IMD’s warning about heat waves in India

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Why in News: Recently, the India Meteorological Department (IMD) warned that the maximum temperatures over northwest, west, and central India would be 3-5° C higher than the long-term average.

About heat waves

A Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season in the North-Western parts of India.

Heat Waves typically occur between March and June, and in some rare cases even extend till July.

The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death.

The Indian Meteorological Department (IMD) has given the following criteria for Heat Waves :

Heat Wave need not be considered till maximum temperature of a station reaches atleast 40°C for Plains and atleast 30°C for Hilly regions

When normal maximum temperature of a station is less than or equal to 40°C Heat Wave Departure from normal is 5°C to 6°C Severe Heat Wave Departure from normal is 7°C or more

When normal maximum temperature of a station is more than 40°C Heat Wave Departure from normal is 4°C to 5°C Severe Heat Wave Departure from normal is 6°C or more

When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat waves should be declared.

Origin of heat waves

Heat waves are formed for one of two reasons: because warmer air is flowing in from elsewhere or because something is producing it locally.

Air is warmed locally when the air is warmed by higher land surface temperature or because the air sinking down from above is compressed along the way, producing hot air near the surface.

A study published recently, in Nature Geoscience offers some clues as to how different processes contribute to the formation of a heat wave.

The following explanation adapts the study’s findings to the Indian context

1In spring, India typically has air flowing in from the west-northwest. This direction is bad news for India for several reasons. In the context of climate change, the Middle East is warming faster than other regions in latitudes similarly close to the equator, and serves as a source of the warm air that blows into India.

2Likewise, air flowing in from the northwest rolls in over the mountains of Afghanistan and Pakistan, so some of the compression also happens on the leeward side of these mountains, entering India with a bristling warmth.

3The air flowing in over the oceans is expected to bring cooler air, since land warms faster than the oceans (because the heat capacity of land is much lower). Alas, the Arabian Sea is warming faster than most other ocean regions.

4Next, the strong upper atmospheric westerly winds that come in from the Atlantic Ocean over to India during spring control the near-surface winds. Any time winds flow from the west to the east, we need to remember that the winds are blowing faster than the planet itself, which is also rotating from west to east. The energy to run past the earth near the surface, against the surface friction, can only come from above. This descending air compresses and warms up to generate some heat waves.

5Finally, the so-called lapse rate – the rate at which temperatures cool from the surface to the upper atmosphere – is declining under global warming. In other words, global warming tends to warm the upper atmosphere faster than the air near the surface. This in turn means that the sinking air is warmer due to global warming, and thus produces heat waves as it sinks and compresses.

Given these are the processes that contribute to the formation of a heat wave, and the ways in which global warming affects them, it must be clear why once-a-decade heat wave events have started to occur once every few years, and are also more intense.

The area covered by these heat waves is also influenced by the background pressure patterns set up by El Niño and La Niña events, and of late it has been expanding.

The other factors that affect the formation of heat waves are the age of the air mass and how far it has travelled. The north-northwestern heatwaves are typically formed with air masses that come from 800-1,600 km away and are around two days old.

Heat waves over peninsular India on the other hand arrive from the oceans, which are closer (around 200-400 km) and are barely a day old. As a result, they are on average less intense.

Impact of Heat waves

Heatwaves have posed severe challenges to human health and have created public health emergencies. Prolonged heat exposure causes heat strokes and heat exhaustion and causes various respiratory and cardiovascular diseases.

Furthermore, the frequent occurrence of heatwaves also adversely affects different sectors of the economy. For instance, the livelihood of poor and marginal farmers is negatively impacted due to the loss of working days.

Apart from the impact on farmers, heatwaves disproportionately impact the lives of daily wage laborers, small street vendors, brickmaking workers, construction workers, and rickshaw pullers.

Heatwaves have an adverse impact on these workers' productivity and thereby affect the overall economy of India.

Prolonged heatwaves adversely impact agricultural productivity and affect the livestock sector as animals are more vulnerable to heatwaves.

Moreover, heatwaves increase the risk of forest fires, causing a sudden rise in demand for electricity and irrigated water.

According to the International Labour Organization (2019) report, India lost around 4.3% of working hours due to heat stress in 1995 and is expected to lose 5.8% of working hours in 2030.

Measures to mitigate the impact of heat waves

An urgent mitigation and adaptation plan is needed to tackle the adverse impact of heatwaves in India.

As deaths due to heatwaves are preventable, the Government must prioritize the preparation of a long-term action plan to safeguard human lives, livestock, and wildlife.

Disseminating public awareness through print, electronic and social media, providing heat-proof shelter facilities during summer, easing access to public drinking water, and huge afforestation, particularly in urban and rural areas, would help mitigate heatwave fatalities.

Reducing outdoor exercise during heat alerts can protect individuals from the adverse effects of extreme heat.

In order to undertake necessary mitigation and prevention measures, it is crucial to prepare a database at the district level involving the age, gender, and occupation of people who have died due to heatwaves.

Conclusion

In the face of frequent heatwaves in many Indian states, respective state governments should coordinate with other departments in designing long-term measures to reduce heatwave fatalities. Furthermore, it is essential to create a comprehensive disaster management plan to safeguard our communities.