



RESEARCH ARTICLE

EL-NINO AND ITS IMPACT ON INDIAN MONSOON AND ECONOMY

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ABSTRACT

The El Nino southern oscillation is known to influence surface temperatures worldwide. El Nino conditions are thought to lead to anomalously warm globe average surface temperature, absent other forcings. Recent research has identified distinct possible types of El Nino events based on the location of peak sea surface temperature anomalies. The recent forecast of low rainfall during the monsoon is a concern for many. The onus of this goes to El Nino acronym of El Nino Southern Oscillation that a country experiences in a cycle of three to seven years. It occurs when there is an interaction between the warm water of Pacific Ocean and atmosphere. This causes different weather events ranging from floods to droughts across the globe. El Nino meant The Little Boy and was first recognized in the coastal areas of South America during the seventeenth century. Monsoon in India influences Australia and different regions in South East Asia. It impacts the economy of the country and that of neighboring countries. The relationship between El Nino and the Indian monsoon rainfall is expected to be useful in forecasting in the monsoon over India.

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INTRODUCTION

Statement of the problem

Monsoon is a familiar though a little known climatic phenomenon. In India, from agriculture to economic policies to disaster management, a lot depends on the Monsoon. The Monsoon is a recurring event i.e. it repeats after a certain frequency of time, a year in our case. But, it may not be uniform in every year. There are a lot of factors which affect its duration and intensity over India. The Monsoon is basically a result of the flow of moisture laden winds because of the variation often temperature across the Indian Ocean. There are a number of climatic phenomena which affect it namely the Indian Ocean dipole, El Nino, La Nina, Equatorial Indian Ocean Oscillation (EQUINOO) etc. These phenomena affect the temperature distribution over the oceans and thus affecting the direction and intensity of flow of the moisture laden winds. There have been recent reports that El Nino may disturb the Indian Monsoon and play badly with Indian agriculture. This brings us to the discussion of the concepts of El Nino and its impact on Indian Monsoon and Economy. In what follows we will look at their origin, mechanism, impact.

What is it?

El Nino is the warm phase of the El Nino Southern Oscillation (ENSO), a climate event that happens when warm water in the Pacific Ocean interacts with the atmosphere, causing various weather events around the world, from droughts to floods. An El Nino arrives on a cycle of about every three to seven years. There are several clues that one is brewing around the corner this year, all of which meteorologists have been keeping a keen eye on for over a year.

Origin

El Nino meaning, The Little Boy, or Christ Child was originally recognized by fishermen of the coast of South America in the 1600s, with 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.

Mechanism

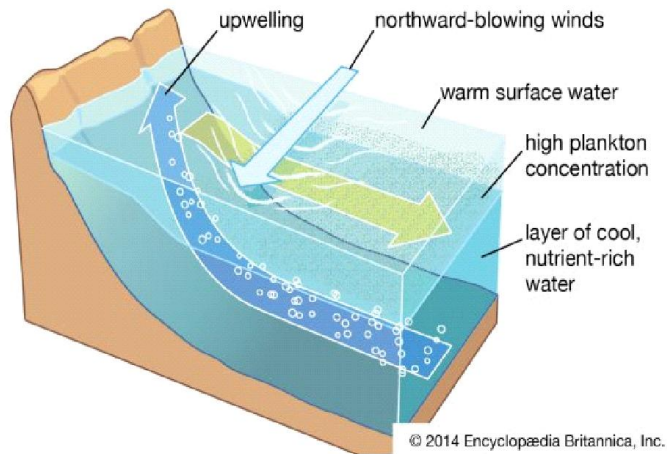
NOW, it is important to understand how these phenomena affect the Monsoon system? To know this, we must first know about the Normal and Abnormal conditions of Oceanic Currents.

What happens in a Normal Condition

- The Peruvian coast (because of Humboldt Current) has relatively high pressure than the areas near north Australia and South-East Asia.
- During normal year two things are strong - Cold Peru Current and Trade Winds.
- As a result, cold water is dragged from Peru towards Australia.

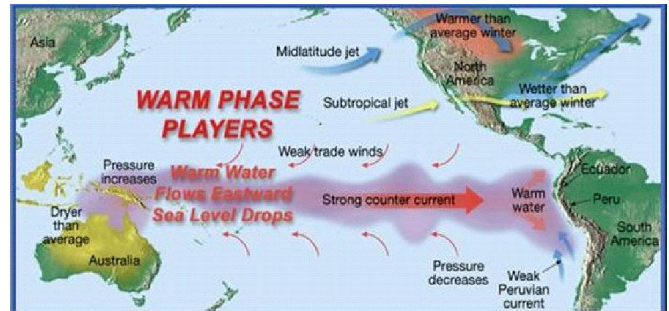


Normal conditions

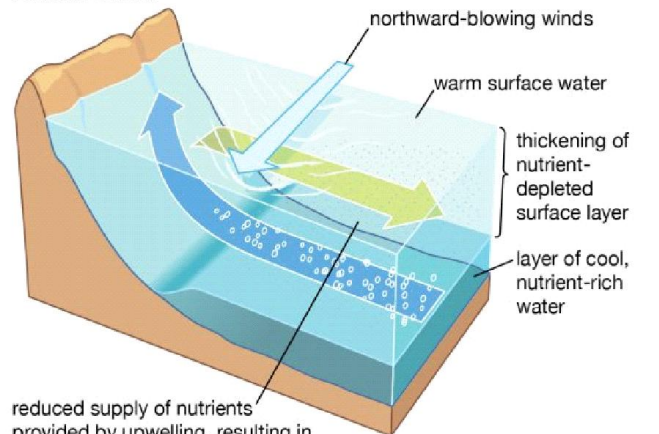


Result of this exchange?

