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# Rethinking likely impact of more CO2

International analysis narrows range of climate's sensitivity.



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Atmospheric carbon dioxide (CO<sub>2</sub>) is likely to be at the upper end of the scale.

For more than 40 years, the estimated range of the eventual global temperature response to a doubling of CO<sub>2</sub> compared to preindustrial levels has remained at 1.5 to 4.5 degrees Celsius.

However, a new study – described as the most advanced and comprehensive analysis of climate sensitivity yet undertaken – suggests that more realistically

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the range is from 2.3 to 4.5 degrees.

There would be less than a 5% chance of staying below two degrees and a 6-18% chance of exceeding 4.5 degrees, according to the authors of 165-page report written over four years and published in the [journal](#) *Reviews of Geophysics*.

The international project was commissioned by the World Climate Research Program (WCRP) and led by Steven Sherwood, from Australia's ARC Centre of Excellence for Climate Extremes.

With the Earth's temperature already at around 1.2 degrees above preindustrial levels, if greenhouse gas emissions trajectories continue unabated the world can expect to see a doubling of carbon dioxide in the next 60 to 80 years, the authors suggest.

Using temperature records since the industrial revolution, paleoclimate records to estimate prehistoric temperatures, satellite observations and detailed models that examine the physics of interactions within the

climate system, they were, they say, to combine more independent lines of evidence than any previous study to get their results.

The range of 2.3 to 4.5 degrees accounts cautiously for alternative views or assumptions and “unknown unknowns,” with a more straightforward calculation yielding an even narrower 2.6 to 3.9 degrees.

“An important part of the process was to ensure that the lines of evidence were more or less independent,” says Sherwood.

“You can think of it as the mathematical version of trying to determine if a rumour you hear separately from two people could have sprung from the same source; or if one of two eyewitnesses to a crime has been influenced by hearing the story of the other one.”

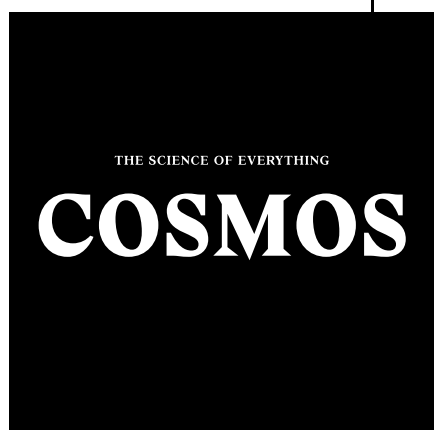
The researchers then went another step further and identified the conditions that would be required for the climate sensitivity to lie outside this most likely range.

They show, they say, that

low climate sensitivities previously thought to be plausible – around 1.5-2 degrees could only occur if there were multiple unexpected and unconnected errors in the data analysis (for example unexpected cloud behaviour and patterns of long-term ocean warming), underlying their judgment that these low values are now extremely unlikely.

A different set of circumstances make it unlikely that global temperatures would rise more than 4.5 degrees for a

doubling of  
carbon dioxide  
from pre-  
industrial  
times,  
although  
these higher  
temperature  
responses are  
still more likely  
than very low  
sensitivities.



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