov)
- National Weather Service Southern Region (srh.noaa.gov)
- National Weather Service Eastern Region (erh.noaa.gov)
- National Centers for Environmental Information (ncdc.noaa.gov)
- Climate Prediction Center (cpc.noaa.gov)
- Southeast River Forecast Center (srh.noaa.gov/serfc)
- National Integrated Drought Information System (drought.gov)
- U.S. Department of Agriculture (usda.gov)
- Southeast Regional Climate Hub (globalchange.ncsu.edu/serch/)
- U.S. Department of the Interior (doi.gov)
- Southeast Climate Science Center (globalchange.ncsu.edu/secsc/)
- State Climatologists (stateclimate.org)
- Carolinas Integrated Sciences and Assessments (cisa.sc.edu)
- Southeast Climate Consortium (seclimate.org)