UNCOMMON CYCLONES IN ARABIAN SEA : GEOGRAPHY

NEWS : *why does the north Indian ocean have two cyclone seasons while all other cyclogenesis regions have just one? How is climate change affecting the region and adding to the unusual activity? Why was there a lot of excitement over Asna, a rare August cyclone?*

WHAT'S IN THE NEWS ?

Introduction to the Indian Ocean's Cyclones

The Indian Ocean is unique due to its monsoonal circulation and its connection to the Pacific and Southern Oceans via "oceanic tunnels." These tunnels influence the region's temperature, wind patterns, and cyclonic activity:

- **Pacific Tunnel**: Transports warm water in the upper 500 meters of the ocean.
- **Southern Ocean Tunnel**: Channels cooler water below approximately 1 kilometer.

These connections shape the Indian Ocean's distinct cyclonic patterns, influenced further by seasonal wind reversals and climatic factors like monsoons.

Cyclogenesis and Monsoonal Impact

Cyclogenesis, or cyclone formation, is closely linked to the monsoonal circulation in the Indian Ocean, which affects atmospheric convection and heat distribution:

- **Monsoonal Circulation**: The Indian Ocean's monsoon winds significantly influence cyclone development by altering heat content in the ocean and triggering atmospheric convection.
    - **Pre-Monsoon Season**: The Arabian Sea heats up quickly, and the Bay of Bengal also warms, leading to increased atmospheric instability, convection, and rainfall. Cyclones tend to form in both basins during this time.
    - **Post-Monsoon Season**: The northeast monsoon delivers heavy rainfall to states along the eastern coast, creating favourable conditions for cyclone formation, especially in the Bay of Bengal.

Reasons for Traditionally Lower Cyclone Frequency in the Indian Ocean

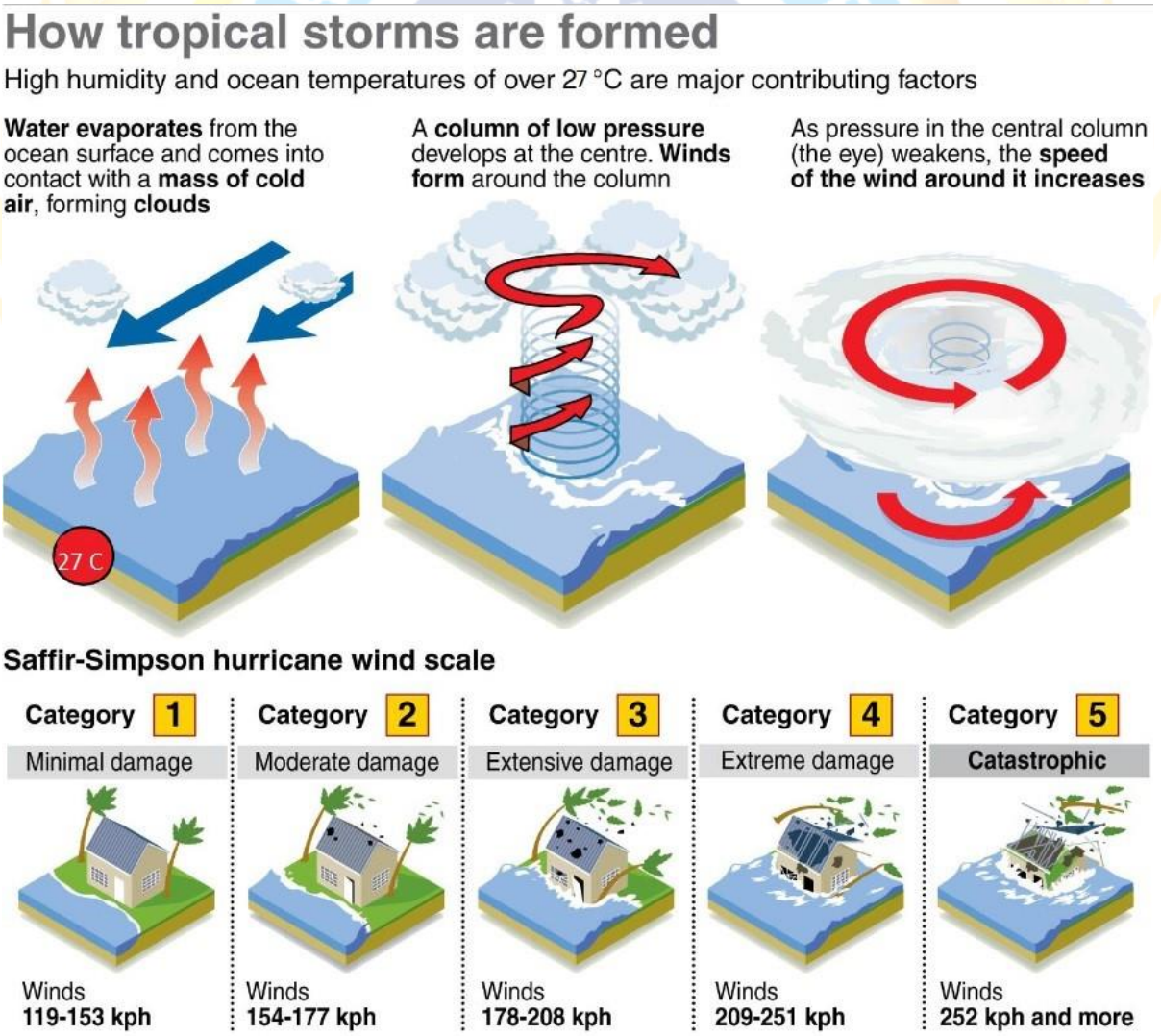
Historically, the Indian Ocean has experienced fewer cyclones compared to other cyclone-prone regions due to several factors:

