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Heat Records Are Broken Around the Globe as Earth Warms, Fast

From north to south, temperatures are surging as greenhouse gases trap heat in the atmosphere and combine with effects from El Niño.

By Brad Plumer and Elena Shao
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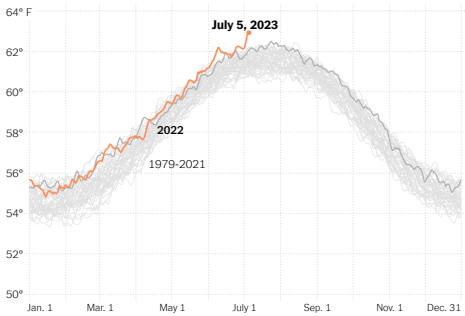
The past three days were quite likely the hottest in Earth's modern history, scientists said on Thursday, as an astonishing surge of heat across the globe continued to shatter temperature records from North America to Antarctica.

The spike comes as forecasters warn that the Earth could be entering a multiyear period of exceptional warmth driven by two main factors: continued emissions of heat-trapping gases, mainly caused by humans burning oil, gas and coal; and the return of El Niño, a cyclical weather pattern.

Earth's Hottest Days on Record Were July 3-5

Daily surface air temperatures worldwide since 1979



Source: Climate Reanalyzer, Climate Change Institute at the University of Maine, based on data from the National Centers for Environmental Prediction Climate Forecast System • By Elena Shao/The New York Times

Already, the surge has been striking. The planet just experienced its warmest June ever recorded, researchers said, with deadly heat waves scorching Texas, Mexico and India. Off the coasts of Antarctica, sea ice levels this year have plummeted to record lows.

And in the North Atlantic, the ocean has been off-the-charts hot. Surface temperatures in May were 2.9 degrees Fahrenheit, or 1.6 degrees Celsius, warmer than typical for this time of year, breaking previous records by an unusually large margin.

The sharp jump in temperatures has unsettled even those scientists who have been tracking climate change.

"It's so far out of line of what's been observed that it's hard to wrap your head around," said Brian McNoldy, a senior research scientist at the University of Miami. "It doesn't seem real."

On Tuesday, global average temperatures climbed to 62.6 degrees Fahrenheit, or 17 Celsius, making it the hottest day Earth has experienced since at least 1940, when records began, and very likely before that, according to an analysis by the European Union's Copernicus Climate Change Service.

Since that was an average, parts of the globe felt that extra heat more forcefully. For instance, in the Southern United States and Northern Mexico, where the heat index has reached triple digits, climate change has made the ongoing heat wave about 5 degrees Fahrenheit hotter than it would have been otherwise, according to scientists at the Lawrence Berkeley National Laboratory in California.

The overall warming of the planet is "well within the realm of what scientists had projected would happen" as humans continue to pump vast amounts of heat-trapping greenhouse gases into the atmosphere, said Zeke Hausfather, a climate scientist at Berkeley Earth and the payments company Stripe.

On the whole, Earth has warmed roughly 2 degrees Fahrenheit since the 19th century and will continue to grow hotter until humans essentially halt all emissions from fossil fuels and stop deforestation.

But other factors layered on top of human-caused warming may have helped temperatures accelerate dramatically in recent months. For instance, a cyclical phenomenon in the Pacific Ocean known as the El Niño-Southern Oscillation causes year-to-year fluctuations by shifting heat in and out of deeper ocean layers. Global surface temperatures tend to be cooler during La Niña years and hotter during El Niño years.

"A big reason we're seeing so many records shattered is that we're transitioning out of an unusually long three-year La Niña, which suppressed temperatures, and into a strong El Niño," Dr. Hausfather said.

That likely portends even more heat is coming. The current El Niño is just getting underway and many researchers don't expect it to peak until December or January, with global temperatures seeing another surge in the months thereafter. That means that next year could be even hotter than this year, scientists said.

Other dynamics may be at work, too. The North Atlantic has seen record heat since early March, before El Niño conditions began. One factor may be a subtropical high pressure system known as the Azores High that has weakened the winds blowing over the ocean and limited the amount of dust blowing from the Sahara, which normally helps cool the ocean.

Those weather patterns could change in the weeks ahead, said Dr. McNoldy of the University of Miami. "But even then we'd probably be going from insanely record-breaking temperatures down to just extremely record-breaking," he said.

The soaring heat has led some meteorologists to increase their warnings about this year's hurricane season. On Thursday, forecasters at Colorado State University said they now expect an above-average Atlantic hurricane season, with around 18 tropical cyclones, a reversal from earlier forecasts of a quieter-than-usual year. Hurricanes in the Atlantic are often suppressed during El Niño years, but that may not be true this year because of the unusually warm ocean waters, which can fuel storms.

Other researchers have suggested that recent efforts to clean up sulfur pollution from ships around the world may be pushing up temperatures slightly, since sulfur dioxide tends to reflect sunlight and cool the planet somewhat. That precise impact is still being debated, however.

"There does seem to be this unusual convergence of warming factors right now," said Gabriel Vecchi, a climate scientist at Princeton. "But this is all happening in a world where we've been increasing greenhouse gases for the past 150 years, and that really loads the dice and makes it much more likely that we're going to get pushed into record-breaking territory."

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