Geosci. Model Dev. Discuss., 6, C985–C989, 2013
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Geoscientific Model Development Discussions
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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.

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Received and published: 10 July 2013

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

- We thank Reviewer #2 for the positive comments on our approach.

"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."

- Reviewer #1 also made similar comments and we have made major changes to the analysis to address this. We have changed the basis of our evaluation of the PPE to the ERA-40 reanalysis for the period 1961 – 1990. CMIP3 is now used only to give context to the anomalies between the PPE and the ERA-40 data, and figures 4 and 5 and supplementary table 1 now include ERA-40 data. We have reduced the up-front discussion of rejection/selection criteria (section 1.2 in the original) and have updated the evaluation of the PPE by comparing it to the ERA-40 dataset. We judge that all members produce plausible pre-industrial climates but indicate a number of shortcomings of some members. See section 3.3 and 4 for the updated assessment and discussion.

"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

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al., 2010 make this statement?"

- We have removed this section of text and have double-checked our references to this study which appear in section 3.2.

"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?"

- This figure has been deleted.

"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."

- We now refer to Jackson et al. in the section on the meridional overturning circulation in the pre-industrial and compare our results to theirs (section 3.2).

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

- We have limited our figures to 4 panels which should alleviate this problem.

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

- We have corrected these inconsistencies in the text and figures.

"3. Please label the tables in the Supplement."

- These tables now have labels.

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

- We have changed ‘levels’ to ‘concentrations’ after CO2 where it occurred in the text.

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

- Done

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

- We have added a semicolon before

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

- This has been capitalized and we've checked that there are no other occurrences.

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

- This sentence has been cut for other reasons.

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

- done

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

- done

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

- This sentence has been rephrased

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

- done

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

- This sentence was deleted for other reasons

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

- done

"15. P.869 l.17: "first" is incorrect; other studies on perturbed physics ensembles with-

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out 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)."

- We have corrected this mistake.

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

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