GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION NO. 2947
TO BE ANSWERED ON WEDNESDAY, 3RD AUGUST, 2022

EXTREME HEAT WAVES

2947. SHRI MAGUNTA SREENIVASULU REDDY:
SHRI S. JAGATHRAKSHAKAN:

Will the Minister of EARTH SCIENCES be pleased to state:

(a) the details of extreme heatwaves in the country in the last few years;
(b) whether the Government has taken note that rising surface temperatures in the Indian Ocean coupled with EI-Nino effect are responsible for heatwaves in India and if so, the details thereof;
(c) whether the extreme heatwaves have any correlation with climate change, if so, the details thereof;
(d) whether the Ministry has conducted any study in this regard and if so,the details thereof and if not, the reasons therefor; and
(e) the details of the preventive steps taken/proposed to be taken by the Government keeping in view that the number of heatwave days in India has increased from 413 over 1981-1990 to 600 over 2011-2020?

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

(a) The details of state-wise average number of Severe Heatwave/heatwave days in the country in the last 10 years is given Annexure.

(b) The study on heatwave have brought out that the warming of the tropical Indian Ocean and more frequent El Nino events in future may lead to more frequent and long lasting heat waves over India.

(c) Yes, As per the recent IPCC Sixth Assessment Report by Working Group I viz. "Climate Change 2021: The Physical Science Basis", theGlobal mean concentrations of anthropogenic aerosols and greenhouse gases which are the drivers of climate change have increased in South Asia region which will result in more intense and frequent increase in the Heatwaves and humid heat stress during the 21stcentury.

(d) The MoES climate change assessment report covers all aspects of regional climate change including the climatic extremes across India (Krishnan et al., 2020). 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 weather extremes including the

extreme heatwaves. 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. The report notes that the frequency of summer (April–June) heat waves over India is projected to be 3 to 4 times higher by the end of the twenty-first century under the Representative Concentration Pathways-8.5 (RCP-8.5) scenario, as compared to the 1976–2005 baseline period (Krishnan et al. 2020). However, it is to be noted that RCP-8.5 is a high concentration pathway (extreme scenario) which would result in a Radiative Forcing of 8.5 W/m^2 in 2100. Therefore the above result regarding heat waves is 'not a fact' but instead provides some insights about likely heat waves occurrences if we follow the RCP-8.5 scenario.

(e) 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. As an initiative IMD is issuing Seasonal Outlook for temperatures for the months of April, May & June in the last week of March for planning purpose. This outlook bring out the expected scenario of heat waves also during the period.

The seasonal outlook is followed by Extended Range Outlook issued on every Thursday for next two weeks. In addition to this, the forecast and the colour coded warnings for severe weather including heat wave warning are issued on daily basis for next five days with outlook for another two days.

IMD has started Forecast Demonstration Project (FDP) on heat waves from April 2017 for the hot weather season under which a detailed daily report including realized data of heat waves, weather systems leading to the occurrence of heat waves, diagnosis on the basis of Numerical Model outputs and forecast and warnings for five days is prepared. This bulletin is disseminated to all concerned including health departments. From April 2018 onwards, IMD started issuing an additional bulletin on heat wave in the morning (8 a.m.) valid for 24 hours for supporting the planning of activities for the day and this bulletin is also disseminated to all concerned. All these bulletins are posted to IMD website also, on a special page created for Heatwaves.

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.

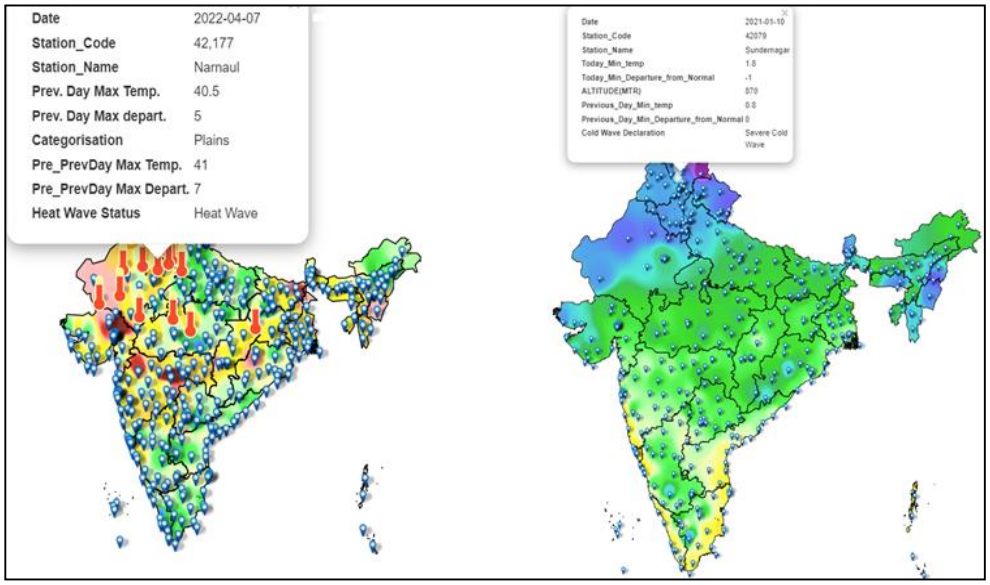
The Heat Action Plan is a comprehensive early warning system and preparedness plan for extreme heat events. The Plan presents immediate as well as longer-term actions to increase preparedness, information-sharing, and response coordination to reduce the health impacts of extreme heat on vulnerable populations. NDMA and IMD are working with 23 states prone to high temperatures leading to heat-wave conditions to develop heat action plans.