- Rain & Floods in Peru, Atkama and even Southern USA
- Drought in Northern Australia, Indonesia- even bushfires.
- Storms and Hurricanes in East Pacific.
- Coral bleaching (high temperature coral dies)
- El Nino decreases earth's rotation rate decreases Coriolis force and increases length of day. (La Nina creates opposite). How? Because El Nino changes the wind pattern, hence Earth needs change speed to conserve its angular momentum of Earth-Atmospheric system.



El Niño event



Result of this exchange?

- In above image, the red (warm) water region around Australia is called Western Pacific Pool (WPP).
- WPP is a zone of low pressure so, warm air ascends, cloud formation and rain over North Australia.
- This air also joins walker cell and begins descending near Peru.
- Descending air - anti-cyclonic condition, high pressure, (stability) no cloud/rain (Drought) in Atacama Desert.

What happens in a El - Nino Condition

- Two things become weak - Cold Peru Current and Trade Winds.
- As result, cold water is not dragged from Peru to Australia.
- But reverse happens - warm water is dragged from Australia towards Peru.
- Consequently, warm water & low pressure condition develops in the Eastern Pacific (Peru) and Cold condition & high pressure in Western Pacific (Australia).

La-Nina

La Nina, “anti-El Nino” or simply “a cold event” is the cooling of water in the Eastern Pacific Ocean.

The following happens in La-Nina

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. For

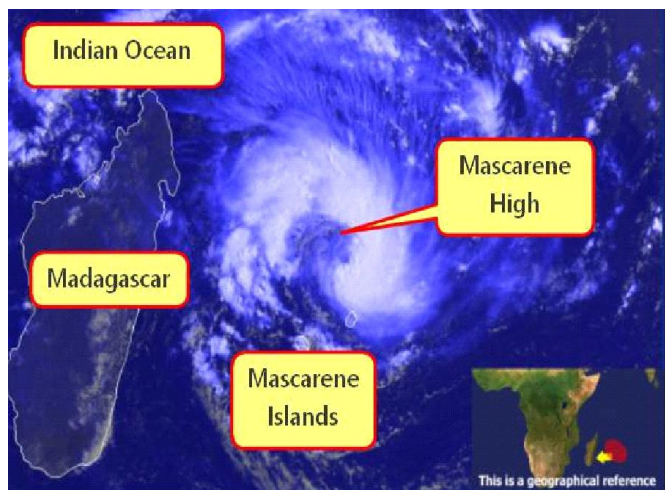
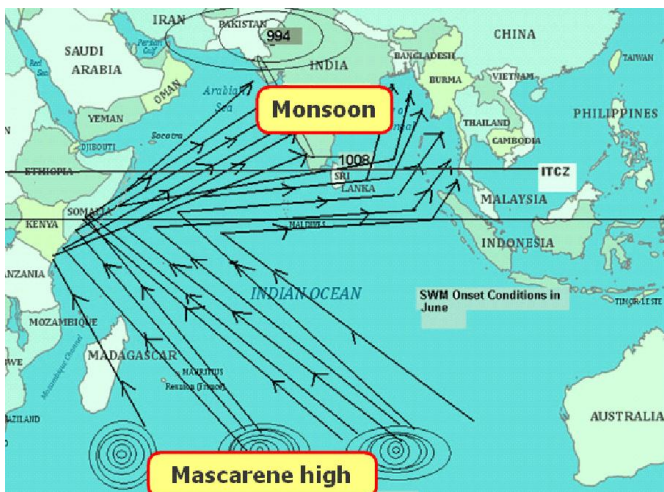
India, an El Nino is often a cause for concern because of its adverse impact on the south-west monsoon; this happened in 2009. A La Nina, on the other hand, is often beneficial for the monsoon, especially in the latter half. The La Nina that appeared in the Pacific in 2010 probably helped 2010's south-west monsoon end on a favorable note. However, it also contributed to the deluge in Australia, which resulted in one of that country's worst natural disasters with large parts of Queensland either under water from floods of unusual proportions or being battered by tropical cyclones.

How does El Nino affect Indian monsoon?

- El Nino-Southern Oscillation (ENSO) water circulation happens between Australia and Peru
- But the wind movement is part of larger atmospheric circulation hence affects the rainfall over India. But how?

