

Indian Ocean Dipole and Precipitation



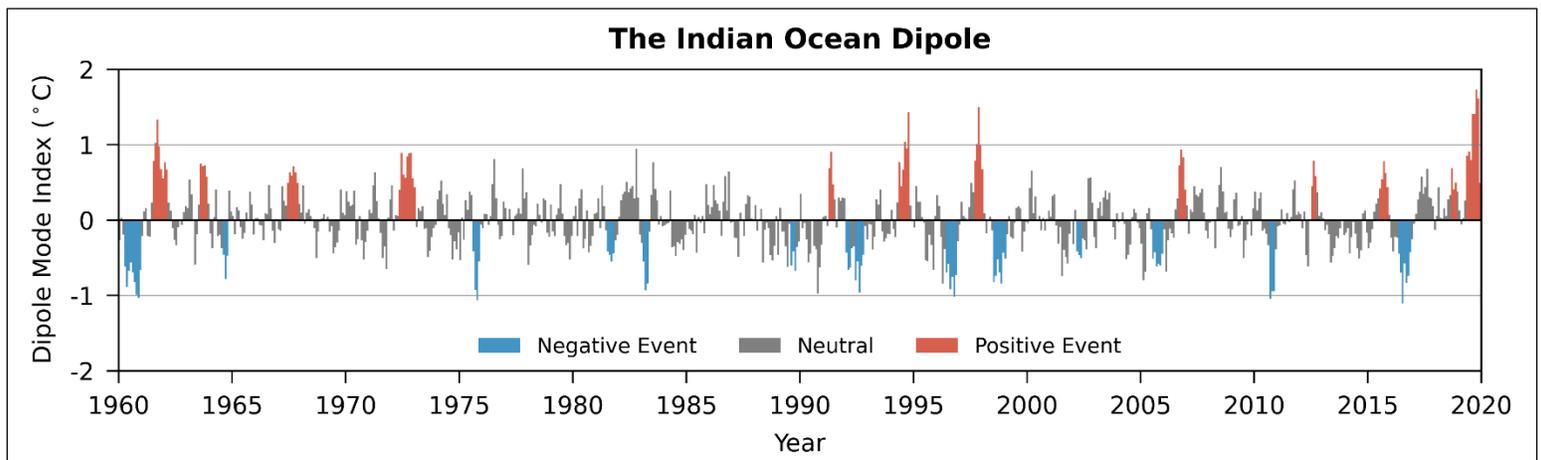
What is the Indian Ocean Dipole?

The Indian Ocean Dipole (IOD) is an irregular oscillation of sea surface temperatures and related atmospheric circulation in the Indian Ocean (Fig. 1). The IOD has positive and negative phases, which are defined by opposing sea surface temperature anomalies in the western and eastern tropical Indian Ocean (Fig. 2). Key characteristics of IOD events include:

- Events occur irregularly and vary in strength and duration.
- Positive and negative IOD events often coincide with El Niño and La Niña events, respectively, but can occur independently.
- Simultaneous positive IOD and El Niño, and negative IOD and La Niña, events may enhance precipitation impacts.

Why is it Important?

The IOD is related to changes in the atmospheric and oceanic circulation in and around the Indian Ocean basin. These changes are responsible for anomalous precipitation patterns in FEWS NET regions (Fig. 2). While precipitation outcomes differ from one IOD event to the next, consistent patterns across past events provide a baseline for prediction. Agroclimatic assumptions used in FEWS NET scenario development are based on historical IOD impacts, observed and predicted strength of the IOD and its duration, and other regional factors, including the influence of El Niño or La Niña events.



