Earth System Science Organization (ESSO)
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SEASONAL CLIMATE OUTLOOK FOR SOUTH ASIA
(September to December 2024)

Highlights

- The sea surface temperatures are below average in the eastern equatorial Pacific Ocean. Currently, neutral El Nino-Southern Oscillation (ENSO) conditions are observed over the equatorial Pacific. The probability forecast indicates a higher chance of La Niña conditions developing around the SON 2024 season and an enhanced probability of La Niña conditions until early next year.

- Above-average sea surface temperatures (SSTs) are currently seen across most of the Indian Ocean. Currently, neutral Indian Ocean Dipole (IOD) conditions prevail over the Indian Ocean. The latest MMCFS forecast indicates that the neutral IOD conditions are likely to continue for next several months.

- The probability forecast for precipitation for September – November (SON) and October – December (OND) seasons indicate that enhanced probability of above normal precipitation is likely in most parts of South Asia except over northwest and extreme north and south where enhanced probability of below normal rainfall is likely.

- In September, the country averaged monthly precipitation is likely to be normal to above normal for all the South Asian countries. In October, the country averaged monthly precipitation is likely to be normal to above normal for all the South Asian countries except Afghanistan, Maldives, Pakistan and Sri Lanka where it is likely to be below normal. In November, it is likely to be normal to above normal in all the south Asian countries except Afghanistan, Myanmar and Pakistan where it is likely to be below normal. In December, 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 SON and OND seasons indicate that enhanced probability of above normal temperatures is likely over most parts of South Asia.

- The country averaged monthly temperatures during September, October, November and December 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

In August 2024, sea surface temperatures (SSTs) in the eastern Pacific Ocean were below average, while they were average to above average in the western and adjoining central Pacific (Fig.1a). Warmer than average SSTs were observed over some parts of the northern and southern extra-tropical Pacific region. Cooler than average SSTs were observed over parts of the south of the extra-tropical Pacific region. Compared to July 2024, negative SST anomalies were seen over the central and western equatorial Pacific Ocean. Positive SST anomalies were seen over the parts of eastern most equatorial Pacific Ocean (Fig.1b). The probability forecast indicates a higher chance of La Niña conditions developing around the SON 2024 season and an enhanced probability of La Niña conditions until early next year (Fig.2).

1.2 Sea Surface Temperatures over Indian Ocean

In August 2024, above-average sea surface temperatures (SSTs) were observed across most of the Indian Ocean, including the Bay of Bengal and the Arabian Sea (Fig. 1a). Compared to July 2024, cooler SSTs were observed in the northern Bay of Bengal and in most parts of the Arabian Sea and eastern equatorial Indian Ocean, while warmer SSTs were observed in the western and central equatorial Indian Ocean, as well as in parts of the Bay of Bengal and the Arabian Sea (Fig. 1b). The latest MMCFS forecast indicates that the neutral IOD conditions are likely to continue for next several months (Fig.3).

