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SEASONAL CLIMATE OUTLOOK FOR SOUTH ASIA

(February to May 2024)

Highlights

- Currently, strong El Niño conditions are prevailing over equatorial Pacific and the sea surface temperatures (SSTs) are warmer than normal over most of the equatorial Pacific Ocean. The latest MMCFS forecast indicates El Niño conditions are likely to weaken during the upcoming season and turn to neutral thereafter. Model also indicates the development of La Niña conditions during the monsoon season.

- Positive Indian Ocean Dipole (IOD) conditions are continuing over the Indian Ocean and the latest MMCFS forecast indicates positive IOD conditions are likely to weaken during the upcoming season and turn to neutral thereafter

- The probability forecast for precipitation for February – April (FMA) and March – May (MAM) indicates enhanced probability of below normal precipitation in most parts of South Asia except over few parts of northeast near Bhutan and south of Peninsular India where probability of above normal precipitation is likely.

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

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

- The country averaged monthly temperatures during February, March, April and May are likely to be normal to above normal for all south Asian countries.

1. Important Global Climate Factors

1.1 Sea Surface Temperatures over the Pacific Ocean

During the January 2024, warmer than normal SSTs were observed over most of the equatorial and the northern extra-tropical Pacific region (Fig.1a). Cooler than normal SSTs were observed over some parts of southern Pacific regions. As compared to December 2023, negative SST anomalies were observed over the central, eastern and south eastern Pacific Ocean (Fig.1b) and also cooling of SSTs were observed over many parts of the north Pacific Ocean. At the same time positive SST anomalies were observed over the western equatorial Pacific Ocean. The latest MMCFS forecast indicates El Niño conditions are likely to weaken during the upcoming season and turn to neutral thereafter. Model also indicates the development of La Niña conditions during the monsoon season. (Fig. 2).

1.2 Sea Surface Temperatures over Indian Ocean

In January 2024, warmer than normal SSTs were observed over the western equatorial Indian Ocean (Fig.1a). The warm SSTs were also observed over the eastern equatorial Indian Ocean. Compared to December 2023, warm SST anomalies were observed over some parts of western and eastern equatorial Indian Ocean whereas cold SST anomalies were observed over north Bay of Bengal. Warm SSTs were also observed over north Arabian Sea (Fig. 1b). The latest MMCFS forecast indicates positive IOD conditions are likely to weaken during the upcoming season and turn to neutral thereafter. (Fig.3).

