

6. Madden Julian Oscillation (MJO)

Prelims Level: Climatology

Mains Level: GS-I Important Geophysical phenomena such as earthquakes, Tsunami, Volcanic activity, cyclone etc., geographical features and their location - changes in Critical Geographical Features (including waterbodies and ice-caps) and in Flora and Fauna and the effects of such changes.

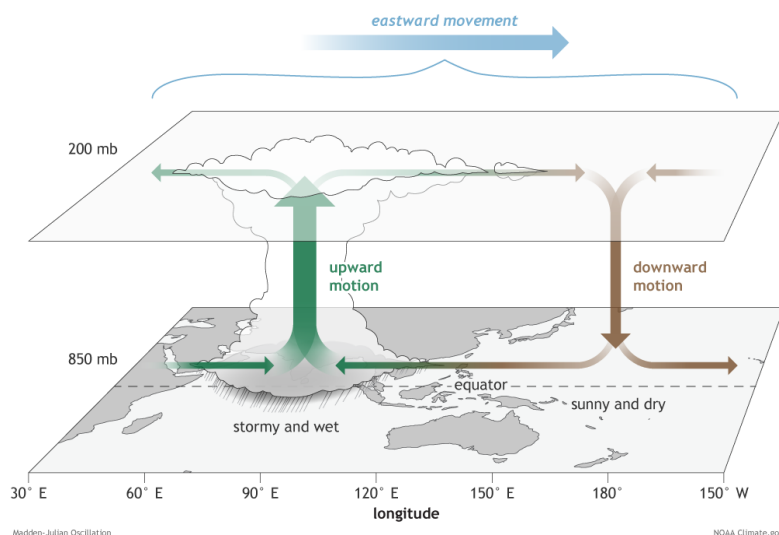
Why in News?

- Warming in Indo-Pacific Ocean is altered the Madden Julian Oscillation.

About:

- Northeast monsoon is the lifeline for Southern part of India, which is witnessing an increase in frequency of tropical cyclones.
- Ind-Pacific Ocean is warming rapidly and there is a near two -fold expansion of warm pool.
- The study, led by Roxy Mathew Koll of the Indian Institute of Tropical Meteorology, and published in the journal Nature, reports a two-fold expansion of the Indo-Pacific warm pool -- the largest expanse of the warmest ocean temperatures on Earth.
- The warm pool has expanded to become double its size, from 2.2×10^7 km² during 1900-1980 to 4×10^7 km² during 1981-2018, says the study.
- This fold expansion is compared to an area equal to the size of Japan.
- According to the study the entire Bay of Bengal becomes part of this giant warm pool, aiding rapid intensification of cyclones.
- It covers most parts of Bay of Bengal, which is affecting climatic patterns.

MJO:



- It is a Phenomenon, that have it can have dramatic impacts in the mid-latitudes.
- Several times a year the MJO is a strong contributor to various extreme events in the United States, including Arctic air outbreaks during the winter months across the central and eastern portions of the United States.
- It is characterized by a band of rain clouds moving eastward over the tropics.
- It regulates tropical cyclone, the monsoons and the El Nino cycle and contributes to severe weather events over Asia, Australia, Africa, Europe and America.
- Imagine ENSO as a person riding a stationary exercise bike in the middle of a stage all day long.
- His unchanging location is associated with the persistent changes in tropical rainfall and winds is being linked to ENSO.
- Now imagine another bike rider entering the stage on the left and pedaling slowly across the stage, passing the stationary bike (ENSO), and exiting the stage at the right.
- This bike rider we will call the MJO and he may cross the stage from left to right several times during the show.
- So, unlike ENSO, which is stationary, the MJO is an eastward moving disturbance of clouds, rainfall, winds, and pressure that traverses the planet in the tropics and returns to its initial starting point in 30 to 60 days, on average.
- This atmospheric disturbance is distinct from ENSO, which once established, is associated with persistent features that last several seasons or longer over the Pacific Ocean basin.
- There can be multiple MJO events within a season, and so the MJO is best described as intra seasonal tropical climate variability that it varies on a week-to-week basis.
- It is first discovered in the early 1970s by Dr. Roland Madden and Dr. Paul Julian when they were studying tropical wind and pressure patterns.
- They often noticed regular oscillations in winds (as defined from departures from average) between Singapore and Canton Island in the west central equatorial Pacific (Madden and Julian, 1971; 1972; Zhang, 2005).
- It consists of two parts, or phases: one is the enhanced rainfall or convective phase and the other is the suppressed rainfall phase.
- Strong MJO activity often dissects the planet into halves: one half within the enhanced convective phase and the other half in the suppressed convective phase.
- These two phases produce opposite changes in clouds and rainfall and this entire dipole that is having two main opposing centres of action propagates eastward.

- The location of the convective phases is often grouped into geographically based stages that climate scientists

Warm Pool:

- A mass of ocean water located in the western Pacific Ocean and eastern Indian Ocean which consistently exhibits the highest water temperature over the largest expanse of earth's surface.
- It is widely known as Tropical warm Pool or Indo-Pacific Warm Pool.

