

## ***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.**

**However, I suggest that the authors be much clearer and much more explicit about what they envisage being the big scientific/practical advances that would come from this MIP. In particular, if a nonlinear response for a given impact-relevant variable is found to exist using the suggested simulations, how might this usefully be used to give more realistic impact assessments?**

Good point, thanks. We have expanded discussion on this in the new first two para-

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graphs of the Conclusions and a new start to section 5 (also in the Abstract).

**Also, the authors say that these simulations will help to "understand" nonlinear responses, but how would this be done in practice if a nonlinear response is found? Can the authors give an illustrative example based on simple physical mechanisms?**

The basic idea is the same as for the cmip5 abrupt4xCO2 experiment (simplified forcing simplifies the understanding of mechanisms of response). We have expanded a little the paragraph introducing this in the Introduction (paragraph starting, 'These three issues...'). We also clarified a related paragraph at the end of section 3.1. A new start to section 5 states that for some applications, the same methods already used to study abrupt4xCO2 are directly applicable. The penultimate paragraph of section 5.2 also addresses this. These discussions link back to the linear and nonlinear mechanisms, which do include example physical mechanisms.

**On a more practical note, how will internal variability be separated from the non-linearity when attempting to quantify the latter?**

A new final paragraph of section 5.2 addresses this. We also mention in the previous paragraph and elsewhere that contamination from internal variability may be reduced as long (100-year) means are possible in these experiments.

**Specific comments: Section 1: "...but this assumption may also be applied either explicitly or implicitly in understanding mechanisms." -> I don't understand this sentence, please be clearer about what is meant here**

We have attempted to clarify this: "In understanding or emulating regional patterns of climate change, it is often assumed explicitly that regional climate change is roughly proportional to global mean warming. In emulation work, this is termed 'pattern scaling' (Santer et al., 1990; Mitchell, 2003; Ishizaki et al., 2012; Tebaldi and Arblaster, 2014), but this assumption may also be applied implicitly in understanding mechanisms. Often,

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physical mechanisms are studied for a single period of a single forcing scenario or in a single high-forcing experiment such as abrupt4xCO2 (implicitly assuming that the understanding is relevant for other periods or scenarios)."

**Section 1 and throughout: "(Chadwick et al., 2013;Held et al., 2010;Williams et al., 2008;Manabe et al., 1990;Andrews and Ringer, 2014)" -> references are neither in chronological nor alphabetical order. Is there a good reason for this? It is typical to arrange references chronologically**

Thanks for spotting this. It was because the Copernicus style for EndNote we downloaded had the incorrect setting for some reason. This is fixed now.

**Section 2: "apriori" -> typo**

Fixed.

**Section 3.2: "Both moisture content and atmospheric dynamics respond to CO2 forcing, so in general we might expect convective precipitation to have a nonlinear response to CO2 forcing." -> we would expect a nonlinear response from the moisture part alone, given the Clausius-Clapeyron, in the absence of any changes in dynamics**

Good point - now stated.

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