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**Outlook for the Temperatures during Winter Season(Dec. 2023- Feb. 2024)
and Forecast for the Rainfall and Tempeatures during December 2023**

Highlights

- a) During the upcoming winter season (December 2023 to February 2024), above normal minimum temperatures are likely over most parts of the country.
- b) During the upcoming winter season (December 2023 to February 2024), Above normal maximum temperatures are likely over most parts of the country except some areas over central and northwest India where normal to below normal maximum temperatures are likely .
- c) The occurrence of coldwaves over north, northwest, central, east and northeast parts of country during the upcoming winter season (December 2023 to February 2024) is likely to be below normal.
- d) Monthly rainfall for December 2023 over the South Peninsular India consisting of five meteorological subdivisions (Tamil Nadu, Puducherry & Karaikal, Coastal Andhra Pradesh & Yanam, Rayalaseema, Kerala & Mahe and South Interior Karnataka) is most likely to be normal (69-131% of Long Period Average (LPA)). Monthly rainfall over the country as a whole during December 2023 is most likely to be above normal (>121 % of LPA). Above-normal rainfall is most likely over most parts of the northwest, adjoining areas of central & east India and some areas of extreme south peninsular India. The below normal rainfall is likely over many parts of the northeast India, north peninsular India and adjoining areas of central India.
- e) During December 2023, monthly minimum temperatures are most likely to be above normal over most parts of the country.
- f) Monthly maximum temperatures for December 2023 are likely to be above normal over most parts of the country except some areas of central India and north India where normal maximum temperatures are likely.

Seasonal Outlook for the Temperatures during December 2023 to February 2024 and Rainfall Forecast for December 2023

1. Background

India Meteorological Department (IMD) has recently adopted a new strategy using Multi-Model Ensemble (MME) based forecasting system for issuing monthly and seasonal outlooks of rainfall and temperature over the country. The MME approach uses the coupled global climate models (CGCMs) from different global climate prediction and research centers including IMD/MoES Monsoon Mission Coupled Forecast System (MMCFS) model.

Now, IMD has prepared a seasonal outlook for temperatures over the country for the upcoming winter season (December 2023 to February 2024) and rainfall and temperature forecasts for December 2023.

2 Seasonal Temperature Forecast for December 2023 to February 2024

Fig.1 and Fig.2 show the forecasted probabilities of the minimum and maximum temperatures respectively for December 2023 to February 2024 (DJF) season. It indicates that during the upcoming winter season (December 2023 to February 2024), above normal minimum temperatures are likely over most part of the country. During the season, above normal maximum temperatures are likely over many parts of the country except some areas over central and neighbouring northwest India where normal to below normal maximum temperatures are likely (Fig.2).

3. Cold wave outlook for December 2023 to February 2024 season.

The forecast for the number of coldwave days as compared to normal number of days in the country for December 2023 to February 2024 season is presented in Figure 3. Below-normal cold wave days are expected over most parts of Northwest, central, east and Northeast India during the winter season.

4. Probabilistic Forecast for the Temperature during December 2023

Fig.4 and Fig.5 show the forecasted probabilities of the minimum and maximum temperatures respectively for December 2023. The monthly mean minimum temperatures are most likely to be above normal over most parts of the country (Fig.4).

The maximum temperatures (Fig.5) during December 2023 are likely to be above normal over most parts of the country except some areas of central India and north India where normal maximum temperatures are likely.

5. Probabilistic Forecast for the Rainfall during December 2023

Monthly rainfall for December 2023 over the South Peninsular India consisting of five meteorological subdivisions (Tamil Nadu, Puducherry & Karaikal, Coastal Andhra

Pradesh & Yanam, Rayalaseema, Kerala & Mahe and South Interior Karnataka) is most likely to be normal (69-131% of Long Period Average (LPA)). The LPA of rainfall over South Peninsular India during December based on data from 1971 to 2020 is about 43.0 mm. Monthly rainfall over the country as a whole during December 2023 is most likely to be above normal (>121 % of Long Period Average (LPA)). The LPA of rainfall over the country as a whole during the month of December based on data from 1971 to 2020 is about 15.9 mm.

The probabilistic forecast of tercile rainfall categories (above normal, normal, and below normal) over the country for the month of December is shown in Fig.6. The forecast suggests that above-normal rainfall is most likely over most parts of the northwest, adjoining areas of central & east India and some areas of extreme south peninsular India. The below normal rainfall is likely over many parts of the northeast India, north peninsular India and adjoining areas of central India. In the map, dotted areas represent areas that receive climatologically very less rainfall during December and the white-shaded areas within the land areas represent areas of rainfall forecast with climatological probabilities.

6. SST conditions in the Pacific and the Indian Oceans

Currently, the moderate to strong El Niño conditions are prevailing over equatorial Pacific Ocean and the sea surface temperatures (SSTs) are above average over most parts of the central and eastern equatorial Pacific Ocean. The latest MMCFS forecast indicates that moderate to strong El Niño conditions are likely to continue during the upcoming winter season.

