GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
STARRED QUESTION NO. *257
TO BE ANSWERED ON WEDNESDAY, 17TH DECEMBER, 2025

SATELLITE-BASED WEATHER & DISASTER FORECASTING SYSTEMS

*257. SHRI RAJMOHAN UNNITHAN:

Will the Minister of EARTH SCIENCES be pleased to state:

(a) whether the Government plans to expand satellite-linked early warning systems and flood-forecasting networks for coastal districts and if so, the details thereof, district-wise particularly Kasaragod district of Kerala;
(b) the initiatives taken by the Government to upgrade India Meteorological Department (IMD) forecasting stations and Doppler radar coverage in North Kerala; and
(c) the timeline for commissioning new systems and the projected benefits for disaster-prone coastal communities?

ANSWER
THE MINISTER OF STATE (INDEPENDENT CHARGE) FOR
MINISTRY OF SCIENCE AND TECHNOLOGY
AND EARTH SCIENCES
(DR. JITENDRA SINGH)

(a) to (c): A Statement is laid on the Table of the House.

STATEMENT LAID ON THE TABLE OF THE LOK SABHA IN REPLY TO (a) to (c) OF STARRED QUESTION NO. *257 REGARDING "SATELLITE-BASED WEATHER & DISASTER FORECASTING SYSTEMS" TO BE ANSWERED ON DECEMBER 17, 2025

(a) The Government has established an organized institutional mechanism based on various technologies, including satellites for observing, monitoring, forecasting, and issuing early-warning alerts for major natural events such as cyclones, heavy rainfall, and extreme weather across the country, including coastal districts. The Ministry of Earth Sciences (MoES) serves as the nodal Ministry responsible for coordinating these efforts. In this regard, the India Meteorological Department (IMD) works round the clock in coordination with other MoES institutions such as the Indian Institute of Tropical Meteorology (IITM), Pune, the National Centre for Medium Range Weather Forecasting (NCMRWF), Noida, and the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.

The Government, through the India Meteorological Department (IMD), has formulated a comprehensive roadmap to expand satellite-linked early warning systems and flood-forecasting networks in collaboration with CWC (Central Water Commission). The expansion is designed to cover all coastal districts of the country through upgrading the current capabilities and addressing the challenges associated with climate extremes and sea-level rise. In recent years, the capability of satellite-based monitoring has increased manifold. Currently, the INSAT-3DS satellite with six imager channel is providing pictures at a 30-minute interval. The infra-red, water vapour, and visible imageries at a very high resolution up to 1 km along winds (atmospheric motion vectors) and related products provided scope for improved monitoring of the weather development.

Currently, the India Meteorological Department (IMD) utilizes INSAT-3DR and the recently launched INSAT-3DS satellites. These satellites provide imaging at a temporal resolution (refresh rate) of 15 minutes and spatial resolutions ranging from 1 km to 4 km. While this supports district-level forecasting, the Government is now working on the INSAT-4th Generation satellites to achieve block-level precision. The upcoming Advanced Meteorological Imager on INSAT-4G will offer a faster refresh rate of 5–10 minutes, allowing for the real-time tracking of rapidly developing weather events (such as flash floods) within specific districts.

Satellite plays a very important role in detecting severe weather phenomenon through the seasons, such as (i) Fog, (ii) cyclones, (iii) thunderstorms, (iv) duststorms, (v) Heavy Rainfall, etc. Round-the-clock data is being received from INSAT-3DR/3DS geostationary and Oceansat-III Low-Earth orbiting satellites at Satellite Meteorology Division of IMD. Data are being sent to forecasters, Government agencies such as NCMRWF, IITM Pune, IMD website, etc. Apart from this, the data is also being regularly sent to GTS (Global Telecommunication System) and updated on the website.

Central Water Commission (CWC) under the Ministry of Jal Shakti is mandated to issue short-range flood forecasts with a lead time of up to 24 hours to concerned State Governments at identified locations. Timely flood forecasts are being issued when a certain threshold limit is reached. Further, the CWC is providing a Seven-day advisory flood forecast on its web portal https://aff.indiawater.gov.in/ for the same 350 stations through rainfall-based mathematical modeling. CWC takes immense steps and adopts various dissemination mechanisms to get maximum reach to 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 flood forecasts formulated by CWC are disseminated to all stakeholders through the Flood Forecasting Website (https://ffs.indiawater.gov.in/)/https://aff.india-water.gov.in/. FloodWatch India 2.0 App/E-mail/Whatsapp/Facebook(CWCOfficial.FF)/X(Twitter-CWCOfficial_FF), 'CWC Flood updates' (Youtube Channel), CAP Alert through NDMA Sachet portal. A total of 6274 CAP alerts were issued throughout the country and disseminated to stakeholders during Monsoon 2025.