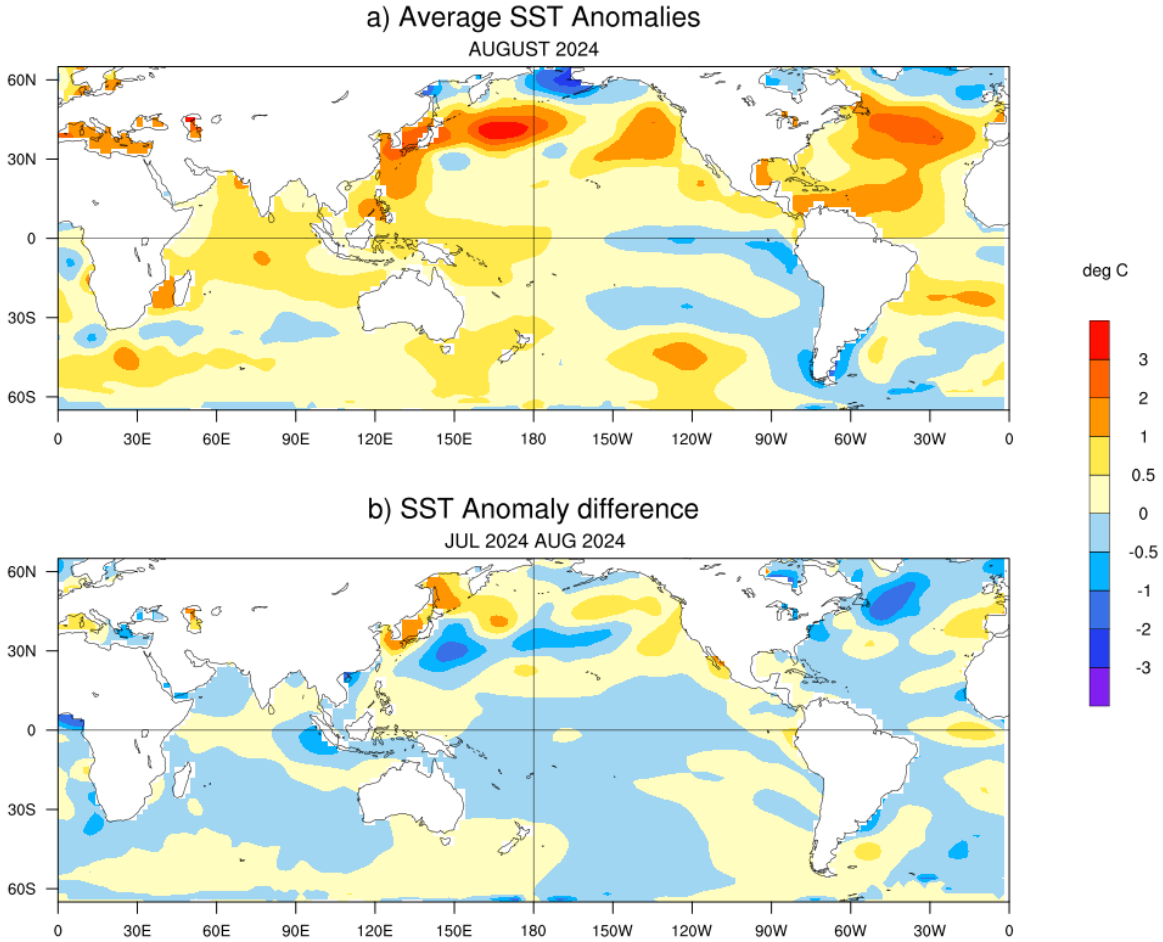

Fig.1(a) Sea surface temperature (SST) anomalies (ºC) during August 2024 and (b) changes in the SST anomalies (ºC) from July to August 2024. SSTs were based on the ERSSTv5, NOAA, and anomalies were computed with respect to 30-year (1991-2020) long term mean.

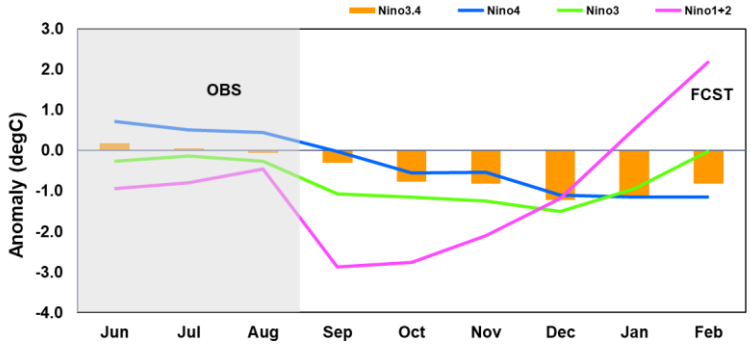

Fig.2: Time series of monthly area-averaged SST anomalies (°C) in the 4 Niño regions. ERSSTv5 observed anomaly for the last 3 months and MMCFS model PDF corrected anomaly forecast for the next 6 months.

