The rising heat: Are extreme temperatures the new normal?

A girl plays in a fountain at a shopping mall in Beijing, China, June 23, 2023. /VCG

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At the onset of summer, Beijing has already endured multiple episodes of extreme heat. On June 22, the temperature at a weather station in Beijing's southern suburbs peaked at 41.1°C, setting a record for June. On June 23, the temperature once again rose beyond 40°C, marking the first instance of two consecutive days with temperatures above 40°C since the observatory's

inception in 1951. After the Dragon Boat Festival, rains are expected to bring temporary relief, but the warm air mass will return strongly, driving temperatures close to 40°C again at the end of this month.

The heatwave is not confined to Beijing. Large areas in Tianjin, Hebei Province, and Shandong Province are also at the epicenter of this thermal onslaught, with numerous weather stations recording historically high temperatures. 2023 has already seen the highest number of hot days for the same period since 1961.

The high temperatures are not confined to China either. By the end of April, temperatures in New Delhi, the capital of India, had soared to 42°C. Early May saw record-breaking heatwaves in Southeast Asian countries like Thailand, Laos, and Vietnam, with temperatures floating between 43°C and 45°C. Currently, tens of millions of people in the southern U.S. states of Texas and New Mexico are on extreme heat alert, with temperatures in some cities exceeding 45°C.

In Southeast Asia, the heat has caused heatstroke and power shortages and sparked bushfires due to slash-and-burn farming practices. This has led to severe air pollution from smog and even caused widespread PM2.5 exceedances in southern Yunnan Province in southwest China. Recent high-temperature-induced summer bushfires in the United States and Canada have also resulted in extensive air pollution. The ongoing heatwave in

North China, apart from posing health risks like heatstroke, has triggered widespread ozone pollution due to the hot and sunny weather.

Due to the dry weather, crops turn yellow and withered in Allen, Texas, U.S., on July 21, 2022. /Xinhua

Every heatwave has its meteorological roots. For instance, the unusually high temperatures in China's Yangtze River Basin in 2022 were a direct result of an unusually strong subtropical high in the Western Pacific. Meteorologists attribute the current heatwave in North China to prolonged control by a warm air mass, characterized by clear cloudless skies, extended sunlight hours, and significant radiative warming.

Experts from the Institute of Atmospheric Physics of the Chinese Academy of Sciences link the heat experienced during the Dragon Boat Festival to the "heat dome" phenomenon. The term refers to a stable Ω-shaped hot air

mass that develops under a large area of high pressure and nearby low pressure in the upper part of the atmosphere. The air close to the ground, after being heated, attempts to rise but is pushed back by the high pressure above, creating a superheated "lid" over the region.

Why does the relatively rare "heat dome" have such a broad impact in China? From the perspective of oceanic and atmospheric circulation, one significant factor is that the three-year La Nina phase has come to an end, and El Nino is on its way back. El Nino refers to a climate phenomenon characterized by persistent and significant warming of the sea surface temperature in the central and eastern equatorial Pacific Ocean, with the opposite cooler conditions termed "La Nina."

Meteorologists tend to believe that La Nina lowers sea temperatures, which somewhat mitigates global warming, whereas El Nino exacerbates it. The likely return of El Nino in 2024 has raised concerns that it could usher in the hottest year in history.

However, when observed on a broader scale, both the "heat dome" and "El Nino" are just phenomena. What we shouldn't overlook is the quietly unfolding climate change. Human activities have substantially increased greenhouse gas emissions, causing the concentration of carbon dioxide in the atmosphere to rise from 280 ppm before the industrial revolution to more than 415 ppm in 2021. The rate of global temperature rise has never

been as rapid as in the past 50 years, with the current temperature level being 1.1℃ higher than pre-industrial times.

Alpinists walk across the receding Morteratsch glacier near Pontresina, Switzerland, May 21, 2023. /VCG

The UK Met Office warns that global temperatures may surge even more as the weather transitions towards El Nino. There's a 66 percent chance that in at least one year between 2023 and 2027, the global average temperature could be 1.5°C higher than the pre-industrial level. If the temperature rise surpasses the threshold set by the Paris Agreement, it could lead to more unpredictable and extreme heatwaves, droughts, wildfires, and heavy rainfall.

The China Environment News quotes researcher Wei Ke from the Institute of Atmospheric Physics of the Chinese Academy of Sciences as saying that global warming not only increases average temperatures, leading to greater

extreme heat, but it also exacerbates abnormal atmospheric circulation, making severe blocking highs and extreme heatwaves more likely.

The Intergovernmental Panel on Climate Change (IPCC) assessment report points out that humans haven't faced such intense warming in the past 6,500 years. On the one hand, we need to bolster our adaptation capabilities, improve the monitoring, forecasting, and warning of extreme weather events like heatwaves, wildfires, droughts, and floods, and prepare for a potentially enduring trend of sea-level rise lasting for a thousand years. On the other hand, it's crucial to make strong efforts to save energy and reduce carbon emissions, take actions aimed at peaking carbon emission and carbon neutrality, and work with the international community to tackle global climate change.