Earth System Science Organization (ESSO)
Ministry of Earth Sciences (MoES)
India Meteorological Department
WMO Regional Climate Centre
Pune, India

SEASONAL CLIMATE OUTLOOK FOR SOUTH ASIA
(February to May 2025)

Highlights

- Over the equatorial Pacific Ocean, sea surface temperatures (SSTs) are below average in most of the central and east-central Pacific Ocean. The weak La Niña conditions are present over Pacific and are expected to persist through the February to March (FMA) season. After that, a transition to ENSO-neutral conditions is likely.

- Near-average sea surface temperatures (SSTs) are currently seen across most of the Indian Ocean. Currently, 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 turn to negative IOD conditions for a short period of time.

- The probability forecast for precipitation for FMA and MAM seasons indicate that enhanced probability of below normal precipitation is likely in most parts of South Asia except over most parts of northeast, southeast and southern parts of Indian Peninsular region where enhanced probability of above normal precipitation is likely.

- In February, the country averaged monthly precipitation is likely to be normal to below normal for countries except Sri Lanka which is likely to be above normal. In March, the country averaged monthly precipitation is likely to be below normal to normal for all countries except Maldives and Sri Lanka where it is likely to be above normal. In April, it is likely to be normal to above normal for all countries except Pakistan where it is likely to be below normal. In May, the country averaged monthly precipitation is likely to be normal to above normal for all the South Asian countries except Afghanistan and Pakistan where it is likely to be below normal.

- Temperature probability forecast for FMA and MAM seasons indicate that enhanced probability of above normal temperatures is likely over most parts of South Asia.

- The country averaged monthly temperatures during February is likely to be below normal for Afghanistan and normal to above normal for all the other countries. In March and April, it is likely to be normal to above normal for all the south Asian countries. In May the country averaged monthly temperatures are likely to be above normal for all the countries except Bangladesh where it is likely to be below normal.

1. Important Global Climate Factors

1.1 Sea Surface Temperatures over the Pacific Ocean

In January 2025, sea surface temperatures (SSTs) were below average in most of the central and east-central Pacific Ocean. Equatorial SSTs were near to above average across the western Pacific Ocean (Fig.1a). Warmer than average SSTs were observed over the extra-tropical Pacific region, while cooler than average SSTs were observed in parts of the southern extra-tropical Pacific region. Compared to December 2024, negative SST anomalies were present over the central equatorial Pacific Ocean, and around the Maritime Continent. Positive SST anomalies were observed over the east-central and western equatorial Pacific Ocean. Cool SST anomalies were observed over the higher latitudes of the North Pacific Ocean and some parts of the South Pacific Ocean. Warm SST anomalies were observed over some parts of the extra tropical Pacific Ocean (Fig.1b). Over the equatorial Pacific Ocean, sea surface temperatures (SSTs) are below average in most of the central and east-central Pacific Ocean. The weak La Niña conditions are present over Pacific and are expected to persist through the February to March (FMA) season. After that, a transition to ENSO-neutral conditions is likely. (Fig.2)

1.2 Sea Surface Temperatures over Indian Ocean

In January 2025, equatorial SSTs were above average across most of the western and eastern Indian Ocean, including the north Bay of Bengal (Fig. 1a). Cooler than average SSTs were observed over western Indian Ocean and most of the Arabian Sea. Compared to December 2024, cooler than normal SSTs were observed across the Indian Ocean, Arabian Sea, and Bay of Bengal (Fig. 1b). The latest MMCFS forecast indicates that the neutral IOD conditions are likely to continue for the next JFM season. (Fig.3).

