GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
RAJYA SABHA
UNSTARRED QUESTION NO. 1954
ANSWERED ON 08/08/2024

CHANGES IN RAINFALL PATTERNS

1954. SHRI K.R.N. RAJESHKUMAR:

Will the Minister of EARTH SCIENCES be pleased to state:

(a) whether there has been a significant change in rainfall patterns across the country, with some areas experiencing excessive rainfall and others facing scarcity, and if so, the details of these changes;
(b) whether the India Meteorological Department (IMD) has studied the reasons for extreme rainfall variability during the recent monsoon season, if so, the details of the key findings; and
(c) the measures taken by Government to address and mitigate the effects of these changes in rainfall patterns?

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

(a) Yes. The analysis of long-term datasets shows that in recent periods, there has been a shift in the rainfall pattern towards more frequent dry spells (27% higher during 1981-2011 relative to 1951-1980) and more intense wet spells during the summer monsoon season. The frequency of localized heavy precipitation occurrences has increased worldwide in response to increased atmospheric moisture content. Over central India, the frequency of daily precipitation extremes with rainfall intensities exceeding 150mm per day increased by about 75% during 1950–2015.

The ministry has done a detailed climate change assessment and prepared a report, "Assessment of Climate Change over the Indian Region" (https://link.springer.com/book/10.1007/978-981-15-4327-2). The research findings are as follows:

- Summer monsoon (June-September) precipitation over India has declined by around 6% from 1951 to 2015.
- A notable decrease over the Indo-Gangetic Plains and the Western Ghats (1951-2015).
- Five states viz., Uttar Pradesh, Bihar, West Bengal, Meghalaya and Nagaland have shown significant decreasing trends in southwest monsoon rainfall during the recent 30 years period (1989-2018).
- The annual rainfall over these five states along with the states of Arunachal Pradesh and Himachal Pradesh also show significant decreasing trends.
- Other states do not show any significant changes in southwest monsoon rainfall during the same period.

- Considering district-wise rainfall, there are many districts in the country, which show significant changes in southwest monsoon and annual rainfall during the recent 30 years period (1989-2018). With regard to the frequency of heavy rainfall days, significant increasing trend is observed over Saurashtra & Kutch, Southeastern parts of Rajasthan, Northern parts of Tamil Nadu, Northern parts of Andhra Pradesh and adjoining areas of Southwest Odisha, many parts of Chhattisgarh, Southwest Madhya Pradesh, West Bengal, Manipur & Mizoram, Konkan & Goa and Uttarakhand.

(b) India Meteorological Department (IMD) analysed the changing rainfall pattern in the country and extremes in the recent 30 years at different spatial scales (States and Districts). A total of 29 reports on "Observed Rainfall Variability and Changes" for various States/UTs were published by IMD in January 2020, and it is available at the following (https://www.imdpune.gov.in/Reports/rainfall%20variability%20page/raintrend%20new.html). The research findings are as follows:

- Goa has recorded the maximum monsoon rainfall over the past 30 years (2878.0 mm), followed by Meghalaya (2702.4 mm). Tamil Nadu reported the lowest (311.7 mm), followed by Rajasthan (414.2 mm).
- There were "significant decreasing trends" in the south-west monsoon from 1989 to 2018 in the Ganga basin states like Uttar Pradesh, Bihar, and West Bengal, which are known to have among the most fertile lands in the country.
- Meghalaya (where Cherrapunji, which is one of the places with the highest precipitation globally, is situated), Nagaland, and Arunachal Pradesh showed decreasing trends in rainfall along with Himachal Pradesh.
- Significant increase in heavy rainfall (6.5 cm or more) days in Gujarat's Saurashtra and arid regions of Kutch and south-eastern Rajasthan, as well as northern Tamil Nadu, northern Andhra Pradesh, south-west Odisha, parts of Chhattisgarh, south-west Madhya Pradesh, parts of West Bengal, Manipur and Mizoram, Konkan, Goa and Uttarakhand.

(c) Associated with climate change due to global warming, temporal and spatial diversity in severe weather, including extremely heavy rainfall, have been observed in the country in recent years. The recent IPCC climate change report indicates that these trends will continue in the future and that they are not preventable. However, to forewarn about such events, IMD issues forecasts and warnings related to severe weather to support the National Disaster Management Authorities (NDMA).

For this purpose, IMD follows a seamless forecasting strategy.The long-range forecasts (for the whole season) issued are followed by extended-range forecasts issued every Thursday with a validity period of four weeks. To follow up the extended range forecast, IMD issues short to medium-range forecasts and warnings at meteorological sub-division levels daily four times by the National Weather Forecasting Centre (NWFC), New Delhi, valid up to the next five days with an outlook for subsequent two days. The short to medium-range forecast and warning at district and station levels are issued by state-level Meteorological Centres (MCs)/Regional Meteorological Centres (RMCs) with a validity of the next five days and updated twice daily. The short to medium-range forecast is followed by a very short-range forecast of severe weather up to three hours (nowcast). These nowcasts are updated every three hours.

While issuing the warning, a suitable color code is used to highlight the impact of the severe weather expected and signal disaster management about the course of action to be taken concerning impending disaster weather events. The green color corresponds to no warning; hence, no action is needed;the yellow color corresponds to being watchful and getting updated information; the orange color corresponds to be alert and be prepared to take action, whereas the red color signals to take action.

In addition to this, as and when the situation arises, press releases are issued by IMD and disseminated by all the platforms mentioned above. IMD has launched various mobile Apps (MAUSAM-weather forecast; Meghdoot-Agromet advisory; Damini- lightning alert; Rain Alarm-Rainfall).

****