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

August 2025

Highlights

Currently, neutral El Niño–Southern Oscillation (ENSO) conditions are prevailing over the equatorial Pacific region. Forecasts from the Monsoon Mission Climate Forecast System (MMCFS), along with other climate models, suggest that these neutral conditions are likely to persist throughout the monsoon season. However, there is an increased likelihood of La Niña conditions developing during the post-monsoon season.

At present, neutral Indian Ocean Dipole (IOD) conditions are prevailing over the Indian Ocean. Forecasts from the MMCFS and other climate models indicate that weak negative IOD conditions are likely to develop towards the end of the monsoon season, persisting for a brief period.

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

In July 2025, sea surface temperatures (SSTs) were near average over central and eastern equatorial Pacific Ocean (Fig. 1a). SSTs were above average over the western parts of equatorial Pacific Ocean. Negative SSTs were observed over Atlantic Oceans. Warmer-than-average SSTs were observed in the northern and southern extra-tropical regions of the Pacific. Compared to June 2025, positive SST anomalies developed over the eastern Pacific Ocean while negative SST anomalies intensified across the western Pacific Ocean. Additionally, cool SST anomalies were present in some parts of both the South and North Pacific Ocean (Fig. 1a). However, warm SST anomalies are present over the north Pacific Ocean between 30 N to 60 N.

In July 2025, sea surface temperatures (SSTs) were warmer than average across much of the equatorial Indian Ocean, while near-average conditions prevailed over the western Indian Ocean (Fig. 1a). Cooler SSTs were observed in the Arabian Sea and the northern Bay of Bengal. Compared to June 2025, a cooling trend was evident across the Arabian Sea, Bay of Bengal, and western Indian Ocean (Fig. 1b), whereas parts of the eastern Indian Ocean experienced warmer SSTs.

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 August 2024 to July 2025 is shown in Fig. 2(a). ENSO-neutral conditions prevailed over the equatorial

Pacific Ocean from August to November 2024. Weak La Niña conditions developed in December 2024 and persisted through January 2025, gradually weakening from February onwards. ENSO-neutral conditions re-emerged and continued through to July 2025. As of now, neutral ENSO conditions are prevailing.

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 the monthly time series of Dipole Mode Index (DMI) for July 2024 to August 2025. Weak negative IOD conditions were observed from October 2024 to January 2025, followed by prevailing neutral IOD conditions over the Indian Ocean.

Positive subsurface temperature anomalies (Fig. 2d) were observed across much of the equatorial Indian Ocean, with localised pockets of warming extending below the 20°C isotherm and reaching down to the thermocline depth.

