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Atmospheric Chemistry and Physics Discussions

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.

Anonymous Referee #1

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The main point of this paper is that the radiative response at the TOA to an imposed radiative forcing relates more directly to, and correlates better with, the temperature change in the tropical free troposphere than it does with the global mean surface air temperature change. They support this with evidence from CMIP5 AOGCMs and the large ensemble of the MPI-ESM1.1 AOGCM. They further argue that the tropospheric temperature is therefore better than the surface temperature for use in the Earth energy balance framework, and show that climate feedback defined in those terms is more constant. This is a reasonable point. However, surface temperature may relate more to some climate feedbacks and to impacts of climate change. Hence their reformulation of the energy balance may to some extent shift the problem elsewhere, because the

relationship between mean tropospheric temperature and the surface temperature and its patterns still has to be separately understood. They acknowledge this limitation at the end of the Conclusions. I think the statement at line 232 could be qualified as well, because this depends on the length of record being used, surface temperature having longer global records.

The paper is clearly written and illustrated. I have some minor points for the authors to consider.

64-65. As a single number to quantify the spread, the standard deviation would also be helpful.

66. Why do you use only a single decade, rather than all the data, for instance by dividing the dataset into two or using regression (cf Barnes and Barnes, 2015, 10.1175/JCLI-D-15-0032.1)? A single decade would be less precise. You could estimate the statistical uncertainty incurred from the control run.

118. It would be useful to remark here that 16 years is chosen to match the CERES dataset, because that was mentioned some lines above (103-104), where it appears actually to be 17 years and 5 months long.

119, 196. Why are monthly anomalies used here, rather than annual? Does it make a difference?

167. Again, the standard deviation would be helpful, and could be compared with lines 64-65.

173, 175. You could give standard errors of the mean for each of these two numbers, and judge the significance of their difference.

174, 175. "analysis" and "calculated" - by what method? From the slope of R against Delta T?

204. "agrees" in what sense?

218. I would say that this is "one source" of the spread, which is not eliminated, but only reduced, by using Theta instead.

233. Why is this material an appendix, rather than being incorporated in the main text?

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