Researchers predict extreme summertime temperatures to become a regular occurrence

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In an article in the current issue of the journal *Climatic Change Letters*, Boston University researchers have estimated the impact near-term increases in global-mean temperatures will have on summertime temperatures in the U.S. and around the globe.

The "2°C global warming target" is in reference to the current international efforts to reduce emissions of heat-trapping gases and limit human-induced global-mean near-surface temperature increases to 2°C (3.5°F) relative to the pre-industrial era, three-fifths of which has already occurred.

"We wanted to determine the impact such a temperature increase might have upon the frequency of seasonal-mean temperature extremes in various regions of the world, even if we were to avoid this target" said Bruce Anderson, associate professor of geography and environment and the study's principal author. "In particular, we wanted to determine if preventing the global-mean temperature increase from reaching this threshold would prevent extreme temperature values from becoming a normal occurrence in these regions."

Anderson's research indicates that if the 2°C increase were to come to pass 70-80% of the land surface will experience summertime temperature values that exceed observed historical extremes (equivalent to the top 5% of summertime temperatures experienced during the second half of the 20th century) in at least half of all years. In other words, even if an increase in the global mean temperature is limited to

2°C, current historical extreme values will still effectively become the norm for 70-80% of the earth's land surface.

"Many regions of the globe—including much of Africa, the southeastern and central portions of Asia, Indonesia, and the Amazon—are already committed to reaching this point, given current amounts of heat-trapping gases in the atmosphere" said Anderson. Global-mean temperatures are expected to increase an additional 0.6°C (1°F) over the coming decades even if no more carbon dioxide, methane, or other heat-trapping gases are added to the atmosphere.

In the United States, the impacts are expected to be most severe over the western third of the country. "In these regions, if the 2°C threshold is passed, it is more likely than not that every summer will be an extreme summer compared with today," said Anderson. Further, the region is expected to follow soon after Africa, Asia, and the Amazon as one in which summertime temperature extremes will become the norm. "While the western third of the U.S. is not committed to reaching such a situation, it is certainly on the brink," said Anderson.

"While previous work, including our own and that of researchers at Stanford, has highlighted that summertime temperature extremes, and how frequently they occur, will change significantly even in response to relatively small increases in global-mean temperatures, the extent and immediacy of the results really caught us off guard," said Anderson. "Because these results are referenced to increases in global-mean temperatures, and not some particular time or change in amount of heat-trapping gases, they hold whether we reach this global-mean temperature increase in the next 40-50 years as currently projected, or the next century. They really are telling us that this is a temperature threshold that poses significant risks to our lives and livelihoods."

Extreme summertime temperatures killed tens of thousands in Europe in

2003 and Russia in 2010 and produced over $50 billion in agriculture losses across the central and eastern U.S. in 1988. In addition, at least 18 states, including much of the southern and south-eastern U.S., suffered through these types of extreme conditions this past summer.

"We find that the results are sensitive to both the observational dataset used to determine the range of historical variability and the numerical model data used to determine the grid-point increases in future temperatures," said Anderson. Despite these caveats, the findings suggest that substantial fractions of the globe could experience seasonal-mean temperature extremes with high regularity well before the 2°C global-warming target is reached.

More information: Anderson BT (2011) Near-term increase in frequency of seasonal temperature extremes prior to the 2°C global warming target. *Climatic Change Letters.*
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