

Interactive comment on “Coupled simulations of the mid-Holocene and Last Glacial Maximum: new results from PMIP2” by P. Braconnot et al.

Anonymous Referee #2

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Review Braconnot et al. ‘Coupled simulations of the mid-Holocene and Last Glacial Maximum: new results from PMIP2’

General comments This paper discusses results from recent coupled model simulations of the LGM and mid-Holocene climates that were performed in the framework of PMIP2. These results are compared to earlier PMIP1 simulations that have been carried out with either AGCMs with fixed surface ocean conditions or AGCMs coupled to slab-ocean models. This comparison is a good idea, as it is interesting to see to what extent the use of fully coupled atmosphere-ocean models improves the simulated LGM and mid-Holocene climates compared to climate reconstructions based on proxy data. The analysis should be of interest to the readership of Climate of the Past. I would support publication of this paper in CP after major revisions.

My main concern with this paper is that it lacks focus. The authors state that their goal is to provide an overview of PMIP2 results for LGM and mid-Holocene, highlighting the change in global temperature and precipitation. As the authors note, quite a few papers have been recently published that discuss different specific aspects of the new PMIP2 simulations. This manuscript presents a very general overview of the global response in temperature and precipitation, extended by a more detailed discussion of some aspects of the simulations that are not really covered by the previous studies. These new aspects are mainly the location of the ITCZ and the strength of the snow and sea-ice feedbacks. Several interesting new results are presented, but these results are not always analysed in detail, such as the counterintuitive relation between precipitation change at 6 ka and the precipitation in the control experiment (shown in Figure 9), or the finding that interactive vegetation induces land surface processes in favour of a drier climate (p. 1313). This is not very satisfactory and I would urge the authors to provide a more in-depth analysis in these cases. The paper is already quite long, so extending it to provide a detailed explanation for these interesting results seems not an ideal solution. One alternative could be to focus the paper on Section 4, and to publish the results presented in Section 5 elsewhere.

Specific comments

The title is not very informative. I suggest replacing 'new results from PMIP2' by something like 'the hydrological cycle in the tropics' (if the paper is focused on Section 4).

Page 1300, line 17-18: 'the models are run long enough for the trends over the final 100 years to be small'. Please specify how you have defined 'small'.

Page 1300, line 27: 'For most of the modelling groups, the version of the GCMs used for PMIP2 is identical to the version used for future climate change predictions'. I propose to indicate in which cases model versions were used that are not identical, e.g. in Table 2.

Page 1301. I suggest mentioning that different atmospheric model components have

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been used in PMIP1 and PMIP2. So the differences between results of PMIP1 and 2 are not just due to the different way the oceans are treated (and to a lesser extent the ice sheets), although this is probably the dominant factor. And what about the land surface components?

Page 1301, line 2-3: ‘They also all include a sea ice model’ Do all models include a thermodynamic-dynamic sea-ice model?

Page 1306, line 17: ‘results for 6 ka suggested that the northern limit of precipitation shifted to the north over the Sahel region’. Please explain what results.

Page 1309, line 13: ‘ suggest that the change in the ocean circulation has a large impact’. Please explain what change.

Page 1312, line 24. ‘More investigation is needed to fully explain it’. As mentioned, this is not very satisfactory. What do you mean by being ‘saturated’? Please elaborate.

Page 1313, line 10: ‘Part of it’ Please explain. Part of what?

Page 1313, line 25: ‘Additional analyses are needed to fully understand this result’. As mentioned earlier, I would propose to provide these analyses in this paper. It would make the paper much more interesting.

Page 1315, line 17. ‘Interestingly in the southern hemisphere sea-ice was larger during summer and smaller during winter in the PMIP1 simulations’. It is not clear to me why the results for PMIP1 are different. Is this just due to CLIMAP’s seasonal reconstruction for sea-ice cover?

Page 1316, line 3-4: ‘This can be attributed to the colder conditions induced by the ocean response to the insolation forcing’. Please explain in more detail what the ocean response to insolation forcing is. For instance, how much colder is the surface ocean, and where? How long is the lag in the ocean’s response?

Technical comments

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Page 1299, line 11: '0 k' should be '0 ka'. Please use 'ka' throughout the manuscript.

Page 1300, line 18: please rephrase the sentence starting with 'The last 100 or 200 years'

Page 1301, line 7: 'Earth system model' should be 'Earth system models'.

Page 1301, line 12: 'simulations of mid-Holocene' should be 'simulations of the mid-Holocene'

Page 1308, line 8: ' of precipitation for precipitation located to the north of the maximum precipitation.' Please rephrase.

Page 1309, line 1: 'event' should be 'even'

Page 1310, Section 4.2. I propose to first discuss the results for the LGM and subsequently those for the mid-Holocene, as done in the rest of the paper.

Page 1313, line 13. ' for which the vegetation is prescribed the vegetation simulated'. Please rephrase.

Page 1314, line 9. 'For each the model' please remove 'the'.

Page 1318, line 16: '3/3 ' should presumably be '3/4'.

Page 1320, line 3: 'strengths the warming' should presumably be 'strengthens the warming'.

Figure 1 and 3 are too small, I cannot read the scale.

Figure 2: It appears that only results of 5 AO models are shown instead of 6 models as indicated in Table 2. Why?

Figure 6: Please provide (a), (b) etc. and units. An explanation of the different markers is also missing

Figure 7: I suggest to explain in the caption that the control experiments are different

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from Figure 5, and that the model subset is different. Please also explain the meaning of the +-markers.

Figures 10, 11, 12, 13, 14, 15: please provide units

Figures 11, 13: please modify header, should be NH and SH instead of HN and HS.

Figures 11-15: Please make the x-axis labeling consistent, as the notation for 'months' is different.

Figure 13: what does '1000' mean? Why are the values for January missing?

Figure 14, caption: 'substet' should be 'subset', 'waver' should be 'wave'.

Figure 15: I suggest to remove Figure 15, as it is not really discussed in the text.

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