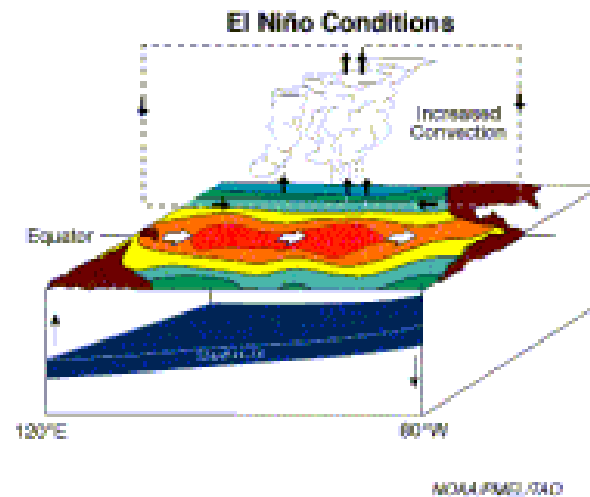
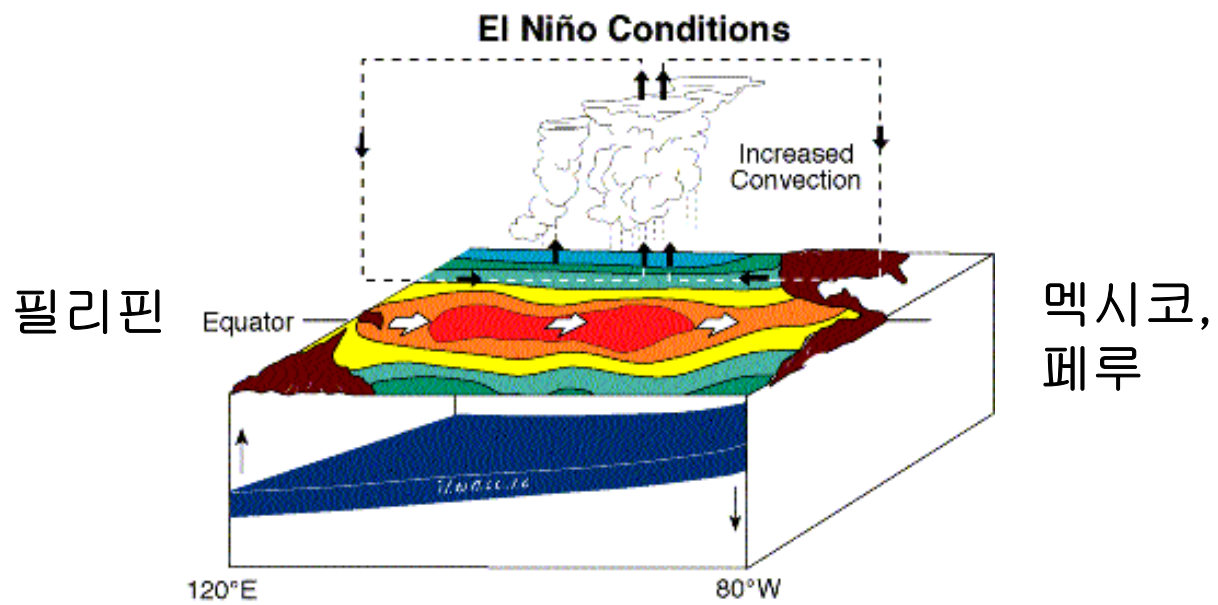
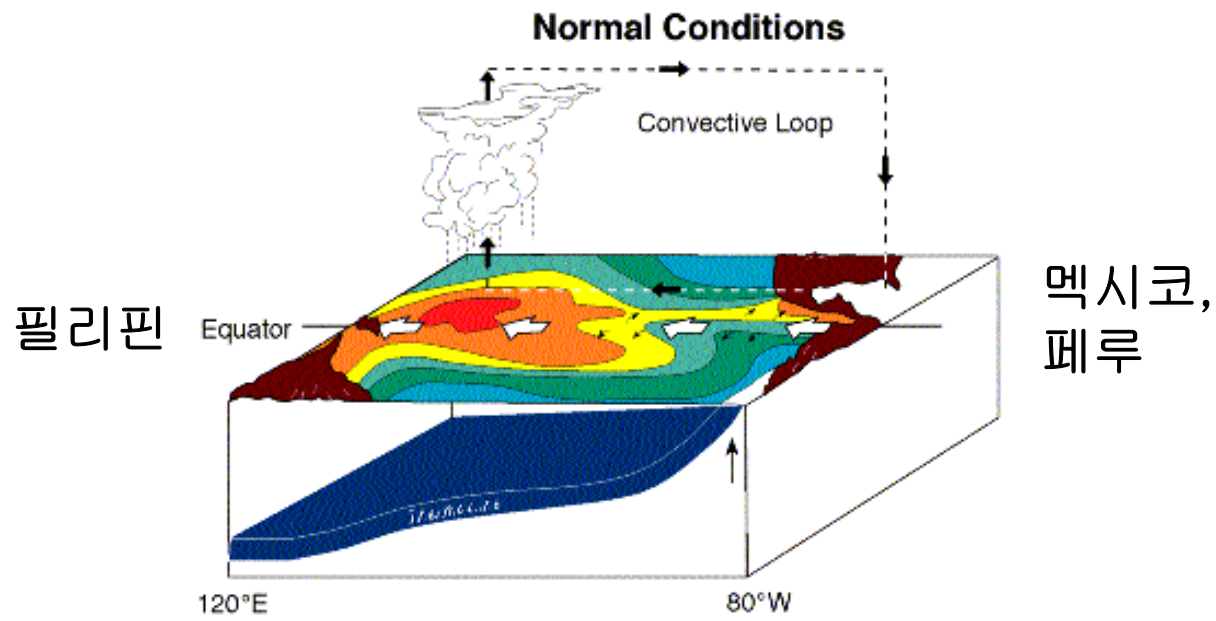