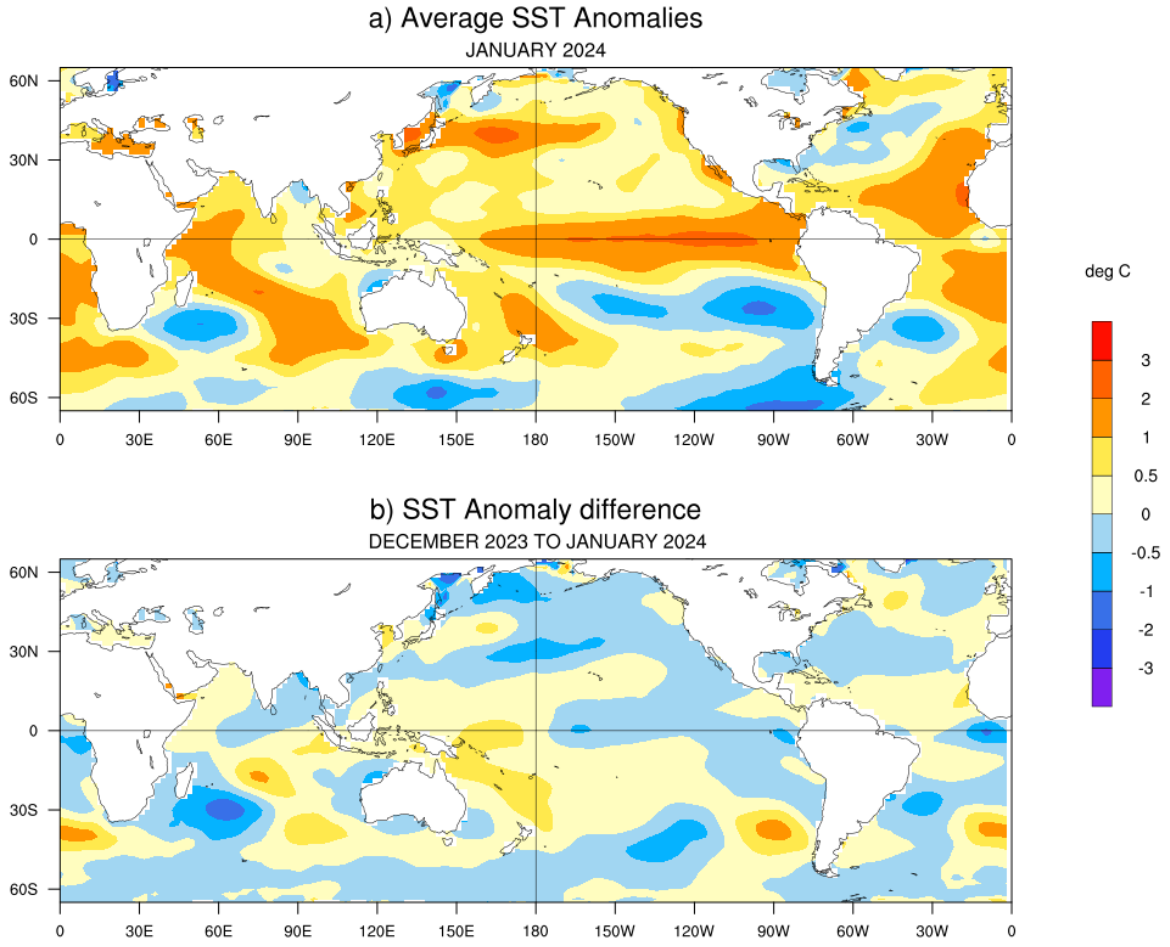

Fig.1(a) Sea surface temperature (SST) anomalies (°C) during January 2024 and (b) changes in the SST anomalies (°C) from December 2023 to January 2024. SSTs were based on the ERSSTv5, NOAA, and anomalies were computed with respect to 30-year (1991-2020) long term mean.

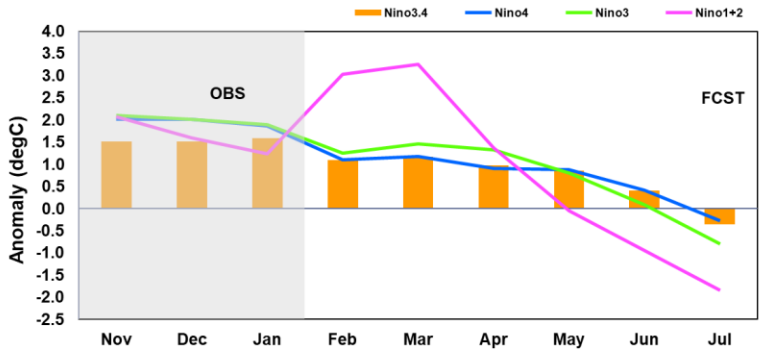

Fig.2: Time series of monthly area-averaged SST anomalies (°C) in the 4 Niño regions. ERSSTv5 observed anomaly for the last 3 months and MMCFS model PDF corrected anomaly forecast for the next 6 months.

