

Impact of El Nino and La Nino on Indian Monsoon

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ABSTRACT

A recurring characteristic of the climate is called Climatic Pattern. The gap between two recurrences may be from one year to as long as tens of thousands of years. Some of the events are in regular cycle, while some are not. When they recur in the form of regular cycles of fluctuations in climate parameters, they are called climate oscillations. The term oscillation is used because such fluctuations are not perfectly periodic. For example, we say that El Nino returns every four and half years. But actually it may or may not return. Or it may return too early or too late. So, El Nino is quasi periodic.

Keywords: El Nino, La Nino, Mansoon

I. INTRODUCTION

EL NIÑO

El Niño was originally recognized by fisherman off the coast of Peru in South America. The ocean off the coast of Peru is one of the world's richest fisheries regions. In most years trade winds flow from the southeast push warm surface water away from the coast. In its place, the cold water comes up on the surface due to upwelling. This cold water is full of nutrients and provides nourishments to planktons. These planktons serve as food for fishes. Fishes in turn provide food to the sea birds. Due to all this, not only there is a good catch of fishes but also good collection of the Guano, the bird excreta, used as a valuable fertilizer. This is what that made Peru number one fishing nation in the world by the early 1970s.



Figure 1

However, every few years, there is a change in the pattern of air circulation. It changes in such a way that the trade winds reverse direction, blowing from west to east. Due to this reversal, the upwelling of the cold water gets weakened. The surface water is warm. This lowers the nutrients available to fish and thus poses problems to the economics of fisheries. The problems don't end here. The accumulation of large mass of warm water allows formation of more and more clouds and this would bring destructive rains that occur in normally dry areas of Peru and Chile. The same is also responsible for bring outbreaks of Malaria and Cholera in some parts of South America.

Peru, as you may know is a Hispanophone country as many people speak Spanish out there. The above mentioned reversal of the winds occurred during Christmas times (Please note that we have Christmas in winter, but Peruvians have in summer, because they are in southern hemisphere), so they named it El Niño or “Christ Child” or “The Little Boy” in their own language. Before, you read further, please understand the location of Eastern, Central and Western Pacific on the map, otherwise it would be too confusing (earth is round...after all)



Figure 2

Now, here is how it affects the entire tropical region.

- ✓ Off the coast of Peru (read in Eastern Pacific and Central Pacific), there is normally cool surface water. But El Niño makes it go warm. When the water becomes warm, the trade winds, which otherwise flow from East to west, either reverse their direction or get lost. The warm water causes lots of clouds getting formed in that area, causing heavy rains in Peruvian desert during El Niño years.
- ✓ Due to this warm water, the air gets up and surface air pressure above Eastern Pacific gets down. On the other hand, the waters cool off in western Pacific and off Asia. This leads to rise in surface pressure over the Indian Ocean, Indonesia, and Australia
- ✓ So, while there is raining (read flooding) in Eastern Pacific; the drought sets in over Asia as high pressure builds over the cooler ocean waters.
- ✓ The net result is:
- ✓ Normal or high rainfall in eastern / central Pacific.

- ✓ Drought or scant rainfall in western Pacific / Asia.

Although El Niño originally referred to local conditions off the coast of Peru and Ecuador, the use of the term has been broadened by many scientists to represent all surface temperature warming in the eastern and central Pacific. The impacts of El Niño, which have been well documented include the following:

- ✓ Heavy rains in Ecuador and Peru.
- ✓ Heavy rains in southern Brazil but drought in north East Brazil
- ✓ Drought in Zimbabwe, Mozambique, South Africa, Ethiopia
- ✓ Warm winter in the northern half of the United States and southern Canada
- ✓ Drought, Scant rains off Asia including India, Indonesia, and Philippines etc.
- ✓ Coral bleaching worldwide
- ✓ Drought in eastern Australia

LA NIÑA

La Niña, which means “The Little Girl” or “El Viejo” or “anti-El Niño” or simply “a cold event” or “a cold episode is the cooling of water in the Eastern Pacific Ocean. Here is what happens in La Niña.

- ✓ The water in Eastern Pacific, which is otherwise cool; gets colder than normal. There is no reversal of the trade winds but it causes strong high pressure over the eastern equatorial Pacific.
- ✓ On the other hand, low pressure is caused over Western Pacific and Off Asia.
- ✓ This has so far caused the following major effects:
 - Drought in Ecuador and Peru. Low temperature, High Pressure in Eastern Pacific
 - Heavy floods in Australia; High Temperature in Western Pacific, Indian Ocean, Off coast Somalia and good rains in India.
 - Drought in East Africa (Somalia Drought of 2011 was linked to it)

ENSO

Both El Nino and La Nina are part of a larger cycle called ENSO, or El Niño–Southern Oscillation. The El Niño (warm event) and La Nina (Cold event) both have now established themselves as the integral part of the global climate system. It is a recurrent phenomenon with an average return period of 41/2 years, but can recur as little as 2 or as much as 10 years apart. Such events have occurred for millennia, and can be expected to continue to occur in the future.

