

## ***Interactive comment on “Mid-Pliocene global climate simulation with MRI-CGCM2.3: set-up and initial results of PlioMIP Experiments 1 and 2” by Y. Kamae and H. Ueda***

**Y. Kamae and H. Ueda**

youichi.kamae@gmail.com

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» This paper documents the implementation of boundary conditions for the mid-Pliocene climate simulation with the MRI model, in the PlioMIP framework. It presents the climate model outputs from three simulations (Experiment 1 with atmospheric model, and two Experiments 2 with the coupled model). In addition, the authors used the vegetation model BIOME4 to simulate the equilibrium vegetation resulting from the three simulated climates. The differences in the simulated vegetation are then used by the authors as an index of the change of surface conditions. It is clear that a great amount of work was necessary to carry out all these simulations. Boundary conditions

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used are well detailed. The way mid-Pliocene and Control experiments were carried out is very clear. Climatic and vegetation outputs are also commented in detail. Globally, the paper is well structured and clear, even if sometimes the English is not very good. Tables and figures are appropriate and correctly labelled. This paper will help the model/model comparison in the frame of the PlioMIP and is of good scientific quality. I recommend that this paper be published with the minor revisions suggested in the following “specific comments”, and “technical comments”.

Thank you for the specific and technical comments. They guided our revision, resulting in a much improved paper. The following are item-by-item responses to the comments.

» \*\*\* Specific comments \*\*\*

» 1/ To my opinion, the vegetation simulations should be mentioned in the abstract, because they constitute an original aspect of this paper, which should be highlighted.

Thank you for the suggestion. We revised the sentence in the abstract (Page 384, lines 10-12, “General characteristics ... in this study”) as:

General characteristics of differences in the simulated mid-Pliocene climate relative to the pre-industrial in the three integrations are compared. In addition, patterns of predicted mid-Pliocene biomes resulting from the three climate simulations are compared in this study.

» 2/ In the SAT section (4.2) and the discussion section (5), you mention the differences in calculated SSTs between AOGCM\_NFA and AOGCM\_FA simulations. Could you (very briefly) compare the calculated SSTs to the SST data? Is one simulation closer to the data than the other? (especially in the Northern Atlantic)

It is difficult to judge which SST (simulated in AOGCM\_FA or AOGCM\_NFA) is closer to the SST data than another because the amplitudes and peak locations of SST increases in both integrations do not match with the data. We added the below sentence at the end of the first paragraph of the discussion section (page 400, line 23).

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Comparing to the data (Fig. 8a), both of the integrations failed to reproduce the pattern and amplitude of the SST increase in the Northern North Atlantic.

» 3/ In section 3.1.1, p 389, from line 10. If you used the anomaly method to implement your topography and SSTs in the AGCM simulation, it means you used the PRISM3D data for modern topography, which is derived from Edwards et al., 1992, and the PRISM3D data for modern SSTs, which is derived from Reynolds and Smith, 1995. These references should appear in the text and in the reference list.

We agree the comments. We revised the sentence “For Pliocene simulation, anomalies of ... are added to those used in Control” in section 3.1.2 (from page 390, line 27 to page 391, line 1) as:

For Pliocene simulation, anomalies (mid-Pliocene minus present day) of SST (Dowsett et al., 2009), topography, and ice sheet height (Sohl et al., 2009) derived from PRISM3D dataset (modern SST data is derived from Reynolds and Smith, 1995; modern topography data is derived from Edwards et al., 1992) are added to those used in Control.

» 4/ In section 3.1.2, p390, line 27-28. For readers who are not familiar with Haywood et al., 2010, you should precise how the anomaly is constructed.

We agree the comment. We revised “anomalies” as “anomalies (mid-Pliocene minus present day)”. It is related to the revision according to the specific comments No. 3.

» References to add : Edwards, M.: Global Gridded Elevation and Bathymetry. In: Global Ecosystems Database, Version 1.0 (on CD-ROM), Documentation Manual, Disc-A: National Geophysical Data Center, Key to Geophysical Records Documentation No. 26 (Incorporated in: Global Change Database, Volume 1), Kineman, J.J., and Ohrenschaal, M.A., eds., Boulder, CO, National Oceanic and Atmospheric Administration, p. A14-1 to A14-4, 1992.

» Reynolds, R.W. and Smith, T. M.: A high resolution global sea surface temperature

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climatology. J. Climate, 8, 1571-1583, 1995.

We added the two papers in the reference list.

» \*\*\* Technical comments \*\*\*

» Although I am not a native English speaker, I suggest some corrections where there are understanding issues or obvious mistakes. The manuscript quality would be improved if it could be corrected by a native English speaker.

» Page 384. Line 5: “using with”, remove “with”.

Revised accordingly

» Line 6: “using of the”, remove “of”.

Revised accordingly

» Page 385. Line 18: “studying on”, remove “on”.

Revised accordingly

»Line 19: “has focuses”, do you mean “has focused” ?

Yes. We revised as “has focused”.

»Line 22: “access”, do you mean “assess” ?

Yes. We revised as “assess”.

» Page 386. Line 14: “using with”, replace by “using an”.

Revised accordingly

» Page 389. Line 6: “broader than it”, remove “than it”.

