

What is El Niño & La Niña?

June 2018

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The El Niño – Southern Oscillation (ENSO) is a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean and the patterns of sea level pressure, lower- and upper-level winds, and tropical rainfall across the Pacific basin.

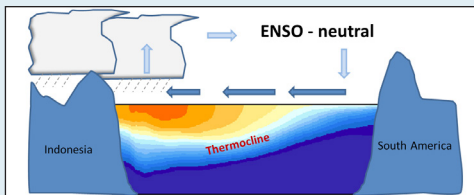
When Does This Occur?

On periods ranging from about two to seven years, the surface waters across a large swath of the tropical Pacific Ocean warm or cool by anywhere from 1°C to 3°C, compared to normal. This irregular oscillation between warm and cool patterns, referred to as the ENSO cycle,

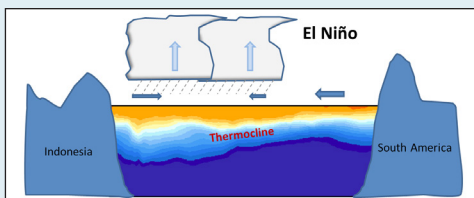
directly affects rainfall distribution in the tropics and can have a strong influence on weather across the United States and other parts of the world. El Niño and La Niña are the extreme phases of the ENSO cycle; between these two phases is a third phase called ENSO-neutral.

ENSO Phases

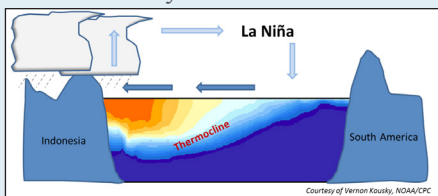
ENSO-neutral: Normally, strong trade winds blow from the east along the equator, pushing warm water into the western Pacific Ocean.



El Niño conditions occur when abnormally warm waters accumulate in tropical latitudes of the central and eastern Pacific Ocean associated with a weakening of the low-level easterly winds. Consequently, tropical rains that usually fall over Indonesia shift eastward.



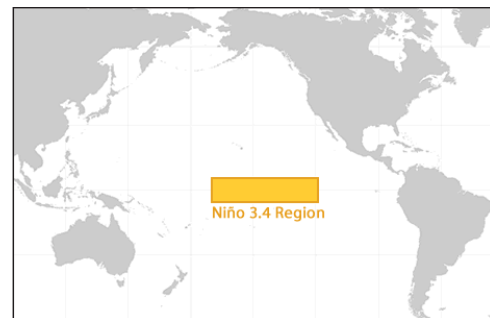
La Niña conditions occur when cooler-than-average waters accumulate in the central and eastern tropical Pacific, associated with a strengthening of the low-level easterly winds over the central tropical Pacific. Heavy rainfall occurs over Indonesia and Malaysia.



The Thermocline is a layer of water in which there is an abrupt change in temperature separating the warmer surface water from the colder deep water.

How do we tell what phase ENSO is in?

NOAA's Climate Prediction Center has determined the average monthly sea surface temperature for a particular swath [5°N-5°S, 170°W-120°W] of the tropical Pacific Ocean by averaging measurements collected there over the 30-year period 1986-2015. Scientists refer to that swath as the Niño 3.4 region. The observed difference from the average temperature



in that region—whether warmer or cooler—is used to indicate the current phase of ENSO.

ENSO INDEX:

Average sea surface temperature in the Niño 3.4 region is calculated for each month, and then averaged with values from the previous month and following month. This running three-month average value is compared with average sea surface temperature for the same three months during 1986 – 2015. The departure from the 30-year average of the three-month average is known as the Oceanic Niño Index or ONI.

- **El Niño** is characterized by a positive ONI greater than or equal to +0.5°C.
- **La Niña** is characterized by a negative ONI less than or equal to -0.5°C.
- Whenever the ONI is between +0.5 and -0.5, conditions are referred to as ENSO-neutral.

