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Government of India
पृथ्वी विज्ञान मंत्रालय(एम. ओ. ई. एस.)
Ministry of Earth Sciences (MoES)
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT
Updated Long Range Forecast Outlook for the 2023 Southwest Monsoon Season (June - September) Rainfall and Monthly Rainfall and Temperature for June 2023

Highlights

a) Southwest monsoon seasonal (June to September) rainfall over the country as a whole is most likely to be **normal (96 to 104% of Long Period Average (LPA))**. The LPA of the seasonal rainfall over the country as a whole for the period **1971-2020 is 87 cm**.

b) Quantitatively, the southwest monsoon seasonal (June to September) rainfall over the country as a whole is likely to be **96% of the LPA with a model error of ± 4%.**

c) Region wise, the southwest monsoon seasonal rainfall is most likely to be below normal over Northwest India (<92% of LPA) and normal over other three broad homogeneous regions; central India (94-106% of LPA), North East India (94-106% of LPA) and South Peninsular India (94-106% of LPA).

d) The southwest monsoon seasonal rainfall over the monsoon core zone consisting of most of the rainfed agriculture areas in the country is most likely to be Normal (94-106% of LPA).

e) In respect of spatial distribution of the monsoon seasonalrainfall, normal to above normal rainfall is likely over the most areas of south peninsular India, some areas of east central India and many areas of northeast and extreme north India. However, normal to below normal rainfall is likely over many areas of northwest India and adjoining west central India, northern parts of the peninsular India and along the foothills of Himalayas.

f) In June, below normal monthly rainfall is expected over most parts of the country except some areas of south peninsular India, northwest India, extreme north India and some isolated pockets of northeast India, where above normal rainfall is expected.

g) In June, above-normal monthly maximum temperatures are likely over most parts of the country, except for the extreme north and some parts of the southern peninsular India, where below-normal and normal temperatures respectively are likely.

h) During June, normal to above-normal minimum temperatures are likely across most parts of the country, except for the extreme north of India and a few areas of northeast India, where below-normal minimum temperatures are likely.

i) The latest global model forecasts indicate high probabilities for the development of El Niño conditions over the equatorial Pacific Ocean and positive IOD conditions over the Indian Ocean during the upcoming monsoon season.

As sea surface temperature (SST) conditions over the Pacific and the Indian Oceans are known to have strong influence on Indian monsoon, India Meteorological Department (IMD) is carefully monitoring the evolution of sea surface conditions over these Ocean basins.IMD will issue the forecast for the July rainfall in the last week of June.

1.   Background

Since 2021, the India Meteorological Department (IMD) has implemented a new strategy for issuing operational long range forecasts on a monthly and seasonal scalesfor rainfall and temperatures across the country. For this, a newly developed Multi-Model Ensemble (MME) forecasting system is used. The MME system utilizes simulations from the coupled global climate models (CGCMs) sourced from various global climate prediction and research centers, including IMD's Monsoon Mission Coupled Forecasting System (MMCFS) model.

On 11 April, 2023, the IMD had issued the first-stage forecasts for the 2023 southwest monsoon seasonal (June to September) rainfall, consisting of quantitative and probabilistic forecasts for the country as a whole, and the spatial distribution of probabilistic forecasts for the tercile categories (above normal, normal, and below normal) ofthe seasonal (June-September) rainfall over the country.

Now, as a part of the second stage forecasts, the IMD has prepared the following forecasts:

i.   Updated quantitative and probabilistic forecasts for the monsoon seasonal rainfall over the country as a whole and spatial distribution of the probabilistic forecasts for the seasonal rainfall over the country.

ii.   Probabilistic forecasts for the seasonal rainfall over the four broad homogenous regions of India (northwest India, central India, south Peninsula, and northeast India)and the monsoon core zone (MCZ) consisting of most of the rainfed agriculture areas of the country.

iii.   Probabilistic forecast for the June rainfall over the country as a whole and spatial distribution of the probabilistic forecasts for the June rainfall over the country.

iv.   Spatial distribution of the probabilistic forecasts for the June Temperatures (Maximum and Minimum) for June over the country.