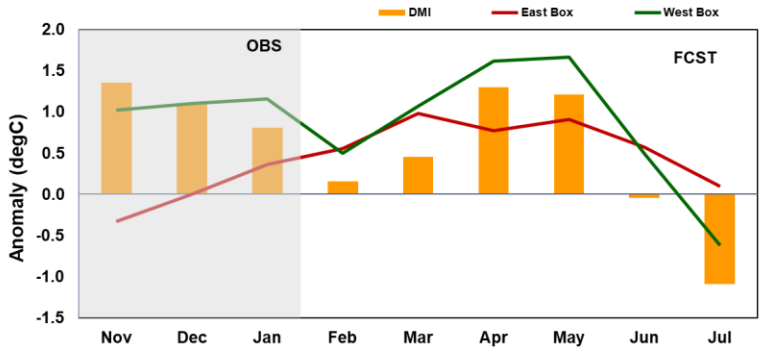

Fig.3: The time series of the monthly area-averaged SST anomaly Indices (°C) over west equatorial Indian Ocean (WEI) & east equatorial Indian Ocean (EEI) along with Dipole Mode Index (DMI=WEI-EEI) representing Indian Ocean Dipole (IOD). ERSSTv5 observed anomaly for the last 3 months and MMCFS model PDF 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 2024 is shown in (Fig.4). Negative OLR anomalies (enhanced convection, blue shading) were observed over southeast Arabian sea, south Indian Ocean, central and east equatorial Pacific Ocean and some parts of south Pacific Ocean. Negative OLR anomalies were also observed over east central Africa, north Australia, and southern tip of north America. Positive OLR anomalies (suppressed convection, orange/red shading) were observed over north and south tropical Pacific Ocean and south America.

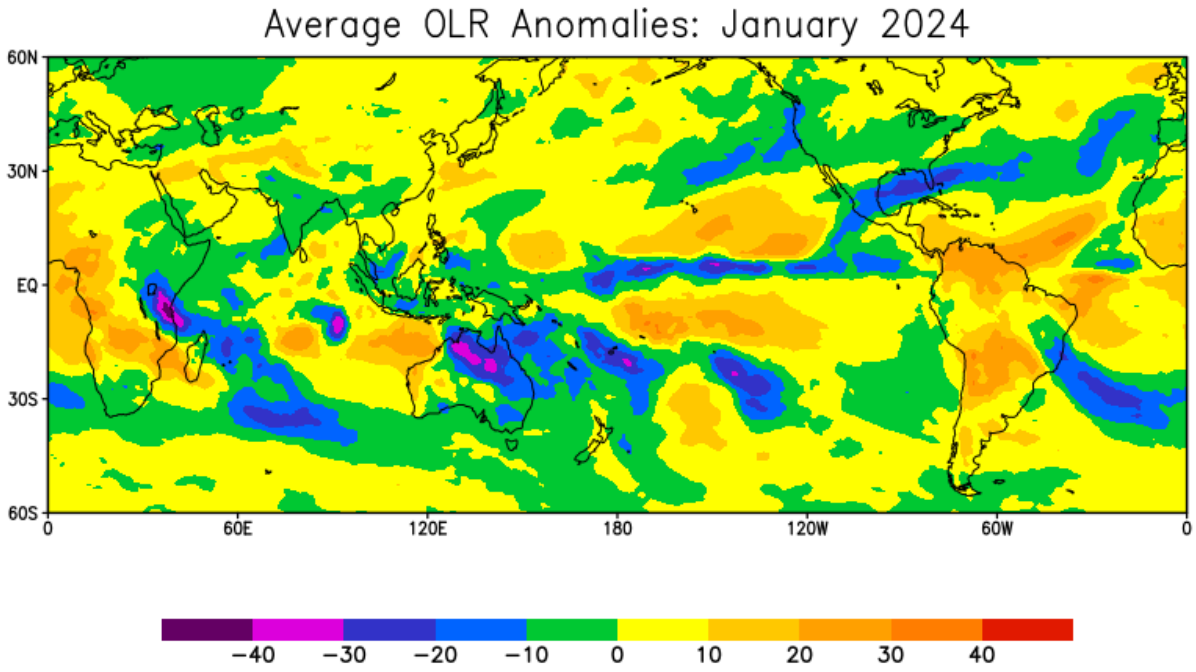

Fig.4: Outgoing Long Wave Radiation (OLR) Anomaly (W/m^2) for January 2024 (Data source: NCEP-NOAA)

1.4 Snow Cover Area over the Northern Hemisphere (NH)

During January 2024, the NH snow cover area (46.89 million Sq. km) was less than the 1991-2020 normal by 0.35 million Sq. km (Fig. 5). Eurasian Snow cover area (28.93 million Sq. km) was 0.72 million Sq. km less than the 1991-2020 normal. North America snow cover area of 17.96 million sq. km was more by 0.36 million Sq. Km with respect to 1991-2020 normal.

