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

July 2025

Highlights

Currently, neutral El Nino-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 as well as other climate model forecasts indicates that the neutral IOD conditions are likely to turn into weak negative IOD conditions during later part of the monsoon season.

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

In June 2025, equatorial 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. Cooler than average SSTs were seen over the north-eastern extra tropical Pacific Ocean. Compared to May 2025, positive SST anomalies developed over the eastern and central Pacific Ocean while negative SST anomalies are seen across the western Pacific Ocean. Additionally, cool SST anomalies were present in some parts of both the South and North Pacific Ocean (Fig. 1a).

In June 2025, equatorial SSTs were above average across the western Indian Ocean (Fig. 1a). Negative SSTs were observed in the middle of the Arabian Sea. Compared to May 2025, cool SSTs were observed across the Arabian Sea, Bay of Bengal and Western Indian Ocean (Fig. 1b) while warm SSTs were observed over some parts of the Eastern Indian Ocean.

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 July 2024 to June 2025 is shown in Fig. 2(a). In July 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 February 2025 onwards. Currently, the neutral El Niño–Southern Oscillation (ENSO) conditions are present. The strong positive subsurface temperature anomalies are observed over the eastern and 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 July 2024 to June 2025. Since last 12 months IOD conditions are within the neutral range and currently, neutral IOD conditions are prevailing over the Indian Ocean. Positive subsurface temperature anomalies (Fig. 2d) were observed across most parts of the equatorial Indian Ocean with small patches of warming below the 20°C isotherm depth, extending down to the thermocline depth.

