

# Global warming brews weird weather

Human influence on extreme heat and rain events is growing.

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Cathal McNaughton/Reuters/Corbis

Climate change will increase the risk of extreme precipitation, such as storms that cause flooding.

Global warming has profoundly changed the odds of extreme heat, rain and snowfall, researchers report on 27 April in *Nature Climate Change*<sup>1</sup>.

Climate change caused by human activities currently drives 75% of daily heat extremes and 18% of heavy rain or snowfall events, the team found — warning that further global warming will sharply increase the risks of such weather. The researchers looked at 'moderate' extremes, which they defined as events expected to occur on 1 in every 1,000 days under present conditions.

"Climate change doesn't 'cause' any single weather event in a deterministic sense," says Erich Fischer, a climate scientist at the Swiss Federal Institute of Technology in Zurich (ETH Zurich), Switzerland, and the study's lead author. "But a warmer and moister atmosphere does clearly favour more frequent hot and wet extremes."

The researchers found that local variations in weather are already large, even though the global average temperature has risen by just 0.85 °C since the start of the Industrial Revolution.

This finding agrees with [earlier research on climate and weather extremes](#). A paper published in *Nature* in 2011, for example, found that climate change has already doubled the risk of the atmospheric conditions that produced catastrophic floods in England and Wales in 2000<sup>2</sup>; an earlier study found the same result for the conditions that triggered a massive European heat wave in 2003<sup>3</sup>.

And human influence on the 'moderate' extremes examined in Fischer's study is set to increase with every degree that the temperature rises, finds the analysis. If the world were to warm by 2 °C above the pre-industrial level, human-caused climate change would drive 40% of rain and snow extremes and 96% of heat extremes, the researchers found.

## Higher temperature, bigger influence

The probability of a daily heat extreme in a world with 2 °C of warming is twice as high as that in a 1.5 °C world, and 5 times that under present conditions. "The rarer and more extreme an event, the higher is the fraction of risk we can attribute to climate warming," says

Fischer.

He and co-author Reto Knutti, also a climate researcher at ETH Zurich, analysed simulations from 25 climate models. First they determined how many daily extreme hot or wet events had occurred between 1901 and 2005. Then they compared these figures with model simulations of extreme weather frequency and severity between 2006 and 2100, under a scenario in which emissions of greenhouse gases remain high.

The team did not investigate how severely any changes would affect societies and ecosystems in different parts of the world. Even so, the results, which agree with the observed increase in extreme rain and heat since the 1950s<sup>4</sup>, make a strong case for policy efforts to keep global warming below 2 °C, says Fischer.

### Model misgivings

Critics caution that existing climate models have trouble replicating observed rain and snowfall trends, raising questions about how well they can project future precipitation.

“All weather events are influenced by the changed environment,” says Kevin Trenberth, a climate researcher with the US National Center for Atmospheric Research in Boulder, Colorado. “The global perspective the authors provide is helpful, but none of the models they use do precipitation realistically and some are quite bad.”

But regardless of model uncertainties, the paper is a stark reminder to policy-makers and the general public that climate change could have dramatic effects on human health and welfare, says Michael Oppenheimer, a climate-policy researcher at Princeton University in New Jersey.

“The risk of heat-related premature deaths has already increased and it will very likely starkly increase further in the future,” he says. “Clearly, governments should not only seek to slow global warming, but must also prepare societies for what warming will inevitably happen.”

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### References

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