

# ***Interactive comment on “The PMIP4 contribution to CMIP6 – Part 2: Two Interglacials, Scientific Objective and Experimental Design for Holocene and Last Interglacial Simulations” by Bette L. Otto-Bliesner et al.***

## **Anonymous Referee #3**

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The authors present a comprehensive description of design and set up for simulations of the mid-Holocene climate at 6 ky BP and of the Last Interglacial (LIG) climate at 127 ky BP including a variety of sensitivity simulations. The paper is clearly written and up to the point. It is perfectly suited for publication in GMD.

I tend to disagree with Referee 1 that the paper should include some speculations on lessons learnt from the interglacial simulations for possible future climate change. The story of future climate change is about the response of our climate system to unprecedented strong variation in external forcing, while the mid-Holocene and the early

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Eemian pose the challenge of explaining climate change in the presence of weak variation in external forcing. In any case, simulating the subtleties of past climate variability is a prerequisite for gaining confidence in understanding the dynamics of our climate system – which the authors clearly state.

Before publication, I would appreciate, if the authors could consider the following issues.

a) The authors correctly highlight uncertainties arising from prescribing or simulating Holocene and Eemian vegetation patterns. The authors recommend using the reconstruction by Hoelzmann et al. (1998) for Holocene North Africa. Is this still the best reconstruction? What about the reconstructions mentioned in the papers cited by the authors or by Lézine et al. (2011), Larrasoana et al. (2013) , ...? Perhaps there are good reasons to still use Hoelzmann's et al data. But this should be critically re-assessed.

b) In the same line: What about lakes? Lakes potentially matter in the mid-Holocene Sahara (e.g., Krinner et al., GRL, 2012). Perhaps also for lakes, the reconstruction by Hoelzmann et al. would be useful.

c) SST biases in the coupled atmosphere – ocean models presumably contribute to an underestimate of Interglacial Monsoon strengths. Hence some SST sensitivity experiments (e.g., strong vs weak gradient between tropical and extratropical SST differences between pre-industrial and mid-Holocene / LIG climate) might be worth considering.

d) Likewise, sensitivity experiments with respect to changes in Arctic sea-ice could be instructive to explore the role of high latitude climate system feedbacks (cf. the papers cited by the authors).

Minor issues:

i) The term Tier 1 (explained in line 132) should be defined earlier.

ii) Fig. 6: I do not understand what Figure 6a refers to. Is it just the geographic location

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of dust sources, or the difference in locations – irrespective of their strength? Please use a superscript in the dimension  $\text{g/m}^2/\text{a}$  .

iii) Fig. 5: What is the meaning of the different shades of grey on the continents? In the upper figure, the color grey also appears on the temperature scale (temperature difference between 1.5 and 2 K)?!

iv) Line 754 ff: Something went wrong with the citation of the Dahl Jensen and . . . and . . . and .

References to papers cited (and not included in the manuscript):

Krinner, G., Lezine, A. M., Braconnot, P., Sepulchre, P., Ramstein, G., Grenier, C., & Gouttevin, I. 2012). A reassessment of lake and wetland feedbacks on the North African Holocene climate. *Geophysical Research Letters*, 39. doi:10.1029/2012gl050992

Larrasoana JC, Roberts AP, Rohling EJ (2013) Dynamics of Green Sahara Periods and Their Role in Hominin Evolution. *PLoS ONE* 8(10): e76514. doi:10.1371/journal.pone.0076514

Lézine, A. M., Zheng, W., Braconnot, P., & Krinner, G. (2011). Late Holocene plant and climate evolution at Lake Yoa, northern Chad: pollen data and climate simulations. *Climate of the Past*, 7 (4), 1351-1362.

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