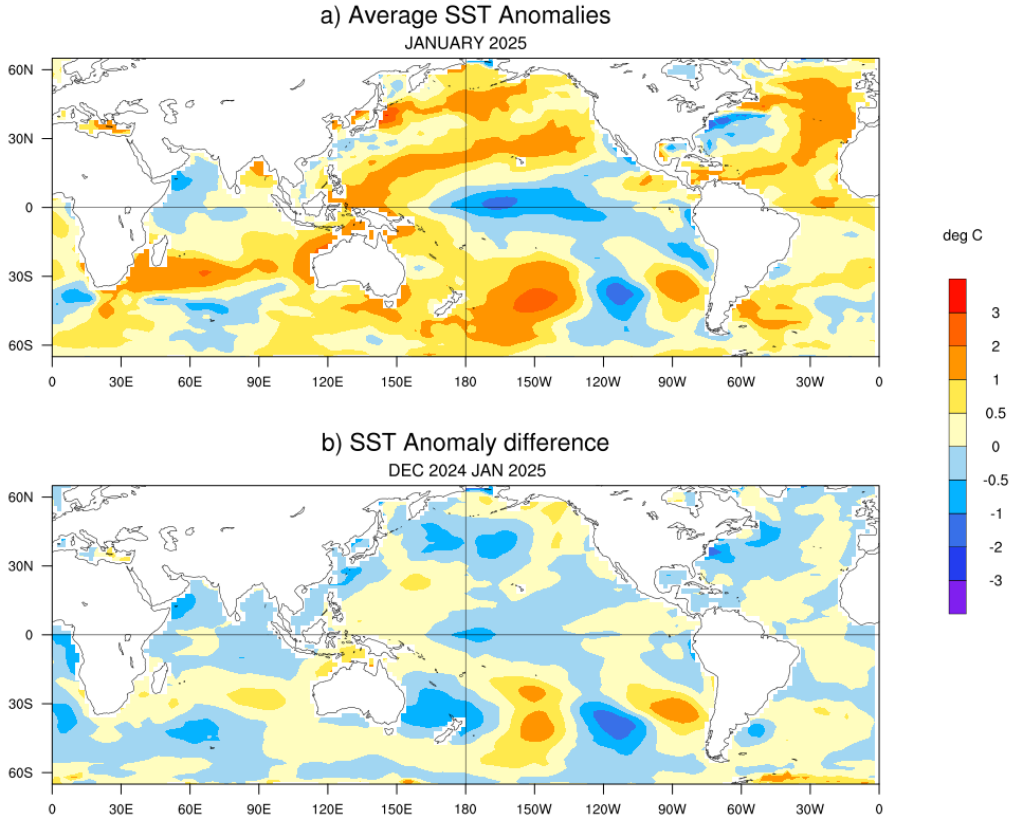

Fig.1: (a) Sea surface temperature (SST) anomalies (^{0}C) during January 2025 and (b) changes in the SST anomalies (^{0}C) from December 2024 to January 2025. SSTs are based on the COBE-SST 2, from NOAA, and anomalies are computed with respect to 30-year (1991-2020) long term mean.

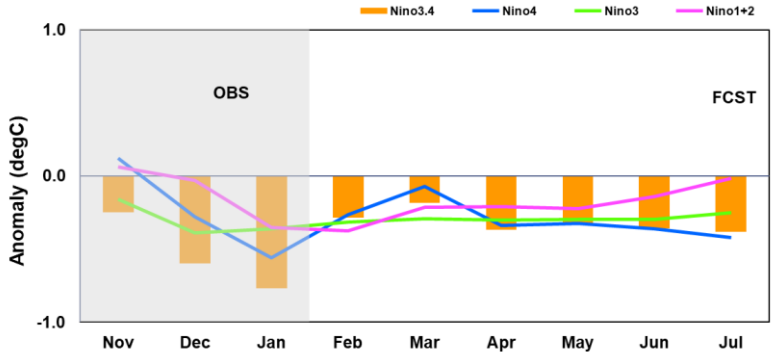

Fig.2: Time series of monthly area-averaged SST anomalies (°C) in the 4 Niño regions. ERSSTv5 observed anomaly for the last 3 months and MMCFS model PDF corrected anomaly forecast for the next 6 months.

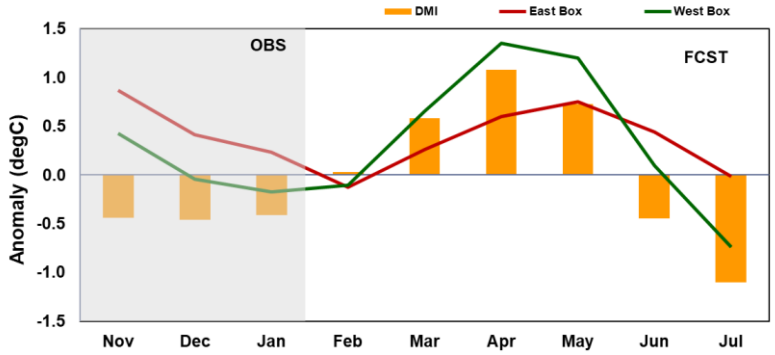

Fig.3: The time series of the monthly area-averaged SST anomaly Indices (°C) over west equatorial Indian Ocean (WEI) & east equatorial Indian Ocean (EEI) along with Dipole Mode Index (DMI=WEI-EEI) representing Indian Ocean Dipole (IOD). ERSSTv5 observed anomaly for the last 3 months and MMCFS model PDF corrected anomaly forecast for the next 6 months.

