

Interactive comment on “Sensitivity of Pliocene climate simulations in MRI-CGCM2.3 to respective boundary conditions” by Youichi Kamae et al.

Anonymous Referee #1

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This manuscript addresses the pertinent question of what is the sensitivity of the climate to Pliocene boundary conditions, which is an area of research relevant to the scope of Climate of the Past. The title clearly reflects the research study and contents. The paper aims to bridge the gap in understanding of how the climate responds to Pliocene boundary conditions by performing a thorough model analysis using recently revised boundary data. It's a significant contribution to the Pliocene Model Intercomparison Project phase 2 (PlioMIP2), where other models also test this sensitivity. The literature review is comprehensive and clearly identifies the current state of the science. The manuscript contents are organized in a logical manner and the novelty of the research (i.e., newly updated boundary conditions) is clearly described in the introduction. The experiment is well designed and sufficient to answer the questions posed in the manuscript. By using the same version of the model and only changing

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the boundary conditions, it allows for an adequate analysis of the sensitivity of the data on climate. The amount of ensembles and spin up equilibrium time of the model is sufficient for the robustness of the results, and the adherence to the PlioMIP2 protocol allows for an future model intercomparison. The model results are presented with an analysis of the mechanisms driving them, and the conclusions drawn are consistent with the interpretation of the results. While the conclusions are substantial, the research requires additional analysis to better explain the responsible physical mechanisms. However, this is clearly identified in the manuscript and may be sufficiently covered in another manuscript. Furthermore, the use of a higher resolution model or earth system model with dynamic vegetation would be a very useful companion study to further evaluate the interactions and feedbacks in the climate system. Overall, the quality of the paper is good and recommended for publication with minor issues addressed below.

1. The color scheme used in Figure 1 (page 19) to illustrate the prescribed land cover for the modern and Pliocene periods makes it hard to distinguish between certain types. For example, deciduous broadleaf+evergreen conifer (03), tundra (10) and land ice (13) are too similar in color and difficult to decipher. A broader range of color scheme is recommended for this figure.
2. The color scheme for Figure 2C (page 20) also makes it difficult to see the single grid cell light blue pixels, in particular, in North America and Asia. I recommend either contouring the small lake areas or using a bolder color to enhance them.
3. For consistency, I recommend using the same surface air temperature (SAT) units throughout the figures and manuscript. For example, Figure 4 uses °C for SAT while Figure 5 uses K.
4. To better follow the naming convention, I recommend reordering the text on page 4 line 30 to be consistent with the “OVL” acronym (e.g., “orography, vegetation, and lakes”).
5. Since “OVL” is used throughout the text, I recommend adding it to the label (“Orog+Veg+Lake (OVL)”) for Figures 4C, 4G (page 22), Figure 6C (page 24), Figure 7C (page 25), Figure 8C (page 26), and Figure 9C (page 27).

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