El Niño is an oscillation of the ocean–atmosphere system in the tropical Pacific having important consequences for weather around the globe.



<http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html>

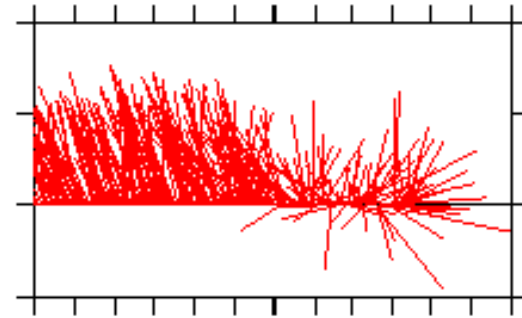
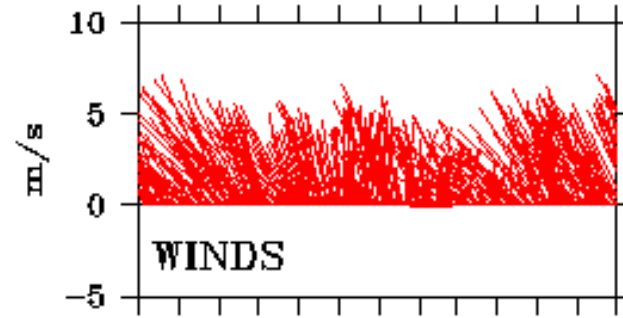


Wind and Temperature at EQ, 110°W

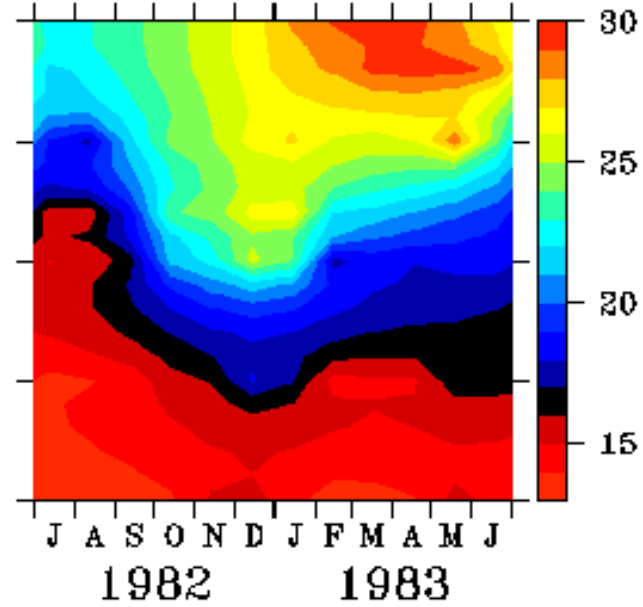
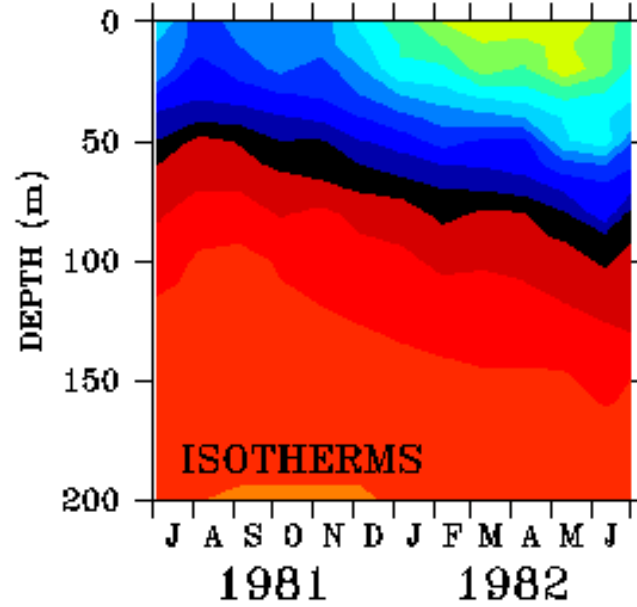
바람

