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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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This paper describes the implementation and results of PlioMIP Experiment 1 in the GENESIS AGCM. The authors present their model results well and have done a good job of documenting the implementation of the prescribed boundary conditions in their model. The information contained in this paper will significantly assist in the analysis of the model intercomparison. There are a few things that would improve the paper, although they are all relatively minor.

The authors appreciate that reviewer 1 acknowledges the description of our implementation strategy, the presentation of the main results, and the value of this manuscript

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to the model intercomparison project (PlioMIP). We would like to respond to the few "minor" comments by reviewer 1.

(1) It is not clear from the paper where the increased discrepancy (compared to modern topography differences) between the GENESIS Pliocene topography and PlioMIP topographic reconstruction comes from. Is this due to interpolation to the GENESIS grid? Whatever the source it should be made clear in the text where the authors discuss this.

Reviewer 1 refers to Figure 1 of the manuscript. Differences in topographic heights between the default GENESIS v3 GCM and the implemented boundary conditions from PlioMIP are shown.

Both the PlioMIP topographic reconstruction and the default GENESIS v3. GCM topography (Kineman, 1985) are on a 2° x 2° grid and did not have to be interpolated. In Figure 1, d, we provide the reader with additional information on the implementation procedure by plotting the difference between provided topography and the general set-up for GENESIS (as used in other studies). Given the (low) spatial resolution, a large topographic discrepancy can result from a "shift" in a single, neighboring grid cell particularly in regions with high topographic terrain (e.g. Himalaya region).

Most importantly, those discrepancies are not influencing the results presented in the manuscript. The subplot (Fig. 1, d) is added to increase transparency in the implementation process and provide guidance when comparing results from this study to results from other GENESIS studies for the pre-industrial and Pliocene.

(2) It would be good to have a figure showing the spin-up of the model. I know this won't be much of an issue with an atmosphere only experiment, but I think it will be a significant issue within PlioMIP as a whole, so it would help to show it. As a minimum, a figure showing a time series of global near-surface (2m) air temperature for the full 50 years of the simulation should be included, but if the model produces a better diagnostic include that as well.

GMDD

4, C1111–C1115, 2011

We agree with reviewer 1 that documenting the spin-up and equilibrium time is crucial.

Following, reviewer 1's suggestion, we calculated global, near-surface 2-m air temperature for both pre-industrial and Pliocene scenarios over the full 50 years of integration. The atmospheric component (in agreement with the notion of reviewer 1) equilibrates fast and both scenarios show low inter-annual variability.

We add a figure to this response (see below) to illustrate that point. Following reviewer 1 and reviewer 2's comment (point no. 3) the authors will also add this figure to the final manuscript to improve the paper. We find that the text adequately documents spin-up and equilibration time (Pg 2581, lines 13-15) and will be sufficient for the interpretation of the results and the new figure.

(3) It would be useful for it to be made clear that this paper only includes PlioMIP Experiment 1. It would make it easier for the reader if this was made plain from the outset, as it will be going into a special issue with a number of papers that describe both Experiment 1 and Experiment 2 with different GCMs. The simplest and best way to do this would be to change the title, perhaps to "Pliocene Model Intercomparison Project Experiment 1: implementation strategy and mid-Pliocene global climatology using GENESIS v3.0 GCM".

We changed the wording to the suggested title making it clear to the reader that we are focused on the implementation of Experiment 1 of the intercomparison project.

(4) Pg 2582 – line 26: The beginning of this paragraph reads slightly wrong. It is unclear what part of the vegetation techniques outlined are 'according to Haywood et al. (2010)'. I presume that the authors are referring to the need, as outlined in Haywood et al. (2010), to ensure that the Pliocene vegetation is comparable to the vegetation used in the pre-industrial experiment, but this needs to be clarified.

The authors added clarifications to that paragraph.

(Page 2582, line 26 – Page 2583, line 12) "Vegetation distributions are prescribed

GMDD

4, C1111–C1115, 2011

based on Dorman and Sellers (1989), with physical attributes and seasonal cycles of leaf area index (phenology) for each biome updated daily (see also Lapola et al., 2008). ... Following Haywood et al. (2010), we compare vegetation of the pre-industrial scenario to observations in order to ensure that the re-classification leads to meaningful biome patterns before applying the transfer scheme to the Pliocene. We find that pre-industrial patterns compare favorably to independent pollen-based patterns (Prentice and Jolly, 2000; Harrison et al., 2001; Bigelow et al., 2003), reconstructions of potential natural vegetation (Ramankutty and Foley, 1999) and modeling studies, e.g., Wohlfahrt et al. (2004) for modern day (not shown)."

(5) Pg 2586 – line 16: I presume you mean Southern Ocean rather than Southern Sea.

We changed "Southern Sea" to "Southern Ocean."

Interactive comment on Geosci. Model Dev. Discuss., 4, 2577, 2011.

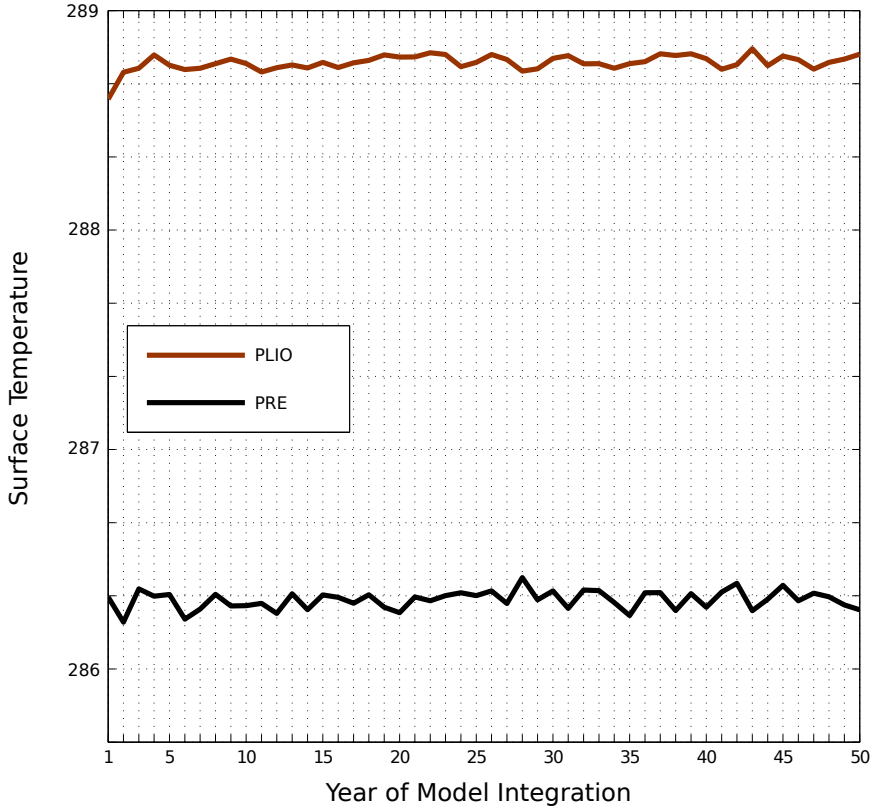

Fig. 1. Equilibrium

GMDD
4, C1111–C1115, 2011

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