1.3 Convection (OLR Anomaly) Pattern over the Asia Pacific Region

The Outgoing Longwave Radiation (OLR) anomaly during January 2025 is shown in (Fig.4). Negative OLR anomalies (enhanced convection, blue shading) were observed over most parts of North Indian Ocean (Arabian Sea and Bay of Bengal), south east Indian Ocean and south China Sea. Negative OLR anomalies were also observed over Southern Peninsular India and maritime continent. Positive OLR anomalies (suppressed convection, orange/red shading) were observed over central and west central Tropical Pacific Ocean. Positive OLR anomalies were also observed over some parts of Africa and Australia.

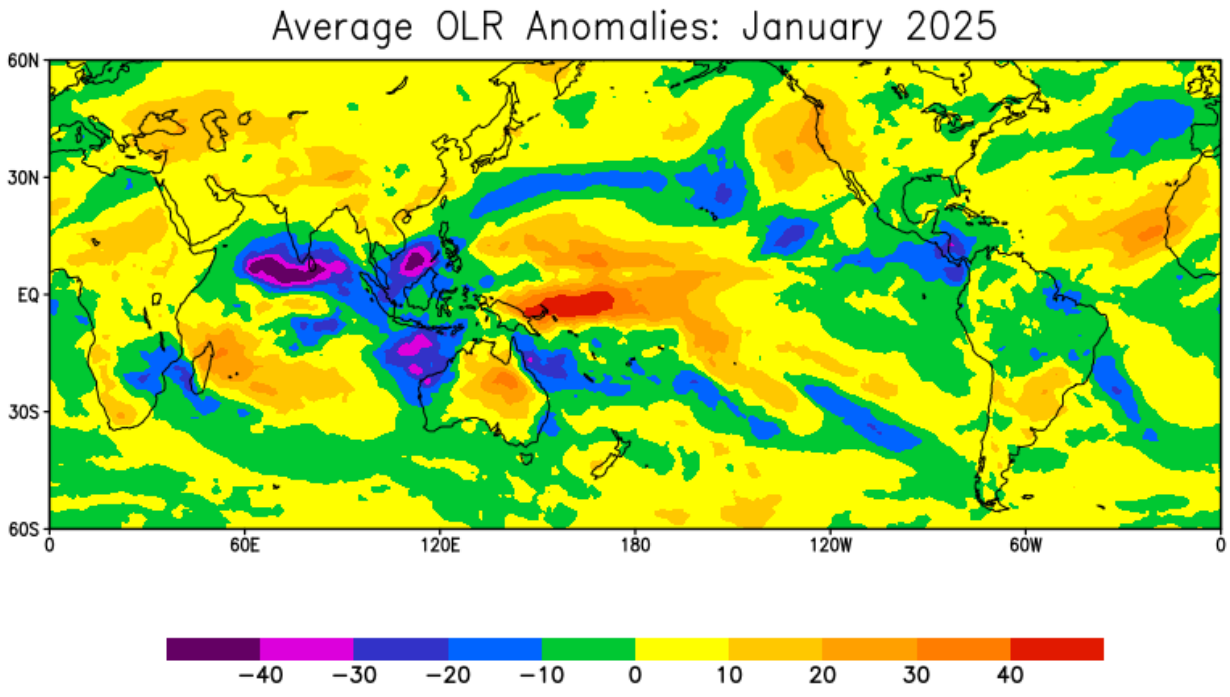

Fig.4: Outgoing Long Wave Radiation (OLR) Anomaly (W/m^2) for January 2025 (Data source: NCEP-NOAA)

1.4 Snow Cover Area over the Northern Hemisphere (NH)

During January 2025, the NH snow cover area (45.02 million Sq. km) was less than the 1991-2020 normal by 2.22 million Sq. km (Fig. 5). Eurasian Snow cover area (27.22 million Sq. km) was 2.43 million Sq. km less than the 1991-2020 normal. North America snow cover area of 17.80 million sq. km was more by 0.21 million Sq. Km with respect to 1991-2020 normal.