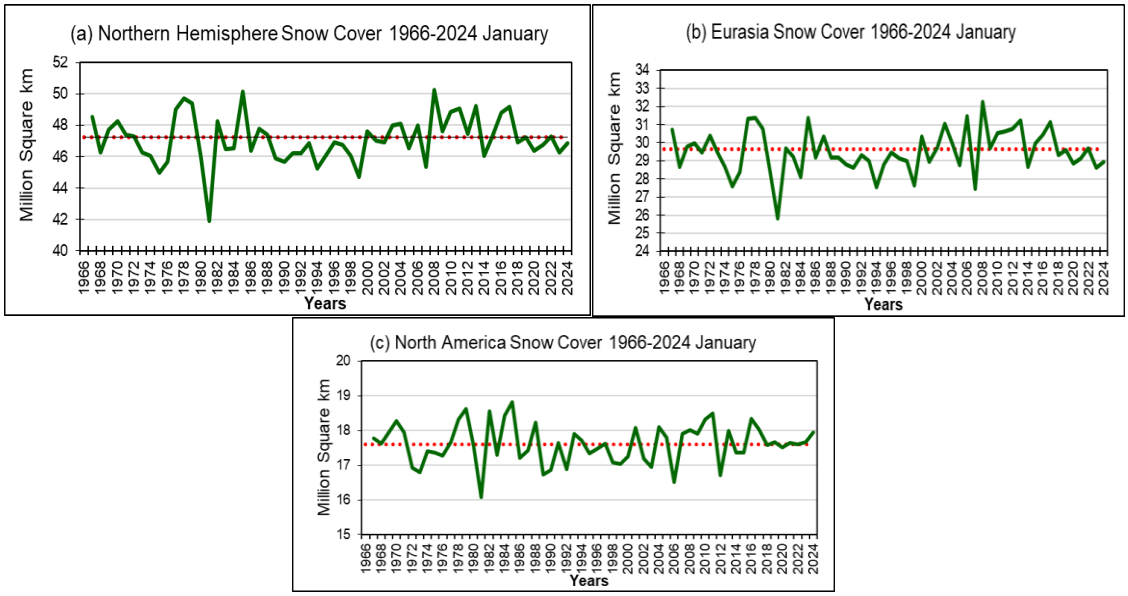

Fig.5. Snow cover area (million Sq. km) for the month of January during the period 1966-2024 (green solid lines) and normal value (1991-2020) (red dotted line) for (a) Northern Hemisphere (b) Eurasia and (c) North America. (Data Source: Rutgers University Snow Lab).

1.5. Madden Julian Oscillation (MJO)

During the first week of January 2024, MJO propagated eastwards from phase 2 (Indian Ocean) to phase 3. It moved to phase 4 (Maritime Continent) in the second week with increased strength. In the third week it entered into phase 5 (Maritime Continent) and then moved eastwards to phase 6 (Western Pacific) and phase 7(Western Pacific) in the last week 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.