NORMAL

EL NINO

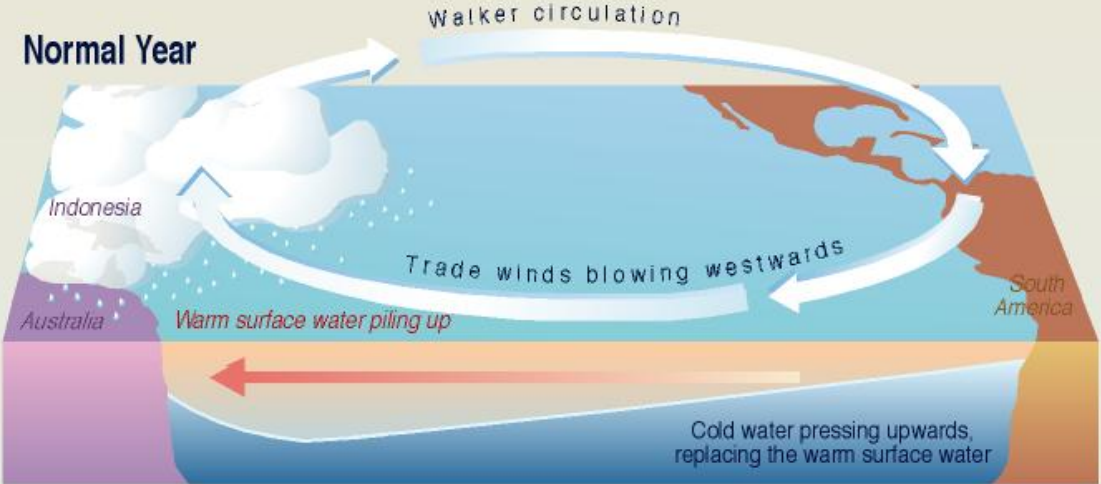


수온

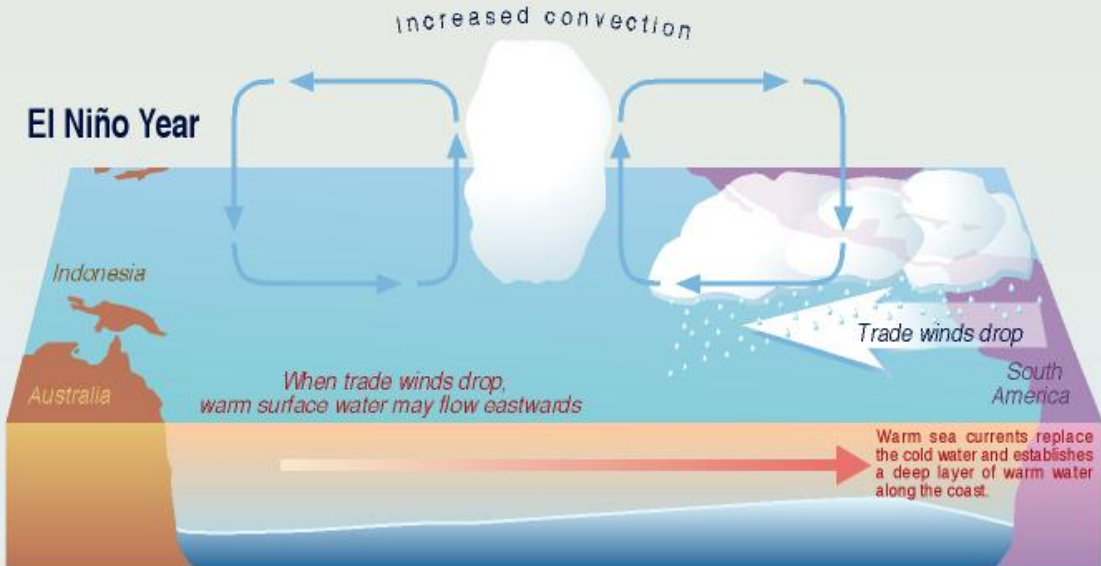


El Niño Phenomenon (ENSO)

Normal Year



El Niño Year



Sources: Climate Prediction Center-NCEP; NOAA.