- **Cooler Waters**: Both the Arabian Sea and the Bay of Bengal generally have cooler temperatures, which are less conducive to cyclone formation.
- **Wind Shear**: Strong vertical wind shear in the region disrupts the development of cyclones by stripping away the energy needed for them to intensify.
- **Less Convective Activity**: The Arabian Sea, in particular, has lower convective activity, which diminishes the likelihood of cyclonic systems developing.
- **Monsoonal Influence**: During the monsoon, intense wind patterns and heavy evaporation create conditions that can inhibit cyclone formation, especially in the Arabian Sea.

Reasons for Increasing Cyclone Frequency

In recent decades, the frequency and intensity of cyclones in the Indian Ocean have risen due to global climate change:

- **Warming Oceans**: The sea surface temperature (SST) in the Indian Ocean has been increasing, particularly due to the transfer of heat from the Pacific and Southern Oceans. Warmer waters provide more energy for cyclogenesis, allowing cyclones to develop more frequently and with greater intensity.
- **Climate Change Impacts**: Global warming is altering the overall climate of the region, increasing heat transfer into the Indian Ocean, which boosts cyclonic activity.
- **Atmospheric Changes**: Shifts in wind patterns, rising humidity levels, and changes in the strength of monsoonal winds affect cyclone formation dynamics, making it easier for cyclones to develop and intensify.
- **Extended Cyclone Seasons**: Climate change is lengthening the periods when conditions are favorable for cyclone formation, extending cyclone seasons and contributing to the occurrence of cyclones outside the traditional seasons.



- **Enhanced Moisture Supply**: Warmer ocean temperatures increase evaporation, supplying more moisture to the atmosphere. This enhanced moisture provides additional fuel for cyclone development, allowing storms to grow more intense

Cyclone Asna: A Case Study

Cyclone Asna, which occurred in August 2023, was an unusual event that exemplified the changing cyclonic patterns in the Indian Ocean:

- **Occurrence**: Cyclone Asna was the first cyclone in the north Indian Ocean during August since 1981, a rare off-season storm for the region.
- **Formation**: The cyclone originated as a land-born depression before transitioning over the Arabian Sea. It grew unusually strong as it absorbed heat and moisture from the warm waters.
- **Characteristics**: Asna was notable for its powerful intensification, even though it initially formed over land. This growth was driven by high soil moisture and the Arabian Sea's elevated temperatures.
- **Impact**: The cyclone caused nearly 50 fatalities and significant damage to infrastructure, crops, and property. It dissipated after encountering dry desert air, which cut off its energy source.
- **Climate Context**: Cyclone Asna's formation and intensity were heavily influenced by factors linked to global warming, including elevated sea surface temperatures, the El Niño effect, and possibly underwater volcanic activity that further warmed the sea.

Conclusion

The increasing frequency and unpredictability of cyclones in the Indian Ocean reflect broader climate changes. Cyclone Asna serves as a recent example of how warming oceans and changing atmospheric patterns are altering the region's cyclonic activity. As sea surface temperatures rise and climatic systems become more volatile, the Indian Ocean may experience more extreme and erratic cyclones in the coming years.

Source: https://epaper.thehindu.com/ccidist-ws/th/th_delhi/issues/98598/OPS/GH3DA7A1C.1+GU2DA91F8.1.html