

## ***Interactive comment on “Pliocene Model Intercomparison (PlioMIP) Phase 2: scientific objectives and experimental design” by A. M. Haywood et al.***

### **Anonymous Referee #1**

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In this paper, Haywood and co-authors summarize the experimental design for the Pliocene Model Intercomparison Project Phase 2 (PlioMIP2). Although the paper is written well and the experiments designed are potentially important for understanding Pliocene and future climate, I find that the experimental design is still confusing. Therefore, I suggest the authors to revise the paper, to provide a clear guideline for future tasks in PlioMIP2.

Major points:

1. Two experiments are included in the CORE, one is pre-industrial control run, and the other is the Pliocene experiment. If I understand correctly, KM5c orbital parameters

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should be used in the Pliocene experiment. The authors need to clarify in Table 3 which orbital parameters should be used? or all experiments use orbital parameters for year 1950 (same as pre-industrial control run)?

2. For all Pliocene experiments, the authors show in Table 3 that “modern” LSM can be used. However, as I understand, this is NOT a real modern LSM, because the authors suggest to close the Bering Strait and the Canadian Arctic Archipelago in all Pliocene experiments (See page 4015 line 15-20) .Therefore, the author should clarify this in Table 3.

3. It is very likely that the changes in LSM (closed Bering Strait and Canadian Arctic Archipelago) bring some difficulties for some model groups, make models crash. If some model groups really can not change LSM, even only with a few grids, the authors should clarify whether the “real modern LSM” can be used in the Pliocene experiments under this situation.

4. The Pliocene soil condition is a state-of-the art condition in the PlioMIP2. However, the information provided in the paper is really helpless in changing soil conditions for some model groups. For example, for CLM, we have to define clay percentage, sand percentage, soil colour, organic, if we want to change soil types. The information provided in the paper now is not enough to change soil conditions for CLM. The authors should clarify which change in soil is obligated, soil colour, or soil structure, or both? The authors should also provide more information about Pliocene soil types. Otherwise it will bring many uncertainties in changing soil for different model groups.

5. The lake condition is also new in the PlioMIP2. However, it seems that large changes in lake areas only appear in Africa. The author should briefly clarify the uncertainties in this lake reconstruction. Why are there almost no lake changes in other continents, for example Eurasia?

6. I suggest the authors to reorganize the Table 3, since this table is the key for future tasks in PlioMIP2.

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Minor points:

Page 4008, line 26, “our strategy for Phase 2 is to utilise state-of-the-art boundary conditions . . . These include a new paleogeography reconstruction detailing ocean bathymetry and land/ice surface topography.” The lake and soil conditions should also be mentioned here, since they are also state-of-the-art boundary conditions in the PlioMIP2.

Page 4013, line 24, “When trying to reconstruct Pliocene CO2 uncertainty is inevitable”. This sentence is confusing. Please reword.

Page 4015, line 16, “In the Standard boundary . . .” should be “in the standard boundary . . .”

Page 4033, figure 2, I suggest to add all Experiment IDs (for example, E280) in the figure. It will be easier for reader to link this figure with the Table 3.

Page 4035, figure 4, I suggest to add a figure, which shows land-sea mask differences in the Torres Strait, Java Sea, South China Sea, Kara Strait, and West Antarctic Seaway. Then it will be easier to notice these differences, when model groups set their own Pliocene LSM conditions.

Page 4036, figure 5, I suggest to add a figure, which shows the differences between Pliocene and modern lake areas.

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