

Tropical Cyclone

[UPSC Notes]

What is a Tropical Cyclone?

Tropical cyclones are irregular wind patterns with constrained air circulation centred on a region of low pressure. The restricted air circulation is brought on by the warm air rising quickly. Its diameter can range from 20-1000 km.

- The Tropical Cyclone rotate in a clockwise direction in the Southern Hemisphere and in a counterclockwise direction in the Northern Hemisphere.
- They are often associated with large-scale destruction
- Tropical cyclones appear around the equator at $5^{\circ} - 30^{\circ}$

Formation of Tropical Cyclone

There are several factors that contribute to the formation of a tropical cyclone, which are listed below:

1. Ocean water at a temperature of 27° or above is the source of moisture that fuels the storm.
2. A regular supply of warm and moist air gets further enhanced in the presence of Warm currents. The storm can be generated by the latent heat of condensation that is released by moisture condensation.
3. The Coriolis force increases with latitude which is powerful enough to start a storm at 5° latitude.
4. Numerous minor low-pressure areas are caused by regional changes in the water and your temperatures.
5. The rising warm, humid air has the potential to quickly produce a strong cyclonic vortex. Deep into the tropical latitudes, upper trough post ferric cyclone remnants can be seen. As divergence dominates on the eastern side of the valleys, thunderstorms began to fall.
6. Due to modest differences in wind streams vertically, cyclone formation processes are restricted to latitudes close to the equator of the sub-tropical air stream.
7. Because wet air helps in the formation of multi-layer, aggressive clouds in the mid-troposphere, high humidity, between 50 and 60%, is necessary.

Stages of Tropical Cyclone

It is important to understand the stage-wise Formation of Tropical Cyclone

- **Origin:** Numerous thunderstorms form over the ocean when favourable conditions are present. As a result, the wind gets lighter and warmer.
- **Early-stage:** Due to its warmth, the air rises, and the moisture it contains leads to condensation. As a result, the latent heat of condensation raises the air's temperature. The thunderstorm intensifies when there is too much moisture over the ocean. This results in the rapid movement of air from the surroundings towards the thunderstorm and a process of deflection taking place because of the Coriolis force developing in a circular air column.
- **Mature stage:** The swirling winds alternate between calm and aggressive regions. It is followed by a heavy downpour. After some time, the air starts to lose moisture and begins to move back towards the non-aggressive regions. As a result, the cloud size decreases from the centre to the margins.

Characteristics of Tropical Cyclone

There are some notable characteristics of tropical cyclone that must be understood in a detailed manner.

Eye: A powerful spiraling wind that revolves around the centre of a cyclone distinguishes it as a mature tropical cyclone. At the centre of a powerful cyclone, there are light winds and the area is known as the "eye". There is little to no precipitation in this area. It ranges in size from 8 km to 200 km across, but the majority being between 30 km to 60 km in diameter. The eye of a tropical cyclone is a low-pressure point.

Eyewall: The tropical cyclone's eyewall, a nearly circular ring of deep convection surrounding the eye, has the strongest surface winds. The area near the eye wall has the strongest sustained winds. In this area, the wind blows the hardest and the rain is the heaviest.

Spiral Bands: Long, narrow rain bands formed by the tropical storm convection, travel in the same direction as the longitudinal airflow. Due to their appearance of spiralling into the centre of the tropical cyclone, spiral bands are so termed.

Longitudinal section of a Tropical Cyclone

The longitudinal section of a tropical cyclone is divided into the following layers:

- The storm is generated by the bottom layer, which reaches depths of up to 3 km.
- The intermediate layer which extends from 3 km to 7 km is where the primary cyclonic storm takes place.
- The outflow layer is located above 7 km where the highest outflow is found.

Categories of Tropical Cyclone

1. **Category One:** The greatest winds in a category one tropical cyclone are gales, with typical bursts of 90 to 125 km/h over open, flat terrain.
2. **Category Two:** A category two cyclone is a violent storm with the wind that frequently gusts between 125 and 64 km/h over flat land.
3. **Category Three:** With normal gas of 165 to 2 24 km/h, category three storms are very destructive and have the strongest winds.
4. **Category Four:** Category four (strong tropical storm) winds often gust between 225 and two 79 km/h above open, flat land.
5. **Category Five:** With consistent wind speeds of 80 km/h and above, category five cyclones have the most destructive winds.

Regional Names for Tropical Cyclones

The Tropical Cyclone is called by different names in different locations.

- Indian Ocean: Cyclones
- Atlantic Region: Hurricanes
- Western Pacific and the South China Sea: Typhoons
- Western Australia: Willy-willies