

# ***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 #1**

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Review of manuscript entitled “The PMIP4 contribution to CMIP6 – Part 2: Two interglacials, scientific objective and experimental design for Holocene and Last Interglacial simulations.”

This manuscript provides an extensive description of the experimental design of the two interglacial PMIP4/CMIP6 simulations. The manuscript is well written and provides modeling groups with all the details needed to perform one of the many described experiments. However, I do have a number of general comments and more technical notes that are listed below.

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## General comments:

I appreciate that fact that two main experiments have been defined, which also serve as entry cards for the other sensitivity tests. This will likely ensure a good number of groups participating in this MIP. However, when it comes to the sensitivity experiments, there seem to be many of them, and moreover, most of them provide a lot of freedom when it comes to the specifics of the experimental design. While I acknowledge that all the involved research groups have different foci, requiring a careful assessment of the proposed sensitivity experiments. However, it seems to me that in the current setup there are perhaps too many sensitivity experiments proposed, with too many options, with the likely result that in the end a proper model inter-comparison becomes difficult since very few groups in fact performed the same sensitivity experiments. The authors have certainly carefully considered the issue and thus the proposed simulations are possibly the optimal solution, however, it seems to me that the topic is of such importance that a general reviewer comment is justified.

The authors did not use phrases like 'future analogue' when describing the Holocene and Last Interglacial simulations, thereby carefully circumventing the discussion whether or not the lessons that one can learn from simulating these periods can be applied to future climate warming. Indeed they correctly describe that the main difference between these two periods and present-day is the latitudinal and seasonal distribution of incoming solar radiation (lines 83-86). However, it seems to me that this manuscript with this list of authors is the exact right spot to discuss this matter. Moreover, since in many studies this direct link between early Holocene / Last Interglacial and future climate change has been made and is still often made, not discussing it here can also be seen as a statement, be it a more concealed one. Therefore I strongly suggest to discuss the topic: What are the differences between early Holocene / Last Interglacial and future climate change? Which lessons from these past periods can be used to inform us about the future? Which systems and their sensitivity are influenced by the difference in the forcing and which ones are for instance solely driven by higher temper-

atures and can thus be seen as direct analogues? Do the authors have data available to provide some examples? Or have studies been done to investigate this? Possible examples that come to mind are Masson-Delmotte et al. (2006, DOI: 0.1007/s00382-005-0081-9c) and Blaschek et al. (2015, DOI: 10.1007/s00382-014-2279-1).

The manuscript describes quite extensively the proxy-based paleoclimate datasets that are available for the early Holocene and the Last Interglacial (section 4). However, it does not seem to come to any conclusions. Is this part solely meant to provide an overview? If so, is this the correct journal and manuscript to do so? Or do the authors mean to provide some guidance for future model-data inter-comparisons? In which case the conclusions of this section should be made more clear.

Minor and technical comments:

Lines 87-88: The second part of this sentence describes the possible results of these forcings, but since this paragraph solely describes the forcings themselves, it could be better to move this part to later in the manuscript.

Lines 87-88: Provide references for the warmer NH summers and enhanced NH monsoons.

Lines 106-107: Different model biases and the issue of model complexity are discussed here. How do the presented experimental designs overcome these issues? Please shortly discuss, perhaps later in the manuscript.

Lines 181-183: It would be easier for the reader if the order in which the two periods are described is always the same, either first early Holocene and then Last Interglacial or the other way around.

Line 197: What is meant with 'surface', really surface or something like 2m-temperature, reference temperature?

Line 198: Are these surface winds?

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Line 284: Perhaps 130-126 ka for consistency.

Lines 344-348: Consider mentioning again that daily output is needed to calculate output on angular calendar months vs a fixed calendar months. Is the second part of this paragraph clear to the reader? Do they know what 'output needed to force regional area-limited models' is?

Lines 344-363: Are these paragraphs needed or can the manuscript simply refer to the website where all this information can be found?

Line 383: What feedbacks is this sentence referring to?

Line 404: 'can' or 'should' be prescribed from the last deglaciation experiment? It seems to me that these are the details that could in the end result in a model inter-comparison in which all simulations are slightly different from one another.

Lines 409-412: Is the CO<sub>2</sub> concentration for 116ka so uncertain?

Lines 426-440: Make it more clear which of these sensitivity experiments are proposed for both the Holocene and the Last Interglacial and which ones only for the Holocene (in line with Table 2).

Line 445: remove first 'is'.

Line 445: year of reference to Hoelzmann is missing.

Lines 446-449: This part is rather vague. Are sensitivity experiments in this direction foreseen in PMIP4 or not?

Line 470: This line seems to suggest that the 'coral records' do not provide evidence of sea level rise. Please rephrase.

Line 471: Can this value also be given in Sv for easier comparison?

Line 484: 0.13Sv doesn't seem small at all, is this a typo?

Line 489: I understand that the 8.2ka-event happened close to 8.5ka, but is it really

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necessary to introduce yet another simulation? Can't one simply use either 9.5 or 6ka in line with the other experiments?

Lines 489-492: This is somewhat unclear to me. Should the 2.5Sv pulse be introduced in year 500? Should both fluxes cease after this or should the background flux continue?

Lines 492-493: Does 'evidence for the recovery' mean that some upward trend should be visible or that it should again be close to the initial state? Why not give a more concrete number like a minimum of 100yrs after the end of the pulse?

Lines 479-493: It seems that this experimental design is similar to experiments that have been performed previously (Wagner et al., 2013, DOI: 10.1007/s00382-013-1706-z and Morrill et al., 2013, DOI: 10.5194/cp-9-955-2013), please refer to these manuscripts and discuss how and why those simulations differed from the design that is proposed here.

Lines 509-512: Why not start from 127ka? Should groups perform a 128ka equilibrium simulation as initial condition for the transient 128-122ka simulation? According to table 2 one should use 127ka as initial condition, but will this not lead to some spurious jump in the climate?

Line 540: Should this be 'small' rather than 'large'?

Line 572: Bakker et al. 2013 does not include LIG proxy-based climate reconstruction data. Perhaps Bakker et al., 2014 (DOI: 10.1016/j.quascirev.2014.06.031) is meant?

Lines 622-623: A number of datasets that are mentioned throughout the manuscript are not available on the website, when will they be?

Table 1: For 'Other GHG gases' 6ka and 127ka say '0', is that different from 'CMIP DECK piControl? What does 'SSI,ap if needed' mean?

Table 2: part of experiment 3.1 could also be considered as part of 3.3 (sensitivity to

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ice sheets). The hol8.2 ka event simulation is somewhat confusing, should it be 8.2 or 8.5 ka orbital? Why is a freshwater forcing coming from the Antarctic Ice Sheet not taken into account?

Figure 1: Is the horizontal placement of the global sea-level peak in panel k suggesting the timing of the Last Interglacial high-stand?

Figures 3 and 4: Color bars are missing and quality is rather low.

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Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-279, 2016.

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