

Response to Agata De Boer

This paper makes a very important contribution to the quest to understand Arctic Sea-Ice during the LIG, contains interesting diagnostics, a great model-data comparison, and I enjoyed reading it.

Because this topic is so important, I'd like to request a few extra figures that may help us understand the models and the LIG Arctic sea ice better. Is there any chance you can produce (perhaps in the supplement?) any of the following variables for the various models for the pre-industrial and LIG? In order of preference:

- Sea-ice drifts or surface currents: Was the surface circulation at the LIG different from today and what are the models showing for the PI? Do they have a realistic PI circulation?

- Winds or windstress over the ocean: This will drive sea-ice export as well as influence sea-ice distributions. It would be interesting to see if there are any consistent changes between the PI and LIG that could be useful in interpreting the data or model differences.

- The barotropic streamfunction or upper layer circulation if different from the surface: Are the models getting the Arctic gyres right and do these gyres systematically change at the LIG? This may also indicate what may happen in the Atlantic layer which is thought to affect sea-ice, at least in the Barents Sea.

- SLP patterns: This should be a straight forward plot indication atmospheric circulation differences between the different models and between the PI and LIG

We thank Agata De Boer for her comments. We will try and add a simple figure with the SLP patterns, since this is the variable which is available for the largest number of models.

A point I'd like to challenge is that models produce a similar response to future CO2 warming and the LIG forcing (Figure 10). If one takes away the one outlier (INMCM4-8) then the correlation breaks down. The response to 1pctCO2 is much stronger in some models than others model, while the response to LIG forcing is similar in the models.

We agree that the relationship is not very strong on the figure of the manuscript. We will reconsider this result in the light of the results made available for additional models.

Figure 5 is very interesting and I keep coming back to it but find it very difficult to dissect what the different models are showing because the symbols overlap to much or are hidden behind the lines.

The data-model comparison figure will be redesigned to account for changes in the interpretation of the data. We will also try to make it clearer.

Thanks for a great paper and I am hoping you will have the means to make some of these clarifying figures. Agatha de Boer

Thank you. This is also meant to be a paper that gives the readers the motivation to carry more analyses of the PMIP4 data!