In normal, non–El Niño conditions (top panel of schematic diagram), [the trade winds blow towards the west across the tropical Pacific.](#)

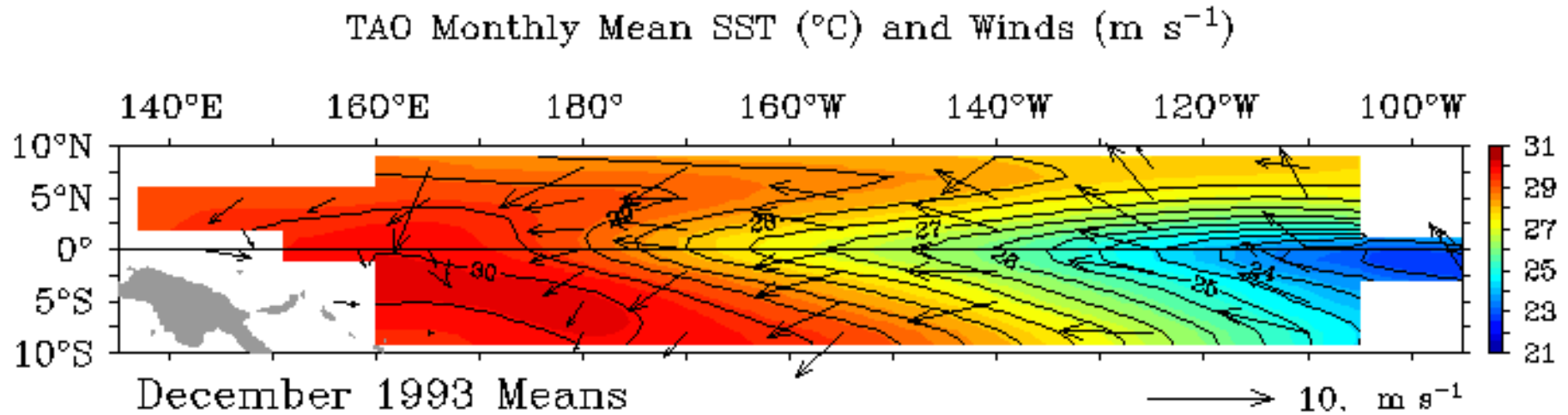
These winds pile up warm surface water in the west Pacific, so that the sea surface is about 1/2 meter higher at Indonesia than at Ecuador.

The sea surface temperature is about 8 degrees C higher in the west, with cool temperatures off South America, due to an upwelling of cold water from deeper levels. This cold water is nutrient–rich, supporting high levels of primary productivity, diverse marine ecosystems, and major fisheries. Rainfall is found in rising air over the warmest water, and the east Pacific is relatively dry. The observations at 110 W (left diagram of 110 W conditions) show that the cool water (below about 17 degrees C, the black band in these plots) is within 50m of the surface.

