

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION NO.701
TO BE ANSWERED ON FRIDAY, FEBRUARY 05, 2021

EXTREME CLIMATIC EVENTS

701. SHRI E.T. MOHAMMED BASHEER:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) whether the Government is aware that extreme climatic events have increased significantly across India at the turn of millennium/in the 21st century;
- (b) if so, the details thereof; and
- (c) the steps taken by the Government to Control the adverse effects of the various Natural Calamities like Floods, droughts across the country?

ANSWER

**MINISTER FOR MINISTRY OF SCIENCE AND TECHNOLOGY AND
MINISTRY OF EARTH SCIENCES
(DR. HARSH VARDHAN)**

- (a) Yes, Sir. Extreme climatic events or disaster weather events have increased significantly across India during 21st century.
- (b) Increase in various extreme weather and climate events such as heavy rainfall, floods, droughts, cyclones, heat waves and cold waves have been observed in the country in line with the increase in the extreme events observed over various parts of the globe.

Ministry of Earth Sciences (MoES), has recently published a Climate Change assessment report entitled "Assessment of Climate Change over the Indian Region" which covers all the aspects of regional climate change including the climatic extremes across India. The preparation of this report was led by the Center for Climate Change Research (CCCR) at the Indian Institute of Tropical Meteorology (IITM) Pune. This report is the first of its kind where a comprehensive discussion has been made regarding the impact of human-induced global climate change on the regional climate and monsoon of the Indian subcontinent, adjoining Indian Ocean and the Himalayas. Based on the available climate records, the report documents that the surface air temperature over India has risen by about 0.7 °C during

1901–2018 which is accompanied with an increase in atmospheric moisture content. The sea surface temperatures in the tropical Indian Ocean have also increased by about 1°C during 1951–2015. Clear signatures of human-induced changes in climate have emerged over the Indian region on account of anthropogenic GHG and aerosol forcing, and changes in land use and land cover which have contributed to an increase in the climatic extremes.

The number of Cyclones and Number of stations reported very heavy and extremely heavy rainfall events since 2012 is given in **Annexure-I**. It can be seen that during recent years' frequency of cyclones and stations reporting very heavy and extremely heavy rainfall has been increased. Also the analysis of past data of cyclones over North Indian Ocean (Bay of Bengal and Arabian Sea) during the period from 1891 to 2020 indicates that, frequency of Very Severe Cyclonic Storms has increased in recent few years over the Arabian Sea, since 1990.

Statistics of the number of days associated with the heat wave and cold waves (state wise) per annum for decades 1971-80, 1981-90, 1991-00,2001-10 and 2011-19 are given in **Annexure-II & III**. It is found that, states like Rajasthan or Andhra Pradesh and Union Territories (UT) like Delhi is reporting increased number of Heat Waves and Haryana, J&K and Uttar Pradesh report increased number of cold waves during the recent years.

Future projections of regional climate, performed under different climate change scenarios, too indicate robust changes in the mean, variability and extremes of several key climatic parameters over the Indian subcontinent and adjoining areas (e.g. land temperature and precipitation, monsoons, Indian Ocean temperature and sea level, tropical cyclones, Himalayan cryosphere, etc).

- (c) To minimize the adverse effect of the hazardous extreme weather events, India Meteorological Department (IMD) is effectively functioning in the country maintaining accurate weather forecasting along with early detection of natural disasters. IMD is dedicated for monitoring, detection and forecasting of weather and climate including early warning for severe weather events such as, heavy rainfall, extreme temperature, thunderstorms, cyclones etc. The weather forecasting and early warning systems in the country are comparable to most of the developed countries in the world. Efforts are continuously made to enhance the level of efficiency of the forecasting systems and to improve skill of weather forecast. During the past few years, IMD has been continuously improving weather prediction services in terms of accuracy, lead time and associated impact. The accuracy of the weather forecast is more than 80% qualitatively and 65-70% quantitatively for various regions in the country. The forecasts and warnings are issued by IMD at the national, State and district levels. It has a network of State Meteorological Centres for better coordination with State and district level agencies. With the upgradation of observations and prediction system noticeable improvements have been made in the recent past in the skill of prediction, especially with respect to heavy-rainfall, heat-wave, thunderstorm and cyclones.

