



# Pacific Weather Changing: More Multi-Year El Nino and La Nina

**For Prelims:** [El Nino and La Nina](#), Walker Circulation, Tropical Pacific Ocean, El Nino-Southern Oscillation, Extreme Weather Events.

**For Mains:** Impacts of Rising Multi-year El Nino and La Nina Events

**Source:** [DTE](#)

## Why in News?

A recent study has raised concerns about the **impact of human activities on the duration and behaviour of [El Nino and La Nina](#) events.**

- It found that [Walker Circulation](#) has changed its behavior since the industrial era and **multi-year El Nino and La Nina events could become more frequent.**

## What do the Recent Studies Suggest?

- The **Walker Circulation**, a key atmospheric component of ENSO, drives weather patterns worldwide. Researchers aimed to assess whether [greenhouse gas emissions](#) had **influenced this critical climate driver.**
- The study's findings revealed that the transition from El Nino to La Nina has slightly slowed over time. This suggests that **multi-year [climate patterns](#)** may become more frequent in the future, posing heightened risks of **droughts, fires, heavy rainfall, and floods.**
- While the overall strength of the **Walker Circulation has not yet decreased**, researchers speculate that **elevated [carbon dioxide](#) levels could weaken it.**
  - Many climate models also predict a **decline in the Walker Circulation by the end of the century.**
- The study also highlighted a **connection between volcanic eruptions and the weakening of the Walker Circulation.** This phenomenon often leads to El Nino-like conditions.
  - The research identified three significant **El Nino events in the twentieth century that followed volcanic eruptions: Mount Agung in 1963, El Chichón in 1982, and Mount Pinatubo in 1991.**
- **Walker Circulation:**
  - The Walker Circulation is a **large-scale atmospheric circulation pattern** in the tropical Pacific region of the Earth.
    - It is a system of winds that plays a crucial role in shaping climate and weather patterns in the tropics and beyond.
  - The **Walker Circulation is primarily associated with the Pacific Ocean** but has global impacts.

- A **weaker Walker Circulation** is associated with **El Nino**, while a **stronger circulation** signals **La Nina**.

- **El Nino:**

- **El Nino** is a climate pattern that describes the **unusual warming of surface waters in the Tropical Pacific Ocean**. It means Little Boy in Spanish and it occurs more frequently than La Nina.
  - It is known to **suppress monsoon rainfall in India**.
- It occurs due to the weakening or reversal of trade winds in the tropical Pacific.
  - Normally, **trade winds blow from east to west**, pushing warm surface waters towards the **western Pacific**.

- **La Nina:**

- La Nina is a pattern that describes the **unusual cooling of the Tropical Pacific Ocean**. It means "**Little Girl**" in Spanish and is sometimes called **El Viejo, anti-El Niño, or simply "a cold event."**
  - It is known to aid rainfall over India.
- It occurs as a result of the **strengthening of the trade winds in the tropical Pacific Ocean**.
  - During La Nina events, these trade winds become **even stronger, intensifying the normal east-to-west flow** of warm surface waters across the equatorial Pacific.
  - This strengthening of the trade winds leads to cooler-than-average sea surface temperatures in the **central and eastern equatorial Pacific**.

- **El Nino-Southern Oscillation (ENSO):**

- It is a climate phenomenon resulting from the interaction between ocean and atmospheric conditions.
  - The "**southern oscillation**" component refers to **differences in sea-level air pressure over the western and eastern Pacific Oceans**.
- **El Nino and La Nina** represent the warm and cool phases of the **El Nino-Southern Oscillation (ENSO) cycle**.
  - El Nino and La Nina episodes typically occur every 2 to 7 years. La Nina events may last **between one and three years**.
    - However, it is rare for El Nino events to last longer than a year.
  - Multi-year El Niño and La Nina events are those that persist for more than one year without returning to normal conditions in between.
    - In 2023, **La Nina concluded a three-year period**, and El Nino made its presence felt. Such long-lasting ENSO phases are unusual.

