GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. 41
ANSWERED ON 29/01/2026

ADVANCEMENTS IN WEATHER FORECASTING

41. SHRI BABUBHAI JESANGBHAI DESAI:

Will the Minister of **EARTH SCIENCES** be pleased to state:

(a) whether advancements in weather forecasting, climate services and ocean research during 2024–25 have been reviewed;
(b) if so, the improvements noted in disaster early warning systems;
(c) the details of outreach initiatives taken, so far; and
(d) the future plans outlined in the Annual Report 2025?

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

(a) Yes. The progress of various activities of the Ministry of Earth Sciences (MoES), including advancements in weather forecasting, climate services, and ocean services during 2024-25, have been reviewed recently during the annual review meeting held in December 2025. Apart from that, the progress of all activities/projects under various central sector schemes during the last five years (2021-22 to 2025-2026) was reviewed by an Independent Review Committee (IRC) in August 2025 for continuation of the activities during the next Finance Commission cycle.

(b) Various initiatives were taken by the India Meteorological Department (IMD)-MoES, for the improvement of the disaster early warning systems for extreme weather and climate events. Major achievements in this regard are listed below:

- Developed indigenous, technology-driven, and citizen-centric weather forecasting systems that strengthen disaster preparedness and improve public safety across India. An in-house developed Decision Support System (DSS) is a major step in the direction of promoting self-reliance under the "Atmanirbhar Bharat" initiative.

- A Dual Polarized Solid State Power Amplifier-based state-of-the-art C-Band Doppler Weather Radar (DWR) was commissioned at Raipur, Chhattisgarh. This radar is capable of detecting various severe weather phenomena like monsoon depressions and low-pressure systems, heavy rainfall, thunderstorms, lightning, squalls, turbulence, hailstorms, etc., within a radial coverage of 250 km.

- Impact-based forecasts and risk-based warnings are being disseminated at the district level, empowering authorities to take timely preventive actions against cyclones, heavy rainfall, thunderstorms, heatwaves, and cold waves.

- Developed "Mausamgram" (Har Har Mausam, Har Ghar Mausam), a unique citizen-focused platform providing location-specific, hyperlocal weather forecasts down to the village level. "Mausamgram" delivers hourly forecasts for the next 36 hours, three-hourly forecasts for the next five days, and six-hourly forecasts for up to ten days. Users can conveniently access weather information by searching through PIN code or location name, or by selecting the state, district, block, and gram panchayat. This user-friendly system ensures easy access to hyperlocal forecasts, enabling citizens to obtain accurate and timely weather updates tailored to their specific location.

There is 40% improvement in forecast accuracy for all types of severe weather events in recent decades as compared to the previous decade. All India average Extended Range Forecast of monsoon rainfall accuracy increases by 15% in week 1, 4% in week 2, and 18% in week 3 during 2020-2024 against 2015-2019. There is about 22%, 7%, 15% and 67% improvement in 24-hour Quantitative Precipitation Forecast (QPF) during 2020-2024 compared to 2015-19.

The ocean-based early warning services provided by the Indian National Centre for Ocean Information Systems (INCOIS), MoES, include tsunami early warnings, storm-surge alerts, high-wave, current, and swell surge advisories. It also delivers search and rescue support, oil-spill trajectory forecasts, small-vessel advisories, marine heatwave information, and various other ocean services for a wide range of coastal user communities. INCOIS also provides Potential Fishing Zone (PFZ) Advisory services for fishermen. These services are delivered using real-time observations, high-resolution models, machine-learning-based analytics, and advanced dissemination platforms to support disaster preparedness and response across all coastal States and UTs. INCOIS continuously enhances its early warning and advisory systems through the adoption of advanced technologies.

INCOIS has been strengthening its ocean forecasting and tsunami early warning capabilities through several key initiatives. Efforts are also underway to extend medium-range ocean state forecasts from the current 10 days to 45 days, providing enhanced support for coastal planning and marine operations. To enable advanced real-time modelling, INCOIS has commissioned HPC–Tarang, a high-performance computing system dedicated to operational ocean forecasting.

(c) Major outreach activities organized during 2024-25 are as follows:

- A national-level stakeholder meeting was convened by the IMD during January 14-15, 2025, at Bharat Mandapam to engage with various sectors on the importance of weather and climate services in improving operational planning, policy-making, and disaster management.

- Twenty-one State-level Stakeholder workshops were organized during the year in major cities across the country, aimed at fostering collaboration, sharing information, and gathering valuable inputs from diverse perspectives.

- A grand exhibition was organized by IMD at BHARAT MANDPAM, New Delhi, on 14th January 2024, to showcase various meteorological advancements. One of the main attractions of the exhibition event was the WALKTHROUGH, which showcased ancient and modern scientific prowess of IMD originating from the ancient scientific knowledge of Bharat to the birth of IMD and the modern day acclaimed clinical approach of IMD in Cyclone forecasting of cyclone "BIPARJOY".

- A spectacular Tableau commemorating 150 years of IMD was displayed in the Republic Day parade at Rajpath, New Delhi, on 26th January, 2025. The Tableau magnificently depicted the transformative contributions of IMD to Meteorology and Society since 1875.

- A popular lecture series was also held in hybrid mode during the year, with 31 scientific lectures delivered by eminent international personalities.