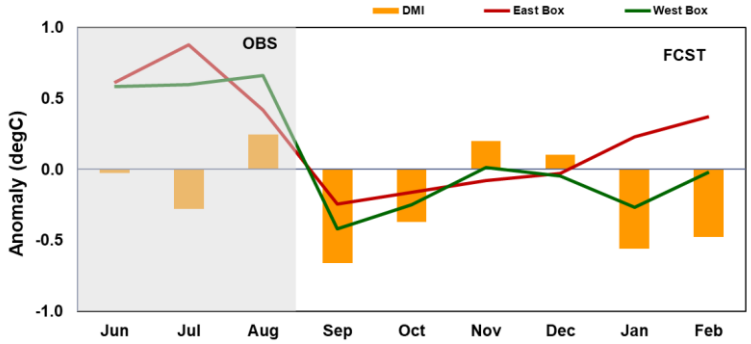

Fig.3: The time series of the monthly area-averaged SST anomaly Indices (°C) over west equatorial Indian Ocean (WEI) & east equatorial Indian Ocean (EEI) along with Dipole Mode Index (DMI=WEI-EEI) representing Indian Ocean Dipole (IOD). ERSSTv5 observed anomaly for the last 3 months and MMCFS model PDF 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 August 2024 is shown in (Fig.4). Negative OLR anomalies (enhanced convection, blue shading) were observed over Arabian Sea, South Indian Ocean and west central equatorial Pacific Ocean. Negative OLR anomalies were also observed over northwest and west parts of South Asia, along the Himalayan plains, north African Region and maritime continent. Positive OLR anomalies (suppressed convection, orange/red shading) were observed near south China sea, north tropical Pacific Ocean and North and South America.

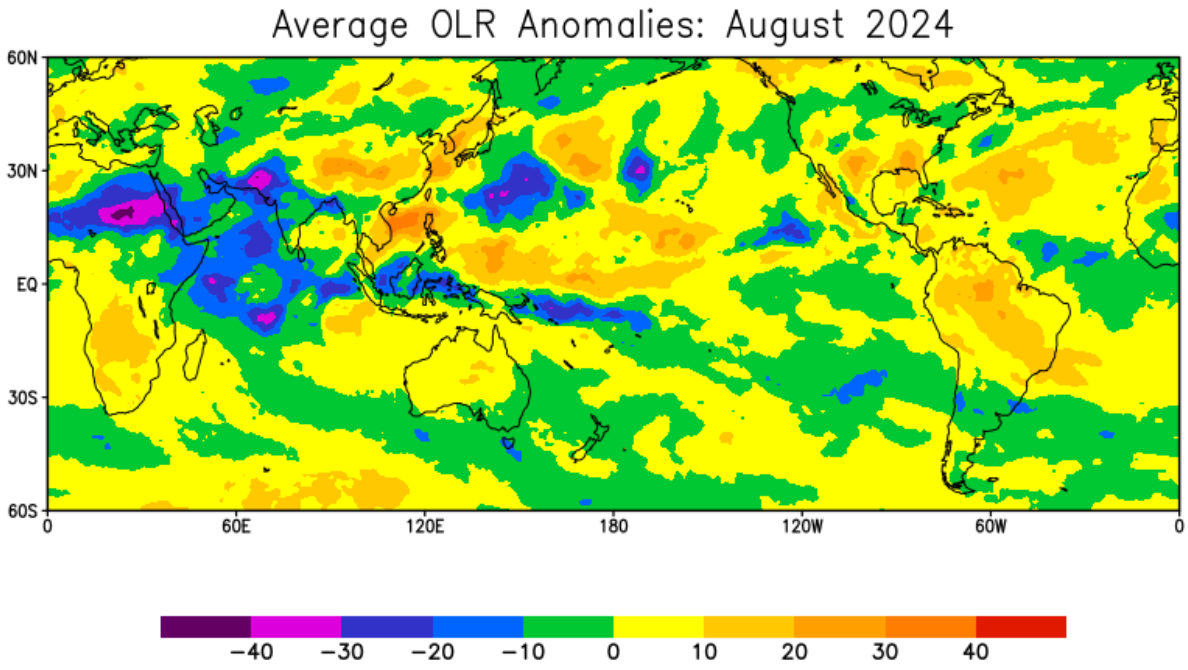

Fig.4: Outgoing Long Wave Radiation (OLR) Anomaly (W/m^2) for August 2024 (Data source: NCEP-NOAA)

1.4 Snow Cover Area over the Northern Hemisphere (NH)

During August 2024, the NH snow cover area (2.61 million Sq. km) was less than the 1991-2020 normal by 0.07 million Sq. km (Fig. 5). Eurasian Snow cover area (0.13 million Sq. km) was 0.15 million Sq. km less than the 1991-2020 normal. North America snow cover area of 2.48 million sq. km was more by 0.07 million Sq. Km with respect to 1991-2020 normal.