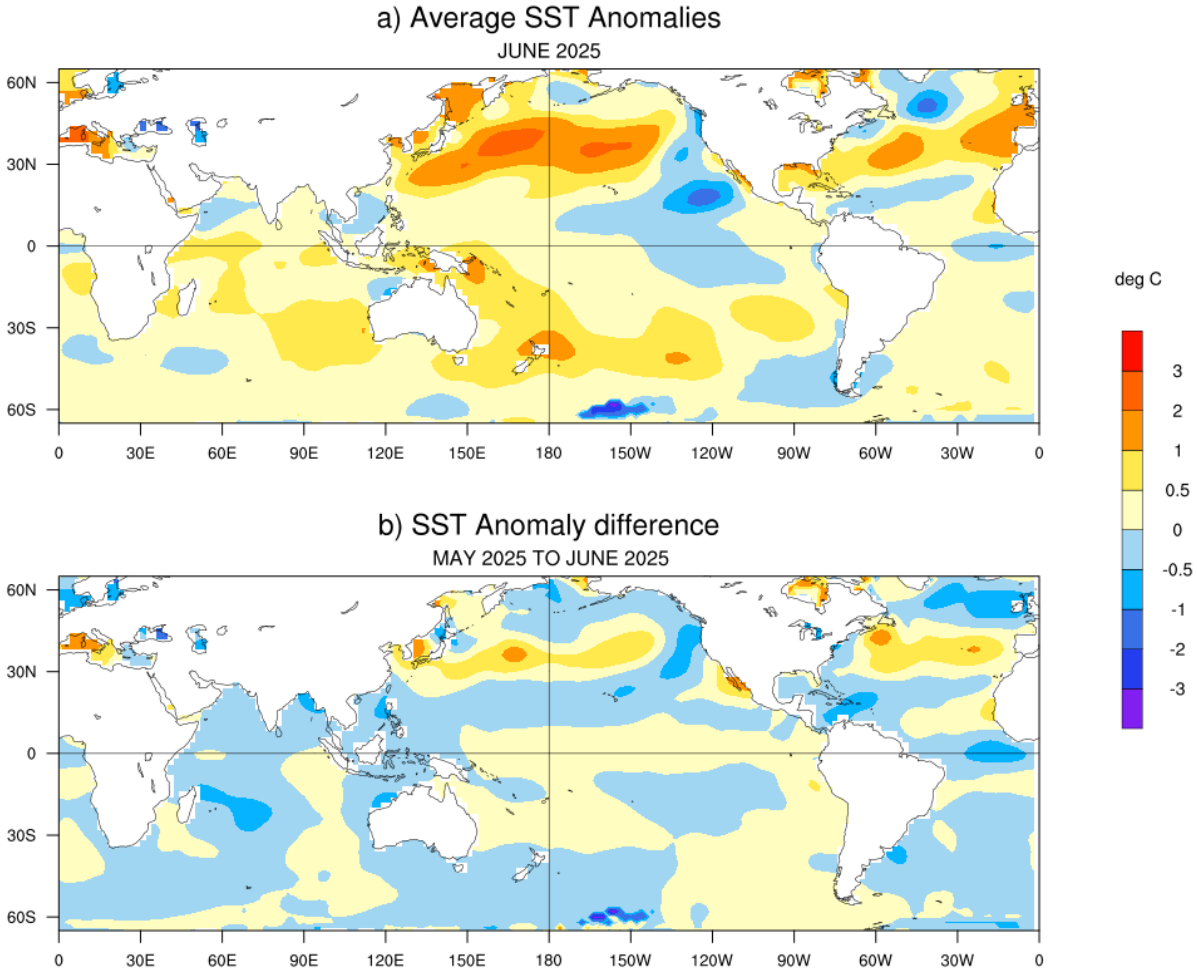

Fig.1: (a) Sea surface temperature (SST) anomalies (0C) during June 2025 and (b) changes in the SST anomalies (0C) from May 2025 to June 2025. SSTs are based on the ERSSTv5 (NCEP-NOAA), and anomalies are computed with respect to 30-year (1991-2020) long term mean.

