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**SEASONAL CLIMATE OUTLOOK FOR SOUTH ASIA**

**(May to August 2022)**

- Currently, La Niña conditions are prevailing over the equatorial Pacific region. The latest MMCFS forecast indicates that the La Niña conditions are likely to continue throughout the forecast period. Other climate models are also indicating enhanced probability for La Niña conditions during the upcoming season.
- The probability forecast for precipitation for May to July (MJJ) and June to August (JJA) indicates that enhanced probability for above normal precipitation is likely over most parts of the South Asia except over extreme northwest parts where enhanced probability for below normal precipitation is likely.
- In general, the country averaged monthly precipitation is likely to be normal to above normal for all the months viz. May to August 2022 for all the countries except Afghanistan and Pakistan. Afghanistan is likely to have below normal precipitation in the first two months and above normal in the latter two months. Pakistan is likely to have below normal precipitation in May and above normal precipitation in June, July and August.
- Temperature probability forecast for MJJ and JJA season indicates that enhanced probability for below normal temperatures are likely over most parts of South Asia except over northwest and north eastern peninsular region where enhanced probability for above normal temperatures are likely.
- In general, the country averaged monthly temperatures during May to August are likely to be normal to above normal for Afghanistan, Bhutan, Pakistan and Maldives. It is likely to be normal to below normal for all the months for Bangladesh, Nepal, Myanmar and Sri Lanka. India is likely to experience normal to above normal in May and August and below normal in June and July.

**DISCLAIMER:**

- (1) The long-range forecasts presented here are currently experimental and are produced using techniques that have not been validated.
- (2) The content is only for general information and its use is not intended to address particular requirements.
- (3) The geographical boundaries shown in this report do not necessarily correspond to the political boundaries.

