

Too hot to handle?

-By Anushiya J and Mahesh Kalshetty

March 2023 was the second-warmest March for the world in the last 174 years, says the March 2023 Global Climate Report by the US National Oceanic and Atmospheric Administration (NOAA). With the seventh-warmest January and fourth-warmest February (in the last 174 years) also being this year — as reported by NOAA — 2023 has, indeed, had a warm start. So, are warmer years becoming a reality?

Diurnal temperature range

The warming happening across continents, regions and nations is not uniform or 'symmetric' round-the-clock (i.e., during day- and night-time). Recent global and regional studies indicate that nights are warming at a faster rate than days across most of the world. The India Meteorological Department has also warned about warmer nights and frequent heat waves this summer. Warmer nights reduce the diurnal temperature range (DTR, the difference between day- and night-time temperatures). A recent study in *Geophysical Research Letters* confirms detectable evidence of human influence on the observed changes in the global DTR.

DTR is a key index for climate change assessments under the World Climate Research Programme (WCRP) and is one of the core indices used to monitor climate extremities. This thermal metric is used to assess the impact on agriculture, water resources, biodiversity, and human health. An ongoing study at the Centre for Study of Science, Technology and Policy (CSTEP) aims to trace the long-term changes in DTR for the Indian sub-continent through season-wise and month-wise comparison of daily DTR values across all Indian districts and identify the hotspots.

Hotspots in India

The comparative analysis of daily DTR values in the month of March for the last 20+ years (from 2000-2023) shows an alarming decline for most Indian districts. Almost 96% of the districts have experienced a significant decreasing trend (of up to -2.9°C) during March, with the central, west, and north-west regions witnessing a very large decline of about -2.1 to -2.9°C . The hotspots are in the states of Madhya Pradesh, Gujarat, Rajasthan, Maharashtra, Bihar, Uttar Pradesh, Karnataka, Telangana, and Haryana.

Large decline in DTR (-1.1 to -2°C) is observed in Bihar, Madhya Pradesh, Dadra and Nagar Haveli, Daman and Diu, Gujarat, Karnataka, Odisha, Punjab, Uttar Pradesh, Haryana, Maharashtra, Rajasthan, and Telangana, while moderate decline in DTR (-0.1 to -1°C) is observed for most parts of the Northeast states, Tamil Nadu, Puducherry, Kerala, and some parts of West Bengal, Uttarakhand, Uttar Pradesh, Punjab, and Delhi.

What does this mean?

Shrinking DTR range has serious implications for ecosystems and human well-being. Crops rely on the temperature difference between day and night to regulate their growth and metabolism. As such, these changes affect the timing of plant development, alter the timing of flowering or fruiting, and reduce crop yields. DTR changes cause asymmetric soil warming as well, increasing the risk of wildfire, and affecting the behaviour and habitat of animals, particularly those that rely on temperature cues for migration, hibernation, or breeding. A shrinking DTR also increases air

pollution, spurs urban-heat-island effects, and causes heat stress, directly endangering public health. But most of all, these declining DTR trends can compound extreme events, inflicting severe hardships and risks on the vulnerable sections. The AR6 Synthesis Report 2023 by the Intergovernmental Panel on Climate Change (IPCC) has signposted that compound climate hazards (when climate change causes two extreme things to happen at the same time, causing substantial impact) can overwhelm adaptive capacity and substantially aggravate the damage in various sectors.

What's the recourse?

The need to understand compound events and the associated climate risks has been receiving attention in recent years. The sizeable decline in DTR throughout India is likely to compound the extreme climate events predicted for the country this year — frequent heat waves, severe El Nino, and droughts.

This calls for amping up our preparedness and adaptive capabilities. More studies should be conducted to assess the compounding risks and their impacts on pollution dispersion, heat stress, thermal comfort, health, etc., to enable holistic and more accurate risk assessments. In addition, vulnerability-mapping in locations with sensitive populations — elderly people, and people suffering from chronic respiratory diseases or with low adaptive capacity — should be undertaken. Together, these can improve the overall preparedness for dealing with climate change events.

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