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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 of Rainfall during Southwest**  
**Monsoon Season (June - September), 2022 and**  
**Monthly Outlook for Rainfall and Temperature during June 2022**

**Highlights of Updated Long Range Forecast of Rainfall for Monsoon Season, 2022**

- 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))**.
- b) Quantitatively, the monsoon seasonal (June to September) rainfall over the country as a whole is likely to be **103% of the Long Period Average (LPA) with a model error of  $\pm 4\%$** . The LPA of the seasonal rainfall over the country as a whole based on data of **1971-2020 is 87 cm**.
- c) The southwest monsoon seasonal rainfall over the four homogeneous region is most likely to be **Above Normal for Central India (>106% of LPA) and South Peninsula (>106% of LPA). Rainfall is most likely to be Normal over Northeast India (96-106% of LPA) and Northwest India (92-108% of LPA)**.
- d) The southwest monsoon seasonal rainfall over the monsoon core zone, which consists of most of the **rainfed agriculture regions is most likely to be Above Normal (>106% of LPA)**.
- e) Monsoon seasonal rainfall is likely to be well distributed spatially (Fig.1) with most parts of the country expected to receive normal to above normal rainfall except some parts of eastcentral, east & northeast India and extreme southwest peninsular India, where it is likely to be below normal.
- f) Prevailing La Niña conditions are likely to continue over equatorial Pacific Ocean and development of negative IOD conditions over the Indian Ocean during the monsoon season is most likely.

**Highlights of Monthly Outlook for Rainfall and Temperature for the Month of June 2022**

- a) **Rainfall**—Normal or above normal rainfall is most likely over many parts of northwest & central India, northern parts of South Peninsula and some parts of east India. Below normal rainfall is most likely over many parts of northeast India, some pockets of central & east India and southern parts of south peninsular India.
- b) **Temperature** - Below normal maximum temperatures are likely over most parts of the country except some parts of northwest India where above normal maximum temperatures are likely. Below normal minimum temperatures are likely over most parts of the country except many parts of northwest and northeast India where above normal minimum temperatures are likely.

IMD will issue the **forecast for the July rainfall in the last week of June 2022**.

## 1. Background

IMD has implemented a new strategy for issuing monthly and seasonal operational forecasts for the rainfall and temperatures over the country by modifying the existing two-stage forecasting strategy since 2021. The new strategy uses the existing statistical forecasting system along with a newly developed Multi-Model Ensemble (MME) forecasting system based on coupled global climate models (CGCMs) from different global climate prediction and research centers including IMD's Monsoon Mission Climate Forecasting System (MMCFs) model. The monthly probabilistic forecast for each of the months will also be issued at the end of the previous month based on the MME approach.

Accordingly, on 14<sup>th</sup> April 2022, IMD issued the first stage forecast for the 2022 southwest monsoon seasonal (June to September) rainfall over the country as a whole using the existing statistical forecasting system and the newly developed MME based forecasting system. The spatial distribution of probabilistic forecasts for tercile categories (above normal, normal, and below normal) for the seasonal rainfall (June to September) over the country was also issued. IMD had released the monthly temperature and rainfall outlook for May 2022 on 30<sup>th</sup> April 2022. Now, IMD has prepared the following forecasts as a part of the second stage forecasts:

1. 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.
2. Probabilistic forecasts for the seasonal rainfall over the four homogenous regions of India (northwest India, central India, south Peninsula, and northeast India) and the monsoon core zone (MCZ).
3. 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.
4. Spatial distribution of the probabilistic forecasts for the June Temperatures (Maximum and Minimum) over the country.

The updated MME forecast for 2022 southwest monsoon season rainfall has been computed using various coupled global model forecasts with May initial conditions. Climate models with the highest forecast skills over the Indian monsoon region including MMCFs have been used to prepare the MME forecast.