The updated MME forecast for the 2023 southwest monsoon season rainfall has been calculated by incorporating forecasts from different coupled global climate models based on the May initial conditions. The MME forecast specifically utilizes best few climate models that have the highest forecast skills over the Indian monsoon region, including IMD's MMCFS model to prepare an improved and reliable forecast.

2.   Sea Surface Temperature (SST) Conditions in the equatorial Pacific & Indian Oceans

Currently, ENSO-neutral conditions are observed across the equatorial Pacific with near to above average sea surface temperatures (SSTs) over most of the central and the east equatorial Pacifc. The latest forecast from MMCFS and other global models indicates high probabilities for the development El Niño conditions during the upcoming monsoon season.

Currently, neutral Indian Ocean Dipole (IOD) conditions are prevailing over the Indian Ocean and the latest forecast from MMCFS and other global climate models indicates the development of positive IOD conditions over the Indian oceanduring the monsoon season.

3.   Second Stage Forecasts for the 2023 Southwest Monsoon Rainfall

3a.   Updated Forecastfor the 2023 Southwest Monsoon Rainfall over the Country as a whole

The forecast suggests that quantitatively, the monsoon seasonal rainfall is likely to be **96% of the Long Period Average (LPA) with a model error of ± 4%.** The LPA of the season rainfall over the country as a whole for the period **1971-2020 is 87 cm**.

The 5 category probability forecasts for the Seasonal (June to September) rainfall over the country as a whole are given below, which suggests monsoon seasonal rainfall is most likely to be normal (96 to 104% of LPA).

Category	Rainfall Range (% of LPA)	Forecast Probability (%)	Climatological Probability (%)
Deficient	< 90	**20**	16
Below Normal	> 90 - 95	**25**	17
Normal	96 -104	**43**	33
Above Normal	> 105 -110	**11**	16
Excess	> 110	**1**	17

3.b. Updated Forecast for the Spatial Distribution of the 2023 Southwest Monsoon Season Rainfall over the Country

The spatial distribution of probabilistic forecasts for tercile categories (above normal, normal, and below normal) for seasonal (June to September) rainfall is depicted in the Figure 1. Normal to below Normal rainfall is likely over many areas of northwest India and adjoining west central India, northern parts of the peninsular India and along the foothills of Himalayas. Normal to above normal rainfall is likely over the most areas of south peninsular India, some areas of east central India and many areas of northeast and extreme north India. The white shaded areas within the land area represent climatological probabilities.

3c. Forecast for the 2023 Southwest Monsoon Rainfall over the four Homogenous regions of the country and Monsoon Core Zone (MCZ)

The tercile category forecasts for the four broad homogenous regions and MCZ for the 2023 southwest monsoon seasonal (June-September) rainfall are given in the tables below. Tercile categories have equal climatological probabilities of 33.33% of LPA each.

Rainfall Category	NW India		Central India		South Peninsula	
	Range (% of LPA)	Forecast Probability (%)	Range (% of LPA)	Forecast Probability (%)	Range (% of LPA)	Forecast Probability (%)
Below Normal	<92	**50**	<94	**34**	<94	**28**
Normal	92-108	**30**	94-106	**37**	94-106	**42**
Above Normal	>108	**20**	>106	**29**	>106	**30**

Rainfall Category	Northeast India		Monsoon Core Zone (MCZ)	
	Range (% of LPA)	Forecast Probability (%)	Range (% of LPA)	Forecast Probability (%)
Below Normal	<94	**30**	<94	**34**
Normal	94-106	**38**	94-106	**36**
Above Normal	>106	**32**	>106	**30**

4.   Probabilistic Forecast for the 2023 June Rainfall over the Country

The MME probability forecast indicates that the average June rainfall for the country as a whole is most likely to be **below normal (<92%** of the Long Period Average (LPA)).The LPA of the June rainfall over the country as a whole for the period 1971-2020 is16.54 cm.