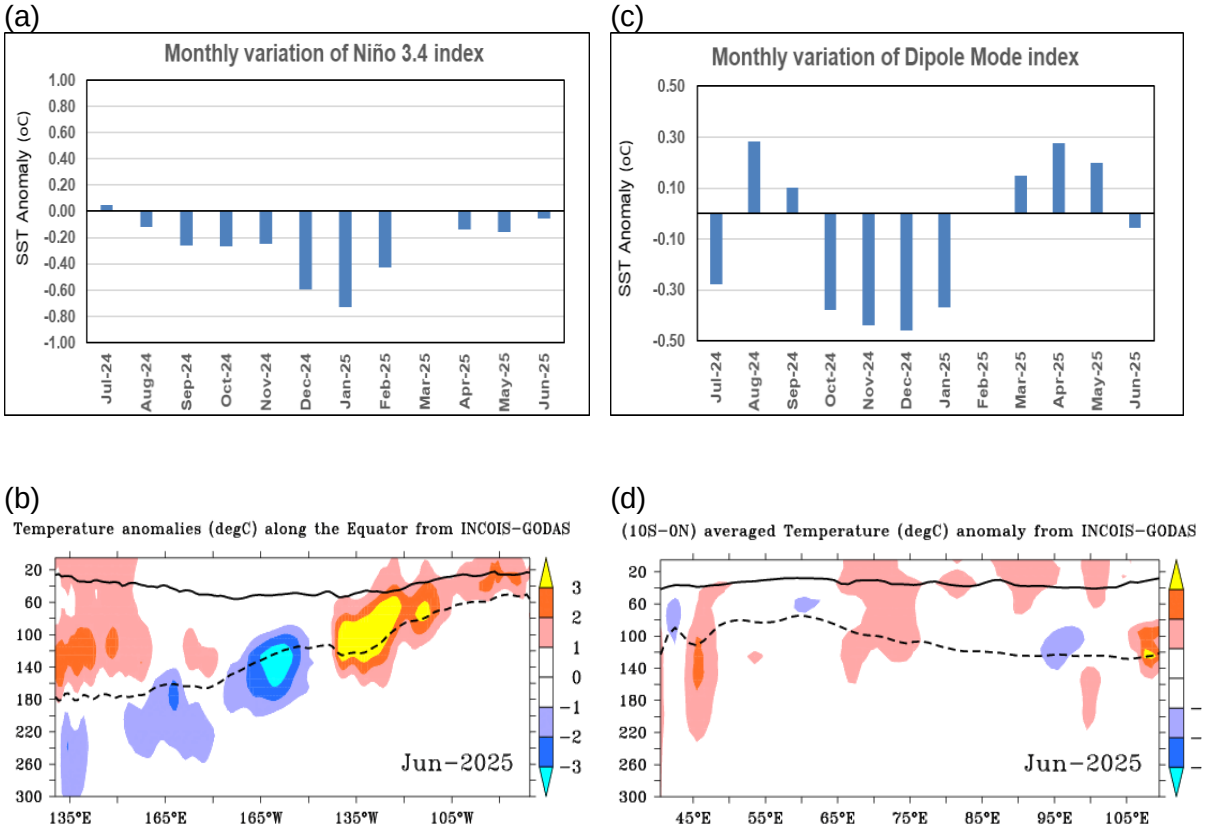

Fig.2: (a) Monthly variation of Niño 3.4 SST index for the last 12 months and (**b**) Depth-longitude section of sub-surface temperature anomalies in the equatorial (5^0S-5^0N) Pacific Ocean for the month of June 2025. (**c**) Same as (**a**) but for the Dipole Mode Index (DMI). (**d**) Same as **(b)** but for the tropical Indian Ocean (10^0S-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 20^0C 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 June 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 June 2025, sea surface temperatures (SSTs) were near average across most of the equatorial Pacific Ocean. Similarly, equatorial SSTs over the Atlantic Oceans were also mostly near average. The 3-month season-averaged SST anomaly forecast for the Pacific Ocean (Fig. 3) indicates near normal SSTs are likely 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 SST anomalies are expected across most parts of the Indian Ocean for the entire forecast period. The latest MMCFS forecast indicates that the weak negative IOD conditions are likely to develop during upcoming season (see Figs. 4b and 5b).

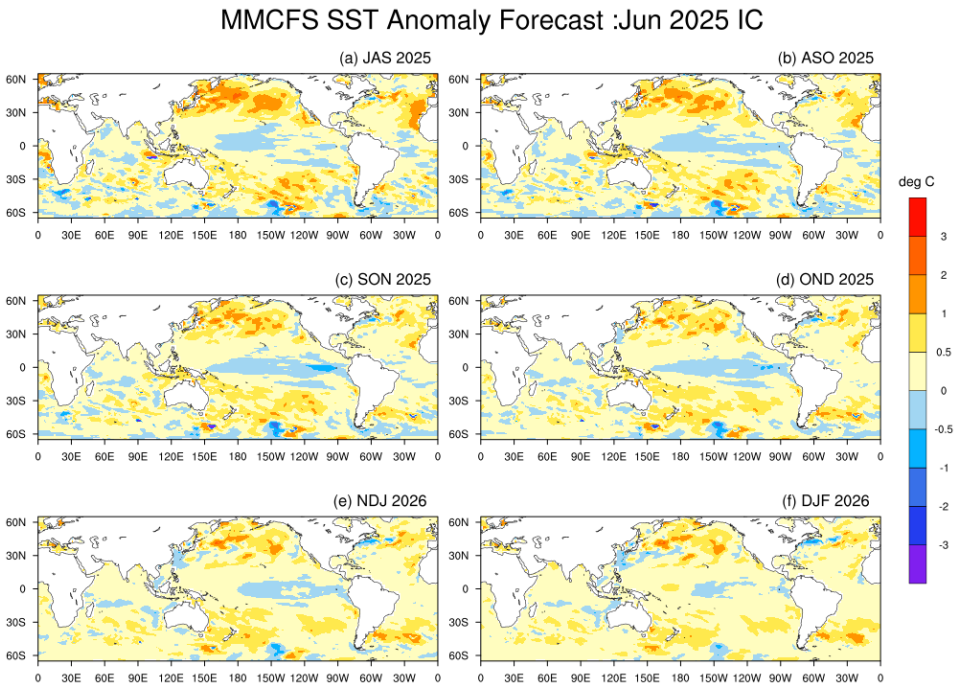

Fig.3: Forecasted Seasonal mean SST anomalies for three-monthly (a) July to September (JAS 2025), (b) August to October (ASO 2025), (c) September to November (SON 2025), (d) October to December (OND 2025), (e) November to January (NDJ 2025) and (f) December to February (DJF 2025) Model bias correction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

