

WHY HASN'T EARTH WARMED AS MUCH AS EXPECTED?

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ABSTRACT

The observed increase in global mean surface temperature (GMST) over the industrial era is less than 40% of that expected from observed increases in long-lived greenhouse gases together with the best-estimate equilibrium climate sensitivity given by the 2007 Assessment Report of the Intergovernmental Panel on Climate Change. Possible reasons for this warming discrepancy are systematically examined here. The warming discrepancy is found to be due mainly to some combination of two factors: the IPCC best estimate of climate sensitivity being too high and/or the greenhouse gas forcing being partially offset by forcing by increased concentrations of atmospheric aerosols; the increase in global heat content due to thermal disequilibrium accounts for less than 25% of the discrepancy, and cooling by natural temperature variation can account for only about 15%. Current uncertainty in climate sensitivity is shown to preclude determining the amount of future fossil fuel CO₂ emissions that would be compatible with any chosen maximum allowable increase in GMST; even the sign of such allowable future emissions is unconstrained. Resolving this situation by empirical determination of Earth's climate sensitivity from the historical record over the industrial period or through use of climate models whose accuracy is evaluated by their performance over this period is shown to require substantial reduction in the uncertainty of aerosol forcing over this period. This paper is in press in the *Journal of Climate*.

This poster will be displayed at ASR Science Team Meeting.

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