

2023 was the hottest summer in 2,000 years

According to a study from the University of Cambridge in United Kingdom, it has been found that 2023 was the hottest summer in the Northern Hemisphere in the past 2,000 years, almost 4°C warmer than the coldest summer during the same period. Although 2023 has been reported as the hottest year on record, the instrumental evidence only reaches back as far as 1850 at best, and most records are limited to certain regions. Such past climate information is gathered from annually resolved tree rings over two millennia, since the height of the Roman Empire, exceeding the extremes of natural climate variability by half a degree Celsius. Researchers opine that this trend will continue unless we reduce greenhouse gas emissions dramatically. This information clearly demonstrates that in the Northern Hemisphere, the 2015 Paris Agreement to limit warming to 1.5°C above pre-industrial levels has already been breached.

Early instrumental temperature records, from 1850–1900, are sparse and inconsistent. The researchers compared early instrumental data with a large-scale tree ring dataset and found the 19th century temperature baseline used to contextualize global warming is several tenths of a degree Celsius colder than previously thought. By re-calibrating this baseline, the researchers calculated that summer 2023 conditions in the Northern Hemisphere were 2.07°C warmer than mean summer temperatures between 1850 and 1900.

Tree rings can provide that context, since they contain annually-resolved and absolutely-dated information about past summer temperatures. Using tree-ring chronologies allows researchers to look much further back in time without the uncertainty associated with some early instrumental measurements.

The available tree-ring data reveals that most of the cooler periods over the past 2,000 years, such as the Little Antique Ice Age in the 6th century and the Little Ice Age in the early 19th century, followed large-sulphur-rich volcanic eruptions. These eruptions spewed huge amounts of aerosols into the stratosphere, triggering rapid surface cooling. The coldest summer of the past 2,000 years, in 536 CE, followed one such eruption, and was 3.93°C colder than the summer of 2023.

However, over the past 60 years, global warming caused by greenhouse gas emissions are causing El Niño events to become stronger, resulting in hotter summers. The current El Niño event is expected to continue into early summer 2024, making it likely that this summer will break temperature records once again.

It's true that the climate is always changing, but the warming in 2023, caused by greenhouse gases, is additionally amplified by El Niño conditions, so we end up with longer and more severe heat waves and extended periods of drought. When we look at the big picture, it shows just how urgent it is that we reduce greenhouse gas emissions immediately.

The researchers note that while their results are robust for the Northern Hemisphere, it is difficult to obtain global averages for the same period since data is sparse for the Southern Hemisphere. The Southern Hemisphere also responds differently to climate change, since it is far more ocean-covered than the Northern hemisphere (Source: *Nature* (2024)).