

**GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION NO. 6108
TO BE ANSWERED ON WEDNESDAY, 1ST APRIL, 2026

MODERNISING CLIMATE MONITORING SYSTEM**

6108. SHRI VIJAYAKUMAR ALIAS VIJAY VASANTH:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) whether the Government has prepared a comprehensive national roadmap to modernise climate monitoring systems in view of increasing extreme weather events such as heatwaves, cyclones, floods and droughts and if so, the details thereof including timelines and financial allocation;
- (b) whether the Department is being upgraded with advanced numerical weather prediction models, artificial intelligence-based forecasting tools and expanded Doppler Weather Radar coverage and if so, the details thereof, region-wise;
- (c) whether the additional Doppler Weather Radars are being installed in vulnerable coastal, Himalayan and flood-prone regions to ensure early warning systems and if so, the details thereof along with the time by which such system is likely to be completed;
- (d) whether satellite-based climate observation capabilities are being strengthened in coordination with the Indian Space Research Organisation to enhance real-time monitoring of cyclones, monsoons, glacier melt and ocean temperatures and if so, the details thereof; and
- (e) whether district and block-level automated weather stations are being expanded to provide hyperlocal weather advisories for farmers, fishermen and disaster management authorities and if so, the details thereof along with current coverage and future targets in this regard?

ANSWER

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

- (a) Yes. The Government has undertaken several measures to strengthen and modernise climate monitoring and weather forecasting systems in response to the increasing frequency and intensity of extreme weather events such as heavy rainfall, heatwaves, cyclones, and droughts in the context of climate change. The Ministry of Earth Sciences (MoES), through its constituent institutions, is implementing a range of programs aimed at enhancing observational networks, improving modeling capabilities, and adopting advanced data assimilation techniques. These efforts include expansion and modernisation of surface and upper-air observational networks, Doppler Weather Radars, ocean observation systems, and high-performance computing (HPC) facilities to support high-resolution numerical weather prediction (NWP) and climate modeling.

To further enhance weather monitoring and forecasting across India and surrounding regions by leveraging advanced observational and computing technologies for greater precision and resolution, the Union Cabinet approved the central sector scheme Mission Mausam in 2024, with a budget outlay of 2,000 crore over two years (2024-25 to 2025-26). The primary objectives include improving weather and climate prediction capabilities, strengthening observation networks, enhancing high-resolution NWP models, and improving last-mile dissemination of weather services. In short, Mission Mausam aims to make the country "Weather Ready and Climate Smart".

- (b)-(c) The Government has adopted advanced, state-of-the-art techniques, including high-resolution weather prediction models, observational systems, and artificial intelligence-enabled forecasting tools, to improve the accuracy of monitoring and prediction of climate change and associated extreme weather events. Currently, MoES has a weather observation network comprising manual observatories, Automatic Weather Stations (AWSs), Automated Rain Gauges (ARGs), Agro-AWS, Doppler Weather Radars (DWRs), upper-air observatories, and satellites to monitor climate change and extreme weather events across the country. At present, 48 Doppler Weather Radars (DWRs) are operational across the country, covering vulnerable coastal areas, the Himalayan regions, and flood-prone zones, with approximately 92% of the country's total geographical area 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.

For forecasting extreme weather events, two global models, GFS 12 km and NCUM 12 km, have been operational since 2018. In addition, the Bharat Forecasting System (BharatFS) and Mithuna-FS were developed with very high resolution to generate forecasts at very high resolution. Furthermore, AI/ML is used for the detection and attribution of climate change and downscaling climate projections, identifying climate fingerprints in heatwaves, heavy rainfall, cyclones, and estimating anthropogenic contributions.

To provide computational support for such high-resolution models and to enable regular real-time operation, the computing facilities have also been substantially increased in computational power to integrate voluminous data and run mesoscale, regional, and global models at higher resolution. Recently, with the 'Arunika' and 'Arka' systems, the Ministry of Earth Sciences has enhanced its total computing power to 28 Peta FLOPS in 2025, a substantial increase from the previous capacity of 6.8 Peta FLOPS, which was in 2014.