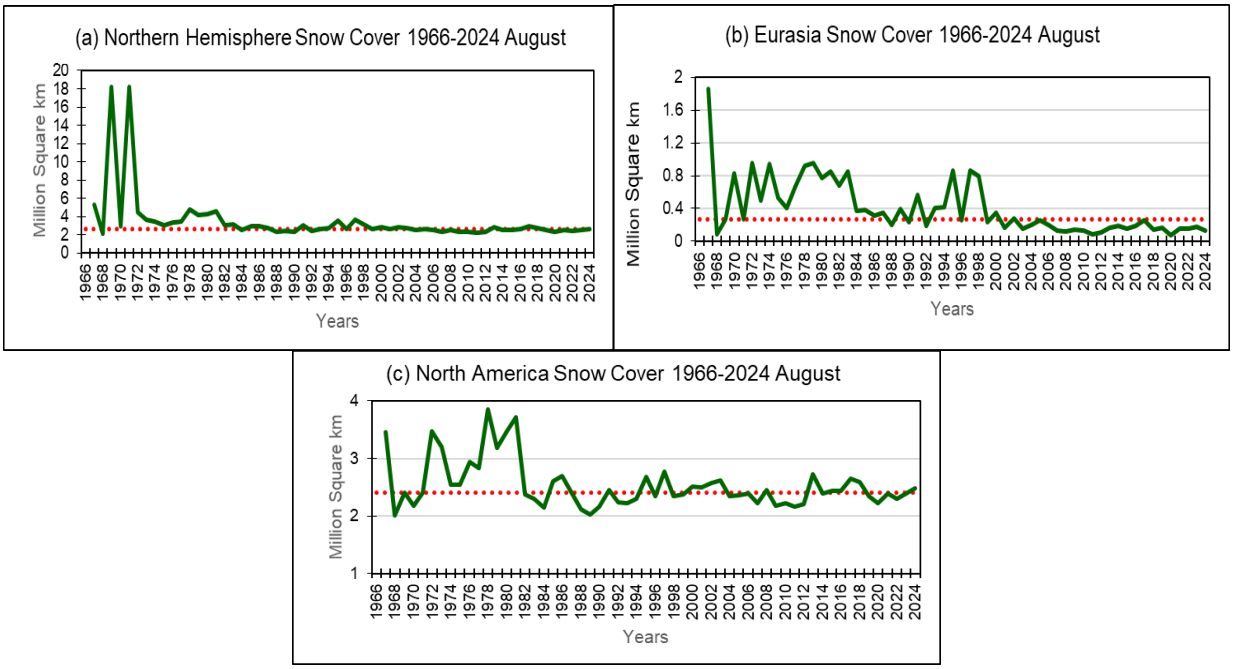

Fig.5. Snow cover area (million Sq. km) for the month of August during the period 1966-2024 (green solid lines) and normal value (1991-2020) (red dotted line) for (a) Northern Hemisphere (b) Eurasia and (c) North America. (Data Source: Rutgers University Snow Lab).

1.5. Madden Julian Oscillation (MJO)

During the first week of August 2024, MJO remained in phase 8 (Western Hemisphere and Africa) with reduced strength. It then moved eastwards to phase 1 (Western Hemisphere and Africa) with enhanced strength in the second week. In the second fortnight it moved to phase 2 and phase 3 (Indian Ocean) with increased strength and finally moved to phase 4 (Maritime Continent) by the end of the month. The MJO phase diagram illustrates the progression of the MJO through different phases, which generally coincide with locations along the equator around the globe.