The spatial distribution of probabilistic forecasts for tercile categories (above normal, normal, and below normal) for June rainfall is displayed in Figure 2. The distribution suggests that below normal rainfall is most likelyover the most parts of the country except some areas of south peninsular India, northwest India, extreme north India and some isolated pockets of northeast India, where normal to above normal rainfall is most likely. The white shaded areas within the land area represent climatological probabilities.

5.   Probabilistic Forecast for the 2023 June Temperatures over the Country

Figures 3a and 3b display the forecasted probabilities of maximum and minimum temperatures, respectively, during June 2023.

In June 2023, above-normal monthly maximum temperatures are likely over most parts of the country, except for the extreme north and some parts of the southern peninsular India, where below-normal and normal temperatures respectivelyare most likely, (Fig. 3a).

During June 2023, normal to above-normal minimum temperatures are likely across most parts of the country, except for the extreme north of India and a few areas of

northeast India, where below-normal minimum temperatures are most likely(Fig. 3b).

6.   Extended Range Forecast and short to medium range forecasting services

IMD also regularly prepares and provides extended range forecasts (7–day averaged forecasts for the next four weeks) for rainfall, maximum temperatures, and minimum temperatures over the country. These forecasts are updated every week on Thursday. These forecasts are based on the Multi-model Ensemble Dynamical Extended Range Forecasting System, which is currently operational at IMD. The forecasts   are   available   through   the   IMD   website https://mausam.imd.gov.in/imd_latest/contents/extendedrangeforecast.php).

The extended range forecast is complemented by short to medium range forecasts issued daily based on very high resolution Global Ensembe Forecasting System (GEFS).

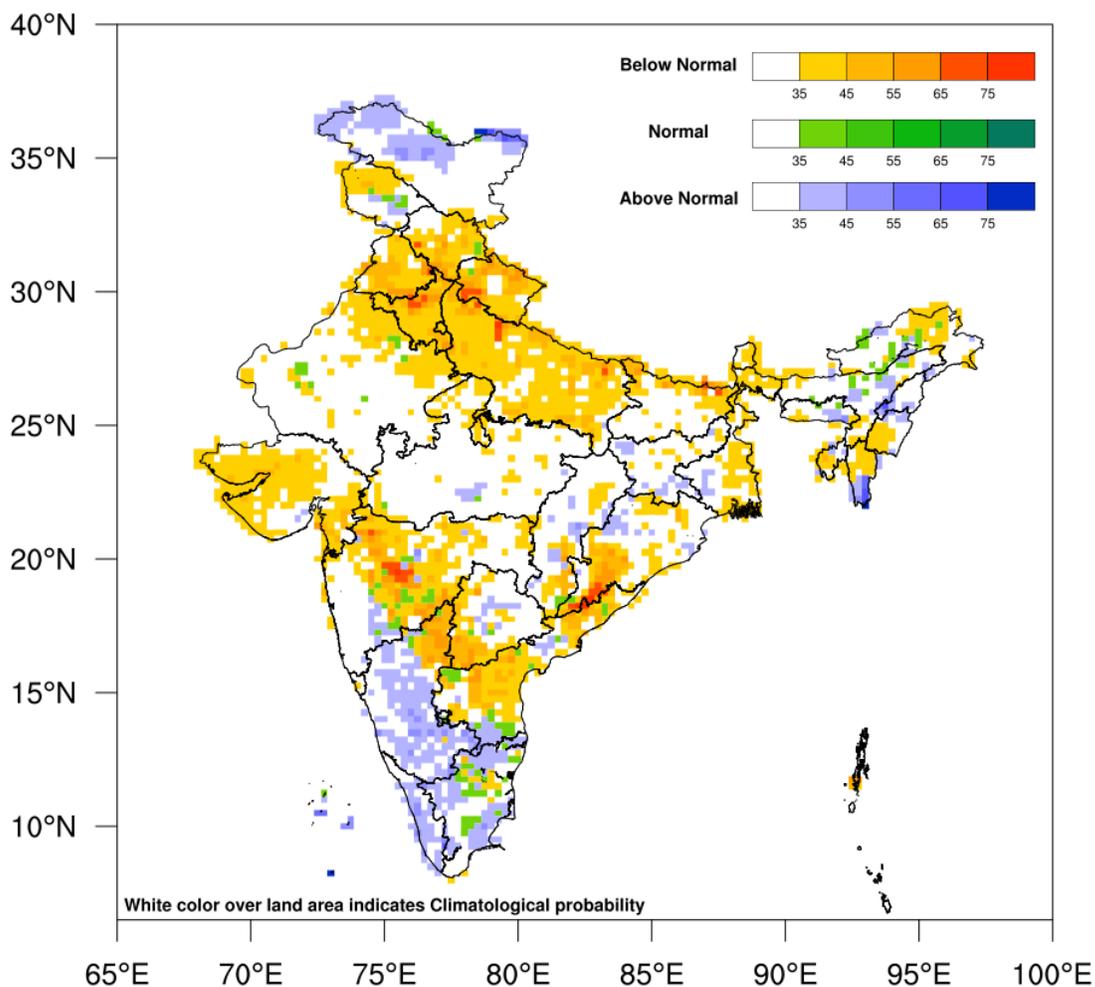Terclie probability rainfall forecast for 2023 southwest monsoon season

