

Interactive comment on “The nonlinMIP intercomparison project: physical basis, experimental design and analysis principles” by P. Good et al.

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Many thanks for the time invested and valuable comments.

Reviewer comments are bold.

- Of the nine figures, six or seven are taken from other papers (the origin of Figure 6 is not clear). Several of these are of low quality, use concepts, models or methods neither explained in the caption nor the text, and are not necessarily well-suited to explain the goals of nonlinMIP. I would suggest to get along with fewer figures and to design new ones that are targeted at the purpose of this paper.

C1

Thanks, we have removed several figures which are unnecessary, on reflection. We have also expanded some of the discussion around the remaining figures, to make proper use of them. The remaining four figures illustrate key conceptual points.

- Section 5 outlines one application of the experiments in nonlinMIP. I hope the authors have more ideas of what one could do with the experiments, and although I don't expect them to go into detail, I think the reader (potential participants in nonlinMIP) would be encouraged to learn what new science can be done.

Response: very good point, thanks. We have included new discussion at the start of section 5 (also, start of Conclusions and the Abstract) on the broader uses of these experiments, which would be relevant to a wider audience.

Detailed comments: The authors cite mostly themselves. I cannot claim to have a very broad overview of the literature, but here are some suggestions, which certainly shouldn't prevent the authors to look more broadly at contributions in the literature, in particular towards the origin of ideas:

Good point. Thanks for the suggestions.

4, 28, here I think that Bala et al. (2008, PNAS) is among the first to note the forcingdependent response of precipitation under geo-engineering.

Yes, although this is a bit off topic as nonlinMIP focuses specifically on responses to a single forcing – CO₂ (the papers previously cited that used idealised geoengineering scenarios were CO₂-only studies). However, this did point us to another useful paper by Bala et al. – a nice example looking at fast responses of precipitation to forcings, which we now include in the previous paragraph.

4, 16, perhaps Bloch-Johnson et al. (2015, GRL), or references therein could provide some background as to why state non-linearity is of interest.

Thanks. We include this, and also two with a paleoclimate focus and one on the AMOC.

C2

5, 18, I am not sure why all these papers are cited here?

Good point. Deleted.

Section 2, in the description of the step-response framework, the first reference I know of is Hasselmann et al. (1993, Clim. Dyn.), even if the mathematical background must go back much further. Here it appears as if this was invented by the first author.

Indeed it does read like this (not our intention). We now include the Hasselmann reference up front to hopefully avoid this impression.

9, 9, here perhaps cite Budyko (1969, Tellus) and Sellers (1969, JAM).

We have included a couple of more up to date papers that would perhaps be of more value to the contemporary reader; and also added a couple of useful ones on nonlinearity in the soil moisture-temperature feedbacks.

In addition I took note of:

6, 13, the parenthesis needs a end.

Fixed. Thanks.

9, 2-6, the paragraph is not well-connected with the rest of the text and the figure is not very clear or well-explained.

We have linked with the previous text by mentioning faster and slower responses explicitly. We also have added some clarifying text, and removed the figure, which is not really helpful.

9, 26, delete one instance of 'different'

Done. Thanks.

9, 27-28, please explain which model is used, either here or in the caption of Figure 6.

C3

Done in the caption.

10, 14, 'doubling difference' is not explained/defined.

This text has been deleted, along with the corresponding figure. However, the doubling difference is defined in the text above (with reference to what is now Figure 3).

Figure 9, is the shown quantity global means?

Yes, this is now stated in both the text and caption.

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C4