# PARLIAMENT QUESTION: MONSOON WARNING SYSTEM

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The accuracy of the forecasting models used by IMD has improved significantly; however, it is not possible to forecast with 100% accuracy. The skill score for 24-hour (1 day) in advance detection of monsoonal heavy rainfall over the meteorological subdivisions is 85% in 2024. At present, the accuracy of IMD's heavy rainfall forecasts, measured as the percentage of correct warnings, is 85%, 73%, 67%, 63%, and 58% for lead times ranging from one to five days, respectively. Overall, forecast accuracy for heavy rainfall events across the country improved by about 40% in 2023–2024 compared to 2014.

IMD issues heavy rainfall impact-based forecasting and risk-based early warnings considering the amount of heavy rainfall and the susceptibility of the area of occurrence of heavy rainfall. The warning is issued at the meteorological subdivision and district level, valid up to 7 and 5 days, respectively. There is also nowcasting every three hours, with validity of the next three hours for heavy rainfall.

IMD's state-of-the-art forecasting system is fully operational in all the districts of the country. The high-resolution models and GIS systems cover all the districts of the country. Regarding the Doppler Weather Radar (DWR) Network, currently, 47 DWRs are in operation across India, with 87% of the total area of the country coming under radar coverage. In the coming years, DWRs will be installed as per the requirement to cover the remaining gap areas in the country, provide redundancy, and replacement of old radars in the DWR network under Mission Mausam of MoES. The Ministry is continuously working to strengthen observational capabilities and R&D infrastructure to achieve greater accuracy in weather forecasting. Further, the IMD has expanded its infrastructure for observations, data exchange, monitoring & analysis, forecasting, and warning services in the country, including vulnerable districts.

To provide computational support for such high-resolution models and to enable them to run regularly in real-time, the computing facilities (Arunika and Arka) have also been substantially increased to integrate voluminous data and run mesoscale, regional, and global models at higher resolutions. Further, recently, a new Central Sector Scheme, "Mission Mausam", was launched by the MoES to make Bharat a "weather-ready and climate-smart" nation. Various steps have been taken to ensure effective dissemination

of warnings to vulnerable populations. The recently launched Bharat Forecasting System (BharatFS) has been developed primarily to improve short- and medium-range weather predictions.

Forecast improvement is a continuous process with augmentation of more observations and Numerical Weather Prediction Models. With further improvement in the observational network consisting of traditional (surface, AWS/ARG/HWSR, and upper air stations-RS/RW, GPS Sonde, Pilot balloon, and wind profilers) and remote-sensing observing platforms (Satellites and Radars), the forecast accuracy is likely to improve further.

All warnings originated by IMD pertaining to Monsoon are made available to SDMAs in near real time for further dissemination over SMS, Mobile App, Sachet Public Portal, GAGAN & NaVIC Satellite terminals, and RSS feed. There is no processing delay in the Sachet platform.

Central Water Commission (CWC) developed the FloodWatch India mobile application during the 2023 monsoon season to provide real-time flood information, forecasts, and alerts to users across the country. The FloodWatch India App, developed and maintained by the CWC, provides near real-time information and presently disseminates flood forecasting information (water levels) for 200 flood forecasting stations across the country, near real-time water levels for an additional 500+flood monitoring stations, and live storage status of 150+major reservoirs, thereby enabling continuous situational awareness for various stakeholders. The application serves as a vital decision-support tool for Disaster Management Authorities at the Central, State, District, and Local levels, besides being accessible to the general public. Timely availability of river flow conditions, flood forecasts, and reservoir storage data strengthens preparedness, early warning, and coordinated response during flood situations. Since its launch, CWC has been continuously sensitizing and engaging stakeholders through various platforms such as workshops, trainings, review meetings, and conferences to promote wider adoption of the application. CWC takes immense steps and adopts various dissemination mechanisms to ensure maximum reach of the flood warnings produced, so that mitigation measures can be adopted by State Governments, State Disaster Management Authority (SDMA), National Disaster Management Authority (NDMA), and the Public. The total number of downloads till date from the Android (Google Play Store) is 35.1k, while from the iOS (Apple App Store) is 2.58k. For wider outreach, the app is prominently displayed on the CWC's official website and showcased in national exhibitions, including the most recent World Trade Fair. The flood forecasts formulated by CWC are disseminated to all stakeholders through the Flood Forecasting Website, FloodWatch India 2.0 App, e-mail, WhatsApp, Facebook (CWCOfficial.FF), X (Twitter CWCOfficial_FF), and the 'CWC Flood Updates' YouTube channel.

The IMD provides threshold-based, impact-based forecasts and risk-based early warnings, which are colour-coded, to all the districts of the country. A suitable colour code is used to highlight the impact of the severe weather expected and signal disaster

management about the course of action to be taken regarding an impending severe weather event. IMD's Impact-Based Forecasting (IBF) provides localized risk assessments for vulnerable populations in advance of extreme events.

CWC monitors the floods in three categories with assigned colors, namely Above Normal-Yellow(River water level between Warning level & Danger level), Severe-Orange(River water level between danger level & Highest Flood Level), and Extreme-Red (River Water Level above Highest Flood Level). As per the Ministry of Home Affairs Standard Operating Procedure (SOP), Above Normal flood situation is updated on daily basis, Severe Flood is updated on 6 hourly basis and Extreme Flood is updated on 3 hourly basis.

Sachet is disseminating alerts, which are colour-coded. SDMAs are converting the forecast/warnings received from five Warnings & Forecast generating Agencies (AGAs)-India Meteorological Department (IMD), Central Water Commission (CWC), Indian National Centre for Ocean Information Services (INCOIS), Defence Geoinformatics Research Establishment (DGRE), and Forest Survey of India (FSI) into impact-based alerts before dissemination on the Sachet platform.

since inception, Sachet disseminates alerts to all States & UTs, and till now approximately 89 thousand alerts have been generated on the SACHET Platform, and 11000 Crore SMSs have been sent to the citizens. At present, there are nearly 13.98 lakh Mobile App Users and 31.57 thousand Browser Notification users in the country.

NDMA regularly undertakes targeted campaigns to inform, educate, and raise public awareness about various hazards and disaster management initiatives, including the SACHET App/Portal.

Awareness about the SACHET App/Portal is being disseminated consistently through electronic and print media, specialized field-based outreach activities such as awareness van campaigns, Nukkad Natak, focused social media campaigns, proactive sharing of the QR code across digital and print events, including Maha Kumbh 2025 and the India International Trade Fair (IITF).

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