Fig.1. Updated Probability forecast of tercile categories* (below normal, normal, and above normal) for the seasonal rainfall over India during the 2023 southwest monsoon season (June -September). The figure illustrates the most likely categories as well as their probabilities. The white shaded areas within the land area represent climatological probabilities.The probabilities were derived using the MME forecast prepared from a group ofcoupled climate models.(*Tercile categories have equal climatological probabilities, of 33.33% each).
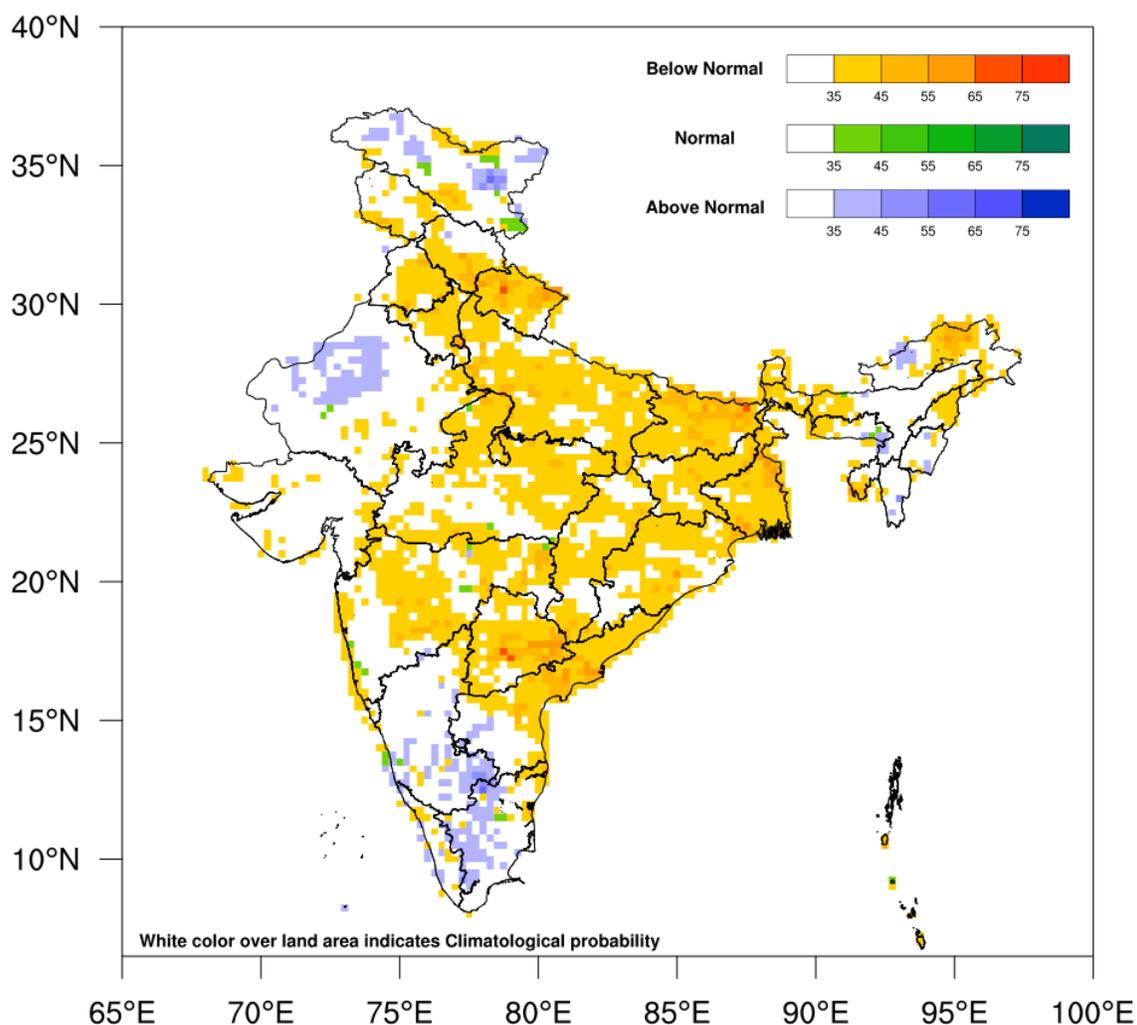
probability rainfall forecast for 2023 JUN