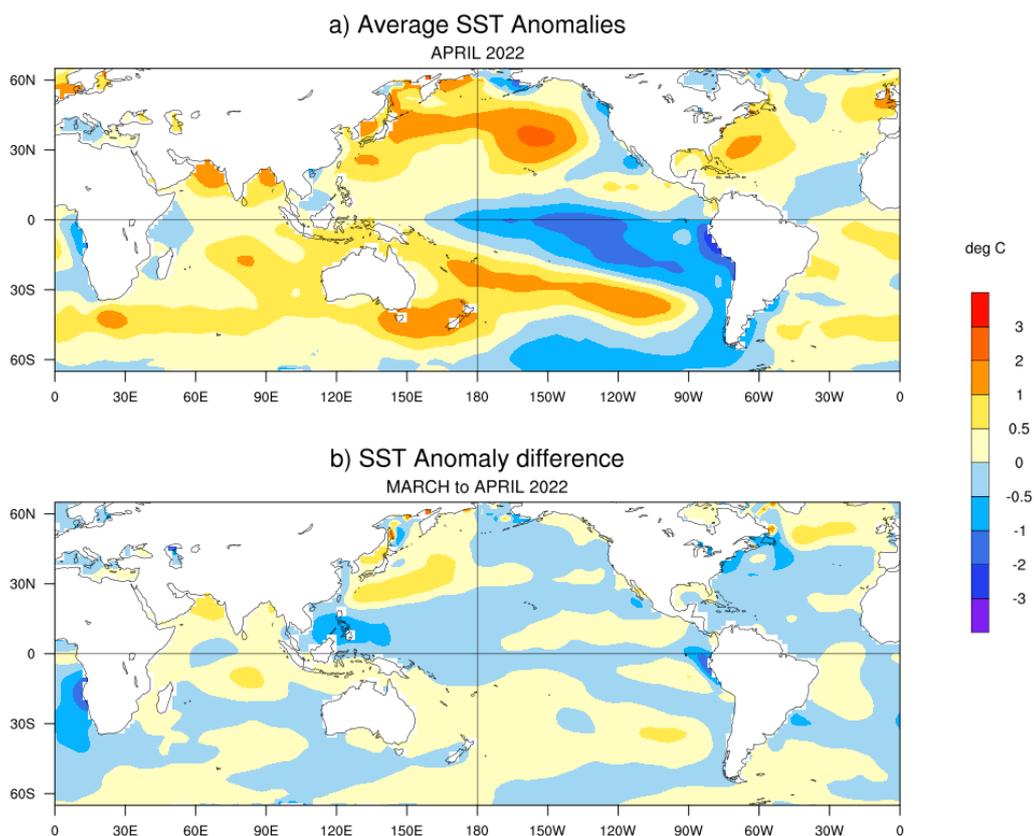
# 1. Important Global Climate Factors

## 1.1 Sea Surface Temperatures over the Pacific Ocean

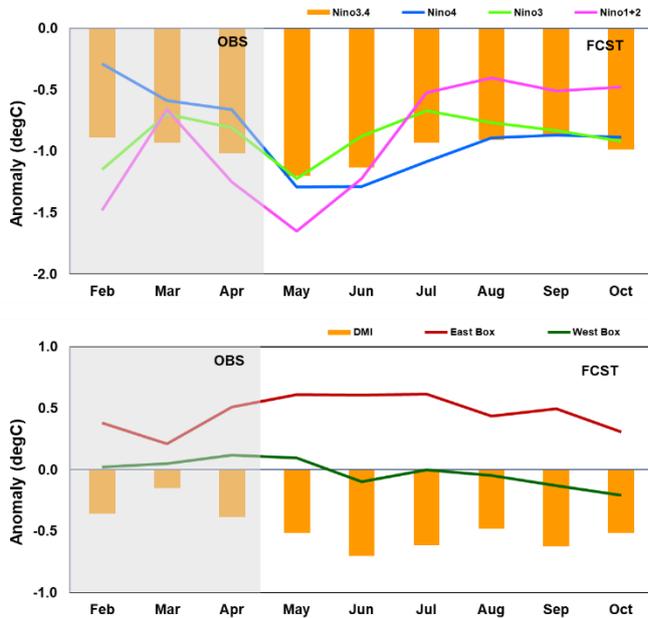
During April 2022, cooler than normal SSTs were observed across the central, eastern, and south eastern tropical Pacific Ocean, and warmer than normal SSTs were observed over west tropical Pacific Ocean (Fig.1a). Warmer than normal SSTs were also observed over the extra-tropical regions of the north and the south Pacific Ocean. As compared to the last month, cooling of SST anomalies were observed over the equatorial western Pacific Ocean (Fig.1b) and warming of SST anomalies were observed over north-western subtropical Pacific Ocean. Currently, La Niña conditions are prevailing over the equatorial Pacific region. The latest MMCFS forecast indicates that the La Niña conditions are likely to continue throughout the forecast period. Other climate models are also indicating enhanced probability for La Niña conditions during the upcoming season (Fig.2).

## 1.2 Sea Surface Temperatures over Indian Ocean

In the north Indian Ocean, warm SST anomalies were observed over the most parts of the Arabian Sea and Bay of Bengal. Also, there were maximum positive SST anomalies observed over south central Indian Ocean (Fig. 1a). As compared to the last month, warming of SST anomalies were observed over the north Indian Ocean except a small region over central equatorial region. (Fig. 1b). At present neutral IOD conditions are present over the Indian Ocean and the latest MMCFS forecast indicates that the negative IOD conditions are likely to develop during the upcoming season (Fig. 3).



**Fig.1: (a)** Sea surface temperature (SST) anomalies ( $^{\circ}\text{C}$ ) during April 2022 and **(b)** changes in the SST anomalies ( $^{\circ}\text{C}$ ) from March 2022 to April 2022. SSTs were based on the ERSSTv5, NOAA, and anomalies were computed with respect to 30-year (1981-2010) long term mean.