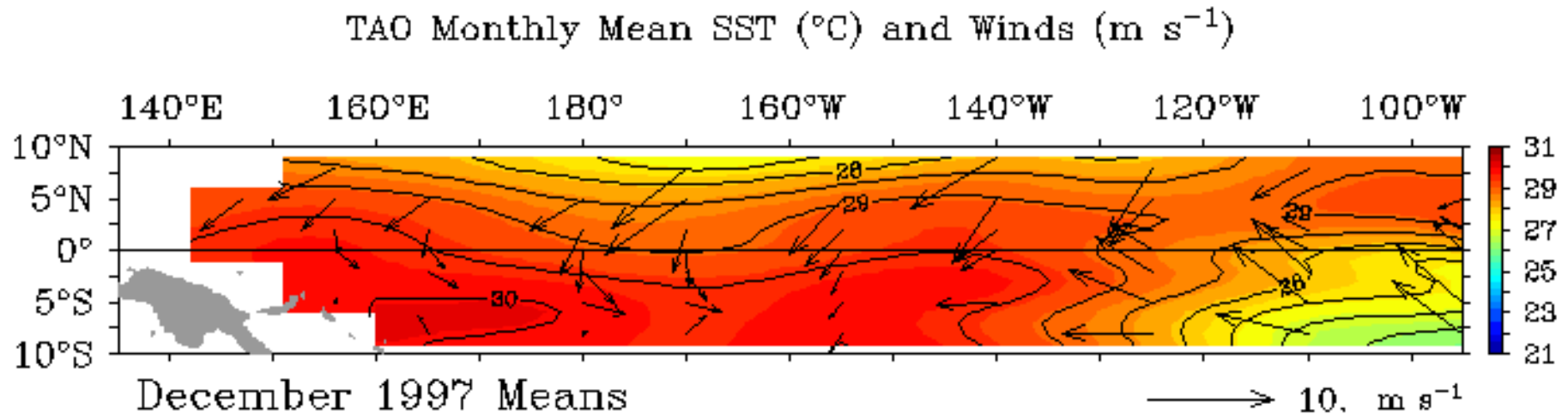
During El Niño (bottom panel of the schematic diagram), [the trade winds relax in the central](#) and western Pacific leading to a depression of the thermocline in the eastern Pacific, and an elevation of the thermocline in the west.

The observations at 110W show, for example, that during 1982–1983, the 17-degree isotherm dropped to about 150m depth. This reduced the efficiency of upwelling to cool the surface and cut off the supply of nutrient rich thermocline water to the euphotic zone. The result was a rise in sea surface temperature and a drastic decline in primary productivity, the latter of which adversely affected higher trophic levels of the food chain, including commercial fisheries in this region. The weakening of easterly tradewinds during El Niño is evident in this figure as well. Rainfall follows the warm water eastward, with associated flooding in Peru and drought in Indonesia and Australia. The eastward displacement of the atmospheric heat source overlaying the warmest water results in large changes in the global atmospheric circulation, which in turn force changes in weather in regions far removed from the tropical Pacific.

Normal Condition

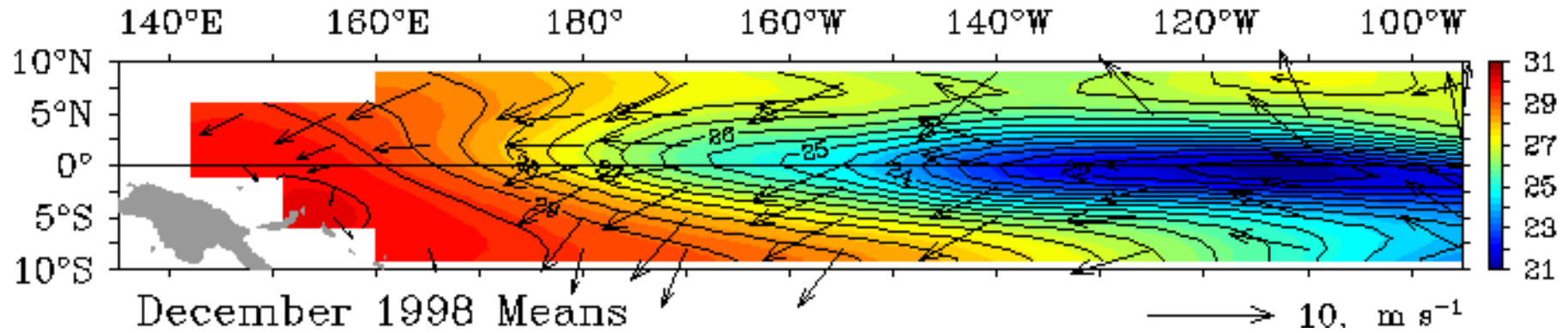


El Nino Condition (Warm, 1997년 12월)