Fig.2. Probability forecast of tercile categories[*] (below normal, normal, and above normal) for the 2023 June rainfall over India. The figure illustrates the most likely categories as well as their probabilities. The white shaded areas within the land area represent climatological probabilities. The probabilities were derived using the MME forecast prepared from a group of coupled climate models.([*]Tercile categories have equal climatological probabilities, of 33.33% each).
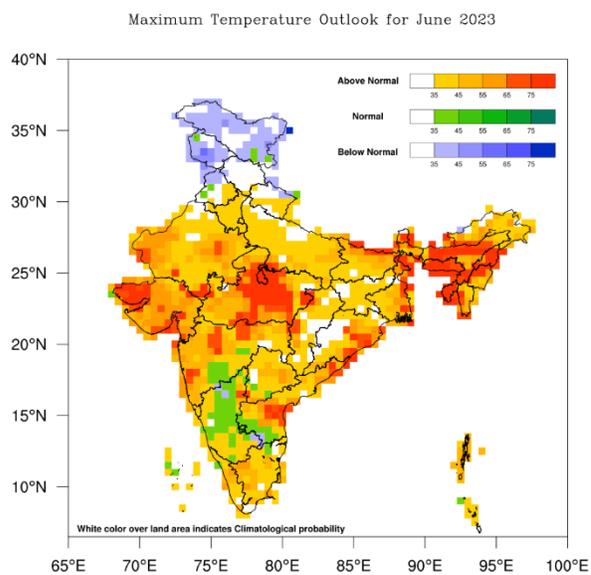
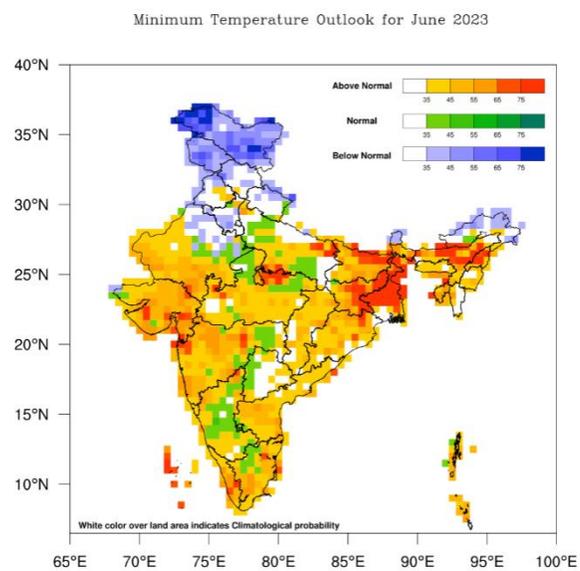**Fig.3a.** Probability forecast of Maximum Temperature for June 2023.

Fig.3b. Probability forecast of Minimum Temperature for June 2023.