Quantifying the Lack of Consistency between Climate Model Projections and Observations of the Evolution of the Earth’s Average Surface Temperature since the Mid-20th Century

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INTRODUCTION
Recent climate change literature has been dominated by studies which show that the equilibrium climate sensitivity is better constrained than the latest estimates from the Intergovernmental Panel on Climate Change (IPCC) and the U.S. National Climate Assessment (NCA) and that the best estimate of the climate sensitivity is considerably lower than the climate model ensemble average. From the recent literature, the central estimate of the equilibrium climate sensitivity is ~2°C, while the climate model average is ~3.5°C, or an equilibrium climate sensitivity that is some 40% lower than the model average.

To the extent that the recent literature produces a more accurate estimate of the equilibrium climate sensitivity than does the model average, it means that the projections of future climate change given by both the IPCC and NCA are, by default, some 40% too large (too rapid) and the associated (and described) impacts are gross overestimates.

A quantitative test of model performance can be made by comparing the range of model projections against observations of the evolution of the global average surface temperature since the mid-20th Century. Here, we perform such a comparison on a collection of 108 model runs comprising the ensemble used in the IPCC’s 5th Scientific Assessment and find that the observed global average temperature evolution for trend lengths (with a few exceptions) since 1980 is less than 97.5% of the model distribution, meaning that the observed trends are significantly different from the average trend simulated by climate models. For periods approaching 40 years in length, the observed trend lies outside of (below) the range that includes 95% of all model simulations.

CONCLUSIONS
We conclude that at the global scale, this suite of climate models has failed. Treating them as mathematical hypotheses, which they are, means that it is the duty of scientists to, unfortunately, reject their predictions in lieu of those with a lower climate sensitivity. It is impossible to present reliable future projections from a collection of climate models which generally cannot simulate observed change. As a consequence, we recommend that selection of the collection of climate models can be demonstrated to accurately capture observed characteristics of known climate changes, policymakers should avoid basing any decisions upon projections made from them. Further, those policies which have already been established using projections from these climate models should be revisited. Assessments which suffer from the inclusion of unreliable climate model projections include those produced by the IPCC and the U.S. Global Climate Change Research Program (including the most recently published National Assessment Projections which and as based upon such assessments include those established by the U.S. Environmental Protection Agency pertaining to the regulation of greenhouse gas emissions under the Clean Air Act.

REFERENCES
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