



## Equatorial Origin Cyclones and Pacific Decadal Oscillation

**For Prelims:** [Tropical Cyclones](#), Low Latitude Cyclones, [Pacific Decadal Oscillation \(PDO\)](#), ENSO

**For Mains:** Impact of PDO on India, ENSO vs PDO

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

### Why in News?

Equatorial-origin [cyclones](#) have been unusually subdued in recent decades.

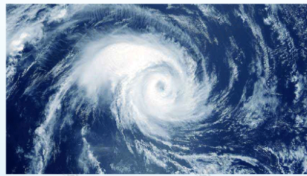
- However, as per a study published in the journal ***Nature Communications***, the combination of global warming and the [Pacific Decadal Oscillation \(PDO\)](#) could make such cyclones more frequent in the coming years.

### What are Equatorial-Origin or Low Latitude Cyclones?

- Equatorial origin or Low Latitudes Cyclones (LLCs) originate between 5°N and 11°N. These cyclones are much smaller in size than those in higher latitudes but **intensify more rapidly**.
  - Cyclones forming near the equator (low-latitude) is usually rare but when the waters are warm, they can gain more moisture and rise in intensity.
  - **Majority of cyclones originate in the Western Pacific Ocean.**
- The last major cyclone of this kind in the Indian neighbourhood was the 2017 **Cyclone Ockhi** which travelled >2000 km and **devastated Kerala, Tamil Nadu and Sri Lanka**.
- The north Indian Ocean (NIO) in the post-monsoon season (Oct-Nov-Dec) is a hotbed for LLCs that **constitute about 60% of all Tropical Cyclones** formed in the NIO (since 1951) but has received relatively less attention.

# CYCLONE

Cyclones are rapid **inward** air circulation around a **low-pressure** area.

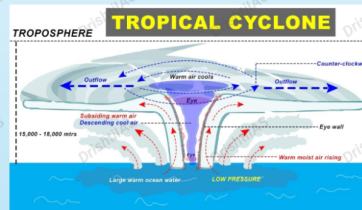


## Cyclone v/s Anticyclone

Pressure System	Pressure Condition at the Center	Pattern of Wind Direction	
		Northern Hemisphere	Southern Hemisphere
Cyclone	Low	Anticlockwise	Clockwise
Anticyclone	High	Clockwise	Anticlockwise

## Classification

- **Tropical Cyclones;** originate between the **Tropics of Capricorn and Cancer**
- **Extra Tropical/ Temperate Cyclones;** originate in the **Polar Regions**



### Conditions for Formation

- Large sea surface with temperature  $>27^{\circ}\text{C}$ .
- Presence of the **Coriolis force**
- Small **variations in the vertical wind speed**
- A **pre-existing weak low- pressure area**
- **Upper divergence** above the sea level system

### Different Names for Tropical Cyclones

- **Typhoons** - Southeast Asia and China
- **Hurricanes** - North Atlantic and eastern Pacific
- **Tornados** - West Africa and southern USA
- **Willy-willies** - Northwest Australia
- **Tropical Cyclones** - Southwest Pacific and Indian Ocean

### Nomenclature

- Nodal Authority - **World Meteorological Organization (WMO)**
- Indian Ocean Region - **Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand** contribute to naming cyclones that occur in this region.

### Cyclones in India

- **Bi-annual Cyclone Season** - March to May and October to December
- Recent Cyclones - **Tauktae, Vayu, Nisarga and Mekanu** (in Arabian Sea) and **Asani, Amphan, Fani, Nivar, Bulbul, Titli, Yaas and Sitrang** (in Bay of Bengal)

## What is Pacific Decadal Oscillation?

### About:

- The Pacific Decadal Oscillation (PDO) is a **long-term ocean fluctuation** of the Pacific Ocean. It is a **cyclical event that repeats every 20-30 years** and just like **ENSO**, has a 'cool' and 'warm' phase.
- **Positive (warm) PDO = cooler west Pacific Ocean** and warmer eastern side (vice versa for negative PDO).
- The term PDO was coined in about 1996 by Steven Hare.

