

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. 3090
ANSWERED ON 19/03/2026

WEATHER FORECASTING FOR AGRARIAN STATES

3090. SMT. REKHA SHARMA:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) the steps taken to strengthen weather forecasting systems benefiting agrarian States such as Haryana;
- (b) whether district-level early warning systems have been improved; and
- (c) if so, the details of benefits accrued to farmers thereby?

ANSWER

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

- (a) The India Meteorological Department (IMD), Ministry of Earth Sciences (MoES), provides district-wise weather forecasts and warnings up to seven days in advance across the country, including Haryana. These forecasts include key weather parameters, such as rainfall, temperature, wind speed, hail, heat waves, cold waves, fog, and thunderstorms. A four-stage colour-coded warning system (Green, Yellow, Orange, and Red) is used to indicate the severity of weather events and the level of preparedness required by State Governments and concerned agencies. For districts placed under Orange and Red category warnings, Impact-Based Forecasts (IBF) are issued, indicating possible impacts on infrastructure, human activities, and agriculture. Agricultural impacts include information related to the type of standing crops, crop growth stage, prevailing pest and disease conditions, and the likely impact of the impending severe weather event, along with suitable advisories for farmers and the general public.

In addition to medium-range forecasts, IMD provides localized Nowcast warnings valid up to three hours, round the clock, for severe weather events such as thunderstorms, lightning, squalls, hailstorms, and heavy rainfall. These warnings are generated using observations from Doppler Weather Radar (DWR) systems, satellite data, and lightning detection networks. Nowcasts are issued at the district and sub-district levels, thereby improving spatial and temporal resolution and enabling farmers to receive more localized, actionable information. Weather forecasts and Agrometeorological Advisories are disseminated to farmers through multiple channels, including print and electronic media, Doordarshan, internet platforms, social media, and SMS services under Public-Private Partnership initiatives. Under this arrangement, about 5.59 million farmers across the country receive weather forecasts, alerts, and agromet advisories. During extreme weather events such as cyclones or deep depressions, SMS-based alerts with appropriate precautionary measures are disseminated through the Kisan Portal. Technological advancements have further enhanced accessibility by enabling farmers to receive

location-specific forecasts and advisories through mobile applications such as Meghdoot, Mausam, and the lightning alert application Damini. Early warnings are also disseminated through the National Disaster Management Authority (NDMA) SACHET portal, social media platforms such as WhatsApp, X, and Facebook, coordination with State and District Disaster Management Authorities, and through electronic media and television broadcasts. Press releases and special weather bulletins are issued well in advance during significant weather events for the benefit of farmers and the general public.

Further, to strengthen localized weather information and last-mile connectivity, IMD, in collaboration with the Ministry of Panchayati Raj (MoPR), has launched Gram Panchayat Level Weather Forecasting (GPLWF) covering nearly all Gram Panchayats in India, including Haryana. These forecasts are available through digital platforms such as e-GramSwaraj, Meri Panchayat App, e-Manchitra, and the IMD platform Mausamgram. The service provides hourly forecasts up to 36 hours, three-hourly forecasts for the next five days, and six-hourly forecasts up to ten days for parameters such as temperature, rainfall, humidity, wind, and cloud cover, enabling farmers to plan agricultural operations more effectively. To further strengthen weather forecasting capabilities, the Government has established a robust institutional mechanism for expanding the observational network and adopting advanced technologies for improved data assimilation and high-resolution modelling. In this regard, IMD, in coordination with other MoES institutions such as the Indian Institute of Tropical Meteorology (IITM), Pune, and the National Centre for Medium Range Weather Forecasting (NCMRWF), Noida, is implementing major research and operational programmes, including the Monsoon Mission and the recently launched Mission Mausam.

Under these initiatives, modern forecasting systems such as the Bharat Forecasting System (BharatFS) and ensemble forecasting techniques have been introduced to improve the accuracy and lead time of forecasts for severe weather events, including heavy rainfall and heat waves. NCMRWF has also developed the Mithuna-FS, a next-generation global coupled forecasting system integrating atmosphere, ocean, land surface, and sea ice components with advanced physics and upgraded data assimilation at 12 km global resolution. The modeling suite also includes a 4 km regional model for monsoon and cyclone prediction and a 330 metre hyper-local urban model for improved forecasts of fog and air quality in metropolitan areas such as Delhi. With the integration of Artificial Intelligence and Machine Learning-based post-processing techniques, these systems are enabling district-level probabilistic forecasts of extreme weather events such as heat waves and thunderstorms, thereby enhancing forecast accuracy by 30–40 percent over the past decade. In addition, IMD has developed indigenous and technology-driven platforms such as its Decision Support System (DSS) and the citizen-centric Mausamgram platform (“Har Har Mausam, Har Ghar Mausam”), which provides hyper-local weather forecasts down to the village level. Users can access forecasts by entering their PIN code or by selecting the State, district, block, and Gram Panchayat, thereby enabling citizens and farmers to receive timely and location-specific weather information.

(b)-(c) District-level early warning systems have been significantly strengthened in recent years through advancements in observational networks, numerical weather prediction models, and improved dissemination mechanisms. There has been a substantial improvement in forecast accuracy, with nearly 40 percent enhancement in forecasting severe weather events over the past decade compared to the previous decade. The accuracy of one-day-ahead heavy rainfall warnings during the 2025 southwest monsoon reached 85 percent compared to 77 percent in 2020, reflecting a 10 percent improvement over the past five years. Similarly, the accuracy of five-day-ahead heavy rainfall forecasts during the 2025 southwest monsoon improved by about 9 percent compared to the previous five-year period. Overall, heavy rainfall prediction accuracy across all lead times improved by about 5 percent in 2025 compared to 2024. In addition, cold wave forecast verification has improved significantly, with the Critical Success Index (CSI) increasing by 10 percent, 20 percent, and 65 percent for 2-day, 3-day, and 4–5-day forecasts, respectively, during 2021–2025 compared to 2017–2021.

These improvements in forecast accuracy and early warning dissemination have resulted in significant benefits to farmers. The National Council of Applied Economic Research (NCAER) has conducted periodic assessments in 2009, 2015, and 2020 to evaluate the economic impact of weather forecast-based advisories in India. The 2020 survey, covering 3,965 farmers across 121 districts in 11 States, indicated that 98 percent of farmers modified at least one agricultural practice in response to agrometeorological advisories. Farmers used the advisories to take informed decisions on the selection of crops and varieties, sowing time, irrigation scheduling, fertilizer application, pest and disease management, and harvesting operations. These actions helped minimize losses from adverse weather conditions and optimize the use of inputs under favourable weather situations.

The study also found that the average annual income of farming households increased significantly when advisories were adopted. Farmers who implemented all nine recommended practices experienced an increase in annual household income from ₹1.98 lakh to ₹3.02 lakh. In rain-fed regions, this translated into an additional annual income of about ₹12,500 for Below Poverty Line (BPL) agricultural households, with the overall estimated income gain amounting to about ₹13,331 crore annually in rain-fed districts across the country. Thus, strengthened district-level early warning systems and improved dissemination of weather forecasts and agrometeorological advisories have enabled farmers to take timely preventive and adaptive measures, thereby reducing crop losses, improving farm productivity, enhancing resource-use efficiency, and strengthening climate resilience in the agricultural sector.
