Earth System
Dynamics
Discussions

Interactive comment on "Bayesian estimation of Earth's climate sensitivity and transient climate response from observational warming and heat content datasets" *by* Philip Goodwin and B. B. Cael

Anonymous Referee #1

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Summary

The authors present an update of the WASP model, using datasets up to the year 2019 of surface temperature, ocean heat content and carbon uptake. They use a time-varying feedback parameter and compare outcomes of climate response and sensitivity on different timescales and using different datasets. They complement this with an analysis of the principal components of their fitted parameters. The model are useful addition to discussions about the information it can be derived from observations and climate sensitivity, and am happy to see an updated version.

Major points

1. The authors compare without much comment different datasets of global warming and ocean heat uptake. The HadCRUT dataset is incomplete dataset of global temperature, with missing data at the poles, which warm faster than the average. In contrast, Cowtan&Way is an example of a dataset that does have global coverage. I would recommend switching HadCRUT out for another dataset that has taken into account polar warming (for instance NOAAGlobalTemp). Alternatively, wait (one week?) for the new version of HadCRUT, which does account for missing data.

Similarly, but probably less important, the authors compared two datasets of ocean heat uptake without comment. According to the IPCC's SROCC report, older estimates of ocean heat uptake have biases that may lead to an underestimate of ocean heat uptake (Bindoff, 2019, p.457). Cheng et al (2017) can be considered superior to the old standard of Levitus (2012).

2. I didn't get an intuitive understanding of how the time varying feedback parameter works. Why is there a difference between equation 4 and 5? It would be nice if some additional details could be included here and a reference to the first paper which you derive this.

Minor points

Abstract: it might be easier to include the 140 year response time scale, for better comparability with climate models?

L61: should multiple be two?

L 71: the first word is a typo, right?

L 83: halocarbons is not capitalised

L 92: I thought all the data used was after 1850. Why do you need volcanic aerosols before that date?

L111: should the j be an i?

L118: why not use the default definition of TCR of a 20 year average?

L240. This section or the discussion can do with more context. Why is this interesting?
(I think it is, but I needed some brain racking!)

L344: Figs 2 -> Fig 2

C3