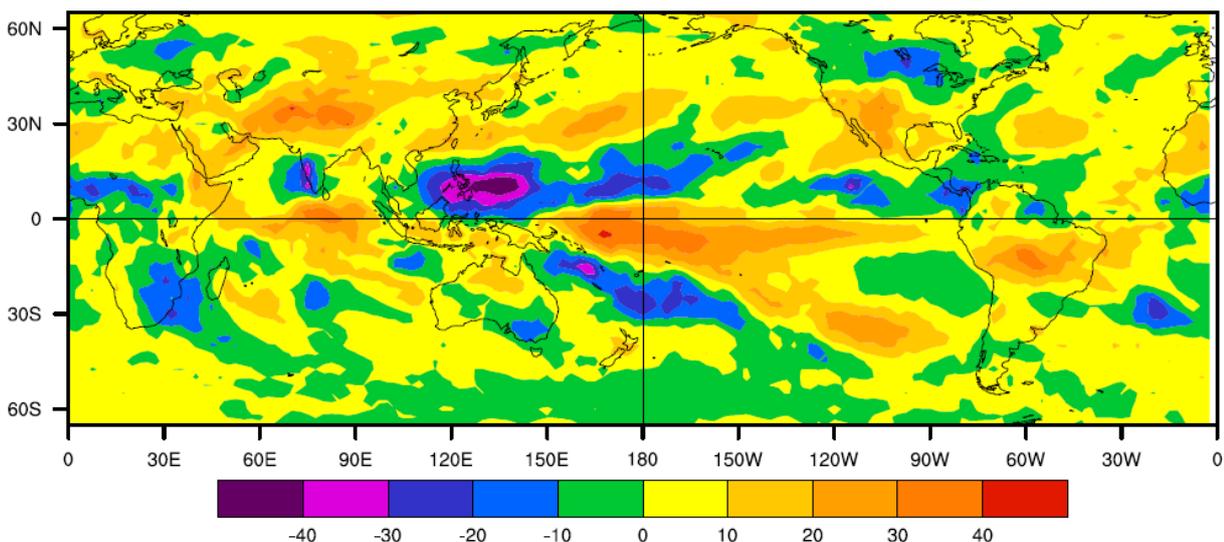
**Fig.2:** Time series of monthly area-averaged SST anomalies (°C) in the 4 Niño regions. ERSSTv5 observed anomaly for the last 3 months and MMCFS model PDF corrected anomaly forecast for the next 6 months.

**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 Long Wave Radiation (OLR) anomaly of April 2022 is shown in (Fig.4). Negative OLR anomalies (enhanced convection, blue shading) were observed over some parts of east central Arabian Sea, adjoining western peninsula, parts of central and southern Africa. Negative OLR anomalies were also present over most parts of western and central tropical Pacific Ocean, parts of Maritime Continent. Positive OLR anomalies (suppressed convection, orange/red shading) were observed over most parts of equatorial Indian Ocean, north Indian region, some parts of Maritime Continent, north Australia and north and south America. Positive OLR anomalies were present along the equatorial Pacific Ocean and south eastern tropical Pacific region.

