[Research Article # cp-2023-34]: "A transient CGCM simulation of the past 3 million years" by Kyung-Sook Yun, Axel Timmermann, Sun-Seon Lee, Matteo Willeit, Andrey Ganopolski, and Jyoti Jadhav

We thank the reviewers for their constructive and helpful comments. We carefully revised the manuscript "A transient CGCM simulation of the past 3 million years" and provide a point by point reply to the individual comments below.

Reply to the comments of Reviewer #2

General Remarks:
This paper describes the first transient CGCM simulation of the last 3 Myrs, with a forcing acceleration factor of 5. The simulation is compared with proxy observations in various climate regimes and in various climate variables. This is a tremendous effort and believe the simulation will be a great resource for the community in future studies. The paper is well written and should be published.

[Ans] We appreciate the reviewer's comments and suggestions. The manuscript has been revised according to the reviewer's comments, as listed below.

Minor comments:
Q. 1. *To better quantify the bias caused by the 5x acceleration, it will be good to have a comparison with a transient simulation without acceleration for one time period (say, about a precessional cycle length of about 20kyr).*

[Ans] We agree with the reviewer that potential biases may occur due to the use of the acceleration technique, in particular in the deep ocean and in high latitudes. The detailed comparison with a range of proxies, however, suggests that at least for near-surface variables the resulting biases or delays are likely very small. Moreover, according to Lunt et al. 2006, who ran an EMIC for the last 30,000 years with different acceleration factors (1, 2, 5, 10), and Timm and Timmermann (2007) and Varma et al. (2016) who ran LOVECLIM and CCSM3 with acceleration of 1 and 10 for different orbital-scale forcings, respectively, significant biases are to be expected for acceleration 10 for deep ocean temperatures and surface conditions in high-latitude regions where the climate is closely connected to the deep Ocean. Our factor 5 acceleration is a good compromise between minimizing distortions, delays and biases due to acceleration (see Figure 8 in Lunt et al. 2006), while at the same time maximizing computational performance. Unfortunately, running another 20,000 year unaccelerated run (300 years per day) with CESM1.2 would take another 2.5 months of computing time on our supercomputer, which is currently not available. Given, the large computational effort and the fact that such runs have already been conducted previously with EMICs (and we don't expect fundamentally different results with CESM1.2), we have refrained from launching a new unaccelerated run, but instead provide a more detailed discussion of the benefits and disadvantages of the method, as described in recent studies (Lunt et al. 2006, in particular for acceleration 5) [line 116-129].

Lunt, D. J., Williamson, M. S., Valdes, P. J., Lenton, T. M., and Marsh, R.: Comparing transient, accelerated, and equilibrium simulations of the last 30 000 years with the GENIE-1 model, Clim. Past, 2, 221–235, doi:10.5194/cp-2-221-2006, 2006.

Q. 2. *Clarify if the temperature discussed in the text and shown in the figures are all annual mean.*

[Ans] Yes. The temperatures discussed in the text and figures are based on all annual means. We revised the text accordingly [e.g., line 817].

Q. 3. *For the model data comparison of long time series, such as those in Figs.4-7, it will be good to have a parallel figure (say, to the right of the time series panel),which show two spectra, one before and one after the MPT. As it stands, it is becoming very hard to judge.*

[Ans] According to the reviewer's suggestion, we added a parallel figure showing two spectra of pre- and post-MPT in Figs. 4-7. Relevant descriptions are added in the revised text [e.g., line 196-198; line 242-244; line 256-257].