

NASA analysis confirms a year of monthly temperature records

June 12 2024, by Sally Younger



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May 2024 was the warmest May on the books, marking a full year of record-high monthly temperatures, NASA scientists found. Average global temperatures for the past 12 months hit record highs for each

respective month—an unprecedented streak—according to scientists from NASA's Goddard Institute for Space Studies (GISS) in New York.

"It's clear we are facing a climate crisis," said NASA Administrator Bill Nelson. "Communities across America—like Arizona, California, Nevada—and communities across the globe are feeling first-hand extreme heat in unprecedented numbers. NASA and the Biden-Harris Administration recognize the urgency of protecting our home planet. We are providing critical climate data to better lives and livelihoods, and benefit all humanity."

The run of record temperatures fits within a long-term warming trend driven by human activity—primarily greenhouse gas emissions. The trend has become evident over the past four decades, with the last 10 consecutive years being the warmest 10 since record-keeping began in the late 19th century. Before this streak of 12 straight months of record temperatures, the second longest streak lasted for seven months between 2015 and 2016.

"We're experiencing more hot days, more hot months, more hot years," said Kate Calvin, NASA's chief scientist and senior climate advisor. "We know that these increases in temperature are driven by our [greenhouse gas emissions](#) and are impacting people and ecosystems around the world."

In NASA's analysis, a temperature baseline is defined by several decades or more—typically 30 years. The average global temperature over the past 12 months was 2.34 degrees Fahrenheit (1.30 degrees Celsius) above the 20th century baseline (1951 to 1980). This is slightly over the 2.69 degree Fahrenheit (1.5 degree Celsius) level with respect to the late 19th century average.

To calculate Earth's global temperature, NASA scientists gather data

from tens of thousands of meteorological stations on land, plus thousands of instruments on ships and buoys on the [ocean surface](#). This raw data is analyzed using methods that account for the varied spacing of temperature stations around the globe and for urban heating effects that could skew the calculations.

El Niño subsiding, La Niña arriving?

Phenomena such as El Niño and La Niña, which alternately warm and cool the tropical Pacific Ocean, can contribute a small amount of variability in global temperatures from year to year. The strong El Niño that began in spring 2023 helped stoke last year's extreme summer and fall heat.

As of May 2024, scientists at the NOAA (National Oceanic and Atmospheric Administration) Climate Prediction Center projected a 49% chance of La Niña developing between June and August, and a 69% chance of it developing between July and September. By cooling a large swath of the tropical Pacific, a La Niña event could partially suppress average global temperatures this year.

It's hard to know whether 2024 will set another global heat record. Factors like volcanic eruptions and sun-blocking aerosol emissions can affect our climate in any given year. NASA missions are actively studying these influences, said Gavin Schmidt, director of GISS.

"There are open questions that can impact our predictions over the next few years and decades, and we're in evidence-gathering mode," Schmidt said. "This year may well end up setting another global temperature record. Right now, it's in line to be close to 2023."

Ocean temperatures and hurricanes

Scientists are watching to see how ocean temperatures may influence this year's hurricane season. Temperatures remained high as the 2024 hurricane and typhoon seasons got underway.

Across the Northern Hemisphere, ocean temperatures for the January-April period were 2.12 degrees Fahrenheit (1.18 degrees Celsius) above average, according to NOAA. Despite the waning El Niño, temperatures at the sea surface and at deeper depths are still above average in many places, said Josh Willis, an oceanographer at NASA's Jet Propulsion Laboratory in Southern California.

Willis cited rising carbon dioxide emissions as the main driver of ocean warming. As much as 90% of the excess atmospheric heat in recent decades has been absorbed by the ocean, with much of that heat stored near the water surface.

"The ocean is the flywheel of our climate," Willis said. "Since the ocean covers more than two-thirds of Earth, whatever sea surface temperatures are, the rest of the planet follows."

La Niña years also can contribute to more active Atlantic hurricane seasons. That's because La Niña conditions weaken [westerly winds](#) high in the atmosphere near the Americas, over the Caribbean Sea and tropical Atlantic Ocean. Wind shear—abrupt changes in wind speed and direction—can cut hurricanes down before they grow. La Niña effectively lifts this brake, allowing tropical storms to form and intensify unimpeded.

NASA's [full dataset of global surface temperatures](#), as well as details of how NASA scientists conducted the analysis, are publicly available from GISS, a NASA laboratory managed by the agency's Goddard Space Flight Center in Greenbelt, Maryland.

Provided by NASA

Citation: NASA analysis confirms a year of monthly temperature records (2024, June 12) retrieved 23 June 2024 from <https://phys.org/news/2024-06-nasa-analysis-year-monthly-temperature.html>

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