For the automation and integration of data and weather forecasts, the Ministry has developed an end-to-end GIS-based Decision Support System (DSS) that serves as the front end of the early warning systems for the timely detection and monitoring of weather hazards. It is supported with specific severe weather modules in order to provide timely impact-based early warnings for extreme weather events like cyclones, heavy rainfall, thunderstorms, lightning, fog, heatwaves, etc., which have devastating impacts on human lives, livelihoods, and infrastructure. This system uses all historical data, their extremes, as well as real-time surface and upper-air meteorological observations available to it for the Indian region and neighbourhood. 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 MoES. For providing impact-based forecasts and warnings, the DSS integrates exposure data with hazard data in the system.

- (d) Yes. The Ministry, in coordination with the Indian Space Research Organisation (ISRO), has strengthened satellite-based observation capabilities for improved monitoring of extreme weather events and climate parameters. In this context, satellites such as INSAT-3DR, INSAT-3DS, and Oceansat-3 are being utilised for cyclogenesis prediction, cyclone detection, monitoring of storm evolution, track forecasting, and landfall assessment. The satellite-derived observations are integrated with ground-based observations and advanced numerical weather prediction models to enhance the accuracy and timeliness of forecasts.

Further, the Government is using satellite-based remote sensing systems to monitor the melting and changes in the Himalayan glaciers. The Indian Space Research Organisation employs advanced remote sensing and Geographic Information System (GIS) technologies to systematically monitor glacier extent, mass, movement, and dynamics in the Himalayan region. Satellite remote sensing serves as an effective tool for glacier inventory and monitoring due to its wide spatial coverage and frequent revisit capability.

- (e) The Ministry is in continuous endeavour of augmenting the observational network, including automated weather stations and R&D infrastructure, towards achieving better accuracy in weather forecasting, as well as strengthening early warning systems. The Government has undertaken various measures for the effective dissemination of weather information and alerts through the Ministry. These include real-time weather updates and dissemination of hyperlocal weather advisories to farmers, fishermen, and disaster management authorities, to facilitate improved crop management and enhance preparedness against adverse weather events:

- Public alerts and information are disseminated through mobile applications such as MAUSAM, MEGHDOOT, DAMINI, and UMANG.

- Digital dissemination channels include e-mail and SMS-based nowcasting and forecasting alerts to registered users.
- Alerts are issued through the Common Alerting Protocol (CAP) and the SACHET App.
- Information is shared via social media and mass media platforms.
- District Collectors are informed through direct e-mail and WhatsApp group notifications, in coordination with the State Governments, State Disaster Management Authority (SDMA), the Fisheries Department, and the Agriculture Department.
- Broadcast dissemination is carried out through community radio, public broadcasting systems, and other local communication networks.
- Dissemination is also undertaken through State Government mobile applications.
- Gram Panchayat-level weather forecasting (GPLWF) is facilitated through digital platforms such as e-Gramswaraj, Meri Panchayat App, and e-Manchitra, in collaboration with the Ministry of Panchayati Raj.
- Weather information is disseminated to Pashu Sakhi and Krishi Sakhi at the block and Panchayat levels in collaboration with the Ministry of Rural Development.
- Weather forecasts are accessible through the Mausamgram portal of the India Meteorological Department.
- Ocean-based early warning advisories for maritime hazards, such as high waves, strong currents, swell surges, storm surges, and tsunamis.
- Provides operational support during maritime emergencies through the Search and Rescue Aid Tool (SARAT) and oil-spill trajectory advisories.

IMD, in collaboration with the Ministry of Panchayati Raj (MoPR), has recently launched Panchayat-level weather forecasts covering nearly all Gram Panchayats in India. These forecasts are accessible through digital platforms such as e-Gramswaraj (<https://egramswaraj.gov.in>), Meri Panchayat app, e-Manchitra of MoPR, and Mausamgram of IMD, MoES (<https://mausamgram.imd.gov.in>).