In addition to El Niño-Southern Oscillation (ENSO) conditions over the Pacific, other factors such as the Indian Ocean SSTs also influence on Indian climate. At present, strong positive IOD conditions are observed over the Indian Ocean and the latest MMCFS forecast indicates that positive IOD conditions are likely to weaken and turn to neutral by the end of this year.

7. 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 and 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). The extended range forecast is followed by short to medium range forecast issued daily by IMD.

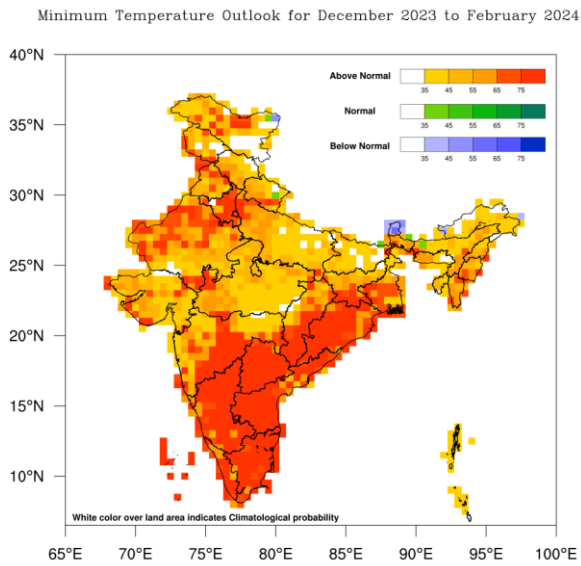


Fig1. Probability forecast of Minimum Temperature for Dec. 2023 to Feb. 2024

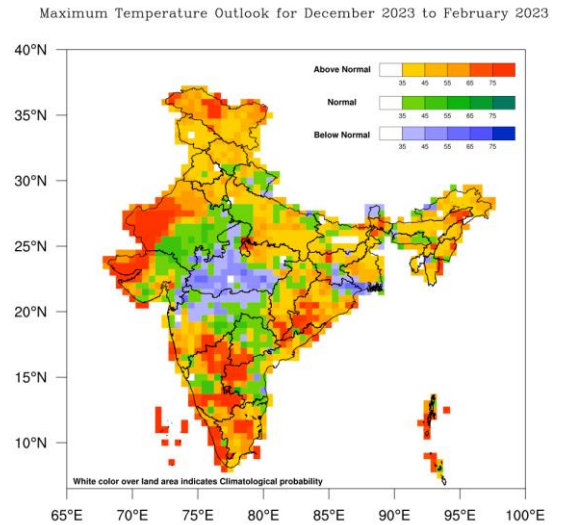


Fig2. Probability forecast of Maximum Temperature for Dec. 2023 to Feb. 2024

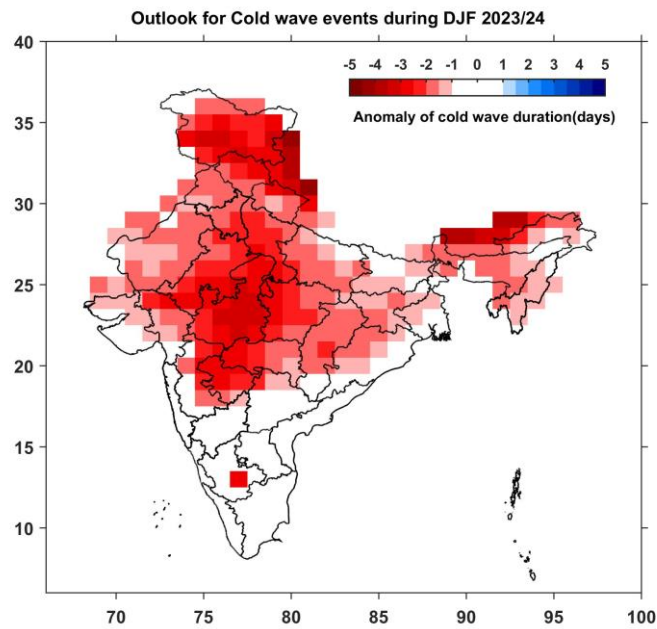


Fig 3. Anomaly(Deviation from the normal) of Cold Wave Duration(days) for Dec. 2023 to Feb. 2024.