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

The ongoing La Niña conditions from the previous year 2021 were slightly weakened in January and subsequently in February 2022, but again started strengthening from March 2022 onwards. Currently, moderate La Niña conditions are prevailing over the Pacific. The latest global models forecast indicates that the La Niña conditions are likely to continue during the upcoming monsoon season.

At present, neutral Indian Ocean Dipole (IOD) conditions are prevailing over the Indian Ocean. The latest forecast from the MMCFS and other global models together indicates the possibility of the development of negative IOD conditions during the monsoon season.

### 3. Second Stage Forecasts for the 2022 Southwest Monsoon Rainfall

#### 3a. Updated Forecast of Southwest Monsoon Seasonal Rainfall over the Country as a Whole during 2022

Quantitatively, the monsoon seasonal rainfall is likely to be **103% of the Long Period Average (LPA) with a model error of  $\pm 4\%$** . The LPA of the season rainfall over the country as a whole based on data of **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. There is maximum probability for monsoon seasonal rainfall to be normal (96 to 104% of LPA).**

Category	Rainfall Range (% of LPA)	Forecast Probability (%)	Climatological Probability (%)
Deficient	< 90	5	16
Below Normal	$\geq 90$ and < 96	14	17
Normal	96 -104	36	33
Above Normal	> 104 -110	26	16
Excess	> 110	19	17

### 3.b. Updated Forecast of Spatial Distribution of Southwest Monsoon Seasonal Rainfall over the Country during 2022

The spatial distribution of probabilistic forecasts for tercile categories (above normal, normal, and below normal) for the seasonal rainfall (June to September) is shown in Fig.1. Monsoon seasonal rainfall is likely to be well distributed spatially with most parts of the country expected to receive normal to above normal rainfall except some parts of eastcentral, east, northeast and extreme southwest peninsular India, where it is likely to be below normal. The white shaded areas within the land area represent climatological probabilities.

### 3c. Forecast of Rainfall over the four Homogenous regions of the country and Monsoon Core Zone (MCZ) during monsoon season, 2022

The tercile category forecasts for the four homogenous regions and MCZ for the 2022 southwest monsoon seasonal (June-September) rainfall are given in the table below. Tercile categories have equal climatological probabilities of 33.33% of LPA each.

Rainfall Category	Northwest India		Central India		South Peninsula	
	Range (% of LPA)	Forecast Probability (%)	Range (% of LPA)	Forecast Probability (%)	Range (% of LPA)	Forecast Probability (%)
Below Normal	<92	<b>21</b>	<94	<b>14</b>	<94	<b>18</b>
Normal	92-108	<b>43</b>	94-106	<b>33</b>	94-106	<b>30</b>
Above Normal	>108	<b>26</b>	>106	<b>53</b>	>106	<b>52</b>
Rainfall Category	Northeast India		Monsoon Core Zone (MCZ)			
	Range (% of LPA)	Forecast Probability (%)	Range (% of LPA)	Forecast Probability (%)		
Below Normal	<94	<b>27</b>	<94	<b>13</b>		
Normal	94-106	<b>47</b>	94-106	<b>33</b>		
Above Normal	>106	<b>26</b>	>106	<b>54</b>		

#### **4. Probabilistic Forecast of Rainfall over the Country during June 2022**

The MME based probability forecast suggests that the rainfall averaged over the country as a **whole during June 2022 is most likely to be normal (92 to 108 % of LPA)**. The LPA of rainfall over the country during June based on data of 1971-2020 is about 165.4 mm. The spatial distribution of probabilistic forecasts for tercile categories (above normal, normal, and below normal) for the June rainfall is shown in Fig.2. During June normal or above normal rainfall is most likely over many parts of northwest & central India, northern parts of South Peninsula and some parts of east and northeast India. Below normal rainfall is most likely over many parts of northeast India & extreme southern peninsular India and some parts of central & east India. The white shaded areas within the land area represent climatological probabilities.

