

## ***Interactive comment on “The influence of internal variability on Earth’s energy balance framework and implications for estimating climate sensitivity” by Andrew E. Dessler et al.***

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It seems to me the key underlying assumption in the paper is that the specific model used (MPI-ESM1.1) has internal variability which is an accurate representation of the Earth’s internal variability. I don’t think the authors have shown this is true. That is, if the model’s surface temperature is considerably more variable than Earth’s actual surface temperature history, that would suggest less correlation in the model between a change in surface temperature and a change in loss of heat to space than is correct. The spaghetti graph in the paper, which overlays 100 model runs (100 runs!?) and compares to the GISS history, obscures how much internal variability there is in the

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individual runs.

I find the arguments about modeled temperature changes at 500 mb unconvincing. That is not how EB estimates of ECS have been done, and in any case, it seems irrelevant to the paper’s central claim that Earth’s surface temperature has too much internal variability to generate a useful estimate of climate sensitivity.

I have never looked specifically at individual runs of this model, but I have looked at individual runs from several other models, and many consistently display much more short term variability than the instrumental temperature history shows. This did not surprise me at all, since models which are too sensitive to forcing are likely going to display higher short term variability.

The paper could be improved by comparing the GISS and Hadley temperature histories to a dozen or two randomly selected individual model runs, on 4 or 6 graphs, so that any differences variability could be visually compared. We should expect to see at least some runs where model variability is comparable to or less than measured variability. If all model runs are more variable than the historical record, I think that cases serious doubt on the accuracy of the key underlying assumption. The paper could be improved much more by calculating the variability in surface temperature for each modeled run as the total range in temperature anomaly over a few different time windows; eg. total temperature range over 5 year, 10 year, and 20 year rolling boxcar periods, and comparing to the same range values from the temperature history. If the model is a reasonable representation of Earth’s internal variability, then the variability for the temperature history will fall well within the distribution of variability for the individual model runs.

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