ENSO & PDO

GEOG 300
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- ENSO: El Niño-Southern Oscillation
- PDO: Pacific Decadal Oscillation
- Both ENSO and PDO are coupled ocean-atmosphere modes of variability focused in the Pacific Ocean

The Child

El Niño means “The (Boy) Child”, referring to the Christ Child, because of the annual Christmastime arrival of warm waters off the west coast of South America

Mean Annual SST Cycle
Boys and Girls

- **El Niño** now refers to the much stronger, more persistent, more widespread warming of the eastern and central equatorial Pacific sea surface with recurs at irregular intervals of 2 to 7 years.
- **La Niña** “the (girl) child”, refers to an anomalous cooling of equatorial Pacific sea surface

South Pacific Gyre

Coastal Upwelling

Equatorial Upwelling
Upwelling

- Coastal and equatorial upwelling occur along the South American coast and along the equator under normal conditions.
- In the presence of upwelling, the thermocline moves closer to the surface and SSTs are much lower.
- If coastal and/or equatorial upwelling ceases, SSTs increase rapidly.

Normal Conditions

El Niño Conditions

La Niña Conditions
Current SST Conditions

El Niño (Warm Event)

The movement of air within along equatorial Pacific. Under normal conditions, controlled by low pressure in the west (Darwin, Australia) and high pressure in the east (Tahiti).
The Walker Circulation is disrupted by El Niño, with higher than normal pressure in the western equatorial Pacific and unusually low pressure in the central and eastern equatorial Pacific.

This shift in atmospheric pressure linked with changes in ocean surface temperature and currents is called the Southern Oscillation. It is thought of as a west-east shift in atmospheric mass accompanying changes in SST. The “centers of action” of this pressure oscillation are at Darwin in the west and Tahiti in the east.

The Southern Oscillation Index (SOI) provides an indication of the state of the El Niño-Southern Oscillation (ENSO) system. The SOI is calculated as the in sea level pressure at Tahiti minus the sea level pressure at Darwin, Australia (normalized by dividing by the standard deviation of the monthly differences). The SOI can be plotted as a time series to identify past El Niño and La Niña events.
ENSO Time Series

El Niño Impacts

Teleconnections: Links between tropical (ENSO) fluctuations and mid-latitude weather anomalies.

El Niño Impacts

La Niña Impacts
Widespread Impacts of Exceptionally Strong 1982-83 El Niño

Pacific Decadal Oscillation (PDO)

- ENSO-like alternating pattern of SST changes in the Pacific
- Differs from ENSO in the locations of the SST changes (NW Pacific and Tropical Eastern North Pacific) and in the length of time between phases (20-30 years).
- PDO interacts with ENSO to reinforce or weaken ENSO events.
Pacific Decadal Oscillation (PDO)

monthly values for the PDO index: 1900-2008