PARLIAMENT QUESTION: WINTER FORECAST BY IMD

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The India Meteorological Department (IMD) has been issuing seasonal temperature outlooks for the winter season, covering the months of December to February (DJF), and the same is generally issued at the end of November. These temperature forecasts are issued using coupled dynamical models. However, since 2023, the Multi-Model Ensemble (MME) technique was used to prepare the temperature forecasts. These forecasts include probabilistic outlooks for maximum and minimum temperatures, along with anomaly forecast for the number of cold wave days. In addition, IMD issues monthly temperature outlooks, including cold wave information, during the cold weather season.

Spatial probabilistic forecasts are provided at the meteorological subdivision level, and the relevant information is made available through press releases, press conferences, and social media. Furthermore, apart from the seasonal and monthly forecasts, weekly cold wave alerts and warnings are issued every Thursday, which are valid for the subsequent four weeks. These weekly forecasts are made available on the IMD website (https://mausam.imd.gov.in/) and are disseminated to all concerned States through meteorological centers/ regional meteorological centers.

Several international centers—such as the European Centre for Medium-Range Weather Forecasts (ECMWF), the NOAA Climate Prediction Centre (CPC), and the UK Met Office—publish global and regional seasonal temperature (2-metre) outlooks based on Climate Model/Multi-Model Ensemble outputs. These products, generally provided in the form of probability and anomaly departure from normal maps, include coverage of the South Asian region; however, they are not specifically tailored for India. IMD issues the official seasonal guidance for the country through its Cold Weather Season Temperature Outlook, which is based on bias-corrected minimum temperature fields derived from climate models.

IMD regularly undertakes verification of its winter forecasts, and the forecast skill has shown notable improvement in recent years owing to the use of the MME scheme based on some of the best coupled global models. Spatial verification plots available on the IMD Pune website (https://imdpune.gov.in/prediction.php) indicate improved performance compared to earlier forecast cycles. The links for the verification of seasonal and monthly temperature forecasts for maximum and minimum temperatures are provided in Annexure-1.

The India Meteorological Department (IMD) has adopted an improved methodology for issuing daily, weekly, monthly, and seasonal forecasts through the MME systems. It includes Monsoon Mission Climate Forecasting System (MMCFS), monthly and seasonal forecast, extended range forecasting system for weekly forecast up to four weeks, and deterministic & probabilistic models for nowcast to

short and medium range forecast up to 7 days. Further, IMD has operationalized the Bharat Forecasting System, presently the highest-resolution operational weather prediction model globally, with a spatial resolution of 6 km. Verification results from recent seasons indicate that the MME system offers improved forecast skill and greater accuracy compared to single-model forecasts. Over time, IMD has strengthened its weather observation network, upgraded forecasting systems, and developed high-resolution datasets to support the assessment of long-term climate variability over India. IMD has further enhanced operational forecasting capabilities through advances in modeling techniques and improved data assimilation processes.

The India Meteorological Department continuously monitors weather and climate conditions across the country and publishes the Annual Climate Summary for India, along with State-wise Annual Climate Statements. The climate data of IMD has been digitized for the entire period since 1901. The data supply has been made easier by developing a climate data supply portal. Further datasets are provided to research and development (R&D) organizations through collaboration to improve understanding and prediction. Recently, Mission Mausam has been launched with the objective of strengthening weather and climate services nationwide. The Mission is aimed at enhancing the monitoring, prediction, and overall understanding of weather and climate systems over the Indian region.

Annexure-1

https://imdpune.gov.in/cmpg/Models_Forecast/special_veri/Seasonal_TMAX_Veri.html https://imdpune.gov.in/cmpg/Models_Forecast/special_veri/Monthly_TMAX_Veri.html https://imdpune.gov.in/cmpg/Models_Forecast/special_veri/Seasonal_TMIN_Veri.html

https://imdpune.gov.in/cmpg/Models_Forecast/special_veri/Monthly_TMIN_Veri.html

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