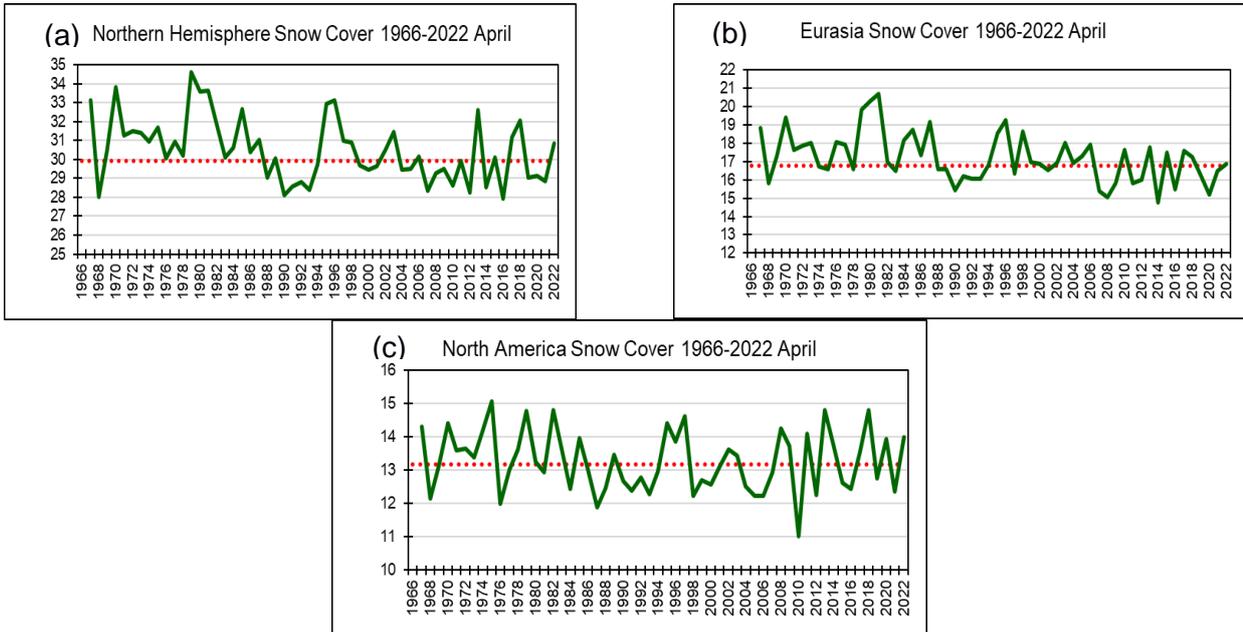
### Average OLR Anomalies April 2022



**Fig.4:** Outgoing Long Wave Radiation (OLR) Anomaly (W/m<sup>2</sup>) for April 2022 (Data source: NCEP-NOAA)

### 1.4 Snow Cover Area over the Northern Hemisphere (NH):

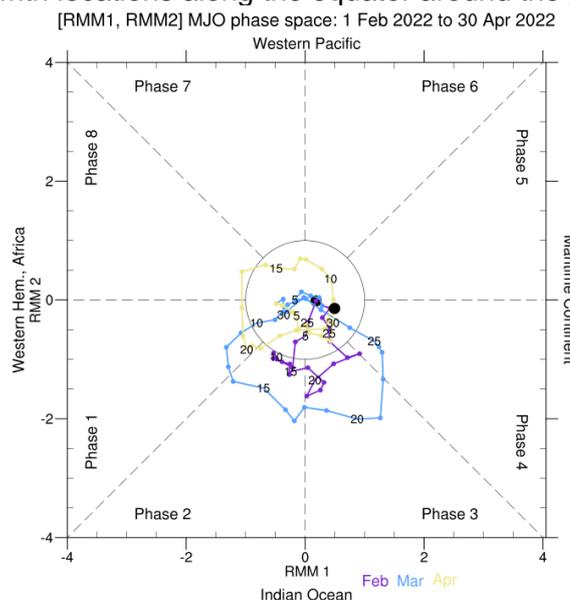
The April 2022, NH snow cover area (30.85 million Sq. km) was more than the 1991-2020 normal by 0.92 million Sq. km (Fig. 5). Eurasian Snow cover area (16.86 million Sq. km) was 0.10 million Sq. km more than the 1991-2020 normal and was having more area under snow in April 2022 compared to April 2021. North America snow cover area of 13.99 million sq. Km was more by 0.822 million Sq. Km with respect to 1991-2020 normal.



**Fig.5.** Snow cover area (million Sq. km) for the month of April during the period 1966-2022 (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 two weeks of April 2022, MJO remained within the circle with very weak intensity. In the third week it propagated in West Hemisphere and Africa (phase 1 and 8) with slightly more amplitude and gradually weakened again and move into the circle in the fourth week again. The MJO phase diagram illustrates the progression of the MJO through different phases, which generally coincide with locations along the equator around the globe.



