

# Climate change: Heatwave made 'at least' five times more likely by warming

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**Last week's record breaking heatwave across much of Europe was made "at least five times" more likely to happen by climate change, say scientists.**

Their rapid attribution study says that rising temperatures "super-charged" the event, making it more likely to happen than through natural variability alone.

Heatwaves in June are now about 4C hotter than they used to be, the researchers said.

Globally, the average temperature for June was the highest on record.

Heatwaves naturally occur in summertime but last week's event in many European countries was unprecedented because it happened so early, and the recorded temperatures were so high.

Records were broken at locations in France, Switzerland, Austria, Germany and Spain.

The new French record, established at Gallargues-le-Montueux last Friday, was more than 1.5C above the previous high mark.

Much of the concern about the heat focused on France, with red alerts in several areas, many schools were closed, exams were postponed and health minister Agnès Buzyn warned that "everyone is at risk".

The immediate cause of the heatwave was the weather, with hot air drawn in from

northern Africa, caused by high pressure over central Europe and a storm stalling over the Atlantic.



Europe swelters in extreme heat

By lucky coincidence, the authors of this new study happened to be in Toulouse, France, at a conference on climate change and extreme events.

The researchers, members of the World Weather Attribution Group decided to use the opportunity to analyse the link between human-induced climate change and the heatwave.

They defined the heatwave as the highest three-day averaged daily mean temperature in June, arguing that this is a better indicator of health impacts than maximums or minimums.

The researchers compared the observations of temperatures recorded during the month of June with climate models that can show how the world would be without the human influence on the climate.

They found that, over France, the probability of having a heatwave had increased by at least a factor of five. However, the researchers say that this influence could be much higher still, by a factor of 100 or more.

"We are very confident that this lower boundary of factor five is valid - but we are not confident we can say much more than that," said Dr Geert Jan van Oldenborgh, senior researcher at the Royal Netherlands Meteorological Institute.

"The reason we are fairly careful is because we found fairly large discrepancies between the modelled properties of heatwaves and the observed properties of heatwaves. They all show stronger heatwaves but the trend in the observations is much larger than in the trends in the model."



The heatwave sparked wildfires in Spain

The scientists say that the observations indicate a heatwave trend of around 4C in June, where the models show a much lower trend.

According to the Copernicus Climate Change Service, June generally was more than 2 degrees above the long term average. Globally the temperature was also the highest for June on record, being about 0.1C higher than 2016.

Heatwaves in the 1970s and 1980s in Europe were limited somewhat because of what's termed aerosol cooling. This is essentially the impact of air pollution which for a number of years exerted a cooling influence. However, as the air has become clearer, heatwaves have come back with a vengeance.

According to those involved with this study, this trend in heatwaves is likely to get worse.

"We experienced a heatwave whose intensity could become the norm in the middle of the century," said Dr Robert Vautard, Senior Scientist, CNRS, France.

"The new record of 45.9C set in France last Friday is one more step to confirmation that, without urgent climate mitigation actions, temperatures in France could potentially rise to about 50°C or more in France by the end of the century."

The researchers believe that if global warming continues to the 2C level envisioned in the Paris climate agreement, heatwaves like the one experienced last week will become the norm in June.

# Climate change made Europe's mega-heatwave five times more likely

*Scientists rushed to study whether the scorching temperatures last week were linked to global warming.*

Quirin Schiermeier



France was one of the places affected by a heatwave that hit Europe around 26 June. Credit: Mustafa Yalcin/Anadolu Agency/Getty

After a series of unusually hot summers, France and other parts of Europe last week experienced another intense heatwave that broke temperature records across the continent.

For one group of climate scientists, the event presented a rare opportunity to rapidly analyse whether the heatwave — which made headlines around the world — [could be attributed to global warming](#). After a seven-day analysis, their results are in: climate change made the temperatures reached in France last week at least five times more likely than they would be in a world without global warming.

The scientists with the World Weather Attribution project decided to take action when they saw the heatwave coming, and ended up performing a near real-time analysis while at a climate conference in Toulouse, France. As they met at the International Conference on Statistical Climatology, the city and most of the country baked — the southeastern town of Gallargues-le-Montueux broke national temperature records, hitting 45.9 °C on 28 June.

“We discussed our approach and gathered data and looked at climate models between talks,” says Friederike Otto, a climate researcher at the University of Oxford, UK. “It was really good to have our attribution group all in one place and discuss our work with others. We got a lot of helpful feedback from the meeting.”

## Attribution science

To find out whether global warming has affected the likelihood of a real event, scientists look at existing weather records and compare them with models, including simulations of how the weather would behave in a world that wasn't warming. The concept has matured since it was conceived more than a decade ago, but it is probabilistic by nature.

"Some say the uncertainties are too big," says Otto. "There are indeed caveats, mostly to do with imperfect climate models. But even with large uncertainty bars, we think it is useful to provide quantitative evidence for how climate change is affecting extreme weather."

Using their models, the researchers calculated that the average temperatures reached over the hottest three-day stretch in France — around 28 °C — were at least five times more likely because of climate change.

But in a second analysis that looked at historical temperature records over the past century, rather than models, the team calculated that the likelihood of such a heatwave in June has in fact increased 100-fold since around 1900, owing to the combined influence of climate change and other factors, such as air pollution.

The probability calculated by the models is likely to be an underestimate, say the researchers — who note that their study has not yet been peer reviewed. That's because unlike the real-world data, the simulations are affected only by climate-related factors, and don't represent aspects such as changes in cloud cover, land use, irrigation and air pollution, which all seem to have an influence on temperature, says Robert Vautard, a climate researcher at the Laboratory for Climate and Environmental Sciences in Gif-sur-Yvette, France, who is part of the attribution team.

"Climate models are missing something when it comes to capture fairly short-lived heat events," says Dim Coumou, a climate scientist at the Free University of Amsterdam who wasn't involved in the study. "But that doesn't make the results less alarming. Heat waves will strongly increase with climate change, and that's a big problem for society."

## Public service

So far, more than 200 attribution studies have examined whether climate change made particular events — including heat spells, droughts, floods and storms — more likely. Researchers have found that about two-thirds of the extreme events they analysed were made more likely, or more severe, by the build-up of greenhouse-gases in the atmosphere. For example, an analysis of a heatwave that hit parts of Europe between May and July last year, which was less intense but longer-lived than the latest one, found that climate change had made its occurrence more than twice as likely in many of the places affected.

Some weather agencies now plan to make climate-attribution studies part of their public services. The German weather service and the European Union's Copernicus Climate Change Service are preparing to routinely analyse the extent to which climate change influences weather in Germany and Europe, and to publish the results in near real time.

Public interest in climate-science information is rising sharply, thanks in part to youth protests urging action by adults — most notably the Fridays for Future campaign launched by Swedish teenage climate activist Greta Thunberg.

"I've been speaking to journalists at least every other day for months," says Otto. "It's crazy, but it has really become a central part of my work."

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