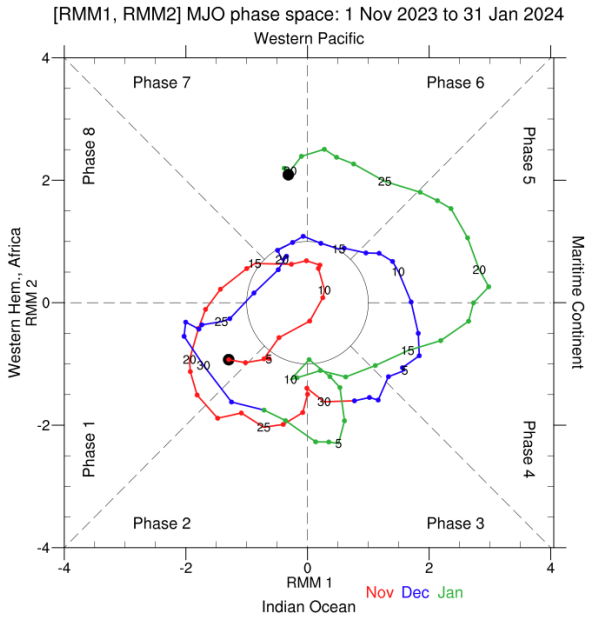

Fig.6. RMM phase diagram for Madden Julian Oscillation (MJO) for the period November 2023 to January 2024. (Data Source: http://www.bom.gov.au/climate/mjo/).

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 2024 (FMA) and March to May 2024 (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 indicates enhanced probability of below normal precipitation in most parts of South Asia except over few parts of northeast near Bhutan and south of Peninsular India where probability of above normal precipitation is likely.

