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Climate of the Past Discussions

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

Anonymous Referee #1

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Pascale Braconnot and co-authors present an overview of new model results from the Palaeoclimate Modelling Intercomparison Project - Phase 2 (PMIP2). The ensemble of models encompasses 7 comprehensive atmosphere-ocean (AO) models, 3 atmosphere-ocean-vegetation (AOV) models and 1 EMIC, run in AO and AOV configuration. In the paper, a number of large-scale features of simulated of mid-Holocene (6k) and Last Glacial Maximum (LGM) are discussed in comparison with present-day climate. Focus of the paper is, however, the shift of the ITCZ and the role of the snow and sea-ice albedo feedback.

The authors find that the shift of the ITCZ is important mainly for the interpretation of the 6k climate. Interestingly, it appears that models which have a wet bias in North Africa for present-day climate yield only a moderate change from present-day to 6k

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Interactive Discussion
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climate in this region. This seems to be a peculiar feature of the PMIP2 models. Earlier results do not corroborate this statement. For example, the ECHAM3-BIOME1 model has wet bias in present-day climate, but yields a considerable greening of the Sahara for 6k climate. The LMD5-BIOME1 predicts only marginal greening for 6k climate, albeit the present-day climate appears to be reasonably realistic at the first glance. In this respect, it is not really appropriate, when the authors state that in PMIP2, the atmosphere-vegetation feedback appears to be less important than in experiments by Claussen and Gayler (1997) and Texier et al. (1997). The latter studies reveal quite a different biogeophysical amplification of the African summer monsoon - basically as a result of differences in simulated subtropical atmospheric circulation - as analysed by deNoblet-Ducoudré et al. (Climate Dynamics, 16, 2000). The authors mention that feedbacks other than the biogeophysical feedback could play a role. I think, it would be instructive to present the albedo values used in the different model configuration as much of the atmosphere-vegetation feedback in West Africa can be attributed to changing albedo values.

The analysis of the snow and sea-ice albedo feedback confirms earlier studies which highlight the importance of the migration of boreal forests. The authors focus on the radiative impact of snow and sea-ice cover on climate change. It would be useful, if the authors could give some consideration to changes in atmospheric circulation. Winter-time warming in 6k climate at high northern latitudes could be either due to changes in the Arctic Oscillation or due to changes in coupled sea-ice albedo feedback and snow-albedo vegetation feedback of both.

The authors confirm that the difference between LGM and present-day climate can be attributed to changes in inland ice and hence, in surface albedo, while changes in atmospheric CO2 concentration are less important (contribute only 50% of the albedo effect). This has been stated earlier by Berger et al. (1996, a report of the Institut d'Astronomie in Louvain-la-Neuve) or Berger (2001) in Geosphere-Biosphere Interaction (one of the co-authors, MC, should have the references) or Jahn et al. (Climate of

CPD
2, S848–S851, 2007

EGU

the Past, 2005). Hence it would be interesting to reassess the old results in the light of PMIP2.

In conclusion, this paper is well written and presents a number of interesting results. It will certainly become useful reference for further discussion. As such, this paper will be an extremely valuable contribution to palaeo-climate modelling. I therefore strongly recommend its publication in CP.

Minor comments:

1) Page 1297, line 20 ff.: Not only PMIP2 simulations are used to study feedbacks in the climate system. Actually, the assessment of feedbacks in the climate system was the focus of a number of experiments using EMICs ranging from the early papers by André Berger's group to the EMIC intercomparison projects.

2) Page 1299, line 22: "Thus, the role of vegetation and feedbacks due to vegetation ca be analyzed." This statement contrasts with a latter statement on page 1313, line 15, that a strict analysis of vegetation feedbacks is hampered by the fact that OA and OAV experiments for 6 ka do not share the same control experiment. Indeed, a careful analysis of feedbacks and amplification of feedbacks by additional feedbacks would require 2n independent experiment which presents a huge effort.

3) Page 1302, line 10 and subsequent paragraphs: Could one not summarise the results listed in this section in a table - just for the readers' convenience.

4) Page 1303, line 6: ice-5G or ICE-5G ?

5) Page 1307, line 5/6: I guess, it should read Braconnot et al.

6) Page 1309, line 1: event or even?

7) Page 1313, line 8: Here, we have AOV experiments, instead of OAV experiments. Oceanographer seem to prefer OAV models, meteorologists, however, AOV. Never mind, but it should be used consistently.

CPD

2, S848–S851, 2007

8) Page 1318, line 16: Is there a plural of albedo? Perhaps, “albedo values” is better than “albedoes”.

9) -“-, same line: 3/3 (?) or ¿ to the feedback ?

10) -“-, last line: W/m2 instead of W/m2.

11) Page 1322, line 13/15: a relationship is found Ĕ between the ratio of the precipitation change and modern precipitation ?

12) Page 1324, line 15: Who is R.W.b.e. al.?

13) Figure 5, Caption, last sentence: Results from PMIP2 OA Ĕ., but the header to figure 5 says PMIP2 OA OAV. ?

14) Generally, almost all figures are hard to read (in the print version of CPD). Some information, for example in the head lines of figures 1 and 3 (is this information really necessary?) and the labels in figure 10b cannot be read at all. What about the head lines in figure 5 and 7? Would it not be sensible to simple have labels a), b), Ĕ like in the other figures. By the way, these labels a), b), Ĕ are missing in figure 6. Hence all figures should be redrawn thereby providing readable labels etc.

Interactive comment on Clim. Past Discuss., 2, 1293, 2006.