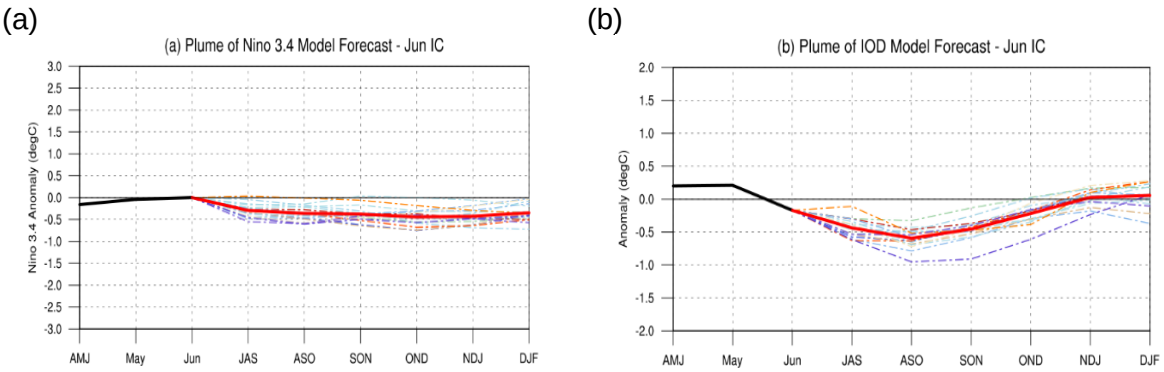

Fig.4: Plume of **(a)** Niño 3.4 SST index, **(b)** Indian Ocean Dipole (IOD) Mode Index forecasted by high-resolution MMCFS. The forecasts were PDF corrected for bias and variance. The solid green line is the observed SST anomaly (ERSSTv5, NOAA) and the solid red line is the ensemble mean SST anomaly forecast of 37 members (MMCFS). The individual ensemble member forecasts are shown in light dotted lines of different colours.

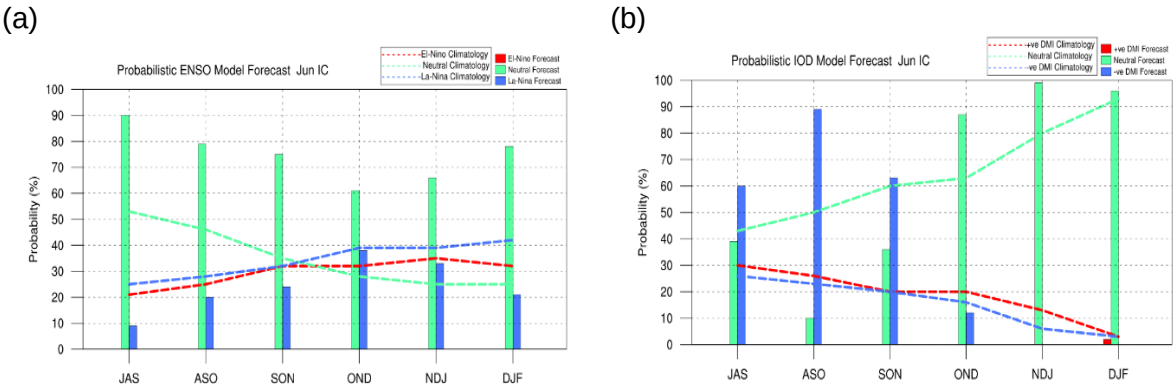

Fig.5: Probability forecast along with climatological probabilities of **(a)** Niño 3.4 and **(b)** Indian Ocean Dipole (IOD) Mode Index from high-resolution MMCFS. The data source for Climatology probabilities: NOAA Extended Reconstructed SST V5. Criteria used for Probabilistic ENSO Forecast: La Niña ≤ -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.