

Climate at a Glance: Climate Sensitivity

Bullet-Point Summary:

- Predictions of substantial global warming assume high climate sensitivity to a doubling of carbon dioxide emissions in the atmosphere.
- For decades, scientists have debated the effect of climate sensitivity, due to the uncertain nature of climate feedback in various models.
- Estimates in peer reviewed studies range from 0.8°C warming to almost 6.0°C warming by 2100.
- Such a large range of uncertainty means climate model temperature projections remain dubious, at best.
- The best evidence indicates climate sensitivity is at the low end of the range, unlikely to exceed 1.5°C in the 21st century.

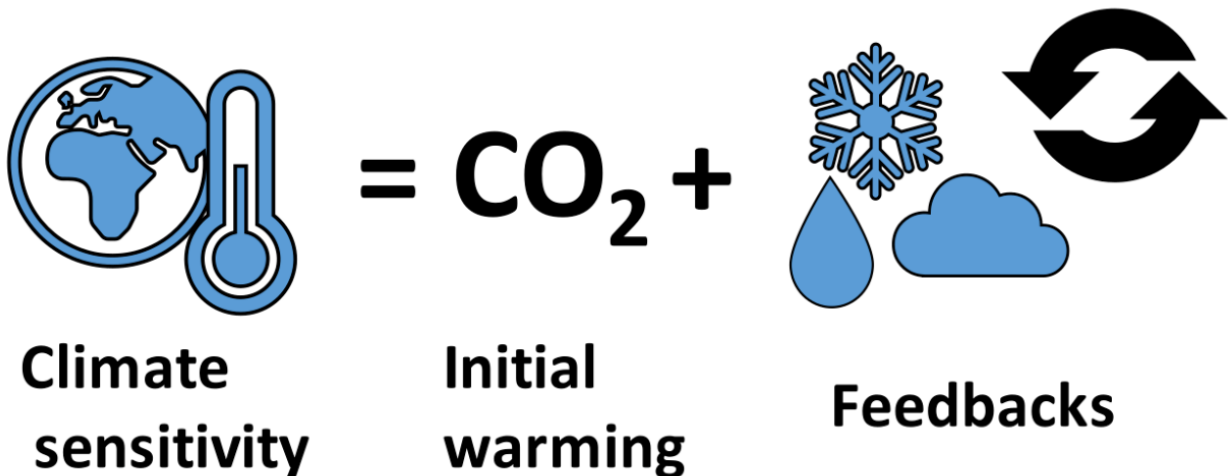


Figure 1: Factors that determine climate sensitivity. After increasing carbon dioxide (CO₂) levels, there is an initial warming. This warming could be amplified or reduced by the net effect of feedbacks (weather processes that change the characteristic of the planet). Diagram by Femkemilene from Wikimedia Commons.

Short Summary:

Declaring future predictions of global warming “settled science” requires a fairly precise calculation of future temperatures. However, since climate sensitivity was first identified more than 40 years ago, scientists and climate models have produced a very broad range of potential future temperature patterns. Calculations for a doubling of atmospheric carbon dioxide range from 0.8°C warming to 6.0°C future warming by 2100.

If climate scientists don’t understand the Earth’s atmosphere well enough to nail down a true climate sensitivity estimate for increased carbon dioxide, how can we trust climate model projections of future warming that rely on such an uncertain value? Climate sensitivity estimates

from real-world atmospheric data suggest (see [here](#) and [here](#)) man-made global warming this century is unlikely to exceed 1.5°C total and its climatic effects might actually be beneficial for humans and the environment.

Further reading:

1. *Explained: Climate Sensitivity*. MIT news. <http://news.mit.edu/2010/explained-climate-sensitivity>
2. Ad Hoc Study Group on Carbon Dioxide and Climate (1979). *Carbon Dioxide and Climate: A Scientific Assessment*. National Academy of Sciences. doi:10.17226/12181. ISBN 978-0-309-11910-8.
https://web.archive.org/web/20110813231807/http://www.atmos.ucla.edu/~brianpm/download/charney_report.pdf
3. *Earth's Climate Sensitivity: Apparent Inconsistencies in Recent Assessments*. Schwartz et al, 7 November 2014, Earth's Future.
<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014EF000273>
4. *On the Observational Determination of Climate Sensitivity and Its Implications* Richard S. Lindzen and Yong-Sang Choi Asia-Pacific J. Atmos. Sci., 47(4), 377-390, 2011
DOI:10.1007/s13143-011-0023-x <http://www-eaps.mit.edu/faculty/lindzen/236-Lindzen-Choi-2011.pdf>
5. *On the Misdiagnosis of Surface Temperature Feedbacks from Variations in Earth's Radiant Energy Balance* Remote Sens. 2011, 3, 1603-1613; doi:10.3390/rs3081603
http://www.drroyspencer.com/wp-content/uploads/Spencer_Misdiagnos_11.pdf