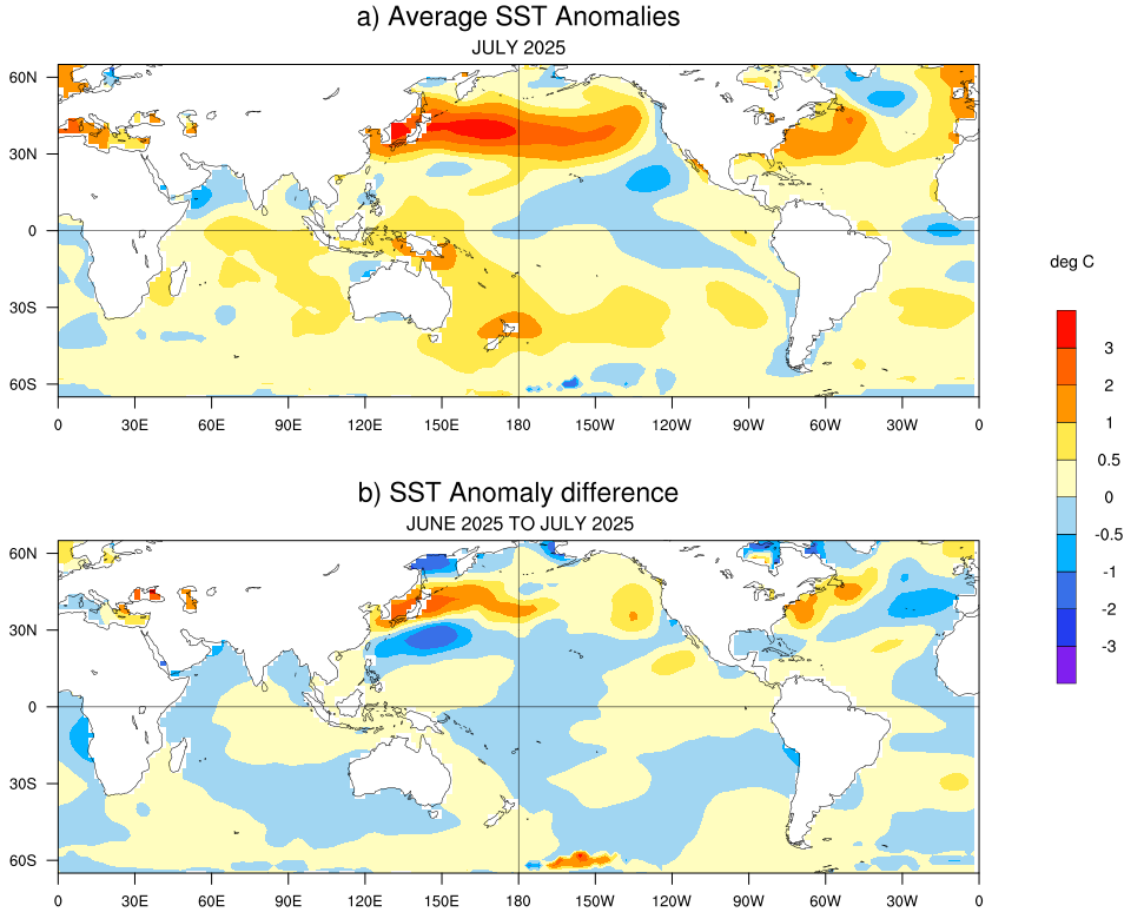
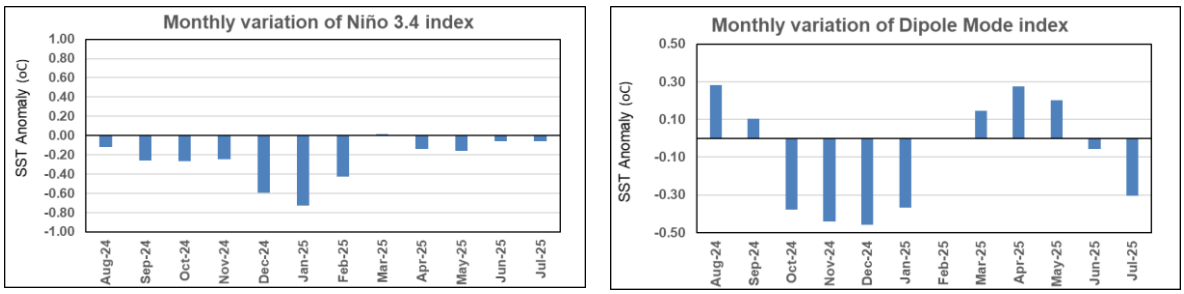


Fig.1: (a) Sea surface temperature (SST) anomalies (0C) during July 2025 and (b) changes in the SST anomalies (0C) from June 2025 to July 2025. SSTs are based on the ERSSTv5 (NCEP-NOAA), and anomalies are computed with respect to 30-year (1991-2020) long term mean.

