



## Mains Practice Question

**Q.** Discuss the Indian Ocean Dipole (IOD) and its impact on the climate and weather patterns of the Indian Ocean region. Examine the potential socio-economic and environmental consequences of positive and negative phases of IOD. (250 words)

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### Approach:

- **Introduction:** Define the Indian Ocean Dipole and its phases briefly and mention its relevance.
- **Body:** Discuss the impact of IOD on climate and weather patterns in different regions and seasons. Examine the potential socio-economic and environmental consequences of positive and negative phases of IOD.
- **Conclusion:** Summarize the main points and suggest some measures.

### Introduction:

The Indian Ocean Dipole (IOD) is a climate phenomenon that refers to the difference in sea surface temperature between two areas of the Indian Ocean: the western pole near the Arabian Sea and the eastern pole near Indonesia. **The IOD has three phases: positive, negative and neutral**, which have significant impacts on the climate and weather patterns of the Indian Ocean region and beyond. India, being a peninsular country surrounded by the Indian Ocean on three sides, is particularly vulnerable to the effects of the IOD.

### Body:

#### Impact of IOD on climate and weather patterns

**Positive Phase of IOD:** During the positive phase of IOD, warmer than average sea surface temperatures occur in the western Indian Ocean, while cooler than average temperatures prevail in the eastern Indian Ocean. This pattern strengthens the temperature gradient across the basin and influences the Walker circulation, which is the east-west atmospheric circulation over the tropical Indian Ocean.

### Impacts:

- **Increased rainfall:** The positive phase of IOD is associated with increased convection and enhanced rainfall in the western Indian Ocean, particularly in regions like East Africa, the Arabian Peninsula, and the western coast of India.
- **Droughts in Southeast Asia:** Conversely, the eastern part of the Indian Ocean experiences reduced rainfall during a positive IOD event, leading to droughts in countries like Indonesia, Malaysia, and parts of Australia.
- **Tropical cyclones:** The positive phase of IOD can also enhance the development of tropical cyclones in the eastern Indian Ocean, including the Bay of Bengal and the Arabian Sea.

### Socio-economic and Environmental Consequences:

- **Agriculture and Food Security:** The increased rainfall in East Africa and parts of India can

benefit agriculture and improve food security. However, the decreased rainfall in Southeast Asia can lead to crop failures, water scarcity, and economic losses.

- **Fisheries:** The positive IOD can impact fisheries by altering ocean currents and affecting the availability of nutrients, leading to changes in fish populations and migration patterns.
- **Human health:** The altered weather patterns and increased rainfall associated with positive IOD can also affect public health, as it may contribute to the spread of waterborne diseases and vector-borne illnesses like malaria.

**Negative Phase of IOD:** During the negative phase of IOD, cooler than average sea surface temperatures occur in the western Indian Ocean, while warmer than average temperatures prevail in the eastern Indian Ocean. This phase weakens the temperature gradient across the basin and influences atmospheric circulation differently compared to the positive phase.

### Impacts:

- **Reduced rainfall in the western Indian Ocean:** The negative IOD phase generally results in decreased convection and reduced rainfall in the western Indian Ocean, affecting countries like East Africa, the Arabian Peninsula, and the western coast of India.
- **Increased rainfall in Southeast Asia:** Conversely, the negative phase of IOD often brings enhanced rainfall to Southeast Asia, including Indonesia, Malaysia, and parts of Australia.
- **Tropical cyclones:** The negative IOD phase can influence the occurrence and intensity of tropical cyclones, potentially affecting the Bay of Bengal and the Arabian Sea.

### Socio-economic and Environmental Consequences:

- **Agriculture and Food Security:** Reduced rainfall in the western Indian Ocean can lead to droughts, crop failures, and water scarcity, negatively impacting agriculture and food security. Conversely, increased rainfall in Southeast Asia can benefit agriculture, but excessive precipitation can also cause flooding and damage crops.
- **Water resources:** The negative IOD can impact water resources, including river flows and reservoir levels, affecting hydropower generation, irrigation systems, and water availability for domestic use.
- **Ecosystems:** Changes in rainfall patterns and oceanographic conditions during the negative IOD phase can affect marine and terrestrial ecosystems, including coral reefs, mangroves, and forests, potentially leading to biodiversity loss and ecological disruptions.

### Conclusion:

- The IOD is a key driver of climate variability and change in India and its neighbouring countries. It has significant socio-economic and environmental consequences for millions of people living in its influence zone. Therefore, understanding and predicting the IOD is crucial for planning and adapting to its impacts on various sectors and communities.