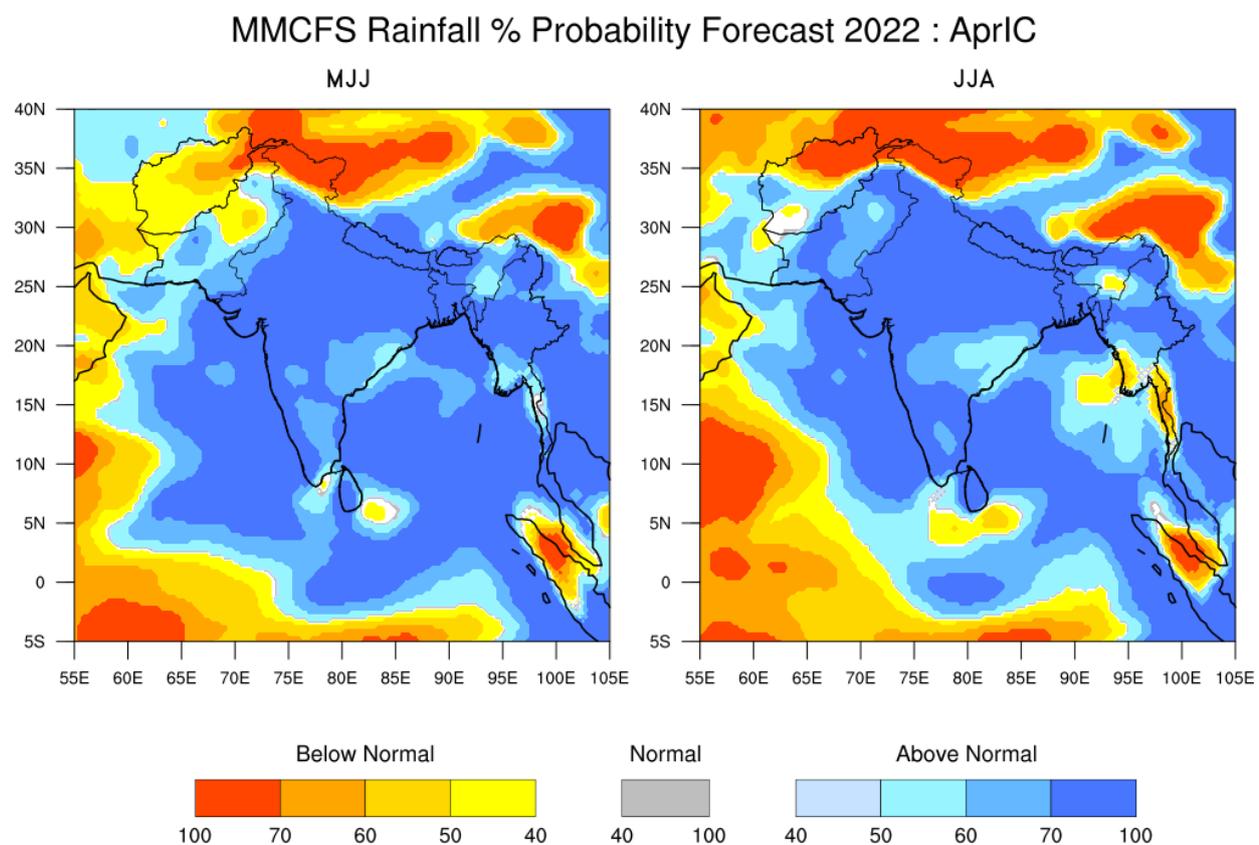
**Fig.6.** RMM phase diagram for Madden Julian Oscillation (MJO) for the period February to April 2022. (Data Source: <http://www.bom.gov.au/climate/mjo/>).

## 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 May to July 2022 (MJJ) and June to August 2022 (JJA) are given in the Figures 7a and 7b respectively. The forecast is prepared based on the April initial conditions. The probability forecast for precipitation for MJJ (Fig.7a) and JJA (Fig.7b) indicates that enhanced probability for above normal precipitation is likely over most parts of the South Asia except over extreme northwest parts where enhanced probability for below normal precipitation is likely. (white colour indicates climatological probability).

