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.

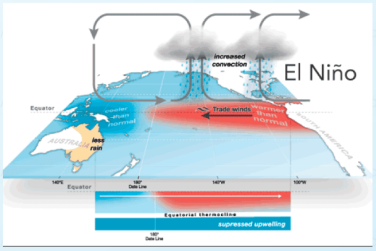

Fig. 1 - Depiction of El Niño Phenomenon

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 Nino (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.

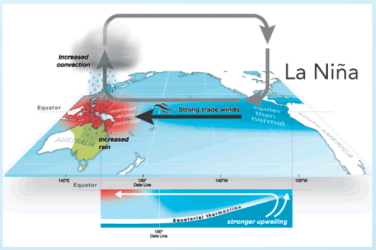

Fig. 2 - Depiction of La Niña Phenomenon

Oceanic Nino 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 Nino episode is determined,** gauged, and forecast.

Drishti IAS

What can be the Impacts of Rising Multi-year El Nino and La Nina 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 Nino events can amplify the risk of prolonged droughts** followed by severe flooding events in different regions.
    - Conversely, multi-year La Nina 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 Nino-induced droughts can lead to **reduced crop yields**, affecting global food supplies and prices.
  - In contrast, multi-year La Nina 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)**