# El Niño and La Niña

## El Niño

- Warming of the ocean surface/ Above average sea surface temp. (SST)
- Easterly winds either weaken or start blowing in the opposite direction
- First noticed by Peruvian fishermen in the 1600s
- More frequent than La Niña

### Impacts

- Drastically higher rainfall in S. America (coastal flooding and erosion)
- Droughts in Indonesia and Australia; wildfires
- Weaker monsoons and even droughts in India and SE Asia
- Reduces the upwelling of cooler, nutrient-rich waters from the deep - along the west coast of South and Central America.

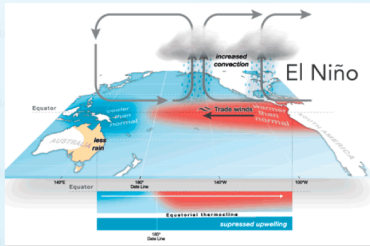


Fig. 1 - Depiction of El Niño Phenomenon

## La Niña

- Also called El Viejo, anti-El Niño, or simply "a cold event"
- Normal easterly winds along the equator become even stronger
- May last 1-3 years, unlike El Niño (which usually lasts no more than a year)

### Impacts

- Heavier rains in SE Africa, catastrophic floods in Australia
- Drier-than-normal conditions in S. America
- Summer Monsoon rainfall - greater than normal rainfall in India; beneficial for agriculture dependent Indian economy
- Off the west coast of the Americas, upwelling increases, bringing cold, nutrient-rich water to the surface.

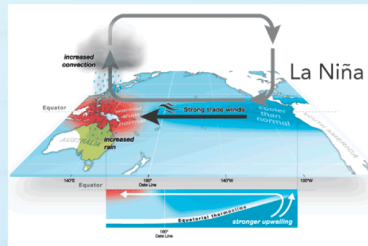


Fig. 2 - Depiction of La Niña Phenomenon

## Oceanic Niño Index (ONI)

- It is a measure of the departure from normal sea surface temperature in the east-central Pacific Ocean.
- It is the standard means by which each El Niño episode is determined, gauged, and forecast.



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## What can be the Impacts of Rising Multi-year El Niño and La Niña Events?

- **Increased Frequency of Extreme Weather Events:** Multi-year El Niño and La Niña events can alter the patterns of precipitation, temperature, wind, and atmospheric pressure across the globe, leading to more frequent and **severe droughts, floods, heat waves, cold snaps, storms, and wildfires.**
- **Natural Disasters:**
  - **Floods and Droughts:** Multi-year **El Niño** events can amplify the risk of **prolonged droughts** followed by severe flooding events in different regions.
    - Conversely, multi-year La Niña events can lead to excessive rainfall and flooding in some areas, followed by extended periods of drought in others.
  - **Tropical Cyclones:** The frequency and intensity of tropical cyclones can be influenced by ENSO events.
    - Multi-year events can result in **variations in cyclone activity in different ocean basins, affecting coastal regions' vulnerability.**
- **Agriculture and Food Security:** Multi-year El Niño-induced droughts can lead to **reduced crop yields**, affecting global food supplies and prices.
  - In contrast, multi-year La Niña events may enhance crop production in some regions but also **lead to excessive rainfall and waterlogging, damaging crops.**
- **Economic and Societal Impacts:**
  - **Economic Costs:** The combined impacts of multi-year ENSO events can result in significant economic costs due to **damage to infrastructure, increased energy demand, and disruptions to global trade** in commodities such as food and minerals.
  - **Health Risks:** Changing weather patterns can affect the spread of diseases, with

**increased risks of [waterborne diseases](#)** during flooding and vector-borne diseases during prolonged droughts.

▪ **Environmental Consequences:**

- **Ecosystems:** Multi-year events can **stress terrestrial and marine ecosystems**, leading to [coral bleaching](#), **forest fires, and habitat disruptions**.
  - Ecosystems may struggle to adapt to the rapid and persistent changes in temperature and precipitation.
- **Biodiversity:** Shifts in environmental conditions can **impact the distribution and survival of species**, particularly those sensitive to climate variations. This can have cascading effects on biodiversity.

## UPSC Civil Services Examination, Previous Year Question (PYQ)

### **Mains**

**Q.** Most of the unusual climatic happenings are explained as an outcome of the El-Nino effect. Do you agree? **(2014)**

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