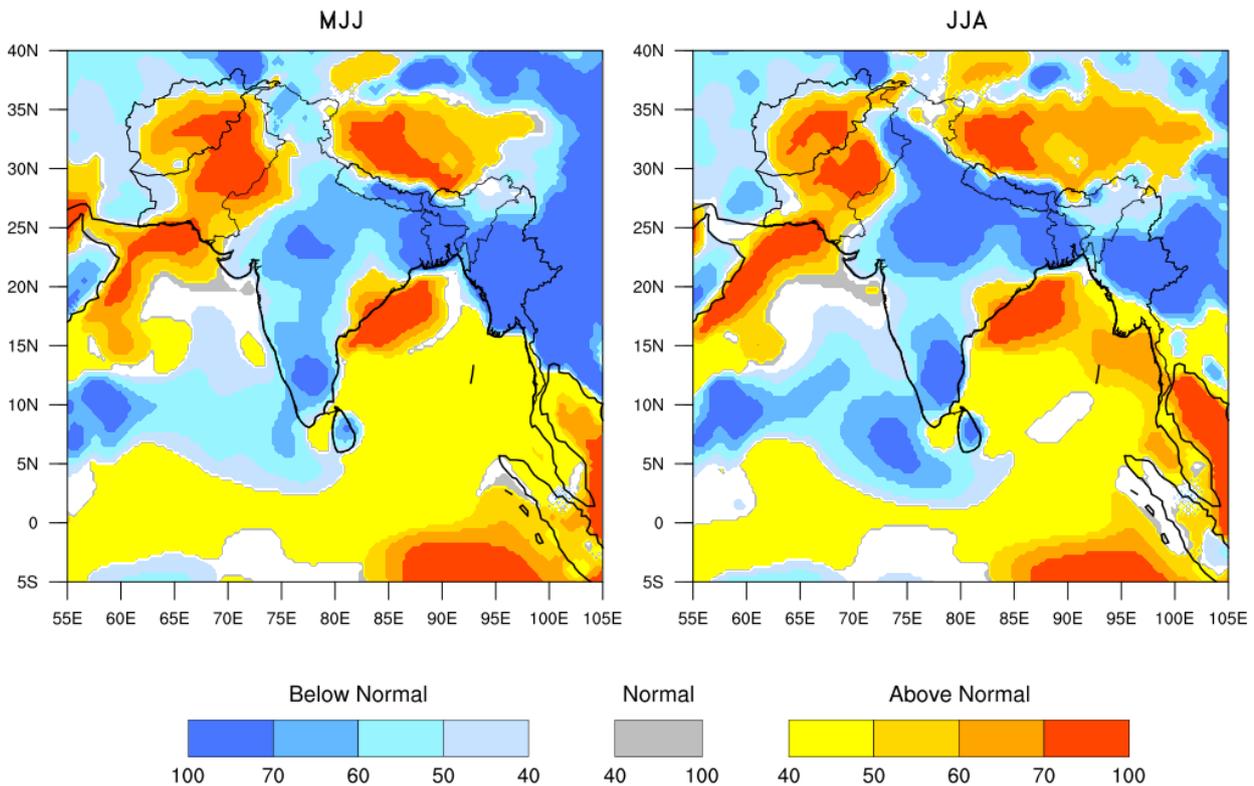


**Fig.7:** Seasonal probability (%) forecasts of precipitation for (a) MJJ 2022 (left) and (b) JJA 2022 (right) based on initial conditions of April 2022.

## 2.2. Temperature Probability Forecast:

The probability forecasts for temperature for the season May to July 2022 (MJJ) and June to August 2022 (JJA) are given in the Figures 8a and 8b respectively. The forecast is prepared based on the April initial conditions. Temperature probability forecast for MJJ and JJA season indicates that enhanced probability for below normal temperatures are likely over most parts of South Asia except over northwest and north eastern peninsular region where enhanced probability for above normal temperatures are likely. (white colour indicates climatological probability).

## MMCFS Temperature % Probability Forecast 2022 : AprilC



**Fig. 8:** Probability (%) forecast for the seasonal mean temperature for (a) MJJ 2022 (left) and (b) JJA 2022 (right) based on initial conditions of April 2022.

