

Interactive comment on “Simulations of the Mid-Pliocene Warm Period using the NASA/GISS ModelE2-R Earth System Model” by M. A. Chandler et al.

Anonymous Referee #2

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General Comments

It seems to me that the goal of this Special Issue is to provide a detailed description of the simulations which are used for the PlioMIP multi-model ensemble. It means you have to describe the simulation which was used in Haywood et al., 2012.

I will join the previous review and say that the paper does not address the results of PlioMIP experiment 2 with the ModelE2-R, because the results presented here are (very!!) different than the ones presented in Haywood et al., 2012, and because the PlioMIP exercise imposes to keep all straits and passages same as present day (except around melted Antarctic Ice Sheet).

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It is very important for the PlioMIP exercise that the authors describe the simulation which is used in the multi model ensemble of Haywood et al., 2012, especially because the GISS model shows a different pattern in the North Atlantic than the other models of PlioMIP, i.e., there is a wide cooling in North Atlantic (see Haywood et al., 2012, figure 5 of Supplement, C). This is why it is important to document this simulation first. I join the previous review, and suggest you describe first the ‘real PlioMIP’ experiment 2, i.e. the one that is used in Haywood et al., 2012, and then describe this ‘other mid-Pliocene’ simulation, which shows really interesting results. To this end, you’ll have to add a discussion on the effect of changing your land-sea mask.

About the description of the results, changes in the ocean and hydrological cycles are well described. The discussion on feedbacks is also relevant.

In contrast, the model description is a preliminary sketch and describes only the atmospheric component. The authors should give more detail in this section, especially about the ocean and sea-ice components.

They should also document integration time for the PlioMIP and other mid-Pliocene simulations, and briefly describe their control run (modern, PI, as CMIP5/PMIP3, which SSTs, maybe references to publications.)

I don’t really understand why the authors chose to present figure 2, which is a multi-model ensemble including a previous GISS model version compared to data, i.e. which does not include any results presented in this paper. . . I think it falls out of the scope of this paper. In addition, this figure is not discussed in the text. To my opinion, what would be useful is to make a data model comparison on the ‘real PlioMIP’ simulation and another on the ‘other mid-Pliocene’ simulation to see what are the improvements when changing the land-sea mask.

Specific corrections

Title : In the PlioMIP group, we generally used “mid-Pliocene” instead of “Mid-

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Pliocene”.

Abstract

Page 2812

Line 4: add reference (IPCC, 2007) or (Jansen, 2007).

Line 9 : add reference for the USGS PRISM first project for the mPWP.

Line 17: I suggest you replace “improvement defined here by” by “i.e.”

Line 21: “these new simulations”. This refers to the ‘other mid-Pliocene’ simulation. Change for “this new simulation”

Introduction

Page 2813

Line 2 : “analog”. Be consistent. (page 2826, line 26: “analogue”)

Page 2814

PlioMIP experiment design

This section should include the integration time and the spin-up, and on which years were made the climatological means presented in the figures. It should also include a brief description of the control run (just as small as “the control run is as prescribed by CMIP5/PMIP3” if it is the case), or create a new section for describing the control run).

Line 13: “Antarctic Sheet”. Add “Ice”.

Lines 15 to 20 : I do not understand whether or not you used the anomaly method for the implementation of topography, like prescribed in Haywood et al., 2010. Please precise.

Line 22 : “narrow ocean passages that existed in the Pliocene remained open”. This can mean 2 things : 1/ the passages are also open in present-day but you had to

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re-open them after the interpolation process, or 2/ you opened passages which are closed at the present-day. This is not the PlioMIP procedure. Please list this passages, or better, provide a map.

Page 2816

Lines 2 to 9: again, I do not understand whether or not you used the anomaly method for the implementation of SSTs, like prescribed in Haywood et al., 2010. Please precise.

Line 18 : "The GISS EaSM's radiation code". Explain what is EaSM.

Page 2817

The model description section is much too light. If I understand well, only atmospheric model is described here. You refer later in the paper to sea-ice parameterization (page 2823, line 18) and to the Gent-McWilliams mixing parameterization of the ocean component (page 2827, line28). You must describe these (briefly) before referring to it. You should also detail briefly the vegetation model, and if possible add references for more detailed descriptions of the different components of the model.

Page 2817

Line 17: "reference Haywood article in this volume". Replace by Haywood et al., 2010, or Haywood et al., 2011, or both.

Page 2819

Line 6: "and those [the results] from the specified SST simulation (PlioMIP Experiment 1)" PlioMIP Experiment 1 is with Atmosphere-only models. Has this simulation been carried out with the same atmospheric model version that the one of ModelE2-R? Where are these results? Please add the reference (if published) or add "(not shown)". If not shown, why not adding them in the paper?

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Lines 6-7 : “compared with the PlioMIP ensemble”. Please cite Haywood et al., 2012.

Line 7 : “Figure 2 draws attention. . .” What you describe here is figure 3, not figure 2.

Lines 25-27 : “Negative temperature anomalies, . . . are a recurrent feature found in the North Atlantic of . . . the PlioMIP ensemble”. When examining Haywood et al., 2012, figure 5 of supplement, only GISS and HadCM3 show significant negative anomalies in the North Atlantic. So I think this sentence is not totally true. Be more precise.

Page 2821

Lines 11-12: “in contrast to the cooling typically seen in model simulations”. I don't think this cooling is typical of Pliocene simulations. See Haywood et al., 2012. Other than GISS models show warming patterns everywhere or others have eventually small patches of negative anomalies in the North Atlantic (but not in the Norwegian sea.)

Line 15 : “figures in Haywood et al., 2012”. Which ones?

Lines 26-27: “it is noteworthy that temperature anomaly lessens poleward of 45°N”. You here describe the North Pacific. What I can see on figure 3, it that anomaly lessens poleward of roughly 33°N and becomes very important between roughly 43°N to 53°N.

Page 2822

Lines 5-8 : “Model E2, like the PlioMIP ensemble, shows that the South Atlantic and southern Indian Ocean regions are somewhat warmer than the corresponding latitudes in the South Pacific”. That's a little vague. . .

Lines 11-13 : “The overarching theme from proxy studies is that tropical temperatures are not sensitive to the forcings and feedbacks that have driven the vast majority of past warm climates”. Please add a reference for this sentence.

Lines 13-16: “In contrast, climate models show that when forcing is either a well-mixed greenhouse gas or the result of changes to solar insolation, tropical temperatures respond measurably”. Please add a reference for this sentence.

Page 2823

Line 18 “No doubt. . .”. Change for “There is no doubt. . .”

Lines 18-19: “No doubt this result is highly sensitive to the ocean-ice parametrization”. Hence the fact that it is important to describe this parametrization in the model description section.

Page 2825

Line 24: “Antarctica”. Replace by “Antarctic”

Line 25: “Sheet is gone”. I’d rather use “absent.”

Page 2832

Table 1 is too small. Moreover, it is not clear what the Pliocene straits which are not specified to “present” look like. Are they, deeper, larger, narrower, not existant? I personally think that a map would be clearer.

Page 2838

Figure 4 : I think again it is a little small. You don’t need to show the oceans up to 30°N/S. You could use a projection which only shows the high latitudes.

Page 2841

Figure 7 : you discuss quite a lot in the text the Precipitation minus Evaporation balance. I think it would be easier for the reader if you added it, or replace the evaporation by the P-E balance.

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