Clim. Past Discuss.,
https://doi.org/10.5194/cp-2019-112-AC2, 2019

Climate of the Past Discussions

Interactive comment on "Changes in the high latitude Southern Hemisphere through the Eocene-Oligocene Transition: a model-data comparison" *by* Alan T. Kennedy-Asser et al.

Alan T. Kennedy-Asser et al.

alan.kennedy@bristol.ac.uk

Received and published: 23 December 2019

We would like to thank the reviewer for taking the time to provide this detailed review of this paper. Similar key points were brought up to reviewer 1, including:

1) Uncertainty in the datasets, particularly relating to orbital variability and potential seasonal biases 2) The low resolution of the model simulations 3) How the models compare to the present day and how this might affect the results

Furthermore, they also ask for further details on aspects of the model setup and spin-up, as well as further discussion of results. Firstly, we address the main points that

Printer-friendly version

Discussion paper

overlap with reviewer 1 below:

1) To understand this, we have repeated our analysis using model simulations with varying orbits and also using only summer temperatures. Although we cannot definitively show the impact of orbital variation on individual records without a comprehensive reinvestigation of the records (which would be beyond the scope of the paper), the additional modelling results show that the impact of variations in the orbit are relatively minor and do not affect the core conclusions of the paper. Likewise for summer temperatures, although this would correct some of the absolute temperature bias for the late Eocene and early Oligocene, it does not make a major difference in improving the models' fit with the data or siginifcantly change the findings. Indeed, the summer model data fits other aspects of the datasets much poorer. There is considerable ongoing debate about the potential impact of seasonality in proxy records (e.g. Hollis et al., 2019, GMD) and so for this paper we would simply start with the assumption that the difference would be comparable to the proxy uncertainty that is already included. We acknowledge that future work could expand and further quantify the proxy data uncertainty (hence why we made our datasets available for other researchers to use and build upon), however a thorough review would be beyond the scope of this paper.

2) As with the comments for reviewer 1, we can add discussion relating to how higher resolution modelling could affect the results. Specifically to answer the comments of reviewer 2, we can add further discussion of how we only expect these models to pick up very large scale climate variability.

3) As we noted in the response for reviewer 1, although both of these models capture many aspects of the modern day climate well, they do show a cold temperature bias in the high latitude Northern Hemisphere during winter. The causes of this are not known but likely contribute to the cold biases found in the model-data comparison carried out here. Understanding why models show these cold biases remains the focus of ongoing work (e.g. DeepMIP). References and discussion about this can be easily added to the text.

We can easily add further discussion of the model setup and spin-up so that readers do not have to look up the respective references. It is worth clarifying that in these simulations the ice sheets are non-interactive and cannot melt or expand. Further discussion of the results and why certain forcings are particularly poor can be added. We expect that both sets of model simulations are adequately spun-up and further spin-up would not change the core conclusions of the paper.

Other comments relating to figures and emphasis in the discussion can easily be corrected.

Interactive comment on Clim. Past Discuss., https://doi.org/10.5194/cp-2019-112, 2019.

Printer-friendly version

Discussion paper