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

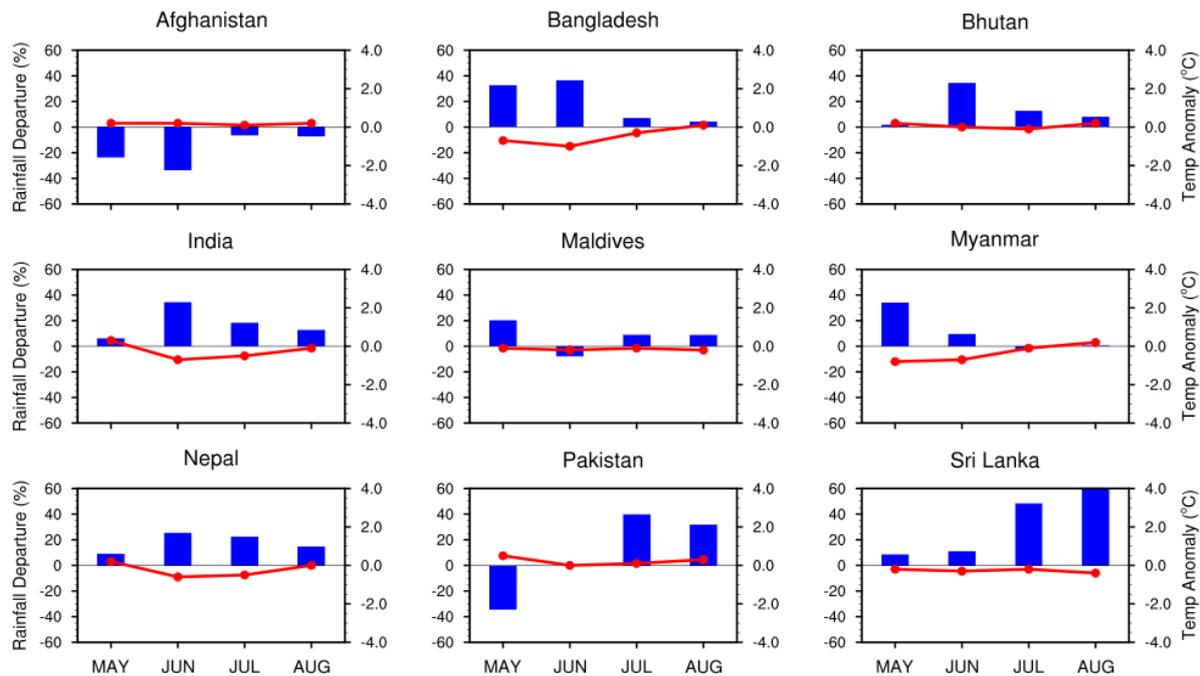
The MMCFS model forecast for monthly precipitation and temperature for the next four months (from May to August 2022) averaged over the 9 south Asian countries viz., Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan and Sri Lanka is shown in the Figures 9. The monthly rainfall anomaly is expressed as percentage departure from Long Period Model Average (LPMA) and monthly temperature anomaly is expressed in degree Celsius.

In May, the country averaged monthly precipitation is likely to be normal to above normal for all countries except Afghanistan and Pakistan (Fig.9). In June, the country averaged monthly precipitation is likely to be normal to above normal for all the countries except Afghanistan. In July and August, the country averaged monthly precipitation is likely to be normal to above normal for all the countries.

In general, the country averaged monthly precipitation is likely to be normal to above normal for all the months viz. May to August 2022 for all the countries except Afghanistan and Pakistan. Afghanistan is likely to have below normal precipitation in the first two months and above normal in the latter two months. Pakistan is likely to have below normal precipitation in May and above normal precipitation in June, July and August.

During May, the country averaged monthly temperatures are normal to above normal for all the countries except Bangladesh and Myanmar where it is likely to be below normal. During June, it is likely to be normal to above normal for Afghanistan, Bhutan, Pakistan and Maldives and below normal for rest of the countries. In July, it is likely to be normal to above normal for all the countries except Bangladesh, India and Nepal. In August, all the countries except Sri Lanka are likely to experience normal to above normal temperatures.

In general, the country averaged monthly temperatures during May to August are likely to be normal to above normal for Afghanistan, Bhutan, Pakistan and Maldives. It is likely to be normal to below normal for all the months for Bangladesh, Nepal, Myanmar and Sri Lanka. India is likely to experience normal to above normal in May and August and below normal in June and July.



**Fig. 9:** Monthly country averaged rainfall forecast expressed as percentage departures (%) and Monthly country averaged temperature anomaly (°C) forecast during May to August 2022. 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).