



## Uncommon Cyclones in the Arabian Sea

**For Prelims:** [Arabian Sea](#), [Asna](#), [Cyclone](#), [El Niño](#), [Southern Ocean](#)

**For Mains:** Important Geophysical phenomena, Climate Change and its impact on Cyclone Dynamics

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

### Why in News?

Recently, the [Arabian Sea](#) witnessed a rare August cyclone, named [Asna](#), which stirred considerable interest due to its unusual timing and origin.

- The **north Indian Ocean**, which includes the Arabian Sea and the Bay of Bengal, **is typically less active** in terms of cyclones compared to global oceanic regions. However, Asna's emergence has brought attention to the growing influence of climate change on **cyclogenesis** in this region.

### Note

Cyclogenesis refers to the development or strengthening of cyclonic circulation in the atmosphere, often leading to the formation of cyclones and associated weather phenomena.

### What are the Factors Contributing to Cyclogenesis in the North Indian Ocean?

- **Oceanic Tunnels:** The Indian Ocean has unique oceanic tunnels connecting it to the **Pacific and Southern Oceans**.
  - The **Pacific Tunnel (Indonesian Throughflow) introduces warm water to the upper 500 meters** of the Indian Ocean, contributing to higher **sea surface temperatures (SSTs)** in the Arabian Sea, potentially enhancing convection and moisture availability.
    - Warm SSTs can provide energy for cyclone development, but the impact may be moderated by other factors.
  - The **Southern Ocean Tunnel brings cooler waters below 1 kilometer depth**, which can stabilise the lower ocean layers and limit vertical mixing of warmer surface waters.
    - The cooler waters may also reduce SSTs and **limit the energy available for cyclone formation**, potentially suppressing cyclonic activity.
- **Pre and Post-Monsoon Cyclones:** The north Indian Ocean, encompassing the Arabian Sea and the Bay of Bengal, experiences **two distinct cyclone seasons, pre-monsoon (April to June) and post-monsoon (October to December)** unlike other regions that typically have one.
  - The region's unique climatic and oceanographic conditions, including the monsoonal circulation and dramatic seasonal wind reversals, contribute to these dual cyclone seasons.
  - During the **pre-monsoon season**, cyclogenesis can occur in **both the Arabian Sea and the Bay of Bengal** due to warming and increased convection.

- In the **post-monsoon season (October-December)**, the northeast monsoon and dry continental air ends up cooling the Arabian Sea, reducing the likelihood of cyclone formation, while the **Bay of Bengal remains more favourable for cyclones**.
- However, the **Climate change** is altering the patterns and intensity of cyclones in the Indian Ocean.

## Note

The **Arabian Sea has fewer cyclones than the Bay of Bengal** due to stronger **vertical wind shear and less convective activity**.

- Despite rapid warming before the monsoon, cooling during the monsoon and persistent cooler temperatures reduce cyclonic development.
- Recent warming trends affect both regions, but the Arabian Sea remains less active.

## How does Climate Change Impact the Indian Ocean?

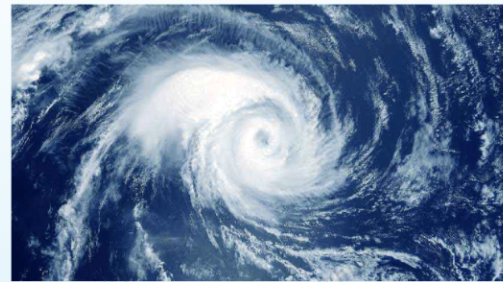
- **Rapid Warming:** Climate change is causing the **Indian Ocean to warm rapidly**. Increased heat from the **Pacific Ocean** and warmer waters pushed in from the **Southern Ocean** contribute to this trend.
  - Changes in **atmospheric winds and humidity**, driven by global climate shifts, further intensify the warming of the Indian Ocean.
- **Global Influence:** The Ocean's rapid warming is affecting the heat uptake by the Pacific Ocean and the sinking of heavy waters in the north Atlantic Ocean.
  - The Indian Ocean is acting like a clearinghouse (modulates global climate variability and contributes to the overall heat balance) for ocean warming during climate change.
- **Cyclogenesis Impact:** The rapid warming and associated climate changes impact **cyclone formation, frequency, and behavior**, highlighting the region's unique response to global warming.

## Cyclone Asna

- Cyclone Asna, a **rare August cyclone**, has drawn significant attention as the first North Indian Ocean cyclone in August since 1981.
  - The name Asna, which means “the one to be acknowledged or praised”, has been given by Pakistan.
- Cyclone Asna originated from a powerful **land-based low-pressure system**, which is typical as most such systems **form over the Bay of Bengal** and bring heavy monsoon rains to India.
  - The system transitioned into a **cyclone upon moving into the warm Arabian Sea**, which was fueled by global warming and regional weather patterns, provided the necessary **energy for Asna to intensify**, but it eventually dissipated due to dry desert air entering the cyclone's circulation.
- Climate change is making cyclones in the Indian Ocean more unpredictable, with factors like **global warming, El Niño, and underwater volcanic eruptions** contributing to extreme weather events in India, where the monsoon season has become increasingly erratic with unpredictable rainfall patterns.

# CYCLONE

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

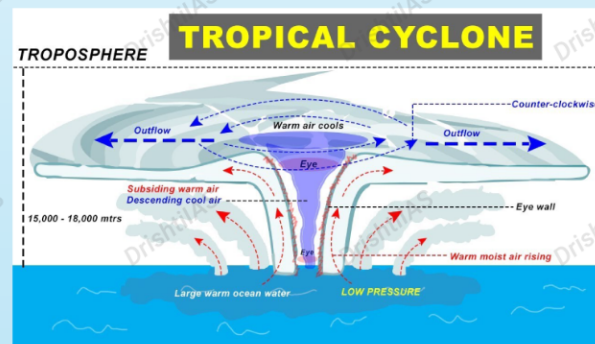


## Cyclone v/s Anticyclone

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)

**Drishti Mains Question:**

**Q.** Explain the factors contributing to cyclogenesis in the North Indian Ocean and the impact of climate change.

**UPSC Civil Services Examination Previous Year Question (PYQ)**

**Prelims**

**Q. Consider the following statements: (2020)**

1. Jet streams occur in the Northern Hemisphere only.
2. Only some cyclones develop an eye.
3. The temperature inside the eye of a cyclone is nearly 10°C lesser than that of the surroundings.

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

- (a) 1 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1 and 3 only

**Ans: (c)**

**Q. In the South Atlantic and South-Eastern Pacific regions in tropical latitudes, cyclone does not originate. What is the reason? (2015)**

- (a) Sea surface temperatures are low
- (b) Inter-Tropical Convergence Zone seldom occurs
- (c) Coriolis force is too weak
- (d) Absence of land in those regions

**Ans: (b)**

**Mains:**

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