#### **5. Probabilistic Forecast of Temperatures over the Country during June 2022**

Fig.3a and Fig.3b show forecast probabilities of the maximum and minimum temperatures respectively during June 2022.

During June, below normal maximum temperatures are likely over most parts of the country except some parts of northwest India where above normal maximum temperatures are likely (Fig.3a).

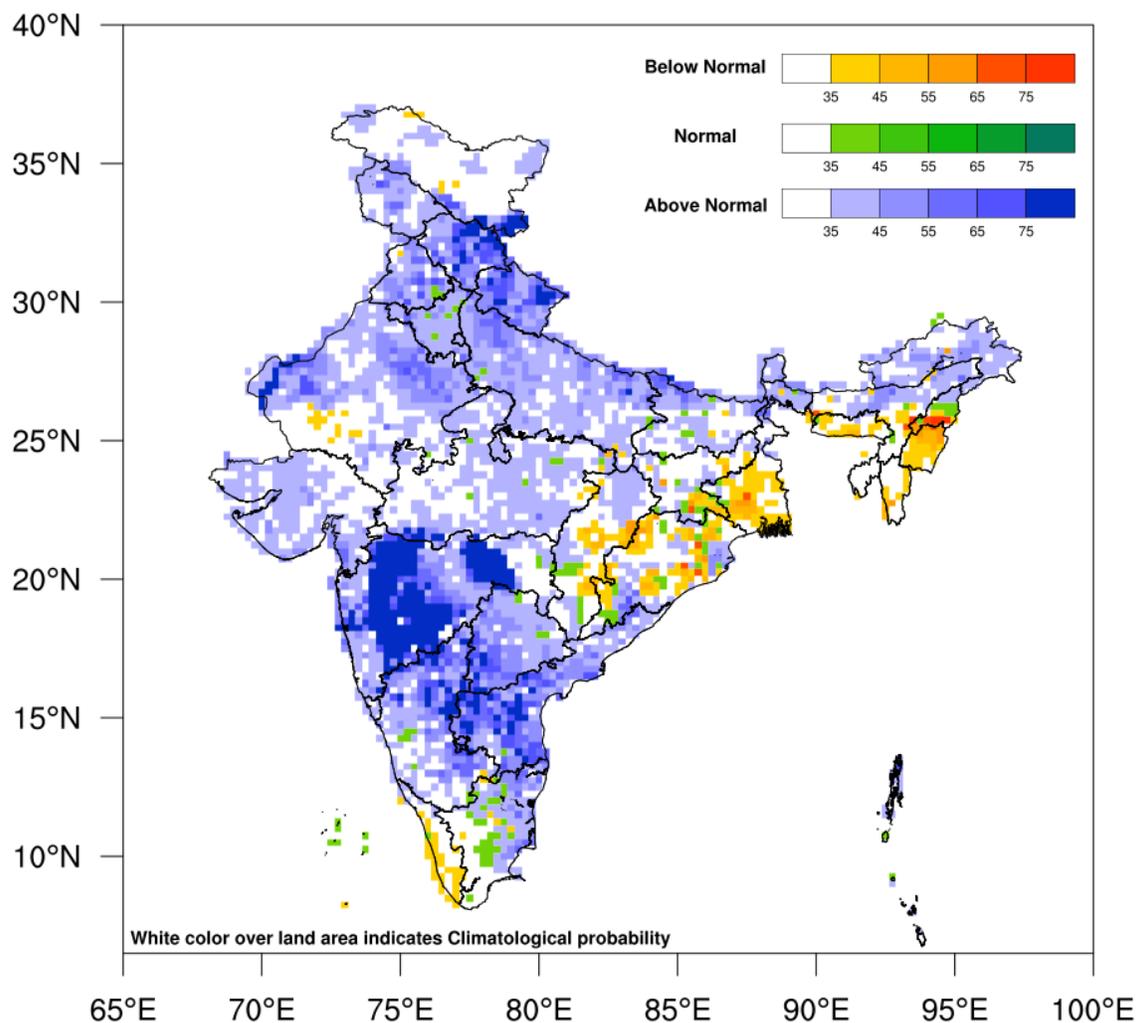
During June, below normal minimum temperatures are likely over most parts of the country except many parts of northwest and northeast India where above normal minimum temperatures are likely (Fig. 3b).