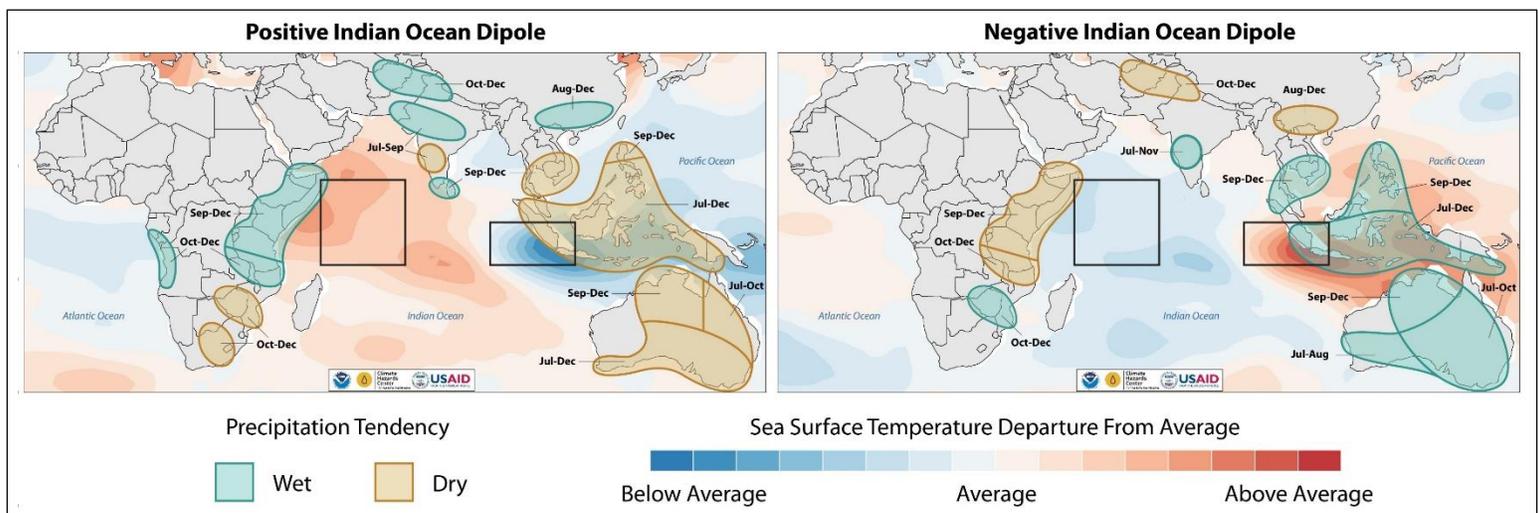
▲ **Fig. 1.** Monthly time series of the IOD based on the [Dipole Mode Index](#) from the [Extended Reconstructed Sea Surface Temperature version 5](#). Positive IOD events occur when the Dipole Mode Index exceeds 0.4°C for at least three months. Negative IOD events occur when the DMI falls below -0.4°C for at least three months.

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Regional Precipitation

The precipitation tendencies related to positive and negative Indian Ocean Dipole (IOD) events are shown in the left- and right-hand panels of Fig. 2, respectively. Corresponding to the seasonality of events, the IOD is related to wet and dry conditions over Africa, Asia, and Oceania during July-December. Opposing precipitation tendencies for contrasting phases of the IOD are generally observed, though there are some areas where outcomes vary by phase.

Over Africa, the IOD is related to wet and dry conditions along the Indian Ocean Rim, extending from Somalia to Mozambique, during September-December. Over Asia, the IOD is related to wet and dry conditions during October-December over central and northern Afghanistan and during August-December over southern China. The IOD is related to widespread wet and dry conditions over Australia. Eastern and southern Australia are sensitive to the IOD in July-October.



▲ **Fig. 2.** The timing of wet and dry conditions based on [Climate Research Unit](#), [CHIRPS](#), and [Global Precipitation Climatology Centre](#) precipitation (green and brown polygons), and sea surface temperature departures from average during July-September (blue and red shading), related to the IOD. The regions used to define the [Dipole Mode Index](#) are outlined in black.

Methods

Wet and dry conditions in Fig. 2 are based on precipitation during the IOD events in Fig. 1 and linear regression between the Dipole Mode Index and precipitation during 1960-2020. The IOD-related sea surface temperatures in Fig. 2 are based on a linear regression between the Dipole Mode Index and sea surface temperature for July to September.

Please Cite As

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