



**Earth System Science Organization (ESSO)
Ministry of Earth Sciences (MoES)
India Meteorological Department (IMD)**

**El Niño Southern Oscillation (ENSO) and
Indian Ocean Dipole (IOD) Bulletin**

May 2025

Highlights

Currently, neutral El Niño-Southern Oscillation (ENSO) conditions are prevailing over the equatorial Pacific region. The latest Monsoon Mission Climate Forecast System (MMCFS) as well as other climate model forecasts indicate that the neutral ENSO conditions are likely to continue during the monsoon season.

At present, neutral Indian Ocean Dipole (IOD) conditions are observed over the Indian Ocean. The latest MMCFS forecast indicates that the neutral IOD conditions are likely to continue for the next several months.

1. Current Sea Surface Temperature (SST) Conditions over the Pacific and Indian Oceans

In April 2025, sea surface temperatures (SSTs) were near average across most of the equatorial Pacific Ocean (Fig. 1a). Warmer-than-average SSTs were observed in the northern and southern extra-tropical regions of the Pacific. Compared to March 2025, negative SST anomalies developed over the eastern, east-central, and far western Pacific Ocean. Additionally, cool SST anomalies were present in parts of both the South and North Pacific Ocean (Fig. 1a).

In April 2025, equatorial SSTs were in the neutral range across the Indian Ocean (Fig. 1a). Above average SSTs were observed in the northern Arabian Sea. Compared to March 2025, cool SSTs were observed across the northern parts of north Bay of Bengal (Fig. 1b). Warm SSTs were observed over most parts of Arabian Sea.

1.1 El Niño Southern Oscillation (ENSO) conditions over the Pacific Ocean

The monthly time series of Niño3.4 SST anomalies for the last 12 months, from May 2024 to April 2025 is shown in Fig. 2(a). In May 2024, ENSO neutral conditions were observed over the equatorial Pacific Ocean, which persisted until November 2024. Since December, weak La Niña conditions have been observed over the equatorial Pacific, persisting until January 2025. Thereafter, these conditions began to weaken from March 2025 onwards. Currently, the El Niño–Southern Oscillation (ENSO) neutral conditions are present.

The strong positive subsurface temperature anomalies are observed over the western Pacific Ocean, both near and above the 20°C isotherm depth (Fig. 2b). Negative subsurface temperature anomalies are observed over the central equatorial Pacific Ocean occurring near and below the thermocline depth (Fig.2b).

1.2. Indian Ocean Dipole (IOD) conditions over the Indian Ocean

Figure 2(c) shows May 2024 to April 2025. In May 2024, positive Indian Ocean Dipole (IOD) conditions were observed over the Indian Ocean. Since last 12 months IOD conditions are within the neutral range and currently, neutral IOD conditions are prevailing over the Indian Ocean.

Strong positive subsurface temperature anomalies (Fig. 2d) were observed in the eastern equatorial Indian Ocean, below the 20°C isotherm depth, extending down to the thermocline depth. Conversely, the western equatorial Indian Ocean have shown significant negative subsurface anomalies, particularly near and below the thermocline depth.