(a) (c)



(b) (d)

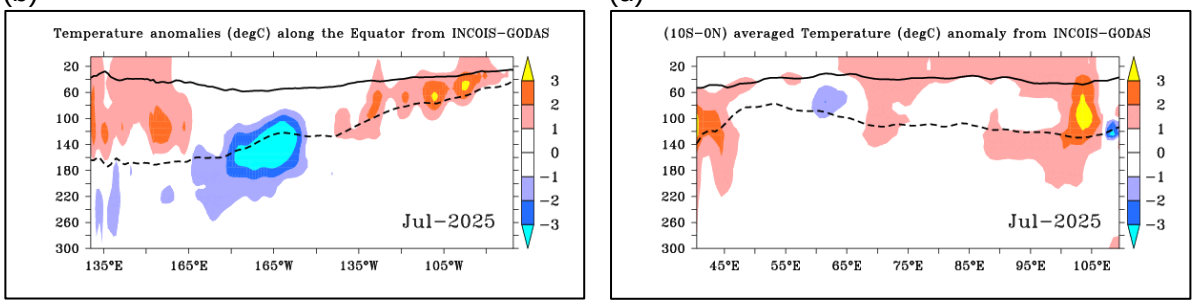


Fig.2: (a) Monthly variation of Niño 3.4 SST index for the last 12 months and (**b**) Depth-longitude section of sub-surface temperature anomalies in the equatorial (5^0S-5^0N) Pacific Ocean for the month of July 2025. (**c**) Same as (**a**) but for the Dipole Mode Index (DMI). (**d**) Same as **(b)** 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 July 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 July 2025, sea surface temperatures (SSTs) were near average over the central and eastern equatorial Pacific Ocean, and SSTs were above average over the western parts of the equatorial Pacific Ocean. Negative SSTs were observed over Atlantic Oceans. 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. During the SON (September–October–November) and OND (October–November–December) seasons, there is an increased probability of La Niña conditions. However, from the NDJ (November–December–January) season onward, neutral ENSO conditions are most likely to prevail. 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-below SST anomalies are expected across most parts of the Indian Ocean for the entire forecast period. The latest MMCFS forecast indicates that the negative IOD conditions are likely to develop during end of the monsoon season and for a short period of time (see Figs. 4b and 5b).