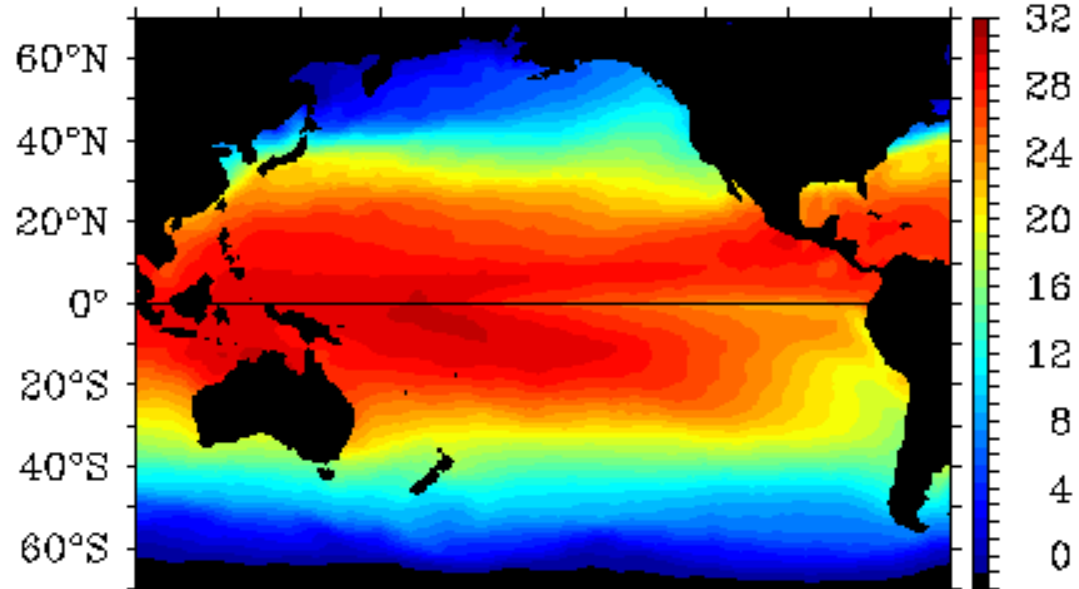


La Nina Condition (Cold, 1998년 12월)

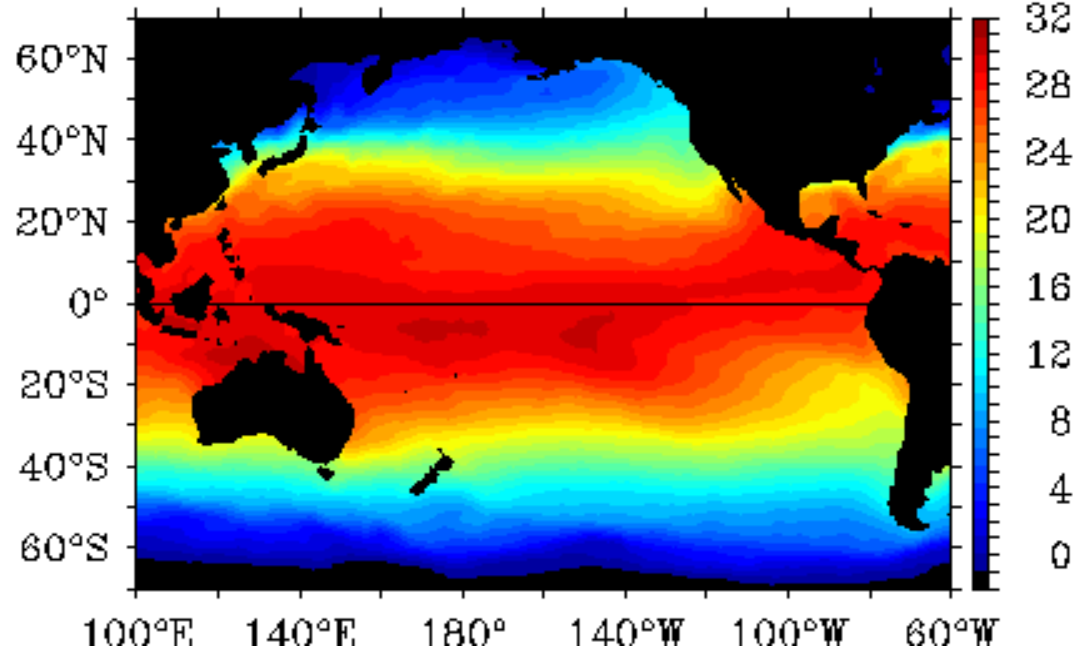
TAO Monthly Mean SST ($^{\circ}\text{C}$) and Winds (m s^{-1})



