Heat waves could increase substantially in size by mid-century, says new study

October 8 2019

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Our planet has been baking under the sun this summer as temperatures reached the hottest ever recorded and heat waves spread across the globe. While the climate continues to warm, scientists expect the frequency and intensity of heat waves to increase. However, a commonly overlooked aspect is the spatial size of heat waves, despite its important implications.

For the first time, in a new study, scientists funded in part by the NOAA Climate Program Office's Climate Observations and Monitoring Program examined this aspect under two different scenarios. They found that by mid-century, in a middle greenhouse emissions scenario, the average size of heat waves could increase by 50%. Under high greenhouse gas concentrations, the average size could increase by 80% and the more extreme heat waves could more than double in size.

"As the physical size of these affected regions increases, more people will be exposed to heat stress," said Brad Lyon, Associate Research Professor at the University of Maine and lead author of the new paper published in *Environmental Research Letters*. "Larger heat waves would also increase electrical loads and peak energy demand on the grid as more people and businesses turn on air conditioning in response."

In addition to heat wave size and exposed population, the authors found that related attributes like duration, magnitude, and cooling degree days (a measure for energy use) could increase substantially. However, Lyon noted that these results were not particularly surprising.

"An increase in attributes like magnitude and duration is consistent with expectations of a warming climate," said Lyon. "What is new in our study is the way we calculated them, which allowed us to consider size as a new heat wave dimension."

Size of heat waves matters to communities

Previous research has generally calculated heat wave statistics at the local level—computing attributes like frequency for each location, or grid point, and then aggregating the results to see spatial patterns. In this study, the authors followed heat waves and quantified their attributes as connected regions that move around and change in size and strength over their lifetime.

"It's sort of like watching what groups of people are doing as they move around together in a park, rather than just counting how many people from all those groups entered the park," said Lyon.

The authors explained that the added stress from a continuous heat wave in a region is very different from scattered conditions that add up to an area of the same size.

"If you have a large contiguous heat wave over a highly populated area, it would be harder for that area to meet peak electric demand than it would be for several areas with smaller heat waves that, when combined, are the same size," said Tony Barnston, Chief Forecaster at Columbia University's International Research Institute for Climate and Society and paper co-author.

By looking at heat waves from this perspective, the authors were able to assess how a heat wave's size, in addition to factors like its intensity and frequency, can impact communities.

Consider heat wave size in future planning

The authors note that their new approach could help utilities stress test their energy system's capacity to meet demand requirements during spatially extensive heat waves. This information could then inform management decisions and planning for the future.

"Heat wave size is another dimension of extreme heat that people don't necessarily think of," said Lyon. "It's a different vantage point from which to view them and assess their impacts."

And as the study suggests, if greenhouse gases and, consequently, heat wave sizes continue to increase, so too could the impacts on our nation's energy systems and public health.

More information: Bradfield Lyon et al, Projected increase in the spatial extent of contiguous U.S. summer heat waves and associated attributes, *Environmental Research Letters* (2019). DOI: 10.1088/1748-9326/ab4b41

Provided by NOAA Headquarters