El- Nino and Southern Oscillation (ENSO)

Concept of El- Nino:

The word 'El Nino' means 'Little Boy' or 'Christ Child' in Spanish language (National Oceanic and Atmospheric Administration, n.d.). El Niño was originally recognized by fishermen who lived along the coastal areas of South America in the 1600s. They identified the appearance of unusually warm water in the Pacific Ocean. The name was chosen based on the time of year (around December) during which these warm waters events tended to occur (National Oceanic and Atmospheric Administration, n.d.). It is considered as the significant weather phenomena that occurs along the Peru coast in South America. The first El Nino event was noticed in the year 1541 (Singh, 2007). It is mainly a sub-surface current that flows from north to south between the latitude of 3°S to 36°S at a distance of about 180 km (Singh, 2007). Owing to the El-Nino current, the cold Peruvian current gets warmer and causes heavy rainfall in the first half of the year. This heavy rainfall turns the coastal desert of Peru lush green leading to a good harvest of bananas and cotton. However, it brings about an oceanic biological disaster as many marine species die as they fail to withstand the high temperature (Chakraborty, 2018).

Concept of La-Nina:

El Nino and La Nina are the opposite phenomena in a single ENSO event. La Nina means 'The Little Girl' in Spanish language (Chakraborty, 2018) (National Oceanic and Atmospheric Administration, n.d.). It is a counter current that becomes active in the tropical western Pacific when El-Nino weakens over tropical eastern Pacific. With the arrival of the La- Nina, the dry condition over Western Pacific is terminated and wet condition is re-introduced (Singh, 2007).

Walker Circulation and El-Nino Southern Oscillation (ENSO):

There exist variations in the complex pattern of atmospheric circulation. The east-west zonal circulation of tropical wind is quite different from the general atmospheric circulation. This typical east-west circulation of tropical wind is referred to as 'Walker Circulation' named after renowned scientist G.T Walker in 1922-23 (Singh, 2007). Walker circulation is a zonal convective cell developed due to pressure gradient from east to west in the equatorial Pacific Ocean. After 2-3 years, this normal east-west pressure gradient becomes just the opposite i.e. west to east. This oscillation of pressure gradient and air circulation after interval of 2 to 3 years have been referred to as 'Southern Oscillation' by Walker. The Southern Oscillation can be described as the bimodal variation in sea level barometric pressure between observation

stations at Darwin, in Australia and Tahiti (National Oceanic and Atmospheric Administration, n.d.).

The functioning of the Walker Circulation and Southern Oscillation is affected by pressure gradient from equatorial eastern Pacific to equatorial western Pacific. This gives rise to two situations namely Normal and El-Nino.

1. **Normal Condition-** Under normal conditions, the Peruvian current remains cold. Consequently, high pressure develops over sea surface in equatorial eastern Pacific mainly near Tahiti due to subsidence of air and cold water. Low pressure develops over equatorial western Pacific mainly near Darwin of Australia due to rise of warm water from ocean bottom (National Oceanic and Atmospheric Administration, n.d.). As a result, an east-west pressure gradient develops and it generates an east-west trade wind on the surface. Along with the wind, the water mass along the coast of South America is also driven westwards. Now, cold water from below upwells to take its place and thus reinforces the high pressure condition. On the other hand, the east west air circulation becomes warm north east trade in equatorial western Pacific. It gets heated up, rises and generates a reverse upper air circulation from west to east. Now it again descends over the equatorial eastern Pacific completing a convective cell to reinforce the high pressure condition (Singh, 2007). It is due to this high pressure that promotes atmospheric stability, dry condition and leads to the formation of Atacama Desert (Chakraborty, 2018).
2. **El Nino-** By October and November, low pressure develops over sea surface in equatorial eastern Pacific mainly near Tahiti owing to high temperature. High pressure develops over equatorial western Pacific mainly near Darwin of Australia (National Oceanic and Atmospheric Administration, n.d.). As a result, a west-east pressure gradient develops and it generates a west-east air circulation on the surface. The upwelling of cold water is stopped near the South American coast. Air gets heated up near the equatorial eastern Pacific, rises up and blows in opposite direction and descends over equatorial western Pacific to reinforce the high pressure and thus a complete cell is formed. The high temperature along the Peru coast causes heavy rainfall that turns the desert lush green (Singh, 2007). However, it leads to oceanic biological disaster. This entire phenomenon is called El-Nino. These two phenomena are jointly called El-Nino Southern Oscillation (ENSO).

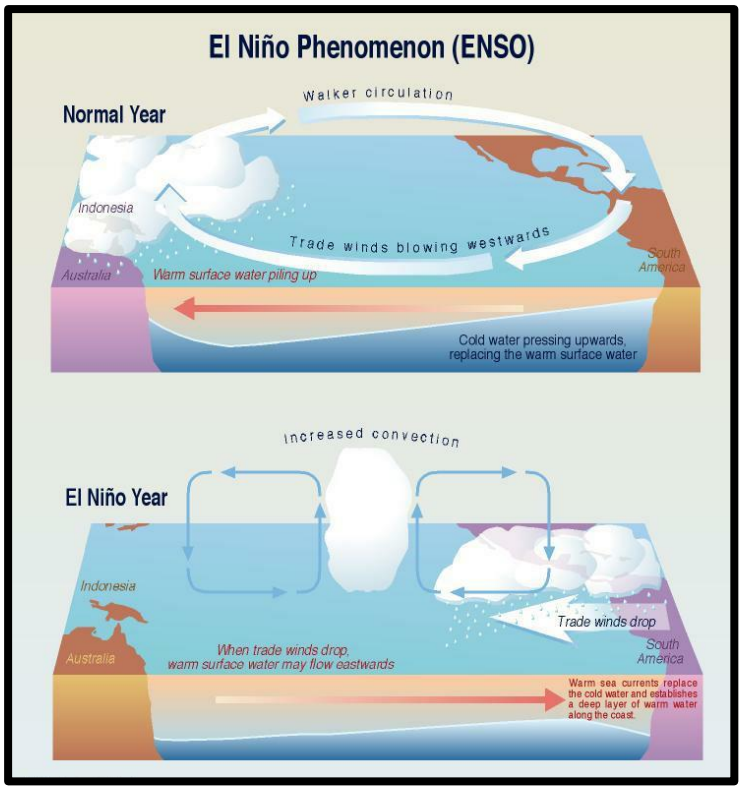

Figure 1: ENSO Phenomena

El Nino exerts a considerable influence on Indian Monsoon. When the El Nino is extended up to southern end of South America, the warm water is pushed eastward and it joins the South Atlantic Westerlies drift (Singh, 2007) (Chakraborty, 2018). It brings warm water to the southern Indian Ocean which weakens the high pressure system and consequently the south west monsoon gets weakened.

Conclusion: It can be said that this entire cycle of El-Nino and Southern Oscillation has turned out be a major attraction of research topic for most of the meteorologists as they believe that it is a mystery by solving which they can get answer of many questions that still remained unanswered.

References:

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