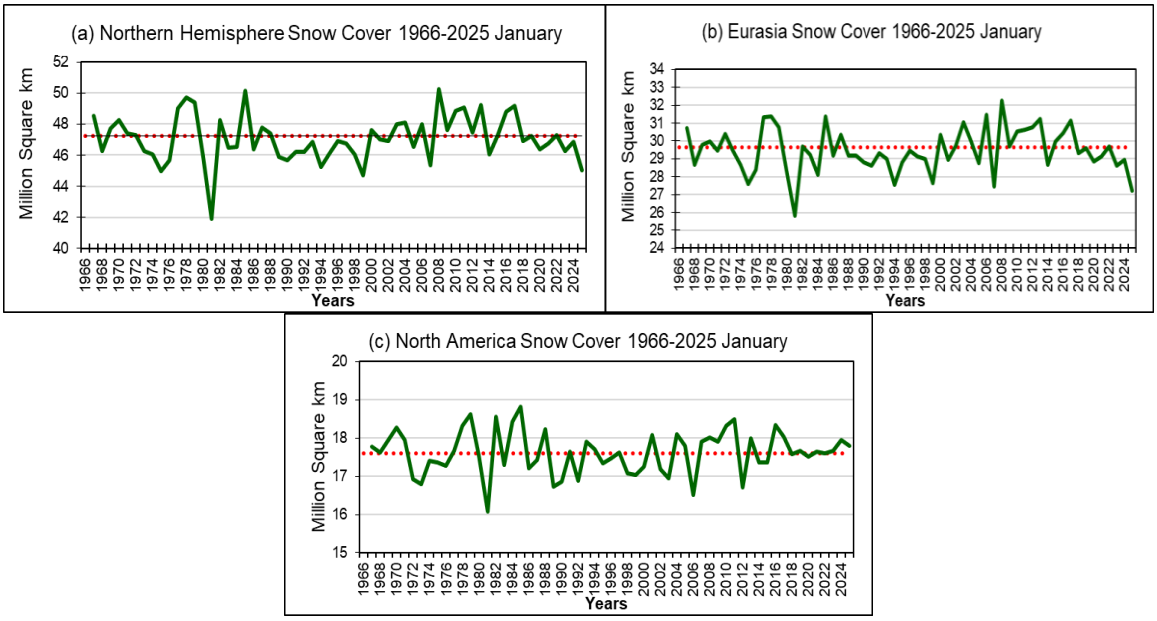

Fig.5. Snow cover area (million Sq. km) for the month of January during the period 1966-2025 (green solid lines) and normal value (1991-2020) (red dotted line) for (a) Northern Hemisphere (b) Eurasia and (c) North America. (Data Source: Rutgers University Snow Lab).

1.5. Madden Julian Oscillation (MJO)

During the first week of January 2025, MJO remained in phase 7 (Western Pacific) with reduced strength. In the second week it moved to phase 1 (Western Hem. And Africa) with enhanced strength. It then moved eastwards to phase 2 (Indian Ocean) in the third week and then further eastwards to phase 5 (Maritime Continent) in week four with enhanced strength. The MJO phase diagram illustrates the progression of the MJO through different phases, which generally coincide with locations along the equator around the globe.

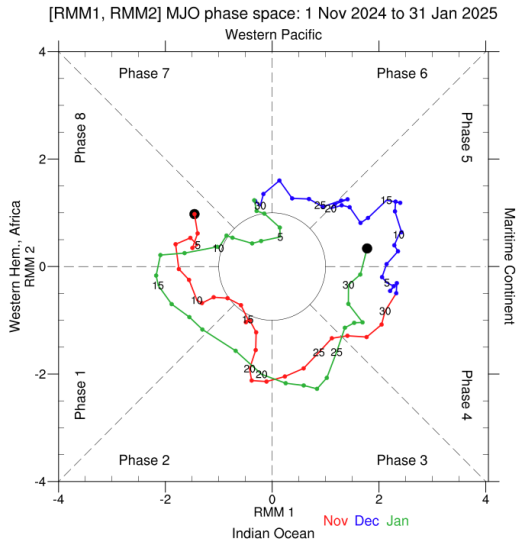

Fig.6. RMM phase diagram for Madden Julian Oscillation (MJO) for the period November 2024 to January 2025. (Data Source: http://www.bom.gov.au/climate/mjo/).