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

IMD also provides extended range forecasts (7-day averaged forecasts for the next four weeks) of rainfall and maximum & minimum temperatures over the country updated every week on Thursday. This is based on the Multi-model ensemble dynamical Extended Range Forecasting System currently operational at IMD. The forecasts are available through the IMD website [https://mausam.imd.gov.in/imd\\_latest/contents/extendedrangeforecast.php](https://mausam.imd.gov.in/imd_latest/contents/extendedrangeforecast.php).

The extended range forecast is followed by a short to medium range forecast issued daily by IMD.

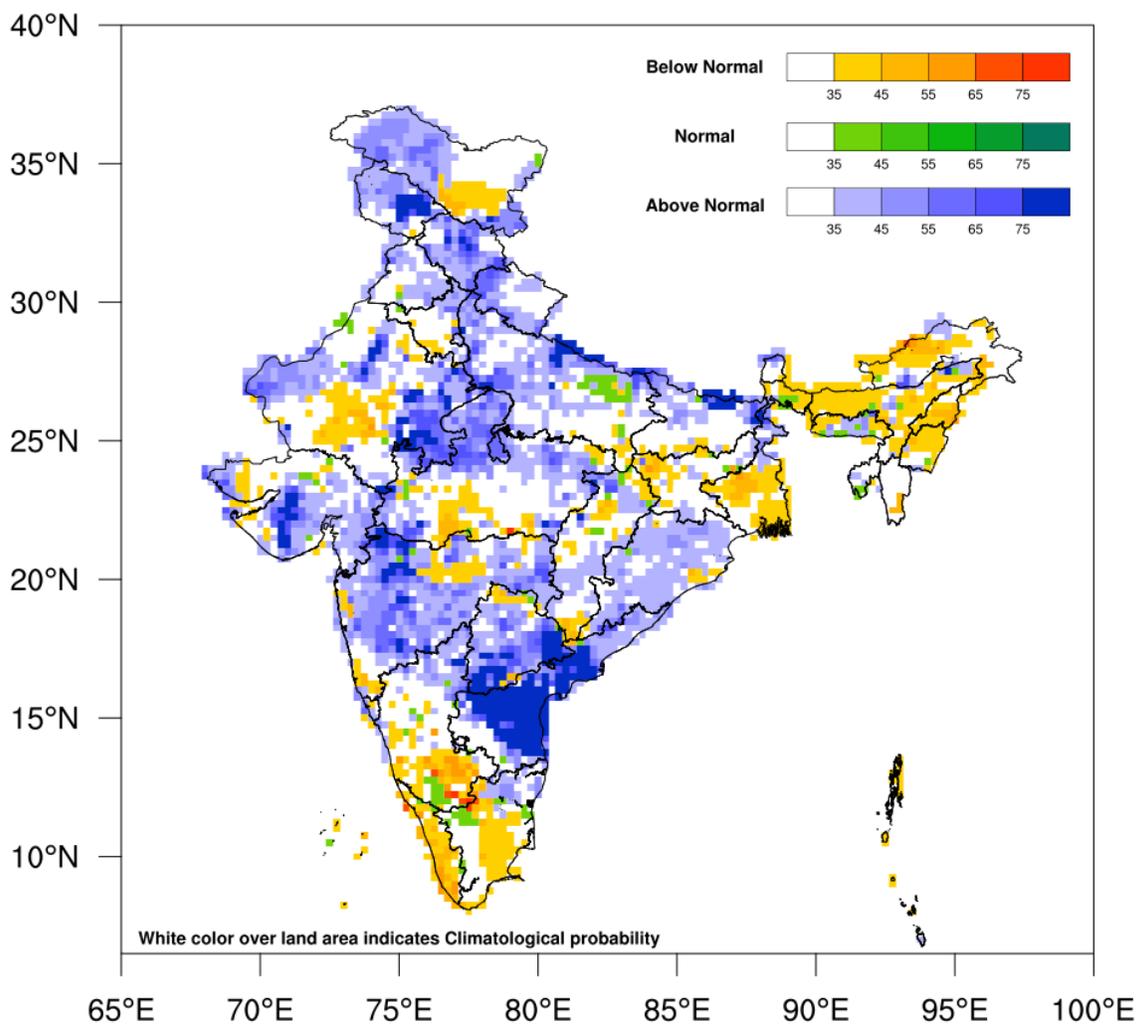
Tercile probability rainfall forecast for 2022 southwest monsoon season