- A race event, 'Run for Mausam - Every Step Counts for Climate Resilience' was strategically organised on the National Youth Day, 12th January 2025, with an objective to popularize the activities of IMD to improve the awareness among the public, especially the youth, for reducing loss of life and property and supporting socioeconomic development.

- IMD also conducted the National Meteorological Olympiad (Met-Olympiad) aimed at fostering enthusiasm and awareness about weather and climate sciences among young students across the nation. This competition provided the students with an opportunity to test their knowledge, participate in engaging challenges, and learn more about the science of meteorology.

- Several inter-school competitions were also organized for the school students at IMD HQ and other sub-offices. IMD also collaborated with the 'MyGov portal' for conducting various online competitions like Quiz, Essay, Poster making, etc.

- Several National & International level workshops were also organized during the year to promote outreach like (i) Weather & Youth (ii) Weather Services & Women (iii) 75 Years of Accomplishment of Mausam Journal (iv) 14th Asia-Oceania Meteorological Satellite Users' Conference (v) iRAD 2025 (vi) 20th RSMC New Delhi Attachment Training (vii) National Conference on 30 years of NWP (viii) 10th meeting of WMO-RSG Asia Node on SDS-WAS and Workshop on Dust and Aerosol etc.

To strengthen awareness, preparedness, and response to ocean-related hazards, INCOIS regularly conducts capacity-building activities across coastal States, such as awareness programmes, workshops, training sessions, and tsunami mock drills and Tsunami Ready implementation programme with active participation from coastal stakeholders. INCOIS conducts regular training programmes, and specialised courses through ITCOOcean in areas such as ocean and climate services, remote sensing, numerical modelling, and related disciplines. These initiatives help enhance awareness, build technical capacity, and strengthen activities in the ocean and climate domains.

In the past year, INCOIS undertook several major outreach and capacity-building initiatives. Two mega marine multi-hazard awareness conclaves were organized at Chennai for the East Coast and Goa for the West Coast. INCOIS also conducted multiple specialized training courses and workshops at its campus, along with 15 field-level user interaction and awareness programmes. Around 5,000 students visited INCOIS labs as part of educational exposure visits. To strengthen coastal preparedness, INCOIS conducted tsunami mock exercises during October and November 2025, and continued supporting the implementation of Tsunami Ready Programme in coastal communities.

During 2024–2025, MoES undertook a series of structured and outcome-oriented outreach and awareness initiatives in the thematic areas of weather forecasting, climate services, and ocean research. These initiatives were implemented through seminars, symposia, workshops, conferences, and training under the Ministry's Outreach and Awareness Program, with the objective of disseminating scientific knowledge, enhancing community preparedness, and promoting data-driven information among stakeholders.

About 85 outreach programs on weather forecasting and climate services were conducted, addressing climate change impacts, environmental sustainability, atmospheric sciences, and weather forecasting. These programs were focused on farmers and agriculture, raising awareness on changing climate patterns, seasonal variability, and adaptive practices. MoES has developed important mobile Apps such as Mausam, Meghdoot, Damini, and UMANG for easily providing accurate and timely forecasts and alerts, agromet advisories, and lightning alerts. Training programs were conducted for effective usage of the above-mentioned Apps, enhancing informed decision-making, disaster preparedness, and livelihoods, etc.

Also, 14 outreach programs were conducted in various Institutions in the coastal areas, focusing on ocean advisories and alerts for ocean and coastal States. In addition, a National campaign named "Swachha Sagar Surakshit Sagar" has been taken up for raising Nationwide awareness on ocean health by carrying out coastal cleanliness and awareness drives at 95 locations along both eastern and western coasts, engaging thousands of volunteers, students, and public participation. Further, MoES has developed mobile Apps such as SAMUDRA, Sagar Vani and Thoondil (app in regional languages) for easy dissemination of information and alerts about Potential Fishing Zones, ocean state forecast to the fishermen community, Navy and Coast Guard etc. by providing timely information on fish availability, waves, winds, cyclones and tsunamis, improving safety, efficiency, and coastal livelihoods.

(d) The new Central Sector Scheme "Mission Mausam" has been launched by MoES with the goal of making Bharat a "Weather-ready and Climate-smart" nation. The major aim of the scheme is to support various weather & climate sensitive sectors like agriculture, irrigation, shipping, water resource management, health, aviation, transport sector, disaster management, offshore oil management, public safety etc. by mitigating the impact of climate change and extreme weather events and strengthen the resilience of the communities to severe weather phenomena like tropical cyclones, severe thunderstorms, dust storms, heavy rains and snowfall events, cold and heat waves, etc.

Sustain and improvement of operational ocean information and advisory services, viz., ecosystem services, multi-hazard services, ocean state forecasting, marine safety services, disaster-related services, coastal water quality services, climate services, and data & value-added products services.

To sustain a wide range of ocean observing networks for the acquisition of marine meteorological and oceanographic data from offshore and the Indian coastal Sea for obtaining continuous data.

To carry out dedicated scientific field campaigns in the open ocean and coastal waters to collect data required for improving ocean model configurations used for operational forecasts and other services.

To carry out focused research and development in ocean modeling, data assimilation, and AI/ML methods to set up an integrated ocean forecast system and generate ocean analysis and reanalysis products of physical oceanographic and marine ecosystem parameters.

Designing, Planning & Implementation, and Maintenance of IT, communication, and web services for various Operational and R&D Projects.

Establish regional Centres and necessary lab facilities for extending the services to all coastal states.

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