El Niño-Southern Oscillation (ENSO)

The El Niño-Southern Oscillation (ENSO) is a naturally occurring phenomenon that involves fluctuating ocean temperatures in the equatorial Pacific. The warmer waters essentially slosh, or oscillate, back and forth across the Pacific, much like water in a bath tub. For North America and much of the globe, the phenomenon is known as a dominant force causing variations in regional climate patterns. The pattern generally fluctuates between two states: warmer than normal central and eastern equatorial Pacific SSTs (El Niño) and cooler than normal central and eastern equatorial Pacific SSTs (La Niña).

Often, sea surface temperatures (SSTs) are used to identify this oscillation, but it is important to understand that changes in sub-surface ocean temperatures are the first to respond to an oncoming change in the ENSO phase. For instance, when ENSO is transitioning into a warm phase the sub-surface temperatures begin to warm above average, while a shallow layer of near average temperature remains at the surface. Eventually, the surface ocean temperatures will respond to the warming of the sub-surface temperatures, and a warm phase of the ENSO cycle ensues. The same cycle occurs, only opposite, for the cool phase of ENSO.

When temperatures in the ENSO region of the Pacific are near average it is known as ENSO neutral, meaning that the oscillation is neither in a warm nor cool phase. Typically, atmospheric patterns during ENSO neutral are controlled more by other climate patterns. (NAO, PNA) that vary on shorter timescales; these are examined on the following pages.

El Niño (Warm Phase of the El Niño Southern Oscillation)

The warm phase of the ENSO cycle features warmer than normal Sea Surface Temperatures (SSTs) across the central and eastern equatorial Pacific along with:

- Weaker low-level atmospheric winds along the equator
- Enhanced convection across the entire equatorial Pacific
- Effects are strongest during northern hemisphere winter due to the

fact that ocean temperatures worldwide are at their warmest. This increased ocean warmth enhances convection, which then alters the jet stream such that it becomes more active over parts of the U.S. during El Niño winters. This results in ***enhanced precipitation across the southern U.S.***

- In the southeast, ***winter temperatures are often cooler than normal***
- During hurricane season (June to November), the jet stream is aligned in such a way that the vertical wind shear is increased over the Caribbean and Atlantic. The increased wind shear helps to prevent tropical disturbances from developing into hurricanes

La Niña (Cool Phase of the El Niño Southern Oscillation)

This phase of the ENSO cycle features cooler than normal Sea Surface Temperatures (SSTs) across the central and eastern equatorial Pacific along with:

- Stronger low-level atmospheric winds along the equator
- Decreased convection across the entire equatorial Pacific results in a more suppressed southern jet stream. Consequently, ***the southern U.S., sees less precipitation***
- In the U.S., ***winter temperatures are often warmer than normal in the southeast,*** and cooler than normal in the Northwest
- During hurricane season (June to November), upper level winds are much lighter, and therefore more favorable for hurricane development in the Caribbean and Atlantic

Source (adapted from):
http://www.nc-climate.ncsu.edu/climate/patterns/ENSO.html