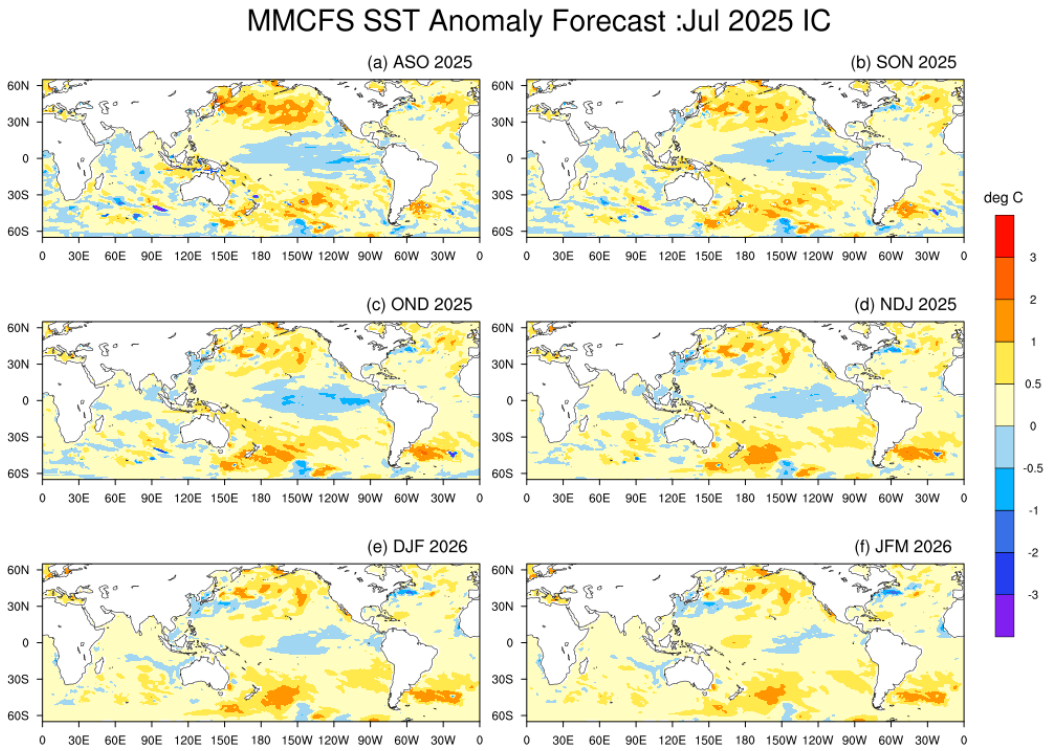


Fig.3: Forecasted Seasonal mean SST anomalies for three-monthly (a) July to September (JAS 2025), (b) August to October (ASO 2025), (c) September to November (SON 2025), (d) October to December (OND 2025), (e) November to January (NDJ 2025) and (f) December to February (DJF 2025) Model bias correction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

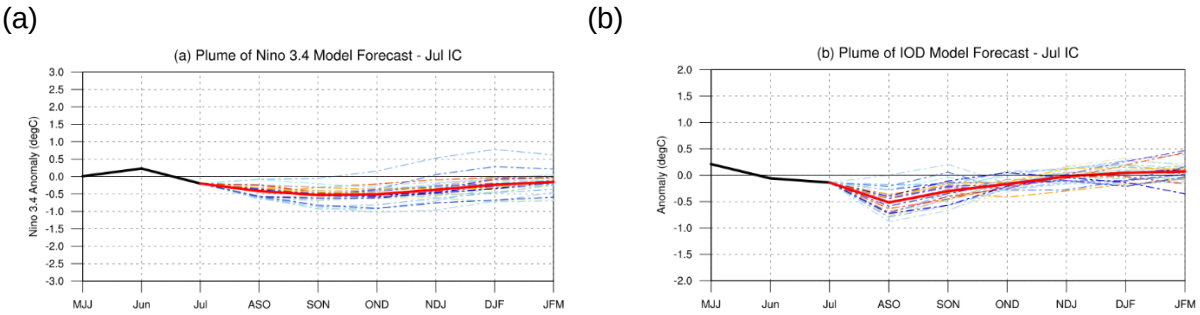


Fig.4: Plume of **(a)** Niño 3.4 SST index, **(b)** Indian Ocean Dipole (IOD) Mode Index forecasted by high-resolution MMCFS. The forecasts were PDF corrected for bias and variance. The solid green line is the observed SST anomaly (ERSSTv5, NOAA) and the solid red line is the ensemble mean SST anomaly forecast of 39 members (MMCFS). The individual ensemble member forecasts are shown in light dotted lines of different colours.

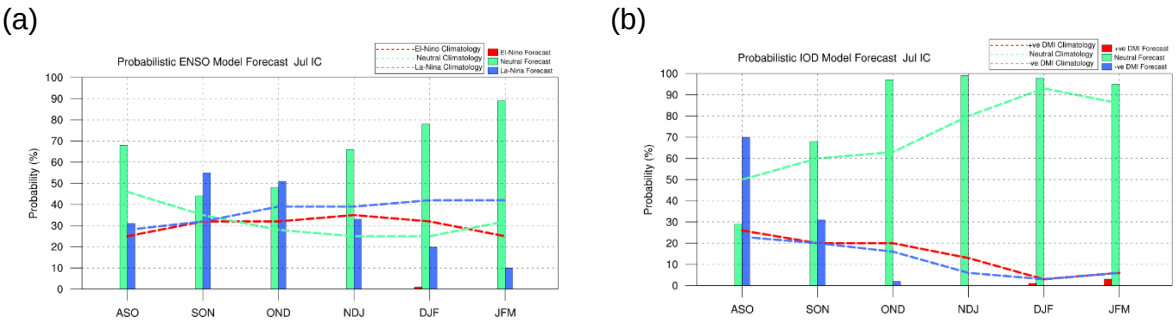


Fig.5: Probability forecast along with climatological probabilities of **(a)** Niño 3.4 and **(b)** Indian Ocean Dipole (IOD) Mode Index from high-resolution MMCFS. The data source for Climatology probabilities: NOAA Extended Reconstructed SST V5. Criteria used for Probabilistic ENSO Forecast: La Niña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