



Interactive comment on “Pre-industrial and mid-Pliocene simulations with NorESM-L” by Z. S. Zhang et al.

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We would like to thank the reviewer for the comments. We will take these comments into account in our revised version of the paper. The following is the detailed response.

1 Introduction, page 121, line 16: remove 't' after the word 'from'.

Will be done in the revised version.

2.4 Ocean model, page 124, line 15: change 'particular' to 'particularly'.

Will be done in the revised version.

3.2 Mid-Pliocene experiment, page 125, line 12: The same land-sea mask is used for both experiments. Is this purely down to simplicity or does changing the mask in this

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model require a large amount of effort?

This question is related to the “PRISM DOT question” below. Will be answered together below.

3.2 Mid-Pliocene experiment, page 125, line 16: change 'PRSIM' to 'PRISM'.

Will be done in the revised version.

3.2 Mid-Pliocene experiment, page 125, line 16: Was there any particular reason as to why the PRISM DOT deep ocean temperature data set was not used to initialise the model for the mid-Pliocene experiment?

The ocean model (Micom) used in the NorESM-L uses a dipole grid system in horizontal, and isopycnic layers in vertical. This is an irregular and complicated 3D grid system. Due to the complexities of the grid system, it is difficult to create a new land-sea mask for the model. If we use a new land-sea mask, we have to create a new latitude and longitude grid system. Then, mapping weight between atmosphere model and ocean model has to be recreated. If the mapping weight is changed, land fractions, runoff and some other boundary conditions have to be recreated. If PRISM DOT deep ocean temperature is used, the initial ocean stratification has to be modified, which may potentially influences the simulation of ocean circulation. All these changes will make climate sensitivities analyses complicated, and also bring uncertainties in future model-model comparisons.

With these in mind, we do not use the new land-sea mask and the PRISM DOT deep ocean temperature. In the mid-Pliocene experiment described in the paper, the climate changes presented in the paper are purely caused by the changes in topography, land cover and atmospheric CO2 level.

4.2.1 Surface temperature, page 129: Are there any suggestions as to what is causing the cooler temperatures found over some regions? For example, are changes in topography related to the temperature reduction over land? It may be worthwhile to write

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a bit more on this.

On land, we agree that change in topography is the main reason for the temperature reduction. We also find similar temperature reduction from other PlioMIP experiments. Over ocean, the air cooling is caused by reduced SST. However, the reason for SST cooling is more complicated. We once analyzed the SST cooling in the Norwegian Sea. We think it is changes in ocean currents that make the weak cooling there. For other region, more detailed analyses are needed. These will be addressed in our future study, and also model-model comparisons. However, they are out the scope of this paper, since this paper only focuses on the documentation of experiment setup.

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