2. Seasonal Outlook for South Asia

The seasonal outlook was prepared based on the forecast from Monsoon Mission Coupled Forecasting System (MMCFS). The model is a fully coupled ocean-atmosphere-land model. The atmospheric component of CFSv2 is Global Forecast System (GFS) with spectral resolution of T382 (approximately 38 km) and 64 hybrid vertical levels and the ocean component is Geophysical Fluid Dynamics Laboratory (GFDL) Flexible Modelling System (FMS) Modular Ocean Model version.

2.1. Precipitation Probability Forecast:

The probability forecasts for precipitation for the seasons February to April 2025 (FMA) and March to May 2025 (MAM) are given in the Figures 7a and 7b respectively. The forecast is prepared based on the January initial conditions. The probability forecast for precipitation for FMA and MAM seasons indicate that enhanced probability of below normal precipitation is likely in most parts of South Asia except over most parts of northeast, southeast and southern parts of Indian Peninsular region where enhanced probability of above normal precipitation is likely.

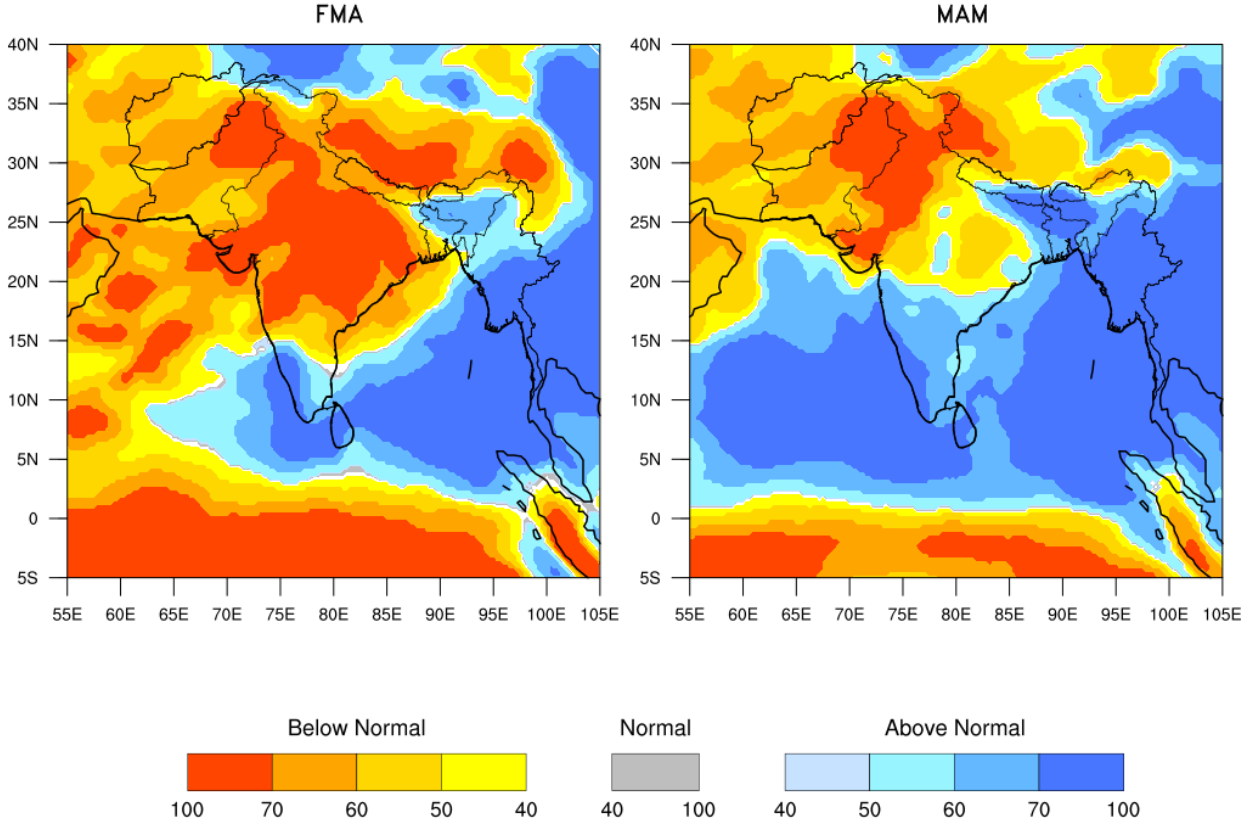

Fig.7: Seasonal probability (%) forecasts of precipitation for (a) FMA 2025 (left) and (b) MAM 2025 (right) based on initial conditions of January 2025.The white colour indicates climatological probability.