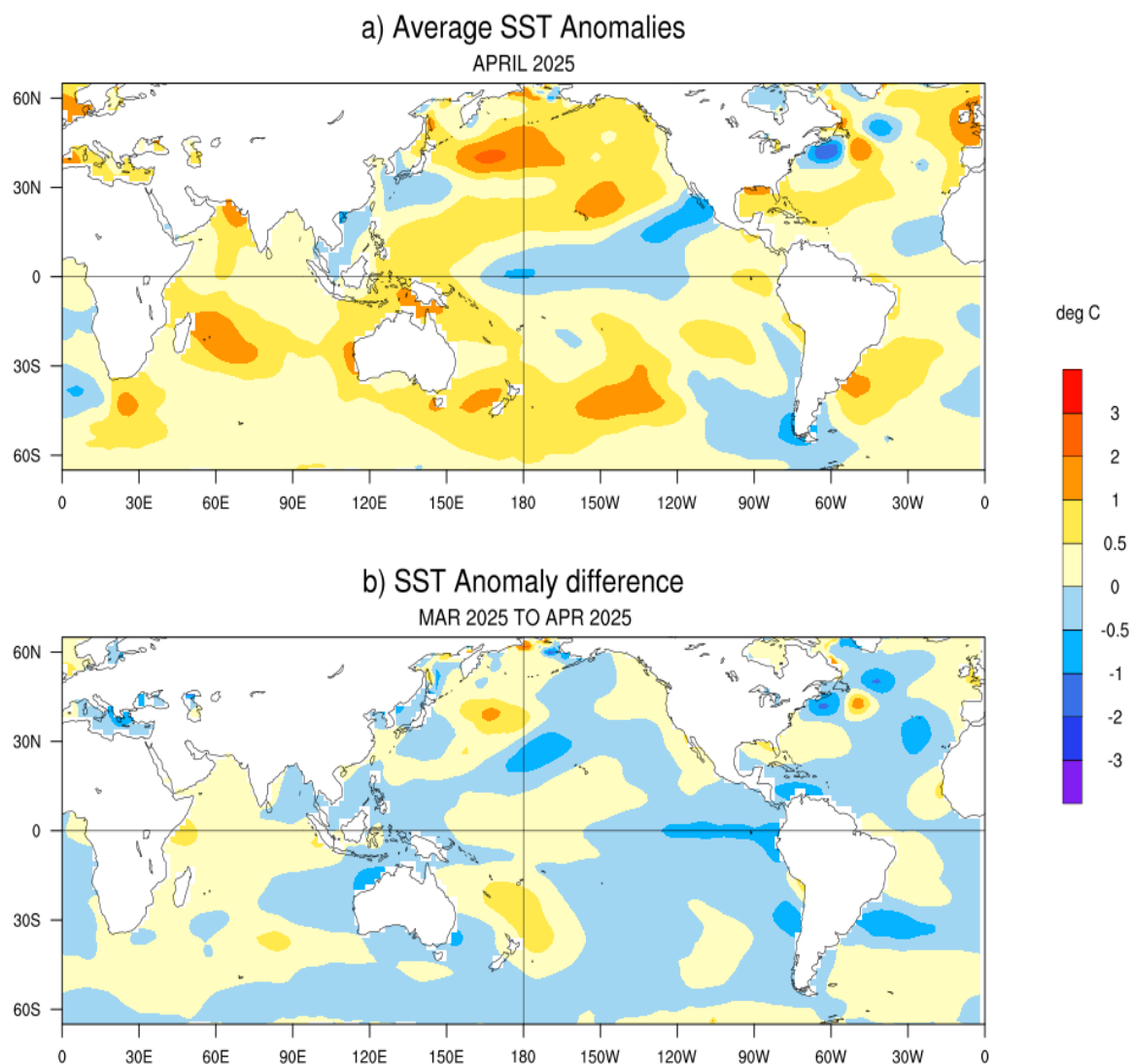


Fig.1: (a) Sea surface temperature (SST) anomalies (°C) during April 2025 and (b) changes in the SST anomalies (°C) from March 2025 to April 2025. SSTs are based on the ERSSTv5 (NCEP-NOAA), and anomalies are computed with respect to 30-year (1991-2020) long term mean.

