

***Interactive comment on* “An efficient method to generate a perturbed parameter ensemble of a fully coupled AOGCM without flux-adjustment” by P. J. Irvine et al.**

Anonymous Referee #2

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General comments

In this paper the authors propose a simple method to generate a perturbed physics ensemble of a fully-coupled AOGCM without using flux adjustments. The removal of flux adjustments is accomplished by screening out "implausible" variants of the perturbed AOGCM based on outputs of projected equilibrium temperature from many but relatively short integrations, which makes this method computationally efficient. They find that the range of key climatology of pre-industrial simulations after 800 years are comparable to those of the CMIP3 multi-model ensemble.

This paper would be a useful addition to a growing pool of literature in which studies

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have proposed various methods to eliminate the need for flux adjustments in perturbed physics ensembles.

Specific Comments

1. I have a slight concern in how they evaluate their models. Regarding pre-industrial simulation results, evaluating the model climatology against observations as they have done is a must in order to find "plausible" variants, but comparing them against the CMIP3 multi-model ensemble would not be evaluating them for plausibility. Furthermore, since one of the aims of generating a perturbed physics ensemble in the first place would be to include as wide a range of possible model behavior (subject to the condition that they reproduce the present climate well, of course), I don't think model variants should be dismissed simply because they are beyond the ranges of CMIP3.

2. On page 854, line 15-18, the authors write that "high values of VDIFF on its own" ... raise "global mean temperatures even if by only a few tenths of a degree (Collins et al., 2007; Brierley et al., 2010)." I take it that by global mean temperature the authors mean global mean surface atmospheric temperature, but did Collins et al., 2007; Brierley et al., 2010 make this statement?

3. In Figure 5(a), the caption says the plot is of global mean temperature but the y-axis label says it is radiative forcing. Which is true?

4. The authors might like to add reference to Jackson et al. (2011) "The sensitivity of the meridional overturning circulation to modelling uncertainty in a perturbed physics ensemble without flux adjustment", *Clim. Dyn.*, in discussing Atlantic meridional overturning circulation.

Technical corrections

1. Figures and their labels are too small overall. Please make them easier to see.

2. There are a number of inconsistencies in both the main text and the figure captions. For example, "Figure x" and "Fig. x", "vapour" and "vapor", "gray" and "grey", "mB" and

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"mb" (although they might be better described in hectopascals), "spin-up" and "spinup".

3. Please label the tables in the Supplement.

4. It might be clearer to add "concentration" after "CO2".

5. P.846 l.21 & l.24 : both sets of brackets should be removed.

6. P.848 l.15 : comma either before or after however should be a semicolon.

7. P.850 l.18: "hadCM3" should be capitalized.

8. P.857 l.2-5: sentence too long or needs a subordinate conjunction.

9. P.857 l.26: insert "and" before "pre-industrial".

10. P.860 l.5: "ENTCEOF" -> "ENTCOEF"

11. P.862 l.1: one of the two "members" may be redundant.

12. P.866 l.4: "Internal" should be lowercase.

13. P.868 l.25: omit comma after "criteria".

14. P.869 l.12: "We'd" -> "We would"

15. P.869 l.17: "first" is incorrect; other studies on perturbed physics ensembles without flux adjustments include Jackson et al.(2011), Shiogama et al. (2012), Yamazaki et al. (2013) (paper status: accepted), Brierley et al. (2010), Collins et al. (2007).

Interactive comment on Geosci. Model Dev. Discuss., 6, 841, 2013.

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