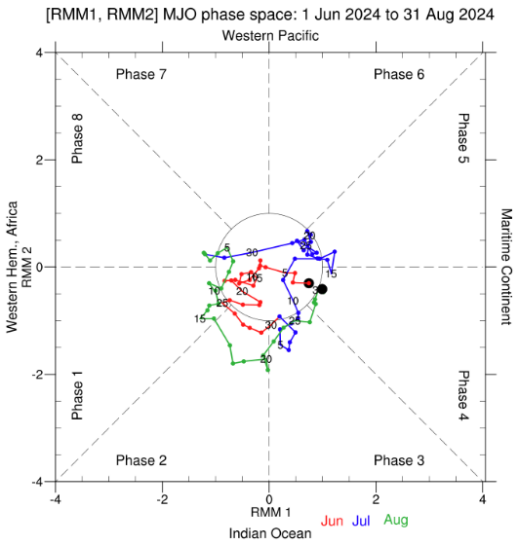

Fig.6. RMM phase diagram for Madden Julian Oscillation (MJO) for the period June to August 2024. (Data Source: http://www.bom.gov.au/climate/mjo/).

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 September to November 2024 (SON) and October to December 2024 (OND) are given in the Figures 7a and 7b respectively. The forecast is prepared based on the August initial conditions. The probability forecast for precipitation for SON and OND seasons indicate that enhanced probability of above normal precipitation is likely in most parts of South Asia except over northwest and extreme north and south where enhanced probability of below normal rainfall is likely to occur.