Recent advancement made in Heat wave forecast and warning follow:-

- **Heat Wave Monitoring and Forecasting Information on GIS**

a) Interactive Map in Web-GIS for actual maximum/minimum temperature & its Departure from normal temperature. (Current Temperature).

b) Interactive Map in Web-GIS for Heat Wave & severe Heat Wave along with Warm Nights & very Warm Nights. (Current Temperature).



c) Interactive Map in Web-GIS for last 5 days actual Maximum/minimum temperature & its Departure from normal temperatures, Heat Wave, severe Heat Waves, Warm Nights and very Warm Nights to assess the impact of the spell of Heat waves. (Past 5 days Heat Wave and Warm Night Situation).

d) Normal Relative Humidity (RH) for March to June months based on 0830 and 1730 IST are provided to assess the impact of RH during the Heat Wave days. The impact of Heat Waves becomes more severe with an increase in the RH.

- Issue special heat wave & its impact bulletin (March to June) at 1600 hrs IST by including impact of Minimum Temperature, humidity and wind.

- Heat Wave hazard analysis for entire country for four hot weather months (MARCH, APRIL, MAY & JUNE) considering the Maximum Temperature, Minimum Temperature, Humidity, Wind and Duration is completed. This will lead to identification of hazard scores based on different meteorological parameters aggravating impact of Heat Waves. These scores could in future be utilized as threshold to generate Heat Wave impact based alerts for the specific locations.

The link for Heat Wave information web-page is
https://internal.imd.gov.in/pages/heatwave_mausam.php

Recently IMD brought out web based online "Climate Hazard & Vulnerability Atlas of India" prepared for the thirteen most hazardous meteorological events, which cause extensive damages, economic, human, and animal losses. The same can be accessed at https://imdpune.gov.in/hazardatlas/abouthazard.html. The climate Hazard and vulnerability atlas will help state government authorities and Disaster Management Agencies for planning and taking appropriate action to tackle various extreme weather events. This atlas serves as a reference to IMD to issue impact based forecast for various extreme weather events, including heatwave.

Annexure

State-wise Average number of Sever Heat wave/Heat Wave days reported in the recent 10 years.

S. No. क्र .सं.	State / UT	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Andhra Pradesh	8	16	11	16	7	10	10	8	13	3	4
2	Assam	0	0	0	0	0	0	0	0	0	0	0
3	Bihar	1	20	1	9	5	11	3	6	12	1	1
4	Chhattisgarh	1	6	3	6	1	2	3	0	3	0	1
5	Delhi	1	11	7	7	3	2	9	6	8	4	3
6	Gujarat	1	1	1	3	2	3	4	3	4	2	0
7	Haryana	3	8	8	9	4	10	13	9	8	3	2
8	Himachal Pradesh	0	0	0	0	0	0	0	0	0	0	0
9	Jharkhand	1	19	5	7	9	16	10	3	10	1	0
10	Karnataka	0	2	1	1	2	3	0	0	2	4	0
11	Kerala	-	-	-	-	-	-	-	-	-	-	-
12	Madhya Pradesh	2	4	5	10	4	10	7	7	13	2	1
13	Maharashtra	1	3	8	5	5	8	6	8	15	5	0
14	Mizoram	-	-	-	-	-	-	-	-	-	-	-
15	Odisha	2	18	9	17	11	19	9	4	8	2	4
16	Punjab	6	17	11	12	3	5	12	4	8	1	2
17	Rajasthan	7	7	9	11	9	15	14	17	20	6	4
18	Tamil Nadu	3	10	4	5	3	3	8	2	11	4	3
19	Telangana	0	9	6	2	7	14	5	0	10	2	0
20	Uttar Pradesh	2	17	6	9	8	5	4	6	13	2	1
21	Uttarakhand	0	27	2	3	2	9	4	5	13	0	7
22	West Bengal	1	6	3	12	1	5	2	2	3	0	3

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