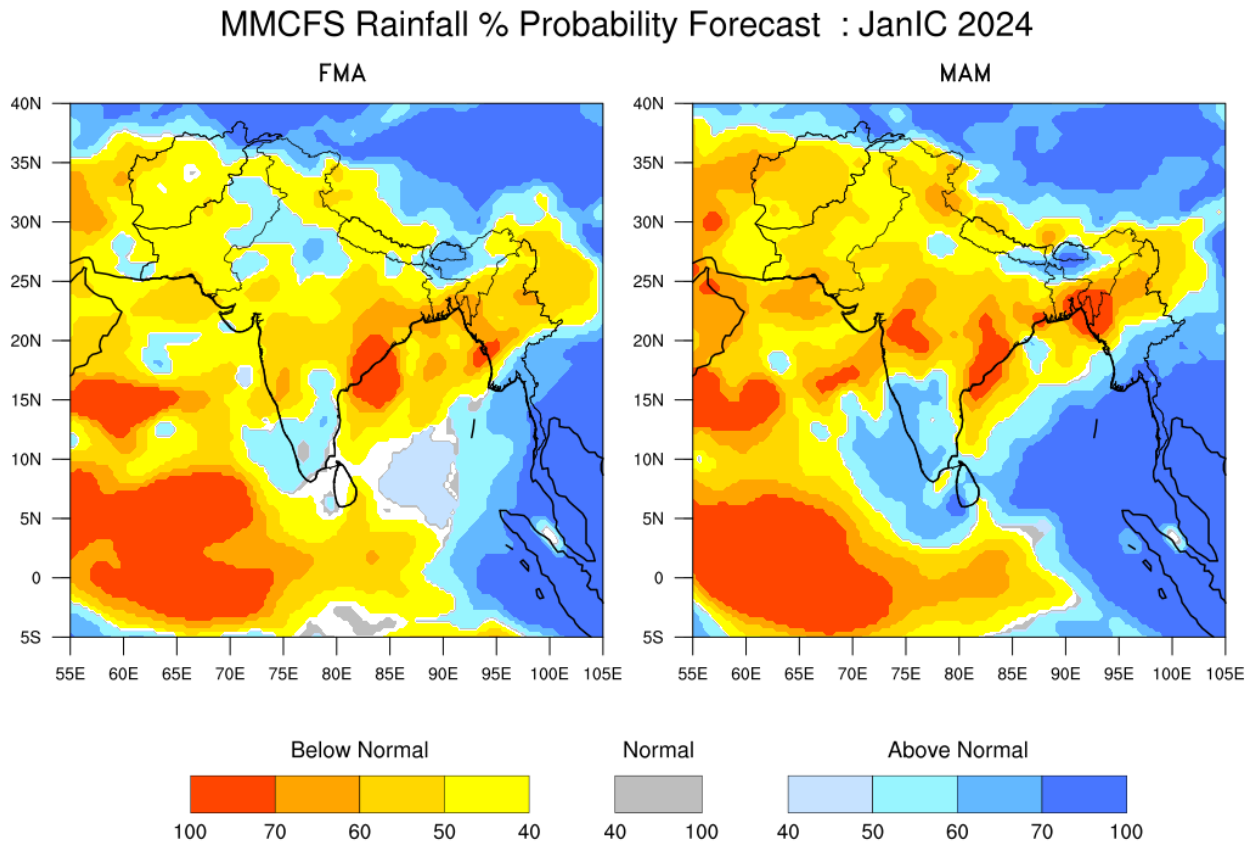

Fig.7: Seasonal probability (%) forecasts of precipitation for (a) FMA 2024 (left) and (b) MAM 2024 (right) based on initial conditions of January 2024.The white colour indicates climatological probability.

2.2. Temperature Probability Forecast*:*

The probability forecasts for temperature for the season February to April 2024 (FMA) and March to May 2024 (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 season and MAM season indicates that enhanced probability of above normal temperatures is likely over most parts of South Asia.

