

Report links weather, human impact

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<http://www.santacruzsentinel.com/general-news/20170424/stanford-study-links-extreme-weather-greenhouse-gases-global-warming>

Weird weather and climate warming are two separate things, but a Stanford team is linking them.

Using math, powerful computers and historical records, research led by Noah Diffenbaugh found that climate change has boosted the odds of extreme heat, drought, punishing rainstorms and retreating sea ice.

"The odds of hitting record-setting level of extremes have been made greater by climate warming," caused by human emission of greenhouse gases, said Diffenbaugh, a professor of Earth system science at Stanford's School of Earth, Energy & Environmental Sciences.

Weather is what the atmosphere does in the short-term — hour-to-hour, day-to-day. It's what's happening outside your window. Climate is the long-term average of weather, over decades and millennium, created by big changes in global forces, such as warming due to carbon emissions.

In the past, scientists typically avoided conflating individual weather events and climate change, citing the challenges of teasing apart human influence from the natural variability of the weather.

The new paper, the latest in a burgeoning new field of climate science called "extreme event attribution," links them. Published in Monday's Proceedings of the National Academy of Sciences, the team built the first-ever "four-step framework" for testing whether global warming has contributed to record-setting weather events.

This approach combines powerful computer models with statistical analyses of climate observations. In their analysis, Diffenbaugh and his group of current and former Stanford colleagues reached two conclusions: First, global warming boosted the odds of a record-breaking heat — for example, a hot week or month — in 85 percent of the surface area of the Earth that they studied.

Secondly, global warming also increased the odds of extreme wet and dry spells. Dry extremes — such as California's 2012-2016 drought — were influenced by global warming 57 percent of the time. Wet extremes — such as catastrophic flooding in north India in June 2013 — were influenced by global warming 41 percent of the time.

This is important for a society trying to plan for the risks of a changing climate, said Diffenbaugh.

"Getting an accurate answer is important for everything from farming to insurance premiums, to international supply chains, to infrastructure planning," he said. "It is very, very important work," said Steven Cohen, executive director of The Earth Institute at Columbia University, where a 2015 study found that natural variability was the dominant driver of the California drought but human-induced warming accounted for 5 to 27 percent of the crisis.

"Most of the analyses so far have focused on one event. What they are doing is developing a methodology and analytical framework that can be tested against many events," he said. "These kinds of methodology and analyses are extremely important if we are going to be able to understand and ultimately respond to these kinds of human-induced changes."

Daithi Stone of Lawrence Berkeley National Laboratory, who studies the role of human activities on climate change, said the Stanford findings are consistent with other studies of extreme heat events. "As the world warms, it makes sense that we should be getting more frequent hot events and less frequent cold events, and this is indeed what is being observed," he said.

But other research has found a more nuanced link between global warming and extreme droughts and deluges, depending strongly on geography, he said.

“We still have some work to do in understanding the role of emissions from human activities in individual wet and dry events and the degree to which there is evidence from the observational record at local scales,” he said.

While the Stanford team did not study why there is a connection, scientists with the National Center for Atmospheric Research have found that warmer oceans — which may be linked to persistent high-pressure systems — can trigger changes in how the atmosphere sweeps across our landscape.

For instance, warm oceans give rise to moister air, strengthening hurricanes and other extreme events.

“If the odds of an individual ingredient are changing — like the pressure patterns that lead to heat waves — that puts a thumb on the scales for the extreme event,” said co-author and former Stanford postdoc Daniel Horton, now an assistant professor at Northwestern University in Evanston, Illinois, in a prepared statement.

One major focus of the Stanford study was Arctic sea ice, which has declined by around 40 percent during the summer season over the past three decades. They found overwhelming statistical evidence that global warming contributed to the severity and probability of the dismal sea ice measurements.

“The trend in the Arctic has been really steep, and our results show that it would have been extremely unlikely to achieve the record-low sea ice extent without global warming,” said Diffenbaugh.

“Our results suggest that the world isn’t quite at the point where every record hot event has a detectable human fingerprint,” he said, “but we are getting close.”