

## ATTRIBUTION SCIENCE

# Europe's mega-heatwave boosted by climate change

*Global warming made record-breaking June temperatures in France five times more likely.*

BY QUIRIN SCHIERMEIER

After a series of unusually hot summers, France and other parts of Europe experienced more record-breaking temperatures late last month. 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, they concluded that climate change made the temperatures reached in France from 26 to 28 June 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.”

## WORLD WITHOUT WARMING

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.



Paris was one of the places affected by a heatwave that hit Europe around 26 June.

But in a second analysis that looked at historical temperature records over the past century, rather than using 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. 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. These 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. Heatwaves will strongly increase with climate change, and that's a big problem for society.”

So far, more than 200 ‘attribution’ studies have examined whether climate change

makes particular events — including hot 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, respectively, 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.” ■