Following are the IMD's specialized services in the areas of extreme weather conditions :

- To cater the services of hydro-meteorological events occurring in short duration of time, IMD is issuing Flash Flood Guidance (FFG) by which a diagnostic value within a watershed required to produce flooding at the outlet of the catchment is estimated, to support the flood warning services.
- IMD provides actual and forecast rainfall information in different spatial and temporal scale like districts, States & meteorological subdivisions level and daily, weekly & seasonal scale to the Ministry of Agriculture for drought monitoring.
- Heat wave is one of the severe weather phenomena for which IMD issues early warning. In the country, appreciable rise in maximum temperatures as well as heat waves are found to be more in the months of April, May & June. IMD is issuing Seasonal Outlook for temperatures for the months of April, May & June in the last week of March for planning purpose, since 2016.
- As an adaptive measure, IMD in collaboration with local health departments have started heat action plan in many parts of the country to forewarn about the heat waves and also advising action to be taken during such occasions. Heat action plan became operational since 2013. NDMA and IMD are working with 23 states prone to high temperatures leading to heat-wave conditions to develop heat action plans.
- To mitigate the casualties due to thunderstorm and associated severe weather phenomena, IMD issues three hourly nowcasts for severe weather including thunderstorm and associated weather phenomena for about 894 stations and all districts in India on regular basis utilizing Radar and satellite data as well as ground based observations. These nowcasts are provided in real time to the users through the Website of IMD.
- IMD has demonstrated its capability to provide early warning for Cyclones with high precision and has earned worldwide accolades globally and nationally for very effective state of art early warning system for monitoring and prediction of cyclones. The cyclone forecast accuracy has significantly improved in recent years as has been demonstrated during cyclones Phailin (2013), Hudhud (2014), Vardah (2016), Titli (2018), Fani & Bulbul (2019) and Amphan, Nisarga & Nivar (2020). During recent years, the loss of life has been drastically reduced being limited to double digit figure in the recent years.

Regarding advance broadcasting / dissemination of weather forecasts and warnings, IMD is always in a continuous process of improvement. At present the forecasts and warnings are broadcasted or disseminated to users including disaster managers by e-mail on regular basis. In addition to this, SMS, WhatsApp and social media & website platforms are effectively used for forecast dissemination.

In addition to this, as and when the situation arises, Press Releases are issued by IMD and the same is also disseminated by all the platforms mentioned above.

IMD has launched seven of its services (Current Weather, Nowcast, City Forecast, Rainfall Information, Tourism Forecast, Warnings and Cyclone) with '**UMANG**' mobile App for use by public.

Moreover, in 2020, India Meteorological Department had developed mobile App '**MAUSAM**' for weather forecasting, '**Meghdoot**' for Agromet advisory dissemination and '**Damini**' for lightning alert.

Annexure-I

YEAR	Number of Cyclones		Number of stations Reported during SW Monsoon season (June to September)	
	TOTAL	Severe Cyclone	Very Heavy Rainfall (115.6-204.4 mm)	Extremely Heavy Rainfall (204.5 mm or more)
2012	2	0	1251	185
2013	5	4	1519	239
2014	3	2	1438	245
2015	4	2	1320	257
2016	4	1	1864	226
2017	3	2	1824	261
2018	7	6	2181	321
2019	8	6	3056	554
2020	5	5	1912	341

Annexure-II

Heat Wave Days						
S. No.	State / UT	1971-80	1981-90	1991-00	2001-10	2011-19
1	Andhra Pradesh	10	9	9	9	11
2	Bihar	7	5	4	6	8
3	Chhattisgarh	2	3	3	5	3
4	Delhi	4	3	6	7	6
5	Gujarat	2	2	2	3	2
6	Haryana	8	9	10	12	8
7	Jharkhand	5	3	2	7	9
8	Karnataka	1	1	2	1	1
9	Kerala	0	0	0	0	0
10	Madhya Pradesh	4	4	5	6	7
11	Maharashtra	4	3	4	6	6
12	Odisha	9	5	5	11	11
13	Punjab	8	5	6	9	8
14	Rajasthan	6	8	10	10	12
15	Tamil Nadu	4	4	4	5	5
16	Telangana	5	6	6	4	6
17	Uttar Pradesh	9	7	8	6	8
18	Uttarakhand	8	5	5	7	7
19	West Bengal	5	2	3	2	4

Annexure-III

Cold Wave Days						
S. No.	State/UT	1971-80	1981-90	1991-00	2001-10	2011-19
1	J and K	4	5	5	6	7
2	Himachal Pradesh	6	3	2	3	4
3	Punjab	6	6	6	7	3
4	Haryana	9	4	3	5	9
5	Uttarakhand	7	7	1	1	1
6	Delhi	4	3	4	5	4
7	UP	8	3	2	4	6
8	Rajasthan	11	8	4	5	4
9	Sikkim	1	12	0	1	0
10	Assam	3	2	0	0	1
11	Madhya Pradesh	9	5	4	3	5
12	West Bengal	3	1	1	1	2
13	Bihar	5	4	3	4	6
14	Gujarat	6	4	2	3	1
15	Jharkhand	7	2	1	5	4
16	Odissa	2	3	1	2	3
17	Tripura	5	2	3	1	2
18	Chattisgarh	3	5	3	3	6
19	Maharashtra	7	2	5	3	5
20	Telangana	6	2	6	4	6
21	Andhra Pradesh	3	1	1	7	7
22	Karnataka	1	0	0	0	0
23	Tamil Nadu	2	2	2	2	0