Recent improvement in the various components of the early warning system for various extreme weather events has definitely helped in reducing the loss of lives significantly. For example, around 7000 people had lost their lives in 1999 Odisha Super Cyclone, while it has been reduced to less than 100 over the entire region from impact of tropical cyclones during recent years. Accurate forecast of 1 cyclone saves around 1100 crore rupees in terms of expenditure towards payment of ex-gratia to kins of dead, cost towards evacuation, and savings to various sectors, e.g., Power, Marine, Aviation, Railways, etc. As a result of these new initiatives, the overall skill of forecasting these severe weather events has improved by 30-40% over the last 10 years, from 2014 to 2024, resulting in a significant reduction in lives lost over the years.

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. IMDs' Impact-Based Forecasting (IBF) provides localized risk assessments for vulnerable populations in advance of extreme events, such as cyclones.

IMD uses various digital platforms like Common Alert Protocol (CAP), Application Programming Interface (API), Website, Mobile Apps, social media etc. for timely sharing and dissemination of various data and warnings and bulletins across various user groups and directly to public. IMD has launched seven of its services (Current Weather, Nowcast, City Forecast, Rainfall Information, Tourism Forecast, Warnings, and Cyclone) with the 'UMANG' Mobile App for use by the public. Moreover, IMD developed a mobile App, 'MAUSAM' for weather forecasting, 'Meghdoot' for Agromet advisory dissemination, and 'Damini' for lightning alerts. A total of 9342 crore SMS have been sent since August 2021, and during the recent cyclone "MonTha", a total of 77.64 crore SMS were sent to people.

(b)-(c) A number of steps have been undertaken by the Government to prevent or minimise the loss of life and property from major natural events such as cyclones, heavy rainfall, heatwaves, thunderstorms, etc. For improving the detection and prediction of these events at a more granular and temporal scale, there has been a quantum jump in the weather observational and modeling systems. 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.

IMD consistently issues timely alerts and forecasts to the public and concerned stakeholders across the country, including North Kerala. Doppler Weather Radar (DWR) at Kochi (by IMD) and Thiruvananthapuram (by ISRO) is already operational in Kerala. The region of North Kerala is also currently under the surveillance of the Doppler Weather Radar at Mangaluru in South Karnataka.

IMD has also brought out a web-based "Climate Hazard & Vulnerability Atlas of India" prepared for the thirteen most hazardous meteorological events, which cause extensive damage and economic, human, and animal losses. The same can be accessed at https://imdpune.gov.in/hazardatlas/abouthazard.html. The Climate Hazard & Vulnerability Atlas of India has helped State Government authorities and disaster-management agencies identify hotspot districts and plan appropriate preventive and adaptive measures to tackle extreme weather events.

India Meteorological Department (IMD), in coordination with other centres in the MoES, has developed an end-to-end GIS-based Decision Support System (DSS), which has been working as the front end of the early warning systems for the timely detection and monitoring of all-weather hazards across the country, including the States regularly affected by cyclones and other natural disasters. It is supported with specific severe weather modules to provide timely impact-based early warnings for extreme weather events like cyclones, heavy rainfall, etc., which devastate human lives, livelihoods, and infrastructure. The system utilizes historical data, including extreme events, as well as real-time surface and upper-air meteorological observations available for the Indian region and its neighbouring areas. It also includes RADAR observations, available every 10 minutes, and satellite products every 15 minutes. It also uses numerical weather prediction products from a suite of models run in the MoES institutions. These include hyperlocal, regional, and global models.

Further, IMD plays a crucial role in safeguarding lives and property through its advanced observational network and forecasting systems, enabling timely preparedness and response in close collaboration with the National Disaster Management Authority (NDMA). The entire system is integrated with modern telecommunication technologies to ensure the timely and effective dissemination of information. This coordinated approach ensures that accurate and timely weather information reaches authorities and the public, enhancing disaster risk reduction efforts across the country, including disaster-prone coastal communities. Currently, 47 DWRs are in operation across India, with 87% of the total area of the country coming under radar coverage, including North Kerala. 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 disaster-prone coastal communities.

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