

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

Anonymous Referee #1

Received and published: 23 June 2016

This manuscript describes a new model intercomparison project devoted to investigating time- or forcing history dependent non-linearities in climate models. With past protocols these have been difficult to distinguish from state-dependent non-linearities. The project foresees a series of fairly simple, yet useful experiments. The experiments will be particularly useful in combination with other related MIPs such as CFMIP and RFMIP.

The manuscript is easy to read and works to provide an overview of nonlinMIP. On the negative side the manuscript comes across as somewhat unengaged. I understand that in order to get a MIP in CMIP6 it is mandatory to publish such a manuscript, and certainly this shines through here:

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- 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.

- 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.

None of this should halt the authors for any longer period of time, and is really in the category of very minor corrections.

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:

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

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.

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

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.

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

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In addition I took note of:

6, 13, the parenthesis needs a end.

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.

9, 26, delete one instance of 'different'

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

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

Figure 9, is the shown quantity global means?

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-56, 2016.

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