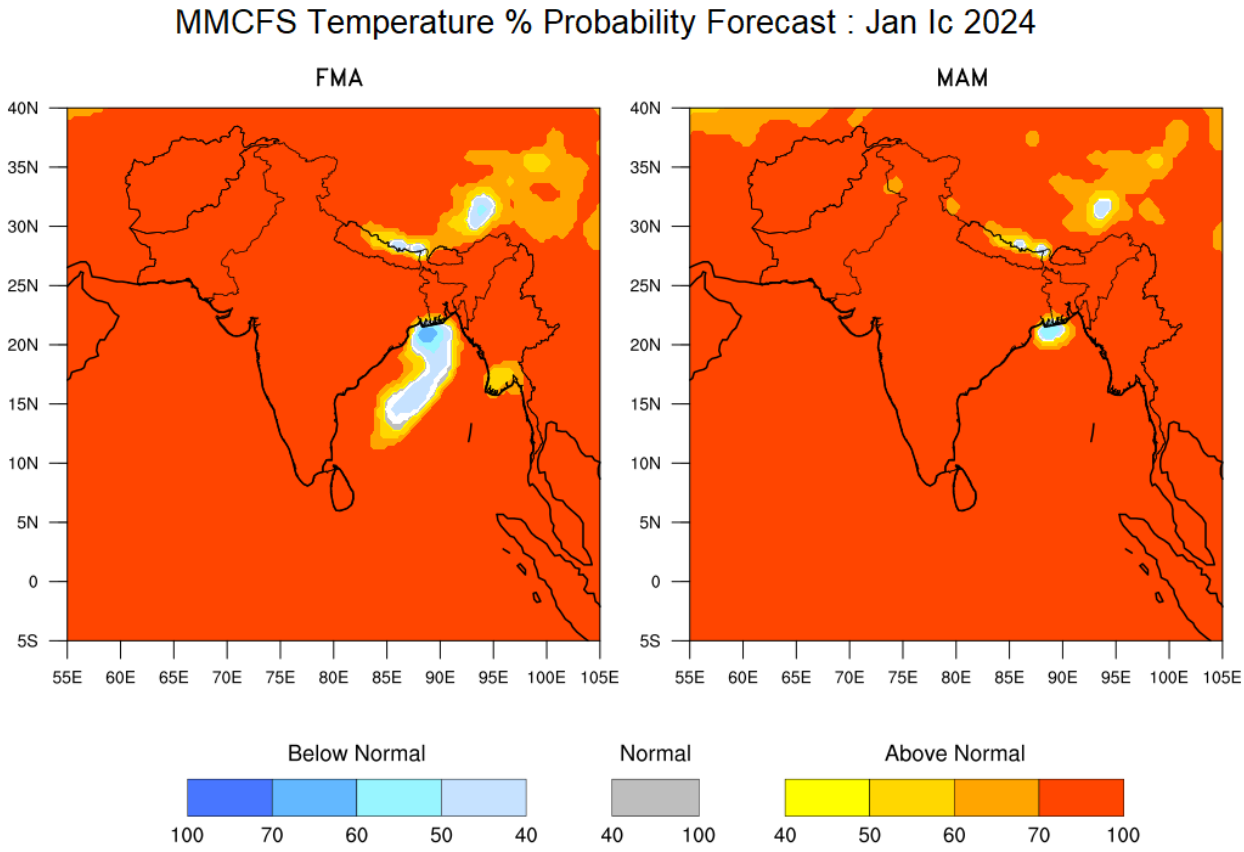

Fig. 8: Probability (%) forecast for the seasonal mean temperature for (a) FMA 2024 (left) and (b) MAM 2024 (right) based on initial conditions of January 2024. The white colour indicates climatological probability.

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 2024) 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 and March, the country averaged monthly precipitation is likely to be normal to above normal for all south Asian countries except Maldives and Sri Lanka where it is likely to be below normal. In April, it is likely to be normal to below normal for all countries except Maldives and Sri Lanka where it is likely to be above normal. In May, it is likely to be normal to below normal for all countries.

The country averaged monthly temperatures during February, March, April and May are likely to be normal to above normal for all south Asian countries.

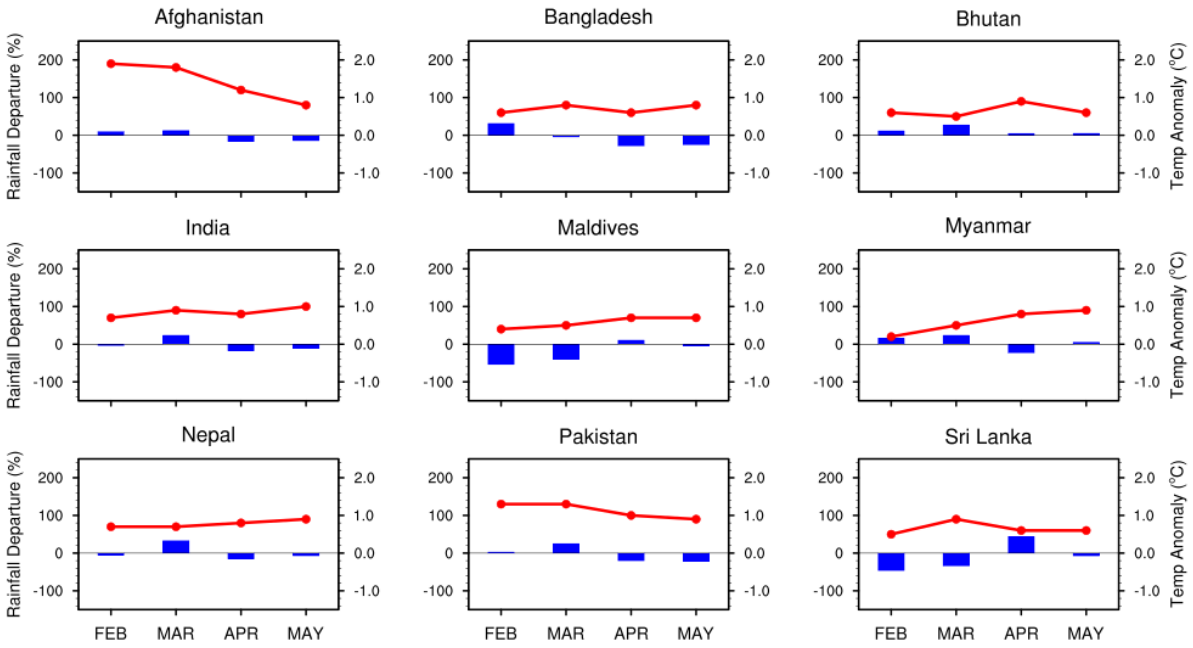

Fig. 9: Monthly country averaged rainfall forecast expressed as percentage departures (%) and Monthly country averaged temperature anomaly (°C) forecast during February to May 2024. Here, the normal range for country averaged monthly precipitation is taken as -10% to +10% (Left Vertical Axis Scale for 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).