

CORPORATE OFFICE

Delhi Office

706 Ground Floor Dr. Mukherjee
Nagar Near Batra Cinema Delhi -
110009

Noida Office

Basement C-32 Noida Sector-2
Uttar Pradesh 201301



Date: 29 - June 2023

INDIAN OCEAN DIPOLE (IOD)

This article covers "Daily Current Affairs" and the topic details "Indian Ocean Dipole (IOD)". The topic "Indian Ocean Dipole (IOD)" has relevance in the Geography section of the UPSC CSE exam.

Relevance:

For Prelims:

What is IOD?

For Mains:

GS 1: Geography

Impact of IOD on Indian Monsoon?

IOD and ENSO relation?

Why in the news?

With the El Niño phenomenon almost certain to affect the Indian monsoon this year, high hopes are pinned on the development of a positive Indian Ocean Dipole (IOD) and its ability to counterbalance the El Niño effect.

What is IOD?

The Indian Ocean Dipole (IOD) refers to a climate phenomenon that occurs in the Indian Ocean, specifically in the equatorial region. It is characterized by the difference in sea surface temperatures (SST) between the western and eastern parts of the Indian Ocean.

The IOD is similar in nature to the El Niño-Southern Oscillation (ENSO) phenomenon in the Pacific Ocean, but it occurs in the Indian Ocean. It is driven by changes in wind patterns and ocean currents, leading to variations in SST and atmospheric pressure.

Impact of IOD on Indian Monsoon?

• **Positive IOD and Indian Monsoon:**

During a positive IOD phase, the western Indian Ocean experiences cooler sea surface temperatures (SST) compared to the eastern Indian Ocean. This leads to the following effects on the Indian monsoon:

1. Above-average rainfall: Positive IOD events are associated with increased monsoon rainfall over the Indian subcontinent. The cooler SSTs in the western Indian Ocean enhance convection and moisture transport, leading to higher rainfall amounts.

2. **Enhanced agricultural productivity:** The surplus rainfall brought by the positive IOD can contribute to favorable conditions for agriculture, promoting crop growth and higher agricultural yields.
3. **Potential for floods:** In extreme cases, excessive rainfall associated with a positive IOD can result in flooding in certain regions, causing disruptions and damage to infrastructure and livelihoods.

- **Negative IOD and Indian Monsoon:**

During a negative IOD phase, warmer SSTs prevail in the western Indian Ocean, while cooler SSTs are observed in the eastern Indian Ocean. This has the following effects on the Indian monsoon:

1. **Below-average rainfall:** Negative IOD events are generally associated with reduced monsoon rainfall over the Indian subcontinent. The warmer SSTs in the western Indian Ocean cause sinking air, inhibiting the uplift of moist air and resulting in suppressed rainfall over the region.
2. **Drier conditions:** The deficiency in rainfall caused by the negative IOD can lead to drier conditions, affecting agricultural activities and water availability in affected regions.
3. **Shift in rainfall patterns:** Negative IOD events can cause a shift in the spatial distribution of rainfall, with some regions experiencing more significant deficits than others.

IOD and ENSO relation?

The Indian Ocean Dipole (IOD) and the El Niño-Southern Oscillation (ENSO) are two distinct climate phenomena, but they can interact and influence each other. The relationship between the IOD and ENSO is complex and can have important implications for regional and global climate patterns. Here are some key aspects of their relationship:

- **Influence on Each Other:** ENSO events in the Pacific Ocean can influence the IOD, and vice versa. During El Niño events, the warmer waters in the central and eastern Pacific Ocean can alter atmospheric circulation patterns and affect the development of the IOD in the Indian Ocean. Similarly, positive IOD events can enhance the development of El Niño events or hinder the development of La Niña events in the Pacific.
- **Combined Impact on Regional Rainfall:** The simultaneous occurrence of a positive IOD and El Niño can have a compounding effect on regional rainfall patterns. This combination often leads to below-average rainfall over the Indian subcontinent and other affected regions. Conversely, the simultaneous occurrence of a negative IOD and La Niña can result in enhanced monsoon rainfall and above-average precipitation.
- **Modulation of Monsoon Variability:** IOD and ENSO can modulate the variability of the Indian monsoon. During El Niño years, the influence of ENSO tends to dominate, and the impact of IOD on the monsoon is relatively weaker. In contrast, during La Niña years, the IOD can play a more significant role in shaping the monsoon rainfall patterns.
- **Mutual Weakening or Reinforcement:** In some cases, the IOD and ENSO can weaken or reinforce each other's effects. For instance, a positive IOD event can weaken the impact of a developing El Niño event, resulting in reduced chances of an intense El Niño. Conversely, a negative IOD can reinforce the effects of La Niña, leading to a more pronounced cooling of the Pacific Ocean and stronger monsoon conditions.
- **Variability and Nonlinear Relationship:** The relationship between the IOD and ENSO is not consistently linear or predictable. The strength, timing, and spatial patterns of the IOD and ENSO events can vary, resulting in different outcomes for regional climate patterns. The interaction

between the two phenomena is influenced by numerous factors, including ocean-atmosphere feedback processes, teleconnections, and internal climate variability.

Understanding the relationship between the IOD and ENSO is essential for improving climate forecasting, particularly for regions impacted by these phenomena, such as the Indian subcontinent and parts of Southeast Asia. Monitoring and studying the IOD and ENSO concurrently help enhance the accuracy of climate predictions and provide valuable insights into the drivers of climate variability on a global scale.

Source:

<https://indianexpress.com/article/explained/explained-climate/indian-ocean-dipole-what-is-it-how-it-can-limit-el-nino-effects-8689360/>

Q.1 Which of the following statements best describes the Indian Ocean Dipole (IOD)?

- (A) It is a climate phenomenon in the Pacific Ocean that affects the Indian monsoon.
- (B) It refers to the variations in sea surface temperatures (SST) in the Indian Ocean that impact the Indian monsoon.
- (C) It is a type of ocean current found in the Indian Ocean that influences global climate patterns.
- (D) It is a weather system characterized by cyclonic storms in the Indian Ocean region.

Answer: (B)

Q.2 Which of the following describes the positive phase of the Indian Ocean Dipole (IOD)?

- (A) Warmer sea surface temperatures in the eastern Indian Ocean compared to the western Indian Ocean.
- (B) Cooler sea surface temperatures in the eastern Indian Ocean compared to the western Indian Ocean.
- (C) Above-average monsoon rainfall over the Indian subcontinent.
- (D) Below-average monsoon rainfall over the Indian subcontinent.

Answer: (A)

Q.3 Discuss the impact of the Indian Ocean Dipole (IOD) on regional climate patterns and its significance for the Indian subcontinent.

Rishabh