2.2. Temperature Probability Forecast*:*

The probability forecasts for temperature for the season February to April 2025 (FMA) and March to May 2025 (MAM) are given in the Figures 8a and 8b respectively. The forecast is prepared based on the January initial conditions. Temperature probability forecast for FMA and MAM seasons indicate that enhanced probability of above normal temperatures is likely over most parts of South Asia.

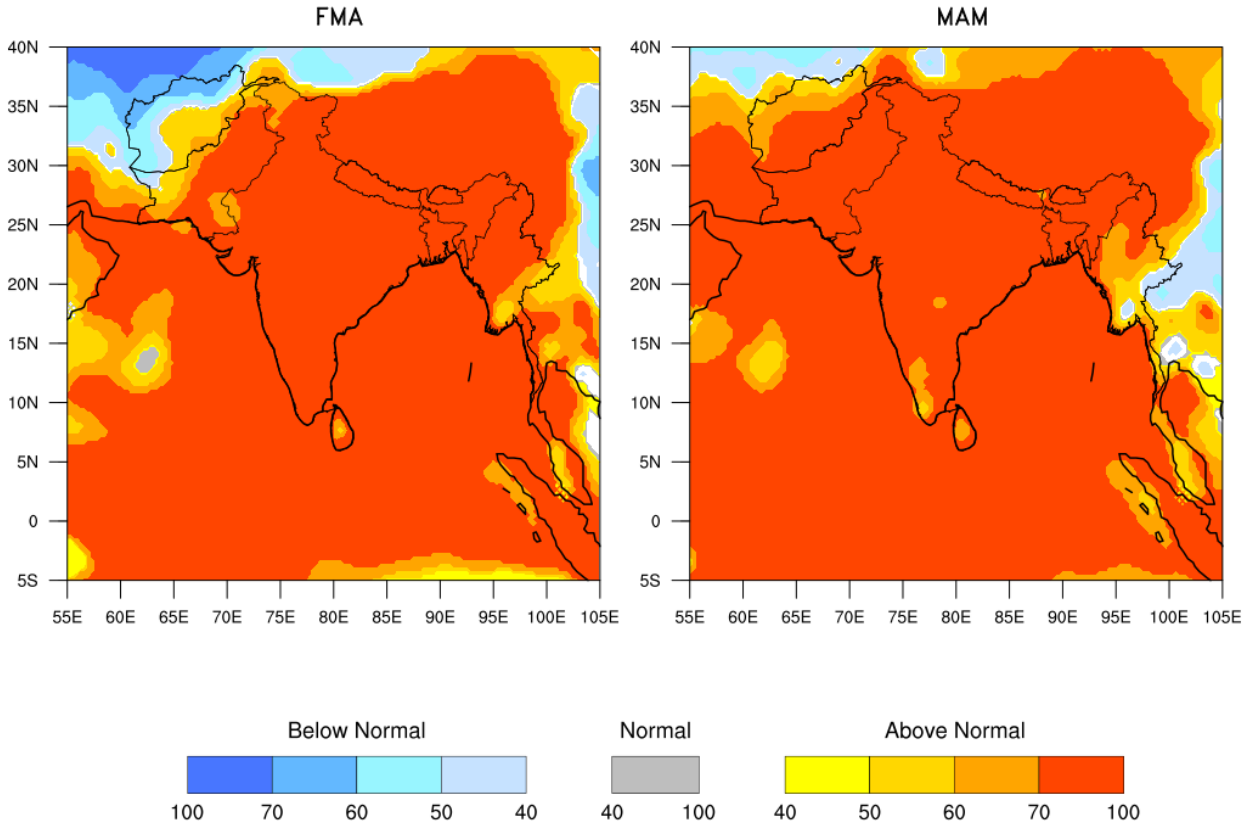

Fig. 8: Probability (%) forecast for the seasonal mean temperature for (a) FMA 2025 (left) and (b) MAM 2025 (right) based on initial conditions of January 2025. The white colour indicates climatological probability.