Normal Conditions December 1993

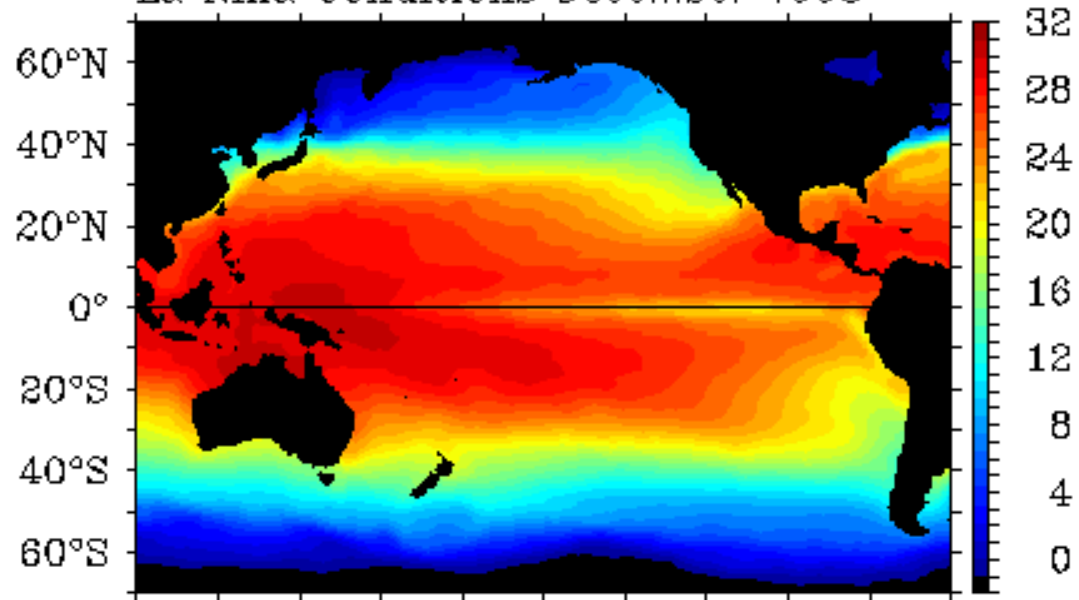


El Nino Conditions December 1997

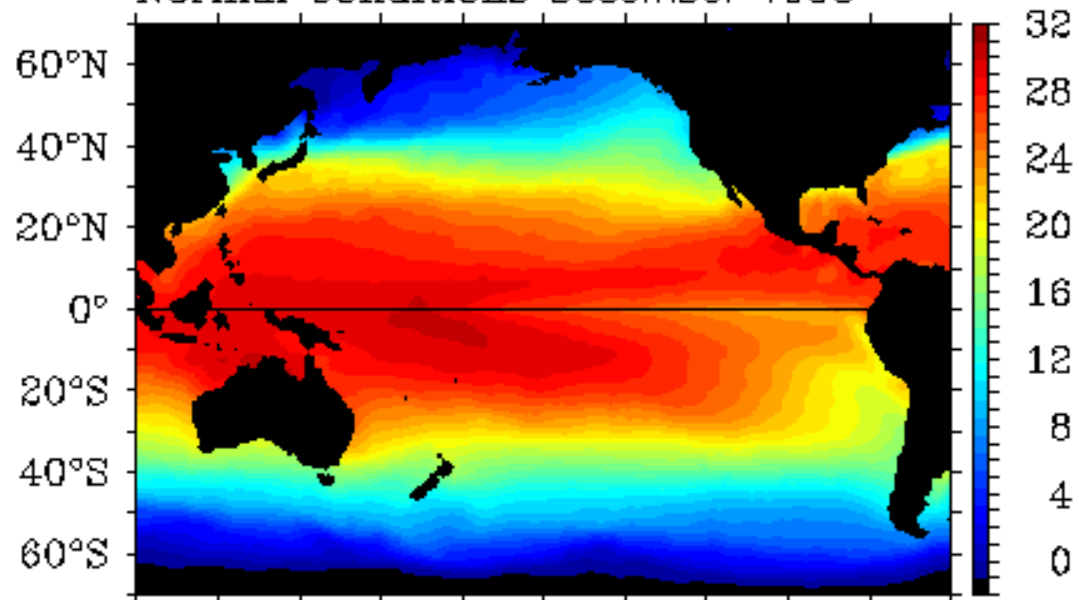


100°E 140°E 180° 140°W 100°W 60°W

La Nina Conditions December 1998



Normal Conditions December 1993



The **Southern Oscillation Index (SOI)**, defined as the normalized difference in surface pressure between **Tahiti**, French Polynesia and **Darwin**, Australia is a measure of the strength of the trade winds, which have a component of flow from regions of high to low pressure.

