

general comments:

This paper identifies and discusses differences in the modelled climate that occur between the COSMOS simulations contributed to PlioMIP1 and PlioMIP2, and studies the effect of orbits warmer than the configuration applied for PlioMIP2. The sensitivity of mid-Pliocene climate (SST, SAT and the distribution of sea ice) to minor differences in PlioMIP's boundary conditions are investigated. The paper is a significant contribution to the model-model and model-data-comparison within PlioMIP2. The basic conclusion from the paper appears sound and the methods are also generally appropriate and well described. Overall I recommend publication subject to minor revision.

1) The title seems to be not so consistent with the introduction. From the title, I think the changes in orbit forcing and PlioMIP's boundary conditions are all the main topic, even the orbit forcing (basically orbit forcing is one of the PlioMIP's boundary conditions) is more important. However, from the introduction, only the last 5 lines (line 27-31 in page 3) you mention the orbit forcing. And you only did one orbit forcing experiment, that gives me a feeling whether it's necessary to put the orbit forcing in this paper. Maybe only analyzing the impact of the changes in PlioMIP's boundary conditions to mid-Pliocene climate could be better.

2) Additionally, I think precipitation and temperature are two basic climate variables. Adding some analysis of the precipitation could be better.

Specific comments:

1) Page 2, line 25: delete “and the Pleistocene-Pliocene”. You only study the mid-Pliocene period, never investigate anything during the Pleistocene-Pliocene period.

2) Page 5, line 6-8: the sentence “that is useful……that is based……”, there are two “that is”.

3) Page 5, line 19-21: I think there are three major components, not four.

4) Consistency: the authors use “PI” instead of “pre-Industrial”, but not all. I think except the first one, the others all use PI could be better. In figure 2, 3, 4, 5 and the main body, the temperature’s unit is K; but in figure 6, 8, it is degree C. Maybe all use degree C could be better.

5) Some paragraphs are really too long (e.g. the first paragraph in SAT, the third paragraph in discussion), it’s really hard for readers to follow (at least for me). I suggest the authors to divide those long paragraphs into two or three shorter paragraphs.

6) Page 17, line 27-29, the sentence “The difference in CO₂ between PlioMIP1 and PlioMIP2 simulations does not change the general impression of large scale mPWP climate patterns, but produces warmer

oceans especially in high latitudes of the Northern Hemisphere” is not so clear. I don’t know which one produces the warmer oceans, the PlioMIP1 or PlioMIP2?

7) What’s the “sea ice compactness” mean? In the results, the authors use “sea ice extent and compactness”, but in the discussion, “sea ice extent and compactness” and “sea ice extent and thickness” are all used. Does that mean “compactness” equal to “thickness”?

8) As a reader, I think the discussion is not so clear and logically organized.

technical corrections:

Missing space, comma and back bracket: page 9, line 17, use “Hemisphere, we find” instead of “Hemisphere we find”; page 11, line30, use “Figure 11f, h” instead of “Figure 11f and 11h”; page 12, line 1, use “(see Figure 12b, d)” instead of “(Figure 12b and 12d””; page 12, line 8, use “(compare Figure 12b, d, f, h with 11f)” instead of “(compare Figure 12b,d,f,h with 11f)”; page 18, line 24, use “ Salzmman et al., 2013), further” instead of “ Salzmman et al., 2013),further”. There are a lot these kind of mistakes, please check the whole paper carefully.