ENSO Impacts

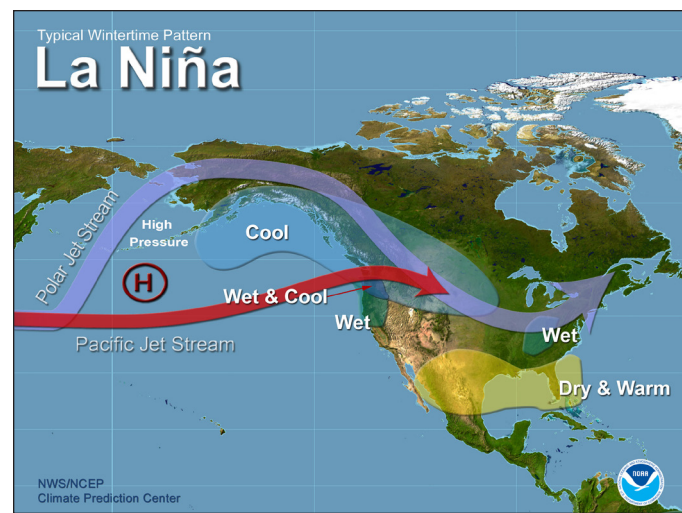
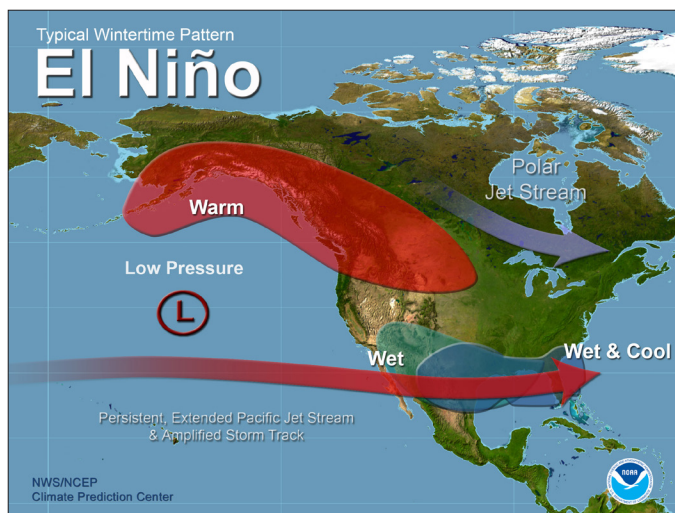
Although the strongest signal of ENSO impacts is in the areas closest to the equatorial Pacific, El Niño and La Niña are such powerful forces that they can shift seasonal temperature and precipitation patterns around the globe. These shifts, known as teleconnections, occur via the effects of tropical sea-surface temperatures on the upper atmosphere.

When different parts of the tropical ocean warm and cool and the pressure gradients shift, the atmospheric wind patterns also shift to alter precipitation patterns. Because each El Niño and La Niña event has unique characteristics of timing, intensity and specific pattern changes, such shifts are never exactly the same during every El Niño and La Niña event.

In addition, the atmospheric effects due to changes in sea-surface temperatures are responsible for only part of the regional climate observed; chaotic fluctuations within the atmosphere and sea surface temperatures in other areas of the globe also influence the weather and climate we experience. Because of this, anticipated ENSO impacts in seasonal forecasts are treated probabilistically and not with absolute certainty.

Source: <https://iri.columbia.edu/our-expertise/climate/enso/why-do-we-care-about-el-nino-and-la-nina/>

Impacts in the United States During Winter



El Niño episodes feature an equatorward-shifted, stronger-than-normal jet stream and wetter-than-average conditions across the southern part of the United States, and less storminess and milder-than-average conditions across the North.

La Niña episodes feature a wave-like jet stream flow over the United States and Canada, with colder and stormier than average conditions across the North, and warmer and less stormy conditions across the South.

Real-Time Monitoring

- El Niño/Southern Oscillation (ENSO) Diagnostic Discussion
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/index.shtml
- ENSO Blog @ Climate.gov
<https://www.climate.gov/news-features/department/enso-blog>