Revised accordingly

» Lines 16-17 : “Over the off the western continent”. Choose between “Over the” or

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“Off the”.

We revised as “Off the”.

» Line 17: “western coast of the continent”. It would be clearer to name the continent, for example “western coast of the Eurasian continent”.

Thank you for the suggestion. We revised as “western coast of the South American continent”.

» Page 390. Line 17 : “Mg/Ca paleothermometry shows generally”, replace by “Mg/Ca paleothermometry, which generally shows”.

Revised accordingly

» Line 22. “the all experiments”, replace by “all the experiments” or by “every experiment”.

We revised as “all the experiments”.

» Line 24 : “As with the present-day condition, any modifications were applied”. Do you mean : “the land/sea mask being set to modern, no modifications were applied” ?

Yes. We revised as “The land/sea mask being set to modern, no modifications were applied”.

» Page 391. Line 8 : “In this study”. I don’t understand if you’re talking about your own study or the one from Sato et al. cited just before, and the meaning of the following sentence is not clear. Please briefly explain why it is important to know that vegetation is not classified into three types.

“This study” means my own study, but the words “in this study” had not so much importance in the sentence. We deleted the words “in this study” to avoid misunderstanding.

» Page 392. Line 2: “Any modifications”, replace by “No modifications”.

Revised accordingly

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» Line 11: “and integrate”, do you mean “then we integrate” ?

Yes. We revised as “then we integrate”.

» Line 13: “then continue the integration”, replace by “Then we continue the integration “ or “ then, the integration is continued”.

We revised as “Then we continue the integration”.

» Lines 21-22: “with the integrations” is useless. You can remove it for more clarity.

We deleted the words.

» Line 25: “large drift than”, replace by “larger drift than”.

Revised accordingly

» Page 393. Line 4: “climate data”. I would rather use “climate outputs”.

Revised accordingly

» Page 394. Line 13: “represented”, I would rather use “presented”.

Revised accordingly

» Line 14: “patterns of them”, remove “of them”.

We deleted “of them”.

» Line 22: “its”, replace by “the” or “their”.

We revised as “their”.

» Page 395. Line 12: “are reached”, replace by “have reached”.

Revised accordingly

» Line 28: “They”, replace by “it” or “this effect”.

We revised as “It”.

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» Page 396. Line 3: “dominated”, replace by “dominant”.

Revised accordingly

» Line 5: “are match”, remove “are”.

Revised accordingly

» Line 5-6: “land glaciers”. In this case, I would rather use “ice sheets”.

Revised accordingly

» Line 27: “It is also noting”, replace by “Note also”

Revised accordingly

» Page 397. Line 8: “dominated”, replace by “dominant”.

Revised accordingly

»Line 9-10: “possible mechanisms for them”. I would rather say “the related possible mechanisms”.

Revised accordingly

» Line 23: “accompanying with”, remove “with”.

Revised accordingly

» Page 398. Lines 12-13: “any significant changes are not appeared”, replace by “no significant changes appeared”.

Revised accordingly

» Page 399. Line 26: “the poleward shift of biomes”. This sentence can lead to a misunderstanding. Not all the biomes are displaced polewards during the mid-Pliocene. It only concerns some temperate and cold biomes. For example “the poleward shift of some temperate and cold biomes”.

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We agree the comment. We revised as “the poleward shift of some temperate and cold biomes”.

» Line 27: “which are”, replace by “and is”.

Revised accordingly

» Page 400. Line 9: “is also appeared”, replace by “also appears”.

Revised accordingly

» Line 14: “are not appeared”, replace by “do not appear”.

Revised accordingly

» Lines 19-20: “the increasing of SST are dominated”, replace by “the SST increase is dominant”.

Revised accordingly

» Line 28: “have already pointed out”, replace by “have already been pointed out”.

Revised accordingly

» Page 401. Line 8: “are also suggestive to drastic changes”, do you mean “are also suggesting drastic changes” ?

Yes. We revised as “are also suggesting drastic changes”.

» Lines 9-10: “Comparisons . . . frameworks...”, replace by “Comparing the changes in the simulated AMOC and discussing the related mechanisms under PlioMIP framework...”.

Revised accordingly

» Lines 10-13: “Changes in surface water . . . and reproducibilities of AMOC”. It seems to me that the sentence would be slightly prettier like this: “Changes in surface water cycle including precipitation, evaporation, runoff, the associated sea-water salinity

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and sea ice cover, during the Pliocene compared to the Control, as well as AMOC reproducibility ...". But this is just a suggestion.

Thank you for the suggestion. We revised as "Changes in surface water cycle including precipitation, evaporation, runoff, the associated sea-water salinity and sea ice cover, during the Pliocene compared to the Control, as well as AMOC reproducibility in the Control simulations ...".

» Line 12: "Pliocen", replace by "Pliocene".

Revised accordingly

» Line 15: "access", do you mean, "assess" ?

Yes. We revised as "assess".

» Line 26: "are suggestive of different characteristics". I would rather say "are suggesting different characteristics".

Revised accordingly

» Page 402. Line 1: "performances of them", replace by "model performances"

Revised accordingly

» Line 2: "for investigate", replace by "to the investigation of".

Revised accordingly

» Page 409. The last reference of the bibliography list, Zachos et al., is 2001, not 2011.

Revised accordingly

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