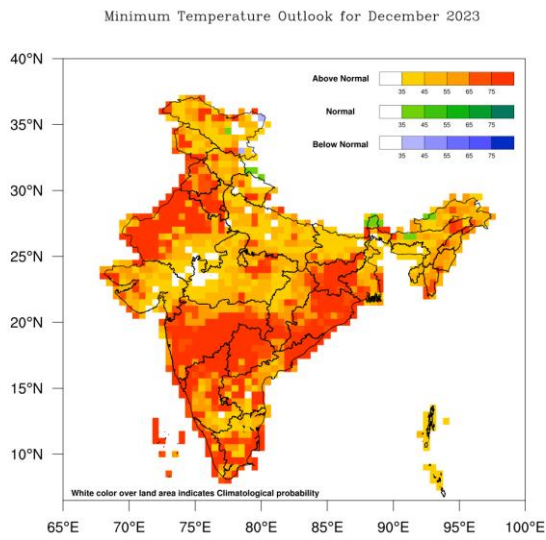


Fig4. Probability forecast of Minimum Temperature for December 2023

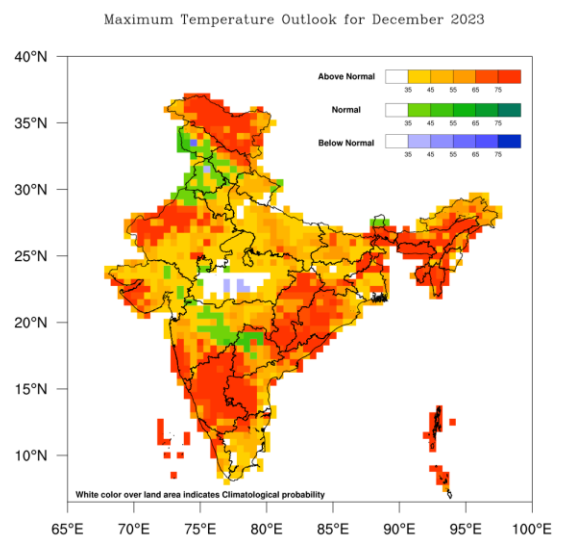


Fig5. Probability forecast of Maximum Temperature for December 2023

probability rainfall forecast for 2023 December

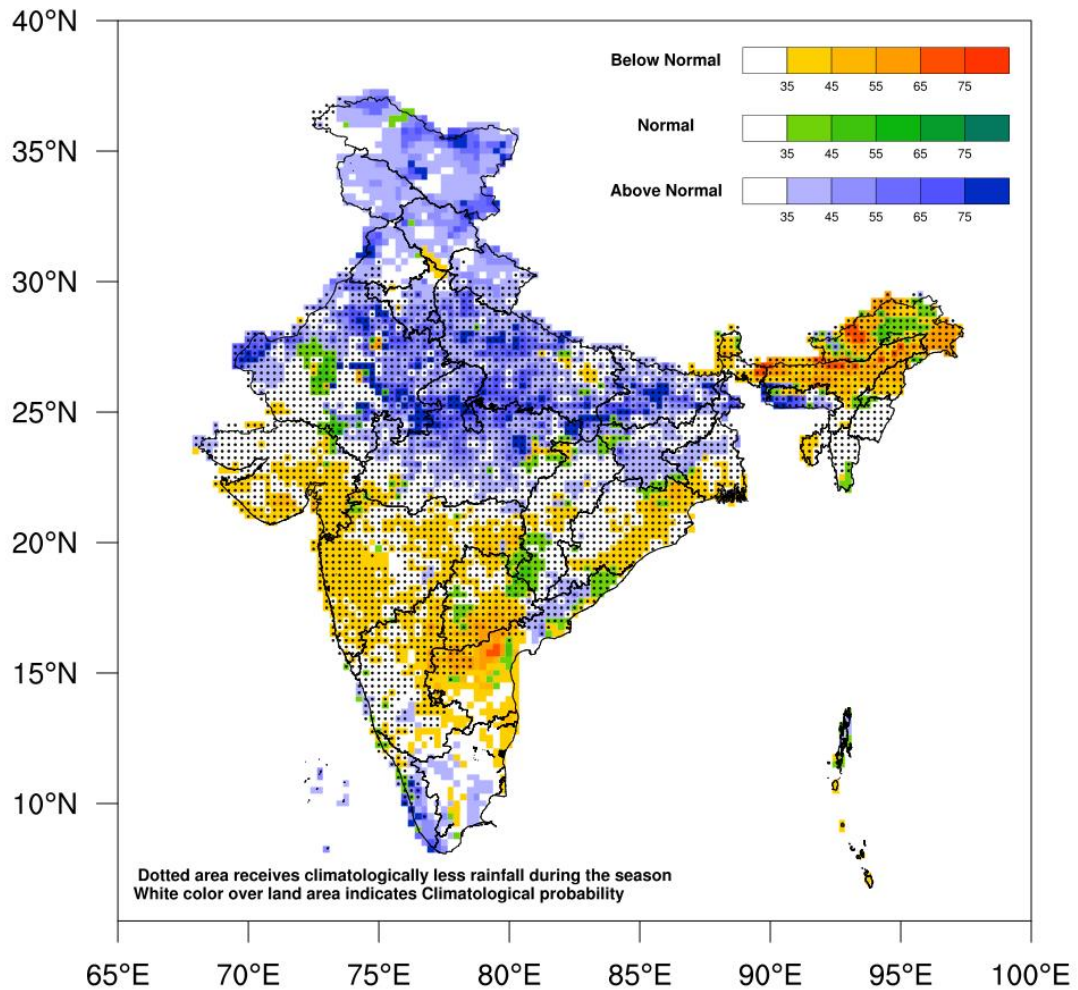


Fig.6. Probability forecast of tercile categories* (below normal, normal and above normal) of rainfall over India during December 2023. The figure illustrates the most likely categories as well as their probabilities. The dotted area shown in the map climatologically receives very less rainfall during December month and the white shaded areas within the land areas represent climatological probabilities.

(*Tercile categories have equal climatological probabilities, of 33.33% each).