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Geoscientific
Model Development
Discussions

Interactive comment on "Pliocene Model Intercomparison Project: implementation strategy and mid-Pliocene Global climatology using GENESIS v3.0 GCM" *by* S. J. Koenig et al.

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The manuscript "Pliocene Model Intercomparison Project: implementation strategy and mid-Pliocene Global climatology using GENESIS v3.0 GCM" by Koenig et al. is a contribution to the Geoscientific Model Development Special Issue "Pliocene Model Intercomparison Project (PlioMIP): experimental design, mid-Pliocene boundary conditions and implementation". It contains a brief description of the GENESIS atmosphere-only general circulation model used in PlioMIP Experiment 1. The authors explain in detail the experimental design and how mid-Pliocene boundary conditions were included in their model. They provide initial results including surface air temperatures, precipitation

rates and energy balance, as a fruitful basis for further model intercomparison studies.

This is a clear, well written and structured paper, appropriately illustrated. It follows closely the guidelines set out in PlioMIP.

Below is a list of minor points/technical comments which may require some attention:

Reviewer 2 acknowledges the structure that closely follows the guidelines by the overarching intercomparison project. Reviewer 2 also highlights how the document is written and how well it is supported by the figures. We comment on minor points below.

1. Title/Abstract: It should be stated explicitly in text that this is a contribution to PlioMIP Experiment 1 with an atmosphere-only GCM.

Following a similar suggestion by reviewer 1, the authors will change the title accordingly.

2. Model description, page 2580: I would suggest to provide a bit more details about the atmospheric climate model and land surface scheme features.

We agree that the description of the model components is limited in comparison to other GMDD papers on model development. However, the authors argue that the focus of this manuscript is on detailing the implementation process of boundary conditions into the model rather than focusing on the specifics of the models. Those details can be found elsewhere (e.g. Pollard and PMIP Groups, 2000; DeConto et al., 2007 and references therein, Koenig et al. 2011) and are adequately referenced to in the manuscript.

3. Model spin up, page 2581, lines 11–15: Please provide a time series of global 2m air temperature to demonstrate that the model reached equilibrium in the atmosphere, as recommended in the template for model description papers.

Following reviewer 1 (point no. 2) and reviewer 2's suggestion the authors will also add a figure to the final manuscript to improve the paper.

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4. Page 2584, line 9; page 2585, line 4; figures 1 & 2 captions: I would write "plio.genesis" for more clarity.

Agreed. The authors change the caption, text and equations in the manuscript accordingly.

5. Soil texture, page 2585, lines 22–27: It is not clear whether imposed distributions of soil texture in Pliocene simulation are consistent with the prescribed Pliocene vegetation (PlioMIP "preferred" solution).

The authors follow PlioMIPs preferred solution and specify soil as modern. In areas where land has been created in the Pliocene reconstruction (compared to the modern land/sea mask) soils are extrapolated from the nearest modern grid box. They are consistent with the vegetation maps.

6. River routing: Please specify which option, "preferred" or "alternate", was specified as regards river routing and if necessary how river routes were altered.

The setup was chosen to follow modern river routes (PlioMIP minimum solution).

The authors add a sentence to the manuscript to clarify.

7. Polar amplification, pages 2587–2589: Results regarding polar amplification could be grouped together.

Reviewer 2 refers to the "Discussion" section of the manuscript. The present structure aims at discussing the global response first (pg. 2587, l. 24-end, pg. 2588, l. 1-12) before highlighting key feedbacks that contribute to the regional climate patterns observed (pg. 2588, l. 22-27). Then, suggestions for future proxy (pg. 2588, l. 22-27) and modeling work follow in separate paragraphs (pg. 2588, l. 27-end, pg. 2589, l. 1-11).

As a result of this structure, polar amplification is mentioned multiple times in separate paragraphs. Nevertheless, the authors suggest leaving the structure as is so that these

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main discussion points still remain clear to the reader.

8. Discussion, page 2588, first paragraph: PlioMIP–GMD template for group papers indeed suggests to include references to NAO, ENSO, ITCZ and monsoon behaviour but I wonder if it is worth briefly mentioning these issues without any figure nor quantification.

The authors agree with reviewer 2's notion that those climatic features and dynamics would need more quantification. In the "Results" section, we quantify temperature, precipitation and energy differences relative to a modern control climate on a global scale. Those aforementioned features are closely related to changes in temperature, precipitation and energy fluxes and as a result cannot be left out and should be referenced to when analyzing these climate parameters.

The authors reference to those features in the "Discussion" section rather than the "Results" section of the manuscript with the intention to highlight the strong relationship of the climate fields presented in the "Results" section. The detailed quantification of those components however, should and will be an essential part of the model intercomparison (PlioMIP) itself.

The authors suggest leaving those references in the manuscript and add another sentence to the manuscript that mentions the need of further quantification in the intercomparison phase of the project.

9. References, page 2590, line 16: "Hydrographic" instead of "hydrogrhic"; page 2592, line 10: "J. Geophys. Res." instead of "Jo. Geophys. Res."; page 2592, line 23: BIOME 6000 Participants in author field, remove duplicate date; page 2593, line 9: rewrite _18O.

Done.

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Interactive Comment

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Pollard, D. and PMIP Groups: Comparisons of ice-sheet surface mass budgets from Paleoclimate Modeling Intercomparison Project (PMIP) simulations, Glob. Planet. Change, 24, 79–106, 2000. 2580

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