

Madden Julian oscillation

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Manifest Pedagogy

Geophysical phenomena have been regularly asked in mains. Madden Julian Oscillation as a phenomena and its linkage with Indian monsoon are important dimension of preparation. It was responsible for Indonesian floods and being in news, the topic need be understood both from prelims and mains perspective.

In news

Heavy rains and floods in Indonesia due to Madden Julian oscillation (MJo)

Placing it in the syllabus

Geographical phenomenon

Static dimensions

- Definition of Madden Julian oscillation (MJo)
- Phenomenon of Madden Julian oscillation (MJo)

Current dimensions

- MJO as major reason behind Indonesian floods
- Phenomenon of MJO

Content

Definition of The Madden-Julian Oscillation

It is an oceanic-atmospheric phenomenon which affects weather activities across the globe. It brings major fluctuation in tropical weather on weekly to monthly timescales.

The MJO can be defined as an **eastward moving 'pulse' of clouds, rainfall, winds and pressure near the equator** that typically recurs every 30 to 60 days. It's a traversing phenomenon and is **most prominent over the Indian and Pacific Oceans.**

MJO phenomenon/ how does it work?

A region of enhanced tropical precipitation is first obvious over the western Indian Oceans, which spreads eastwards into the warm waters of the tropical Pacific. This pattern of tropical precipitation will in general lose its identity as it moves over the cooler waters of the eastern Pacific, before returning eventually over the Indian Ocean once more.

A wet phase of improved convection (rainfall) is trailed by a dry phase, where rainstorm movement is suppressed (no precipitation). Each cycle lasts around 30-60 days and there are 8 phases.



Eight phases/stages of MJO are:

- **Stage 1** – Enhanced convection (precipitation) creates over the western Indian Ocean.
- **Stage 2 and 3** – Enhanced convection (precipitation) moves gradually eastwards over Africa, the Indian Ocean and parts of the Indian subcontinent.
- **Stage 4 and 5** – Enhanced convection (precipitation) has achieved the Maritime Continent (Indonesia and West Pacific)
- **Stage 6, 7 and 8** – Enhanced precipitation moves further eastward over the western Pacific, in the long run vanishing in the focal Pacific.
- The next MJO cycle begins.

Following a region of improved convection (precipitation) is a region of suppressed convection (no precipitation). Amid the

MJO cycle there is a 'dipole' (a stark contrast) in precipitation irregularities. For instance, In stage 6 there is enhanced convection over the western Pacific and suppressed convection over the Indian Ocean. In stage 2, it is the contrary path around.

It's climatic impact

- The MJO makes positive conditions for tropical cyclone activity, which makes the MJO critical to screen amid the Atlantic hurricane season.
- The improved precipitation period of the MJO can also bring the onset of the Monsoon seasons around the world. On the other hand, the suppressed convection stage can delay the beginning of the Monsoon season
- There is proof that the MJO impacts the El Nino Southern Oscillation (ENSO) cycle. It doesn't cause El Nino or La Nina, however it can add to the speed of advancement and force of El Nino and La Nina scenes. The MJO appears to be more active during and weak ENSO years.
- There is also proof to recommend that the MJO can impact the beginning of a Sudden Stratospheric Warming (SSW) event.

MJO and Indian Monsoon

The Indian Ocean Dipole (IOD), El Nino and MJO are all oceanic and atmospheric phenomena, which affect weather on a large scale. The impacts of MJO on Indian Monsoon are:

- The journey of MJO goes through 8 stages as explained above. When it is over the Indian Ocean amid the Monsoon season, **it brings great precipitation** over the Indian subcontinent.
- On the other hand, when it observes a more extended cycle and remains over the Pacific Ocean, MJO **brings terrible news for the Indian Monsoon.**
- Basically, it is connected with improved and smothered

precipitation movement in the tropics and is essential for the Indian monsoonal precipitation. It has also been established that if the periodicity of MJO is about 30 days, at that point it brings great precipitation during the Monsoon season.

- If it is over 40 days, at that point MJO doesn't give great showers and could even prompt a dry Monsoon. Shorter the cycle of MJO, better the Indian Monsoon.
- Presence of MJO over the Pacific Ocean alongside an El Nino is adverse for Monsoon downpours.