**Fig.1.** Updated Probability forecast of tercile categories\* (below normal, normal, and above normal) of rainfall over India during monsoon season (June -September), 2022. The figure illustrates the most likely categories as well as their probabilities. The white shaded areas within the land area represent climatological probabilities.

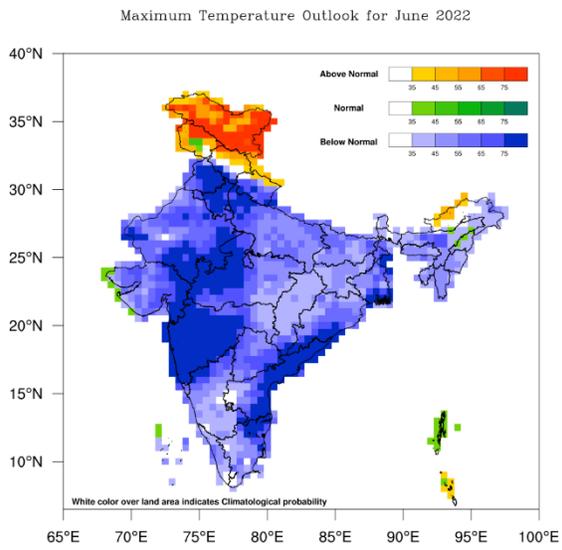
\*Tercile categories have equal climatological probabilities of 33.33% each.

## probability rainfall forecast for 2022 JUN

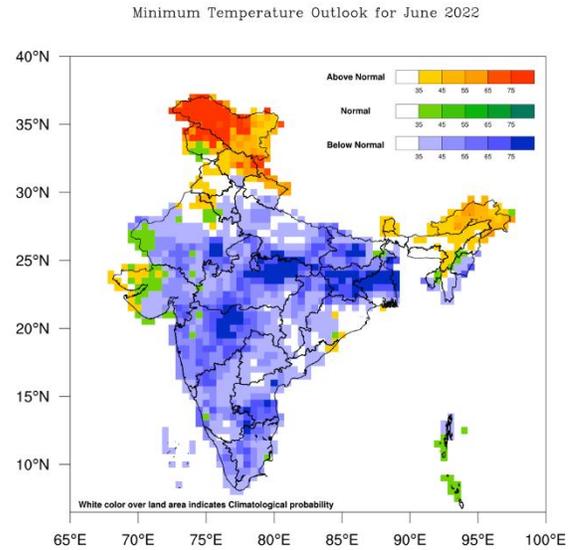


**Fig.2.**Probability forecast of tercile categories\* (below normal, normal, and above normal) of rainfall over India during June 2022. The figure illustrates the most likely categories as well as their probabilities. The white shaded areas within the land area represent climatological probabilities.

\*Tercile categories have equal climatological probabilities of 33.33% each.



**Fig.3a.** Probability forecast of Maximum Temperature during June 2022.



**Fig.3b.** Probability forecast of Minimum Temperature during June 2022.