

Author's comments
to
cp-2020-5
“Sensitivity of mid-Pliocene climate to changes in orbital forcing, and PlioMIP’s boundary conditions”

We want to sincerely thank both reviewers for their positive reviews and suggesting ways to improve our manuscript. All comments raised are highly valuable and has helped us to improve our manuscript, substantially. We have implemented all suggestions into a revised manuscript. Below, we show highlights of changes made, based on the reviewer’s comments.

- Anonymous reviewer #1 raised one major comment about our sensitivity tests to changing CO₂ from 405 to 400 ppm, and the large difference in the North Atlantic SST due to this change. For this, we have carried out additional analyses which show that both simulations are in a quasi-steady state before being analyzed (see Figure S1), and we implemented the reviewer's suggestion by averaging over a longer time period (Figure S2).

- Other changes in the manuscript can be found in the results section, where we have re-arranged the sub-sections. Previously, we described the results in terms of climatic variables, namely SAT, SST and sea ice. To make the manuscript easier to follow, we describe the results in the following order;

1. Comparison of selected climatic variables between PlioMIP1 and PlioMIP2
2. Contributions of palaeogeography and changes in CO₂ to PlioMIP2
3. Effect of alternative orbit (MIS K1) on mid-Pliocene simulations

- Furthermore, additional analyses are carried out to compare simulated mid-Pliocene SSTs with emerging time-slice reconstructions by Foley and Dowsett (2019), and McClymont et al., 2020. The results are presented in Table 2.

We provide a list of other changes that have been implemented in the revised manuscript:

- ✓ A part of the abstract detailing minor changes in boundary conditions are deleted
- ✓ We have added some precipitation analyses showing the difference between PlioMIP1 and PlioMIP2 core simulations in the supplement (Figure S3)
- ✓ We fixed various typographical errors, missing comas and brackets
- ✓ We added 2 new references
- ✓ We added additional author’s affiliation
- ✓ We replaced all occurrences of Pre-industrial by PI except the first one
- ✓ For consistency, we have replaced all occurrences of the temperature unit K by °C
- ✓ Following the suggestions of both reviewers, we have replaced the term “sea ice compactness” with “sea ice concentration”
- ✓ We added additional text in the experimental design section detailing integration length and the period that we analyzed.
- ✓ We have called the simulations by their ID other than describing them at every possible occasion
- ✓ We fixed formulations that are not sufficiently precise in the discussion section, according to the reviewer’s comments

- ✓ We added additional texts to the introduction section based on the comment by reviewer #2

References:

- Foley, K. M., and Dowsett, H.J.: Community sourced mid-Piacenzian sea surface temperature (SST) data: U.S. Geological Survey data release, <https://doi.org/10.5066/P9YP3DTV>, 2019.
- McClymont, E. L., Ford, H. L., Ho, S. L., Tindall, J. C., Haywood, A. M., Alonso-Garcia, M., Bailey, I., Berke, M. A., Littler, K., Patterson, M., Petrick, B., Peterse, F., Ravelo, A. C., Risebrobakken, B., De Schepper, S., Swann, G. E. A., Thirumalai, K., Tierney, J. E., van der Weijst, C., and White, S.: Lessons from a high CO₂ world: an ocean view from ~ 3 million years ago, *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2019-161>, in review, 2020.