We learned that during normal year, the warm water moves towards Australia, this pool of warm water is called Western Pacific Pool (WPP). From WPP air rises above and moves towards two walker cells

1. Towards Peru coast, this affects rainfall in South America.
2. Mascarene High Pressure zone near East Africa, This affects Indian monsoon.



Difference between normal year and el-nino year

During normal year	During el nino year
<ul style="list-style-type: none"> • strong WPP • strong trade winds • strong Mascarene High • Strong push for moisture laden winds towards India • good rain 	<ul style="list-style-type: none"> • weak WPP • weak trade winds • weakening of winds flowing towards Mascarene high • weak push to Monsoon winds towards India • Less rainfall / weak monsoon.
<p>During La Nina years, this push is even stronger - heavy rain and floods.</p> <p>El Nino means Little boy in Spanish. Hence its opposite is called</p> <p>La Nina means little girl.</p>	<p>El Nino caused severe drought in India (2009-10). Sugar price were highest in 30 year history.</p> <p>• Similar drought situation in Australia, Southeast Asia and Africa. (And floods in Brazil and USA Midwest.)</p> <p>• Such condition prevails for 9-24 months.</p>

Impact of El-Nino on Indian economy

When El-Nino affected Normal or High rainfall in Eastern/Central Pacific and Drought or scant rainfall in western pacific/Asia. This leads to a lot of undesirable circumstances. "When the rainfall for the monsoon season of June to September for the country as a whole is within 10% of its long period average, it is categorised as a normal monsoon. When the monsoon rainfall deficiency exceeds 10%, it is categorised as an all-India drought year." – IMD

- In India, almost 50% of the area under cultivation is rain-fed. Indian agriculture is thus heavily dependent on the climate of India: a favorable southwest summer monsoon is critical in securing water for irrigating Indian crops. So, a significant reduction in total rain fall results in a drought like situation.
- Effect of El- Nino in India is that, India may receive below normal rainfall. El-Nino caused droughts in India in 2002, 2004 and 2009. Over half of the major droughts in India the last 140 years have coincided with El- Nino.
- Drought in India has resulted in tens of millions of deaths over the course of the 18th, 19th, and 20th centuries.
- In some parts of India, the failure of the monsoons result in water shortages, resulting in below-average crop yields. This is particularly true of major drought-prone regions such as southern and eastern Maharashtra, northern Karnataka, Andhra Pradesh, Odisha, Gujarat, and Rajasthan.
- A lot of Farmers suicide because they are not be able to repay the loan they had taken for growing the crop.
- Shortages in food supply then result in spike in food prices all across the country pushing inflation up. High food inflation eats into other sectors too such as food processing sector. This pushes the RBI and the government to adopt a more cautious approach to monetary and fiscal policy respectively.
- A tighter monetary policy to tame food inflation may affect the economic growth rate of the nation. Besides, lower agricultural production already lower the GDP of the nation dealing a double blow.
- If the drought is severe, it would dry up major sources of fresh water leading to a water crisis like situation. The ground water level will also go down. This would

not only affect supply of drinking water, but also supplies of water into canals and hand-pumps for agricultural irrigation.

- Weak monsoons also result in lesser power generation from hydro power dams thus leading to even lesser electricity for irrigation purposes. This further reduces the crop yield.
- Another important source of income for the farmers is livestock and the fisheries. Both area affected severely by the drought.
- This is an example of how El- Nino in other parts of the world has an impact on India- India imports agricultural products, such as palm oil from South East Asia (especially Malaysia). If Malaysia experiences El- Nino related drought, prices of agricultural produce, such as Palm oil, may go up. This may also have an adverse impact on other commodity price too. Prices of crops such as sugarcane, rice, coffee, wheat, etc, that are grown in large quantities in South Asia and South East Asia are expected to go up.
- In case 2014 rainfall is below normal, the “Kharif” (July to October) crop may suffer, leading to reduced food production, which in turn may lead to food inflation. Reduced agricultural activity has an effect on other aspects of the economy, especially India’s rural economy. Many Indian industries (textile, construction, power, etc) are dependent on water, hence El-Nino can have an adverse impact on the Indian economy.

Summing up

The Monsoon is a phenomenon which happens because of asymmetric heating of land and sea across the earth. This potential difference results in winds which reverse seasonally.

Monsoon is also referred as the rainy phase of a seasonally-changing pattern. To predict monsoon every year is a tough task. Meteorological organizations around the world are involved in creating simulating models, collecting the data and analyzing it to forecast reliably. One of the key finding is that, among of the various phenomena and variables that could impact monsoon, El Nino is one of the prominent among them. India is a country where 50 to 60% of population is directly or indirectly dependent on agriculture sector. Moreover, almost 50 - 60% of the agricultural lands in India are rain fed and not irrigated. Therefore, there are always huge stakes involved in monsoon phenomenon. El Nino cannot be controlled. The only panacea in the long run is to increase irrigation and reduce dependency on rains. For this inter-linking of Indian rivers is required which has been very slow in India. It needs to speed up.

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