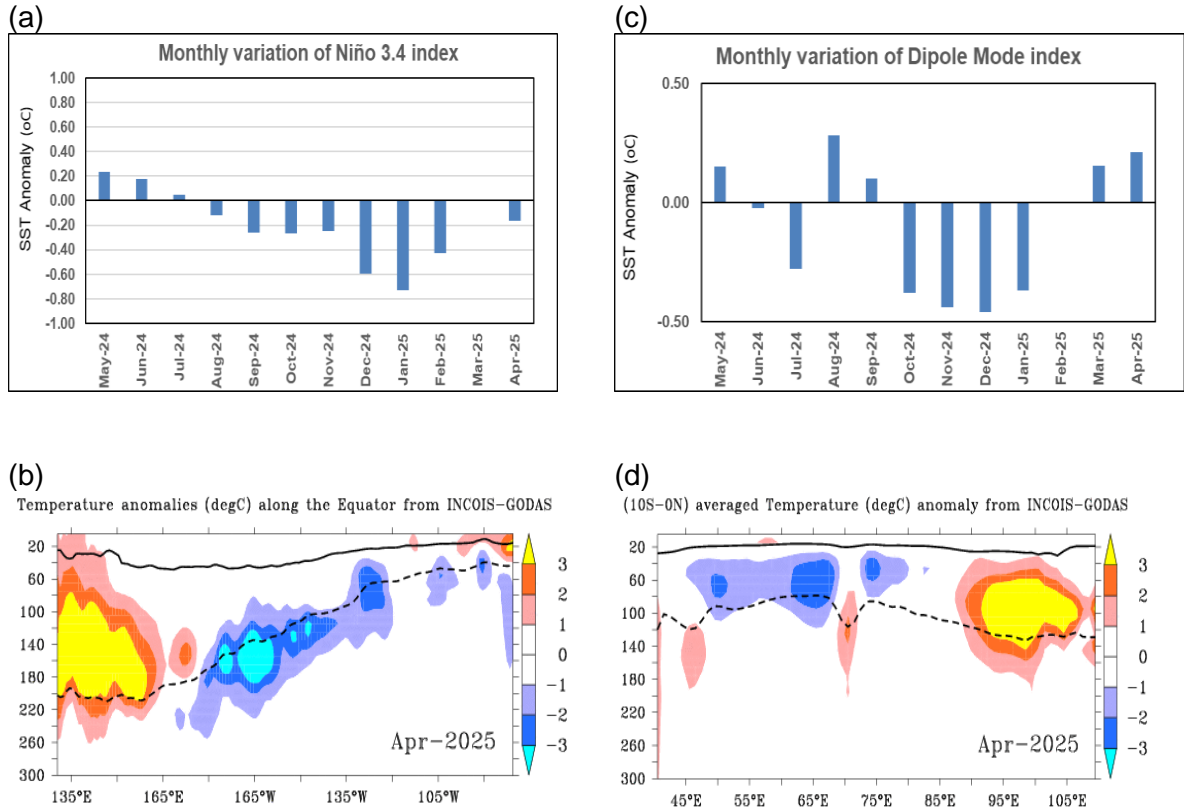


Fig.2: (a) Monthly variation of Niño 3.4 SST index for the last 12 months and **(b)** Depth-longitude section of sub-surface temperature anomalies in the equatorial (5°S-5°N) Pacific Ocean for the month of April 2025. **(c)** Same as **(a)** but for the Dipole Mode Index (DMI). **(d)** Same as **(b)** but for the tropical Indian Ocean (10°S-Eq). The anomalies in **(a)** and **(c)** were computed using the base period of 1991-2020 (Data Source: ERSSTv5) The solid dark line in **(b)** and **(d)** is the 20°C isotherm and the dashed line is thermocline depth (Data Source: INCOIS-GODAS).

2. ENSO and IOD Forecast

The SST forecast was prepared using the high-resolution Monsoon Mission Coupled Forecast System (MMCFS) (AGCM T382L64; ~38 km and OGCM 25 km in the tropics) based on the April 2025 initial conditions. The initial conditions for the model runs were obtained from ESSO-INCOIS and ESSO-NCMRWF analyses. Probability density function (PDF) bias correction was applied to the forecasts of the Niño3.4 index (Fig. 4a) and the DMI (Fig. 4b), based on hindcasts for the period 1999-2008, and anomalies were calculated using the 1991-2020 Climatology.

In April 2025, sea surface temperatures (SSTs) were near average across most of the equatorial Pacific Ocean. The 3-month season-averaged SST anomaly forecast for the Pacific Ocean (Fig. 3) indicates near normal SSTs over the central equatorial Pacific Ocean during most of the forecast period. The latest MMCFS plume and probability forecast (Fig. 4a & 5a) indicates the highest probability for neutral ENSO conditions during the monsoon season. IMD is closely monitoring ENSO conditions. IMD provides monthly updates, reflecting the latest observations and changes in the Pacific Ocean.

The 3-month season-averaged SST anomaly forecast for the Indian Ocean (Fig. 3) suggests that near-average SST anomalies are expected across most parts of the Indian Ocean for the entire forecast period. The latest MMCFS forecast indicates that the current neutral IOD conditions are likely to continue for the several upcoming months (see Figs. 4b and 5b).