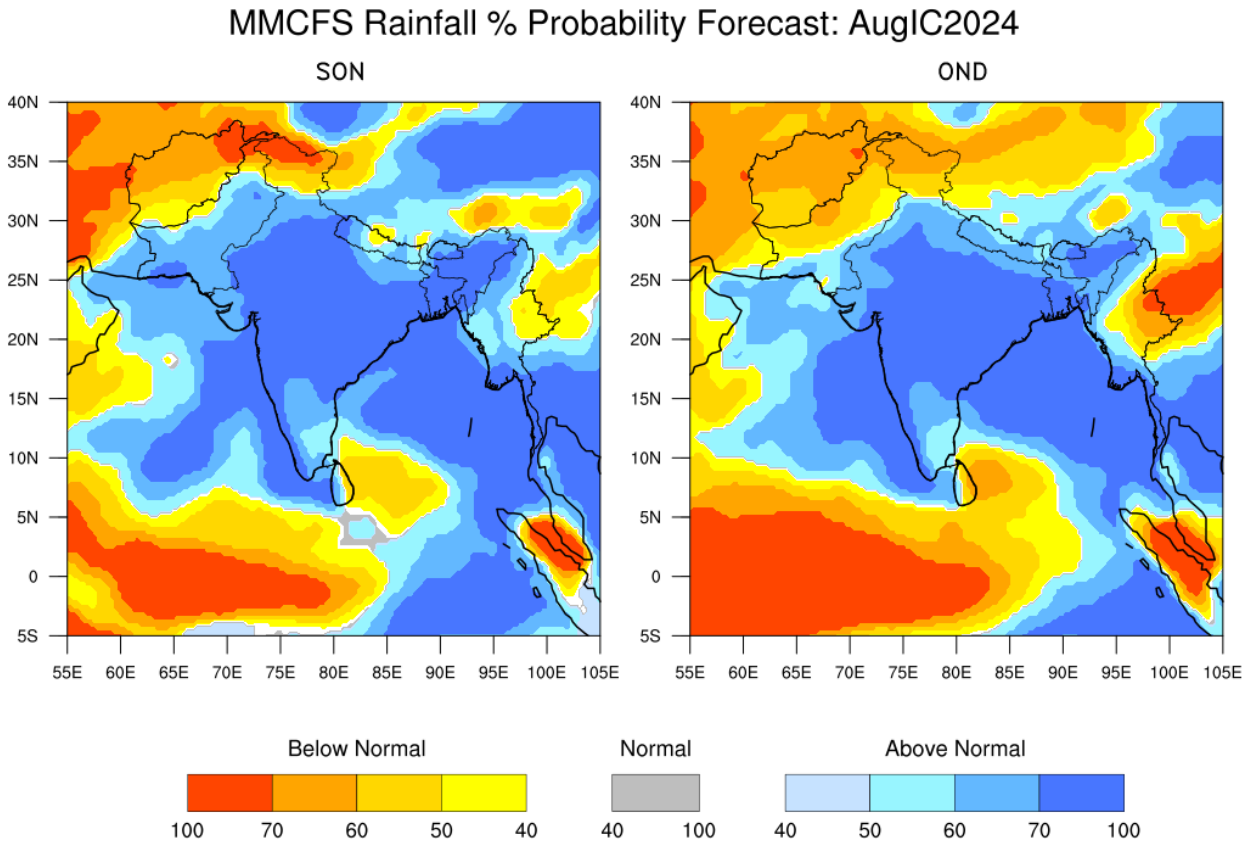

Fig.7: Seasonal probability (%) forecasts of precipitation for (a) SON 2024 (left) and (b) OND 2024 (right) based on initial conditions of August 2024.The white colour indicates climatological probability.

2.2. Temperature Probability Forecast*:*

The probability forecasts for temperature for the season September to November 2024 (SON) and October to December 2024 (OND) are given in the Figures 8a and 8b respectively. The forecast is prepared based on the August initial conditions. Temperature probability forecast for SON and OND seasons indicate that enhanced probability of above normal temperatures is likely over most parts of South Asia except some of the central parts where normal to below normal temperatures are likely.

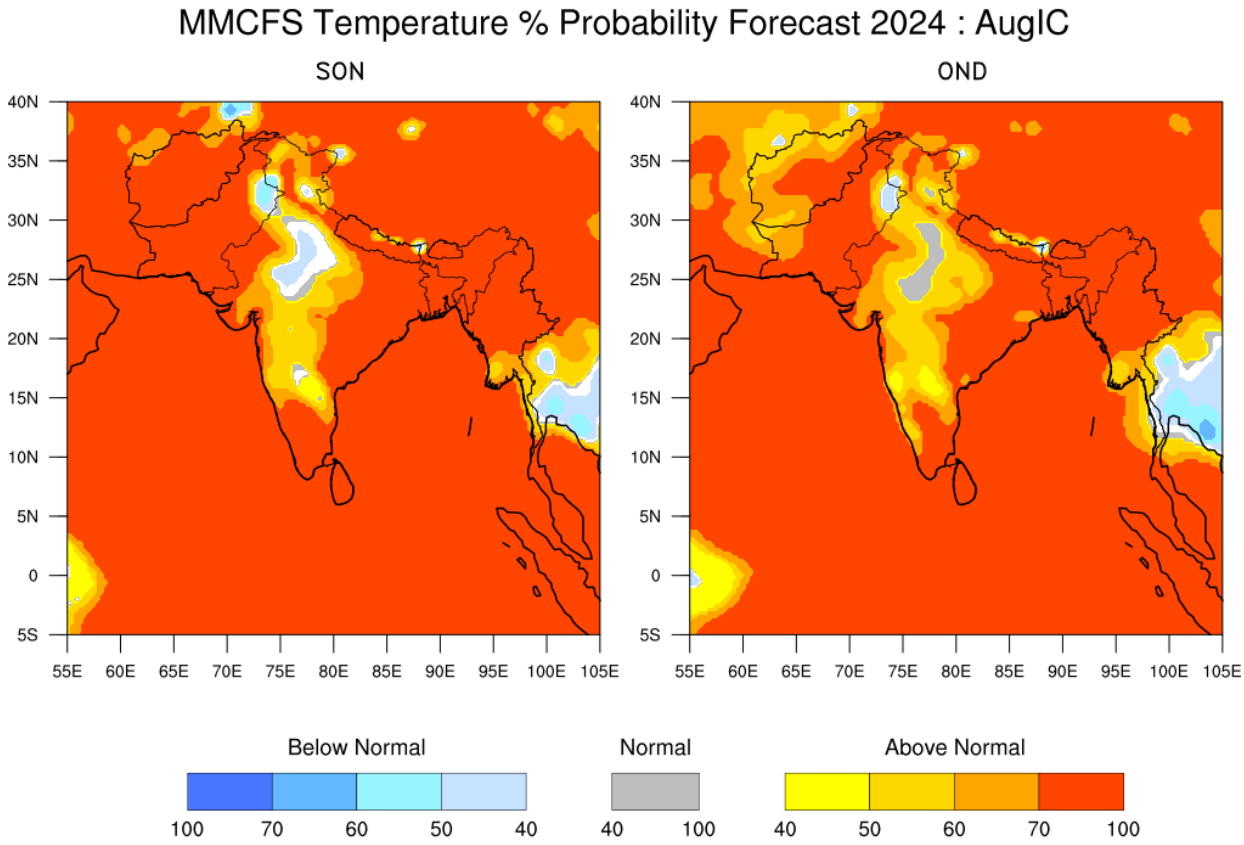

Fig. 8: Probability (%) forecast for the seasonal mean temperature for (a) SON 2024 (left) and (b) OND 2024 (right) based on initial conditions of August 2024. The white colour indicates climatological probability.

