

Interactive comment on “PMIP4/CMIP6 Last Interglacial simulations using different versions of MIROC, with and without vegetation feedback” by Ryouta O’ishi et al.

Anonymous Referee #2

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The authors have run LIG simulations with three different versions of MIRCOC model, the climate change between the LIG and PI are compared with proxy data. They show that all three models have produced expected warming in summer correspond to the imposed orbital forcing. Among the three models, only one model that is coupled with a dynamical vegetation model, is able to reproduce the annual warming over the northern high latitudes. And they conclude that vegetation feedback is necessary for reproducing the comparable warming showing in proxy data. The paper is an overall evaluation on simulated LIG climate by MIRCOC, it is a good documentation for the LIG simulations from this specific model. The authors may consider the following comments and improve the manuscript.

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1. The models are presented in a clear hierarchy, from an AOGCM, to a AOGCM coupled with LPJ vegetation and finally an earth system model with more physical processes are included. The results are obviously not following the complexity of the model components, instead it turned out the version OAGCM+LPJ version is the one that better agree with temperature reconstruction. Besides concluding that vegetation feedback play important role to simulate LIG climate, the authors should discuss more why the other components such as biogeochemistry over the land and in the ocean do not contribute much to the expected LIG warming. Does it imply these components are not important or these components do not work well in LIG climate?

2. For the major conclusion, the important contribution from vegetation feedback to reproduce the warming over land and northern high latitudes, the authors did not present the relevant feedbacks. Is it due to the change in the albedo, or LAI, or evaporations? According to the results from ESM, it seems LAI does not contribute much. It is not clear which physical processes are associated to LAI, if these processes do not contribute to the warming, does it mean they are not important at all or they are not well represented in this model? More discussions on these key questions would provide useful information on how to improve the model.

3. The presentation on the results are lack of the motivation, each section simply starts with showing the figures on temperature, precipitation, sea-ice and vegetation and did not mention why do authors show these results. We may understand that simulated temperature can be compared with proxy data and tell us if the warming in certain regions are well reproduced. What do the resulted precipitation and sea ice imply? It would be helpful that author can provide a few motivation sentences for their results presentation.

4. For the sea-ice, the authors may aim to show that sea-ice feedback is contributing to the high-latitude warming. In this case it is better to use the sea-ice extent instead of thickness, which can better explain the sea-ice-albedo feedback. It would be helpful to add some discussion on sea-ice feedback, instead of only showing the differences

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in sea-ice.

5. For the model-data comparison, the temperature reconstructions from two datasets are used, but no any comments on the uncertainty of each datasets. I suggest the authors provide some information on the data uncertainties in order to gain fair evaluation for the model results.

6. Fig1 shows much less insolation in SON in northern high latitudes, but in all three models simulated warm Arctic in surface air temperature in fig4, especially a strong warming in MIROC4m-LPJ version. Authors should mention this in the text and give some explanations.

7. L129, "We also compare model annual SST..", should be "We also compare modelled annual SST...".

8. Line 150, this section is talking about the precipitation and it is strange to end with a sentence with vegetation distribution in Sahara. Consider to remove. It is more appropriate to mention it as in L193-194, so called "green Sahara" needs the reference, and specify how green it is? Do the proxy data indicate any specific vegetation type development in Sahara, and within how large area?

9. L161, "...on the eastern coast of Greenland", I observed the northern part of Greenland in figure 13. In fig13, it doesn't make sense that warm LIG climate produces more sea-ice than PI in March (fig1 shows more insolation in MAM in northern high latitudes), any explanation?

10. L171-172, "... as well as NH", this is confusing and suggest to rephrase.

Figures:

1. In Fig3, the Greenland ice-sheet distribution in ES2I looks different from others, any explanation?

2. Fig5, though it shows Greenland, would be helpful to have the lat-lon labels.

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3. Fig6 and Fig7, it is difficult to distinguish the dark red and dark blue for proxy data, for example those over the Greenland, suggest to change the colour bar for a clear distinguish.

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