3. Forecast Outlook for the Country Averaged Monthly Precipitation and Temperature

The MMCFS model forecast for monthly precipitation and temperature for the next four months (from February to May 2025) averaged over the 9 south Asian countries viz., Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan and Sri Lanka were shown in the Figures 9. The monthly rainfall anomaly is expressed as percentage departure from Long Period Model Average (LPMA) and monthly temperature anomaly is expressed in degree Celsius.

In February, the country averaged monthly precipitation is likely to be normal to below normal for countries except Sri Lanka which is likely to be above normal. In March, the country averaged monthly precipitation is likely to be below normal to normal for all countries except Maldives and Sri Lanka where it is likely to be above normal. In April, it is likely to be normal to above normal for all countries except Pakistan where it is likely to be below normal. In May, the country averaged monthly precipitation is likely to be normal to above normal for all the South Asian countries except Afghanistan and Pakistan where it is likely to be below normal.

The country averaged monthly temperatures during February is likely to be below normal for Afghanistan and normal to above normal for all the other countries. In March and April, it is likely to be normal to above normal for all the south Asian countries. In May the country averaged monthly temperatures are likely to be above normal for all the countries except Bangladesh where it is likely to be below normal.

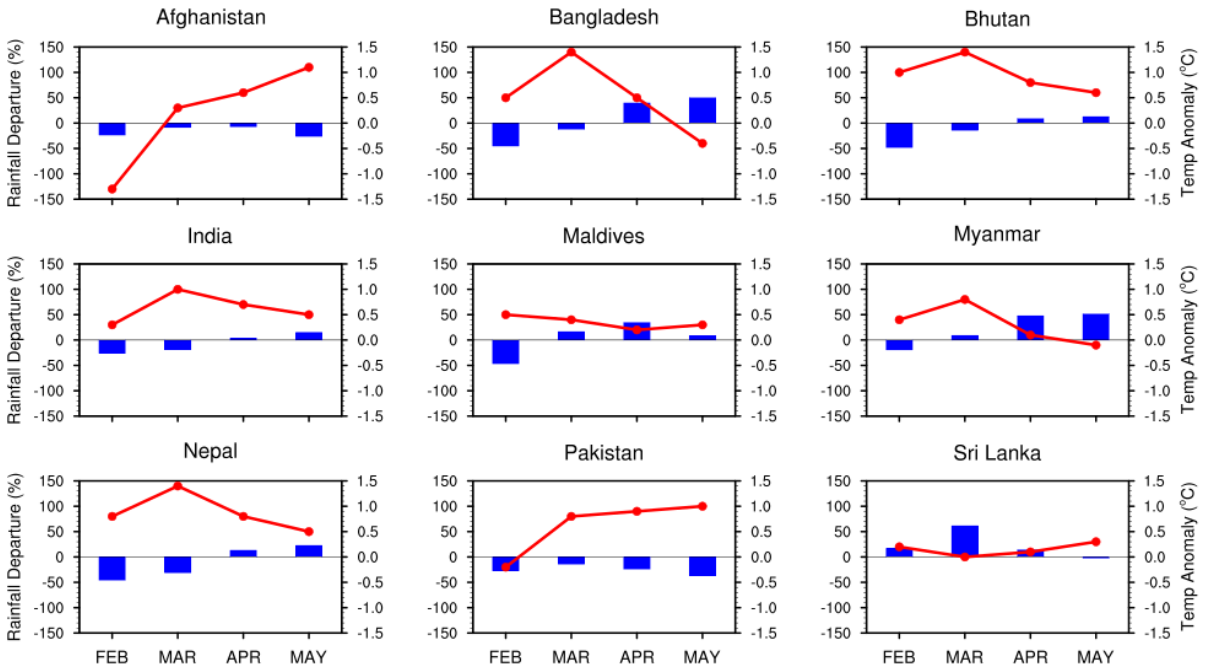

Fig. 9: Monthly country averaged rainfall forecast expressed as percentage departures (%) and Monthly country averaged temperature anomaly (°C) forecast during February to May 2025. Here, the normal range for country averaged monthly precipitation is taken as -10% to +10% (Left Vertical Axis Scale for Precipitation indicated in blue shaded bars) and the normal range for country averaged monthly temperature is taken -0.25°C to +0.25°C (Right Vertical Axis Scale for Temperature indicated in red coloured lines).