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 September to December 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 September, the country averaged monthly precipitation is likely to be normal to above normal for all the South Asian countries. In October, the country averaged monthly precipitation is likely to be normal to above normal for all the South Asian countries except Afghanistan, Maldives, Pakistan and Sri Lanka where it is likely to be below normal. In November, it is likely to be normal to above normal in all the south Asian countries except Afghanistan, Myanmar and Pakistan where it is likely to be below normal. In December, 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 September, October, November and December are likely to be normal to above normal for all South Asian countries.

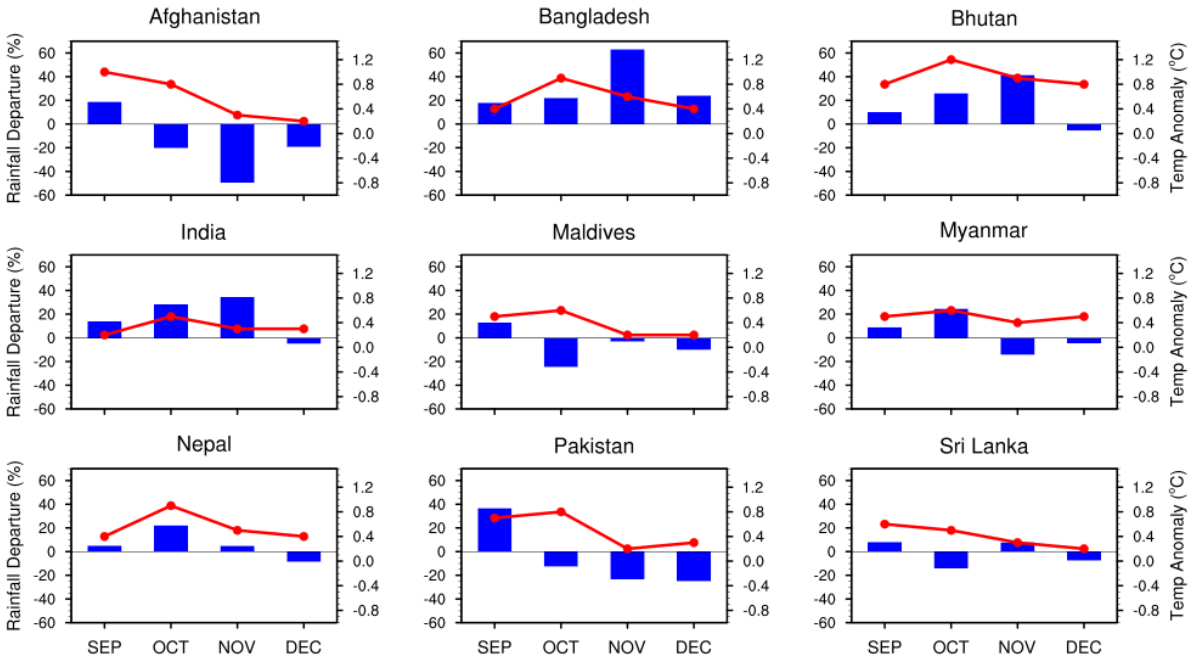

Fig. 9: Monthly country averaged rainfall forecast expressed as percentage departures (%) and Monthly country averaged temperature anomaly (°C) forecast during September to December 2024. Here, the normal range for country averaged monthly precipitation is taken as -10% to +10% (Left Vertical Axis Scale for Precipitation indicated in blue shaded bars) and the normal range for country averaged monthly temperature is taken -0.25ºC to +0.25ºC (Right Vertical Axis Scale for Temperature indicated in red coloured lines).