

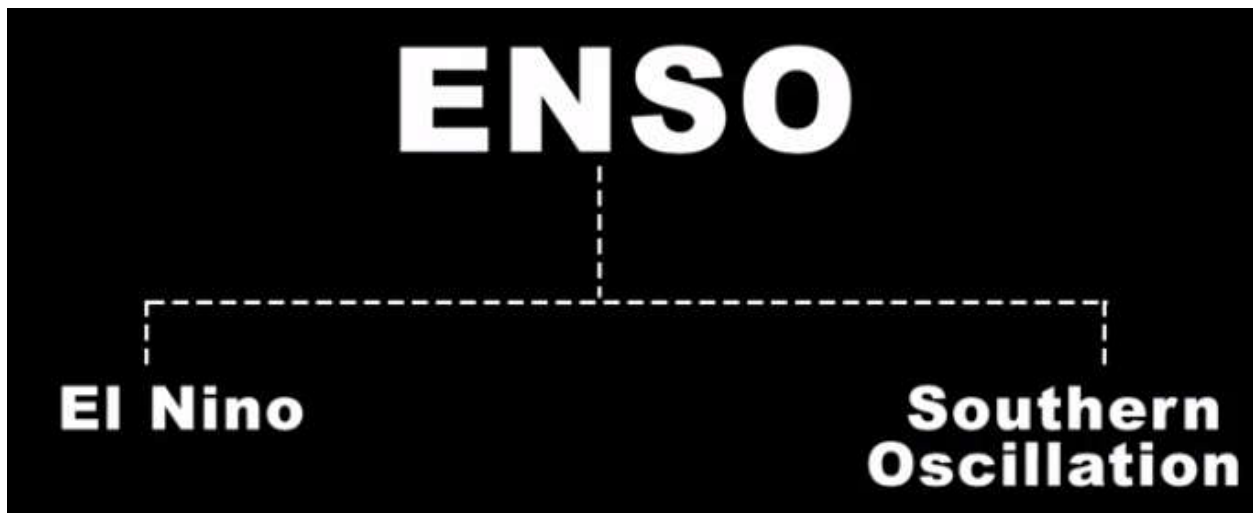
## El Nino-Southern Oscillation (ENSO)

### 1. Introduction

The El Nino-Southern Oscillation (ENSO) is a periodic climate pattern involving changes in the temperature of water in the central and eastern tropical Pacific Ocean. The surface water across a large area of the tropical Pacific Ocean remains warm or cool for three to seven years as compared to normal.

This oscillating warming and cooling pattern, 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.

ENSO is one of the most important climate phenomena on Earth due to its ability to change the global atmospheric circulation, which in turn, influences temperature and precipitation across the globe. Pacific Ocean temperature oscillate back and forth from warm temp to cold temp and vice versa.



## 2. Phases of ENSO

To understand how ENSO occurs, it can be divided into three phases.

### i. Neutral Phase

In this phase, central Pacific Ocean is warm. Trade winds are winds that blow in tropical region from eastern side to western side. Equator receives great amount of sun rays that warms the Pacific Ocean. Trade winds pushes the warm ocean currents towards the Asian side because trade winds blow from east to west and that make the western Pacific Ocean warm.



Region around New Zealand, Australia and Indonesia is called western Pacific pool, here ocean temperature is warm. The warm ocean currents affect the surrounding atmosphere by increasing the temperature and moisture content. Warm air rises high in the atmosphere through convection process and that's how clouds are formed and then it rains. The warm air then travels east, towards eastern Pacific Ocean.

The warmer air when goes up, it reaches, it reaches the end of troposphere. Top of the troposphere is cold. When warm air meets cool air, it slowly loses its moisture content and air becomes dry. The dry air moves towards eastern Pacific side and comes down over the Peruvian coastal region, making the region cold. This pattern of rising air in the west and falling in the east continuously is known as Walker circulation.

## **ii. El Nino phase**

In neutral phase trade winds play an important role in pushing warm ocean currents towards the western pacific. In this phase trade winds are weak. There are few months in the year when trade winds are weak. When trade winds are weak, the warm ocean currents do not get any type of push. The warm pull of ocean water at the western pacific, slowly moves towards the central and eastern side of Pacific Ocean. Warm ocean current is replacing the cold ocean current that exists in the central and eastern side of Pacific Ocean. Cold water is dense, so it settles down the deep ocean and warm water goes up and takes over the surface of the ocean.

When this warm ocean current moves, everything that is associated with it like the convection process, formation of rain clouds, everything moves along this warm ocean current. Hence, Walker circulation breaks into two parts. As a result, ocean temperature near Australia is cool and there is no rain. So, the inland part of Australia witnesses severe drought condition. But on the other hand, near the Peruvian coast, the warm pool of ocean current brings heavy rain, floods to the American Continent. So, El Nino is about warm ocean current.

## **iii. La Nina Phase**

This is like neutral phase, in this phase the trade winds are strong. Since trade winds blow from east to west, hence it pushes the warm ocean currents from eastern pacific to western pacific. Cold water is dense, and it settles down the deep ocean. So that means the temperature of ocean surface is warm. Now if the trade wind pushes the warm surface ocean currents towards the western pacific, the cold water from deep ocean immediately comes up at the surface, this process is called as thermocline.

Thermocline is the rising path of water temperature and rest of the process is same as in the neutral phase. Western pacific region of Australia, Indonesia, New Zealand get heavy rain storms. The effect of La Nina is more in these countries than El Nino. So, El Nino is warm ocean current and La Nina is cold ocean current. El Nino is eastern pacific, and La Nina will be at the opposite region that western pacific and it oscillates back and forth.

Following is the youtube link to have better understanding of El Nino-Southern Oscillation (ENSO):

<https://www.youtube.com/watch?v=iVCviVp4rLU>