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Future summers could regularly be hotter than the hottest on record

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Source: National Center for Atmospheric Research (NCAR)

Summary: If climate change continues on its current trajectory, the probability that any summer between 2061 and 2080 will be warmer than the hottest on record is 80 percent across the world's land areas, according to a new study. If greenhouse gas emissions are reduced, however, that probability drops to 41 percent, according to the study.

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If greenhouse gas emissions remain unabated, virtually every summer between 2061-2080 could be hotter than any in the historical record.

Credit: © Sunny Forest / Fotolia

In 50 years, summers across most of the globe could regularly be hotter than any summer experienced so far by people alive today, according to a study by scientists at the National Center for Atmospheric Research (NCAR).

If climate change continues on its current trajectory, the probability that any summer between 2061 and 2080 will be warmer than the hottest on record is 80 percent across the world's land areas, excluding Antarctica, which was not studied.

If greenhouse gas emissions are reduced, however, that probability drops to 41 percent, according to the study.

"Extremely hot summers always pose a challenge to society," said NCAR scientist Flavio Lehner, lead author of the study. "They can increase the risk for health issues, but can also damage crops and deepen droughts. Such summers are a true test of our adaptability to rising temperatures."

The study, which is available online, is part of an upcoming special issue of the journal Climatic Change that will focus on quantifying the benefits of reducing greenhouse gas emissions. The research was funded by the U.S. National Science Foundation (NSF) and the Swiss National Science Foundation.

Simulating a range of summers

The research team, which includes NCAR scientists Clara Deser and Benjamin Sanderson, used two existing sets of model simulations to investigate what future summers might look like. Both had been created by running the NCAR-based Community Earth System Model 15 times, with one assuming that greenhouse gas emissions remain unabated and the other assuming that society reduces emissions.

The Community Earth System Model is funded by NSF and the U.S. Department of Energy. The simulations were run on the Yellowstone system at the NCAR-Wyoming Supercomputing Center.

By using simulations that were created by running the same model multiple times, with only tiny differences in the initial starting conditions, the scientists could examine the range of summertime temperatures we might expect in the future for the "business-as-usual" and reduced-emissions scenarios.

"This is the first time that the risk of record summer heat and its dependence on the rate of greenhouse gas emissions has been so comprehensively evaluated from a large set of simulations with a single state-of-the-art climate model," Deser said.

The scientists compared the results to summertime temperatures recorded between 1920 and 2014 as well as to 15 sets of simulated summertime temperatures for the same historic period. By simulating past summers -- instead of relying solely on observations -- the scientists established a large range of temperatures that could have occurred naturally under the same conditions, including greenhouse gas concentrations and volcanic eruptions.

"Instead of just comparing the future to 95 summers from the past, the models give us the opportunity to create more than 1,400 possible past summers," Lehner said. "The result is a more comprehensive and robust look at what should be considered natural variability and what can be attributed to climate change."

Emissions cuts could yield big benefits

The scientists found that between 2061 and 2080, summers in large parts of North and South America, central Europe, Asia, and Africa have a greater than 90 percent chance of being warmer than any summer in the historic record if emissions continue unabated. This means that virtually every summer would be as warm as the hottest to date.

In some regions, the likelihood of summers being warmer than any in the historical record remained less than 50 percent, but in those places -- including Alaska, the central U.S., Scandinavia, Siberia, and continental Australia -- summer temperatures naturally vary a great deal, making it more difficult to detect the impact of climate change.

Reducing emissions would lower the global probability that future summers will be hotter than any in the past, but the benefits would not be spread uniformly. In some regions, including the U.S. East Coast and large parts of the tropics, the probability would remain above 90 percent, even if emissions were reduced.

But it would be a sizable boon for other regions of the world. Parts of Brazil, central Europe, and eastern China would see a reduction of more than 50 percentage points in the chance that future summers would be hotter than the historic range. Since these areas are densely inhabited, a large part of the global population would benefit significantly from climate change mitigation.

"We've thought of climate change as 'global warming'; among what matters is how this overall warming affects conditions that hit people where they live," said Eric DeWeaver, program director in NSF's Division of Atmospheric and Geospace Sciences, which funds NCAR. "Extreme temperatures pose risks to people around the globe. These scientists show the power of ensembles of simulations for understanding how these risks depend on the level of greenhouse gas emissions."

Lehner recently published another study looking at the overlay of population on warming projections. "It's often overlooked that the majority of the world's population lives in regions that will see a comparably fast rise in temperatures," he said.

Story Source:

The above post is reprinted from materials provided by National Center for Atmospheric Research (NCAR). Note: Materials may be edited for content and length.

Journal Reference:

1. Flavio Lehner, Clara Deser, Benjamin M. Sanderson. **Future risk of record-breaking summer temperatures and its mitigation.** *Climatic Change*, 2016; DOI: 10.1007/s10584-016-1616-2

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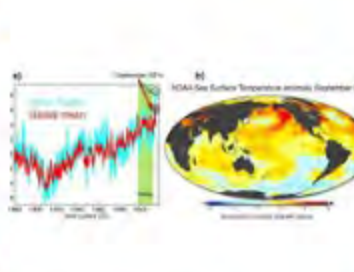
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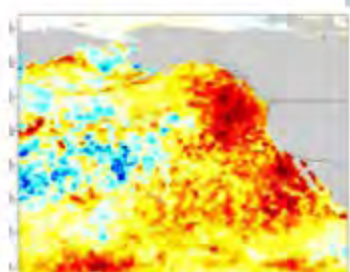
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