IMPACT OF EL NIÑO AND LA NINA ON INDIAN WEATHER

- ✓ El Nino and La Nina are among the most powerful phenomenon on the Earth. These are known to alter climate across more than half the planet and dramatically impact weather patterns.
- ✓ Over Indian subcontinent, El Nino during winter results in development of warm conditions. During summer, it leads to dry

conditions and deficient monsoon. It also leads to drought in Australia. On the other hand, La Nina results in better than normal monsoon in India. At the same time, in Australia it has caused floods.

- ✓ In the recent past, India experienced deficient rainfall during El Nino years 2002 and 2009 whereas monsoon was normal during El Nino years 1994 and 1997. This so far implies that in about 50 per cent of the years with El Nino during summer, India experienced droughts during monsoon.
- ✓ This implies that El Nino is not the only factor that affects monsoon in India. There are other factors that affect India’s rainfall pattern. These include North Atlantic SST, Equatorial SE Indian Ocean SST, East Asia Mean Sea Level Pressure, North Atlantic Mean Sea Level Pressure and North Central Pacific wind at 1.5 km above sea level.

DIFFERENCE BETWEEN EL NINO AND LA NINA

Table 1

Feature	El-Nino	La-Nina
Meaning	El Nino is a Spanish term which represents “little boy”	La Nina is a Spanish term which represents ‘little girl’.
Temperature at Sea Surface	Temperature at sea surface is warmer than normal sea-surface temperatures. El Nino is a warming of the Pacific Ocean between South America and the Date Line, centred directly on the Equator, and typically extending several degrees of latitude to either side of the equator.	Temperature at sea surface is cooler than normal sea-surface temperatures. La Nina exists when cooler than usual ocean temperatures occur on the equator between South America and the Date Line.
Pressure	It accompanies high air surface pressure in the western Pacific	accompanies low air surface pressure in the eastern Pacific
Trade winds	El Niño occurs when tropical Pacific Ocean trade winds die out and ocean temperatures become unusually warm	La Nina, which occurs when the trade winds blow unusually hard and the sea temperature become colder than normal
Seasons	Winters are warmer and drier than average in the Northwest of pacific, and wetter in Southwest of pacific and experience reduced snowfalls.	Winters are wetter and cause above-average precipitation across the Northwest of pacific and drier and below average precipitation in South west of pacific.

Coriolis force	El Nino results in a decrease in the earth's rotation rate (very minimal) , an increase in the length of day, and therefore a decrease in the strength of the Coriolis force	La Nino results in increase in the earth's rotation rate, decrease in the length of day, and therefore a increase in the strength of the Coriolis force.
Ocean waters in Pacific	Warm water approaches the coasts of South America which results in reduced upwelling of nutrient-rich deep water impacting impacts on the fish populations.	Cold water causes increased upwelling of deep cold ocean waters numbers of drought occurrence, with more nutrient-filled eastern Pacific waters.
Cyclones	Comparatively less compared to La Niña as wind speed is low	La Nina had a greater tendency to trigger intense tropical cyclones as wind direction changes pilling up water between Indonesia and nearby areas as winds from Africa onwards gets blocked.

II. CONCLUSION

It is undeniable that the El Nino has been used to explain unusual climatic changes across the globe. But, modern climatology taken into account various other phenomena also. However, El-Nino has far-reaching and varied effect on climate across the world. The major reason for these unusual climatic happenings is the shifting in tropical rainfall, which in turn affects the wind patterns across the world. When the El-Nino effect causes the rainy areas centered on Indonesia and the Pacific region to move eastward, the subsequent changes result in unseasonable weather in many regions of the world. The El Nino is typically characterized by warm ocean currents and heavy rains, however, it also plays havoc with the normal weather conditions in different areas of the world. Also, the increase in temperatures affects fishing adversely, disrupts local weather and indigenous marine life in the areas concerned, other than having an effect on climatic conditions worldwide. When the linkage between El Nino and climate effects were initially suggested by the British scientist, Gilbert Walker, it was deemed ridiculous that one phenomenon could have an effect on regions as far off as Australia, India etc and Canada. However, the occurrence of El Nino in the past few decades has proved without a doubt, their far-reaching consequences. Some of the effects of El Nino in the past have been causing of droughts and forest fires in

South Asia (Indonesia and Philippines) and Australia, floods in the South American countries in the eastern Pacific region, increased rain in certain other areas of the world etc.

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