

Rising CO₂ may increase dangerous weather extremes, whatever happens to global temperatures

June 12 2018



Credit: University of Bristol

New research from the University of Oxford and collaborators at several other institutions, including the University of Bristol, provides compelling evidence that meeting the global warming target of 1.5°C may not be enough to limit the damage caused by extreme weather.

The paper, published today in *Nature Climate Change*, demonstrates that higher atmospheric CO₂ concentrations directly increase [temperature](#) and rainfall extremes, meaning there could be dangerous changes in these extremes even if the global mean temperature rise remains within 1.5°C. The research highlights the need for climate policy to complement temperature goals with explicit limits on CO₂ concentrations.

Much of the focus of climate change mitigation has been on the goal of limiting warming to 1.5°C warming agreed at the 2015 United Nations climate summit in Paris. However, the atmospheric CO₂ concentrations required to limit warming to 1.5°C depend on the climate response. Researchers from Oxford and other institutions participating in the HAPPI-MIP project (Half a degree Additional warming, Prognosis and Projected Impacts Model Intercomparison Project) simulated future climate under the range of CO₂ concentrations that all might be consistent with 1.5°C of global [warming](#).

In the models, CO₂ levels at the higher end of this range were shown to directly increase Northern Hemisphere summer temperature, heat stress, and tropical precipitation extremes. This means that even if a low temperature response helps us to meet the temperature target, there may still be 'dangerous' changes in extremes – in other words, severe weather impacts beyond those currently expected at 1.5°C.

The research points up the need to set explicit CO₂ [concentration](#) goals to limit the adverse effects of high-impact weather extremes. It also supports existing findings that proposed geo-engineering solutions aimed at reducing [global warming](#) impacts without reducing CO₂ concentrations may not be effective at counteracting changes in extremes.

Hugh Baker, DPhil student at Oxford's Department of Physics and lead

author of the research, said: "Future work is needed to confirm exactly why we see this direct CO₂ effect, but current research points to a combination of circulation and cloud cover changes, and an increase in the amount of direct radiation on the Earth's surface due to simply having more CO₂ in the atmosphere."

Oxford's Professor Myles Allen adds: "This puts paid to the Pollyanna argument that we should wait and see before reducing emissions in case the global temperature response to rising CO₂ turns out to be lower than current models predict. Hugh's paper shows that the accumulation of CO₂ in the atmosphere itself increases the risk of key damaging weather extremes, regardless of the global temperature response. It's not enough to get lucky."

Dr. Dann Mitchell, a co-author of the paper from the University of Bristol's School of Geographical Sciences, said: "Geo-engineering techniques that reduce the amount of sunlight hitting the Earth's surface are increasingly thought of as a way of achieving the Paris Goals because they decrease surface temperature. However, our results show that for extreme [climate](#) such as heatwaves, changing the global mean temperature is not enough, you need to reduce CO₂ concentrations themselves."

More information: Hugh S. Baker et al. Higher CO₂ concentrations increase extreme event risk in a 1.5 °C world, *Nature Climate Change* (2018). [DOI: 10.1038/s41558-018-0190-1](https://doi.org/10.1038/s41558-018-0190-1)

Provided by University of Bristol

Citation: Rising CO₂ may increase dangerous weather extremes, whatever happens to global temperatures (2018, June 12) retrieved 7 July 2024 from

<https://phys.org/news/2018-06-co2-dangerous-weather-extremes-global.html>

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