MMCFS SST Anomaly Forecast :Apr 2025 IC

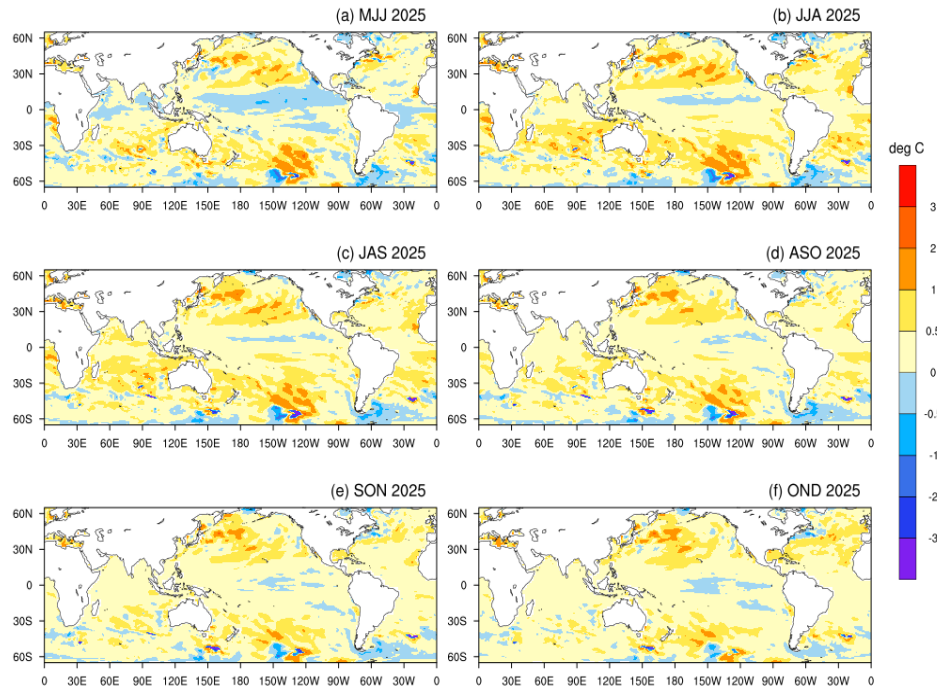


Fig.3: Forecasted Seasonal mean SST anomalies for three-monthly (a) May to July (MJJ 2025), (b) June to August (JJA 2025), (c) July to September (JAS 2025), (d) August to October (ASO 2025), (e) September to November (SON 2025) and (f) October to December (OND 2025) Model bias correction base period: 1999-2008; Climatology base period:1991-2020).

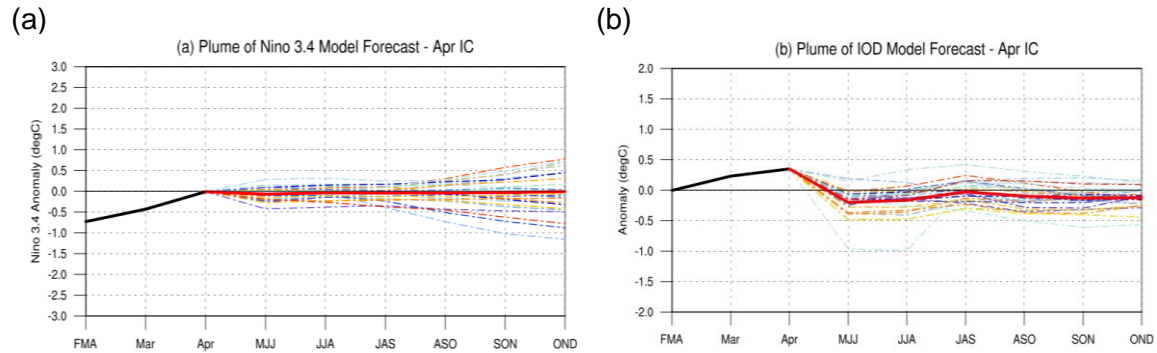


Fig.4: Plume of (a) Niño 3.4 SST index, (b) Indian Ocean Dipole (IOD) Mode Index forecasted by high-resolution MMCFS. The forecasts were PDF corrected for bias and variance. The solid green line is the observed SST anomaly (ERSSTv5, NOAA) and the solid red line is the ensemble mean SST anomaly forecast of 45 members (MMCFS). The individual ensemble member forecasts are shown in light dotted lines of different colours.

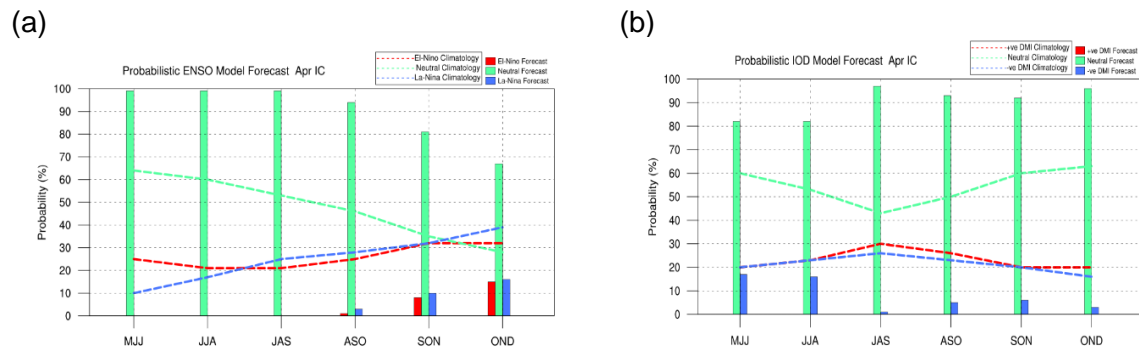


Fig.5: Probability forecast along with climatological probabilities of (a) Niño 3.4 and (b) Indian Ocean Dipole (IOD) Mode Index from high-resolution MMCFS. The data source for Climatology probabilities: NOAA Extended Reconstructed SST V5. Criteria used for Probabilistic ENSO Forecast: La Niña ≤ -0.5 , Neutral <0.5 to >0.5 , El Niño ≥ 0.5 . Criteria used for Probabilistic DMI Forecast: negative DMI ≤ -0.4 , Neutral <0.4 to >0.4 , positive DMI ≥ 0.4 .