Don't rule out severe global climate change yet

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A key metric of global warming is the Earth's "equilibrium climate sensitivity" (ECS), which represents the global surface warming that will accompany a doubling of atmospheric carbon dioxide. For nearly four decades, ECS was thought to be somewhere between 2.7 degrees Fahrenheit (F) and 8.1 degrees F, but a more precise estimate has eluded climate scientists.

That was until Peter Cox and colleagues published a paper in *Nature* earlier this year, which arrived at a more precise estimate, indicating a likely range for ECS of 4.0 degrees F to 6.1 degrees F. The finding was noteworthy because the study suggested that the true likely range for climate sensitivity could be reduced by more than 50 percent. The results were widely highlighted as ruling out the worst-case global warming scenarios.

Scientists at Lawrence Livermore National Laboratory (LLNL) and the University of Washington have concluded that it is too early to rule out such scenarios. "While the work of Peter Cox and his colleagues represents a novel and thought-provoking analysis, we find that large values of climate sensitivity are still in the cards," said Stephen Po-Chedley, lead author of the LLNL follow-up comment published in *Nature*.

In the original study, Cox et al. analyzed a set of 16 climate models, relating the models' natural year-to-year fluctuations in global temperature to their overall equilibrium climate sensitivity. They found that models with the most global temperature variability tend to exhibit greater climate sensitivity. On the other hand, models with the least global temperature variability tend to have small values of ECS. Cox et al. found that the real-world variability was somewhere in between these low and high variability extremes. Using a statistical approach, they were able to create an observationally constrained estimate of ECS.

When Po-Chedley and colleagues consider 11 additional climate models, the constraint on ECS is substantially weaker and encompasses large values of ECS. The expanded analysis also shows that the temperature variability metric that Cox et al. use is sensitive to the combined influence of solar, volcanic and greenhouse gas forcing in the latter half of the 20th century. When alternative analysis time periods are chosen, the risk of the worst-case global warming scenarios increases

substantially. These results make it difficult to discount the possibility that the Earth's climate sensitivity is large.

Aside from the sensitivity of the estimated value of ECS to the climate models included and the time period selected, Po-Chedley also noted that "the Cox et al. results represent one study among hundreds of publications attempting to estimate climate sensitivity. Although the analysis is interesting and useful, it alone does not provide a definitive constraint on climate sensitivity."

More information: Peter M. Cox et al. Emergent constraint on equilibrium climate sensitivity from global temperature variability, *Nature* (2018). DOI: 10.1038/nature25450

Stephen Po-Chedley et al. Climate constraint reflects forced signal, *Nature* (2018). DOI: 10.1038/s41586-018-0640-y

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