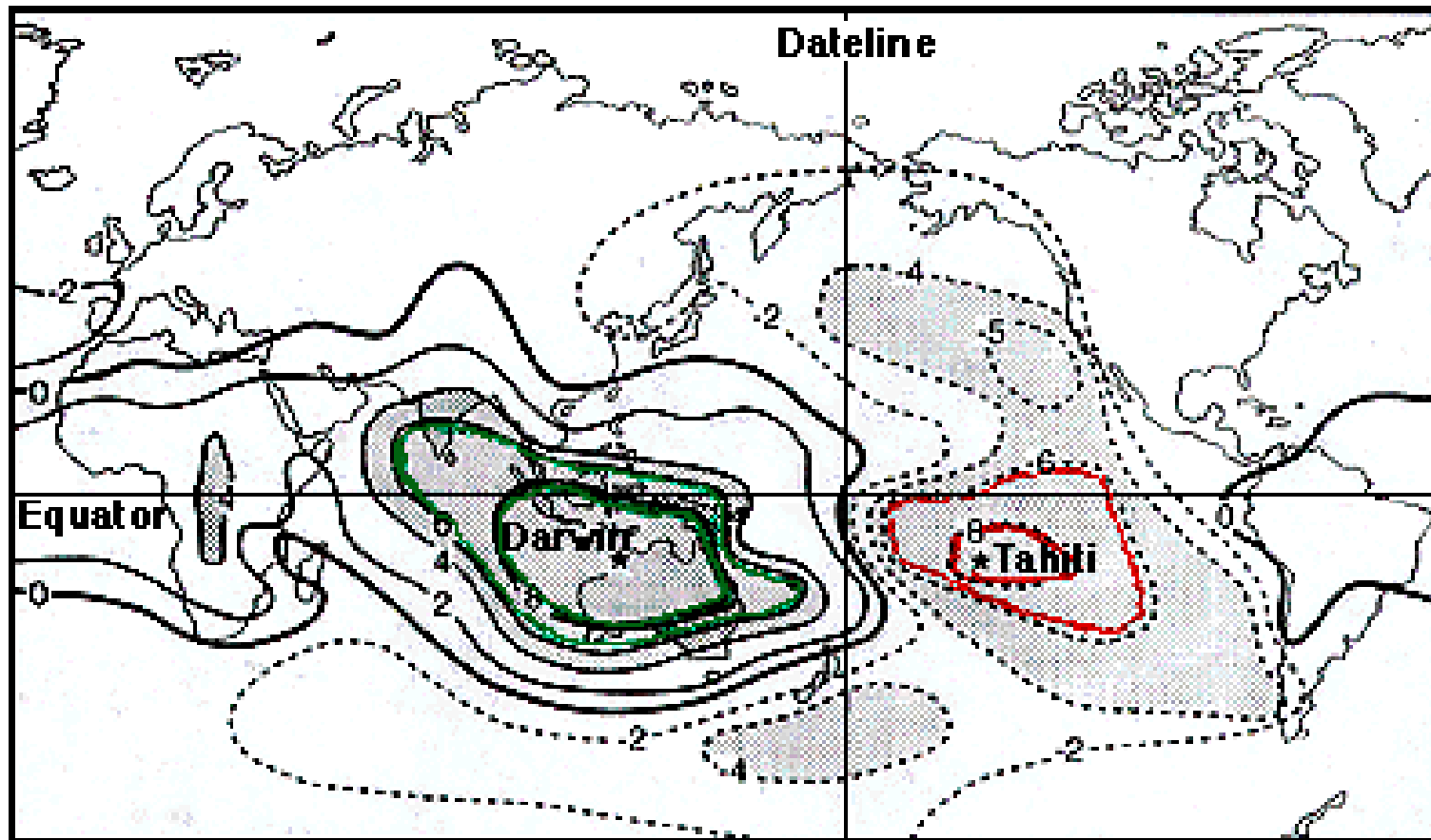
High SOI (large pressure difference) is associated with stronger than normal trade winds and La Niña conditions, and low SOI (smaller pressure difference) is associated with weaker than normal trade winds and El Niño conditions.

ENSO (El Niño/ Southern Oscillation)

El Niño => the warm phase of ENSO, low SOI

La Niña => the cold phase of ENSO , high SOI

**SOI: Tahiti and Darwin as "centers of action",
mslp correlations between two locations**



Tahiti and Darwin are at opposite ends of the Southern Oscillation's seesaw, and so the difference in pressure between them is used to measure the Southern Oscillation. The numbers represent a statistical measure called the correlation coefficient. The figure shows that the pressure variation at Tahiti is as closely related to Darwin as are locations near to Darwin, but with the opposite sign (i.e., if the Pressure is high at Darwin, it is low at Tahiti and vice versa). (After Rasmusson, 1984.)