### Impact of PDO:

- On Global Climate: PDO phase can have significant implications for the global climate, affecting Pacific and Atlantic hurricane activity, droughts and flooding around the Pacific basin, the productivity of marine ecosystems, and global land temperature patterns.
- On Cyclones: A warmer (positive-phased) PDO implies fewer equatorial-origin cyclones.
  - In 2019, the PDO entered a cooler, negative phase and which if continues, could mean more such cyclones in post-monsoon months.

### ENSO and PDO:

- ENSO with a positive PDO is generally not good, however, **ENSO with a negative PDO brings more rain to India.**



- If both ENSO and the PDO are in the same phase, it is believed that El Niño/La Niña impacts may be magnified.

▪ **PDO vs ENSO:**

- **El Niño or La Niña events** repeat in the Pacific over 2-7 years, however, **PDO has a signature for a longer time** (on the decadal scale).
- A 'positive' or 'warmer phase' of a PDO **can be known only after several years of measuring ocean temperatures** and their interaction with the atmosphere (stage of an ENSO can be determined any year).

## El Niño Southern Oscillation (ENSO)

Describes the fluctuations in temperature between the ocean and atmosphere in the east-central Equatorial Pacific

**Significance:**

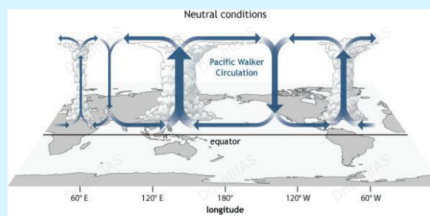
- Ability to change the global atmospheric circulation, influencing temperature and precipitation worldwide

**States of ENSO:**

- The two opposite phases - El Niño and La Niña
- The middle of the continuum - Neutral

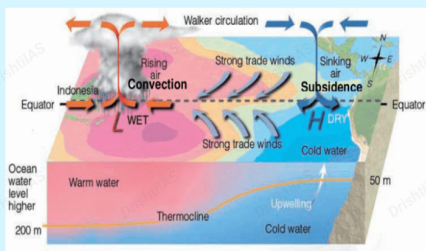
### Walker Circulation (WC)

- An **atmospheric system of air flow** in the equatorial Pacific Ocean
  - The trade winds across the tropical Pacific flow from east to west: air rises above the warm waters of the western Pacific, flows eastward at high altitudes, and descends over the eastern Pacific
- WC and ENSO:
  - A weak/reverse WC produces El Niño
  - Stronger WC results in La Niña



### Normal (non ENSO) Conditions in the Pacific Ocean

**NEUTRAL ENSO**



- Trade winds (easterlies) blow west along the equator, taking warm water from S. America towards Asia
- To replace that warm water, **cold water rises from the depths** — a process called **upwelling**
  - **El Niño and La Niña** are two climate patterns that **break these normal conditions**
- During an El Niño, sea level pressure tends to be lower in the eastern Pacific and higher in the western Pacific while the opposite tends to occur during a La Niña
  - This see-saw in atmospheric pressure between the eastern and western tropical Pacific is called the **Southern Oscillation (SO)**



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

**Prelims:**

**Q. La Niña is suspected to have caused recent floods in Australia. How is La Niña different from El Niño? (2011)**

1. La Niña is characterised by an usually cold ocean temperature in equatorial Indian Ocean whereas El Niño is characterised by unusually warm ocean temperature in the equatorial Pacific Ocean.
2. El Niño has adverse effect on south-west monsoon of India but La Niña has no effect on monsoon climate.

**Which of the statements given above is/are correct?**

- (a)** 1 only
- (b)** 2 only
- (c)** Both 1 and 2
- (d)** Neither 1 nor 2

**Ans: (d)**

**Mains:**

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

**Q.** Tropical cyclones are largely confined to the South China Sea, Bay of Bengal and Gulf of Mexico. Why? **(2014)**

PDF Reference URL: <https://www.drishtiias.com/printpdf/equatorial-origin-cyclones-and-pacific-decadal-oscillation>

