

## ***Interactive comment on “Ice-sheet configuration in the CMIP5/PMIP3 Last Glacial Maximum experiments” by A. Abe-Ouchi et al.***

### **Anonymous Referee #1**

Received and published: 22 June 2015

The manuscript by Abe-Ouchi et al. describes methodology of development of “blended” LGM ice sheets for the PMIP3 intercomparison project. The manuscript also presents results of simulations illustrating influence of differences ice sheets reconstructions on simulated climate. I believe this is useful paper and I would recommend it for publication in the GMD after minor revision.

#### General comments

Methodological part of the paper which documents methodology of “blended” ice sheets development is clear and needs only some editorial changes. Interpretation of climate impact of three different ice sheet reconstructions performed with the same model, in spite of obvious limitations an AGCM-slab ocean model configuration, is also straightforward. However, I see a problem when the authors compare PMIP2

C1201

and PMIP3 modeling results. These are very different models and even if the same ice sheets reconstruction would be used in PMIP2 and PMIP3, significant differences between global SAT anomalies averaged over the different models ensemble are unavoidable. Even more, because radiative forcing of ice sheet depends not only on prescribed ice sheets but also on models (for PMIP3 this difference is more than 30% across the model ensemble), differences in global mean radiative forcing of ice sheets cannot be solely attributed to differences in ice sheet reconstructions used in PMIP2 and PMIP3. Therefore the authors cannot claim that simulated difference in radiative forcing of ice sheets, elevation and land area between PMIP3 and PMIP2 of 1 W/m<sup>2</sup> is caused by difference in ice sheet reconstruction. Similarly 0.5C extra cooling in PMIP3 ensemble cannot be attributed to different ice sheet reconstructions. Obviously, I do not suggest redoing PMIP3 ensemble with PMIP2 ice sheets reconstruction but such experiment can be perform in principle with the AGCM-slab ocean model. In any case, this potential caveats should be discussed in the manuscript.

Some parts of the manuscripts, especially introduction, require improvements of the style. In particular, several sentences (like that on page 4298, lines 2-9) are lengthy and difficult for understanding. I would also suggest to use more precise scientific terminology. In particular, sheet reconstructions are not “boundary conditions”, at least, in mathematical or physical sense. Another example is “shallow ice-sheet model”. This is rather rear and confusing term. I would suggest using the standard term – ice sheet model based on shallow ice approximation.

#### Specific comments

p. 4295, l. 2. “. . . the creation of boundary conditions. . .” See my general comments.

p. 4295, l. 10. “albedo mask” sounds strange. Do you mean ice sheet mask?

p. 4295, l. 22. “There are much larger differences in the climate response to the latest reconstructions. . .” The meaning is not clear.

C1202

p. 4296, l 5. I cannot see how PMIP type experiment can help in understanding of the causes of uncertainties in future climate predictions.

P. 4296, l 8. Please remove "change".

p. 4297, l. 7. I would suggest to use "ice sheet topography" instead of "overall form of the ice sheet".

p. 4297, l. 29. "the change in land-sea geography has impacts on sea level. . ." I suppose that it is other way around, namely, sea level affects land/sea distribution.

p. 4301, l. 12 What is EOFs?

p. 4301, l. 23. What is "margin forcing"?

p. 4307. In the left hand side of the Eq. 10 should be "Mask\_1,ave"

p. 4307, l. 15. The meaning of "masked surface altitude" is not clear to me.

p. 4308. L. 10. "The ANU reconstruction consistently shows the largest changes. . ." Do you mean that the ice volume of ALL ice sheets in ANU reconstruction are larger than in the other two?

p. 4310, l. 12. Why "but"? I would say "and" instead

p. 4311, l.5. Please remove "change".

p. 4311. L. 5. Please make it clear (see my general comment) that the difference of 1 W/m<sup>2</sup> is caused not only by different ice sheet reconstructions but also because of using of different climate models.

p. 4312, l. 3. "increase in global mean annual temperature of ca 0.5 C compared to the PMIP2 experiments". In fact, according to the Table 3, global SAT is lower in the PMIP3 compare to PMIP2.

p. 4312, l. 6. What is "ideal world" and how it is related to ice sheet reconstructions?

C1203

p. 4312, l.18. "implied" or prescribed?

p. 4312, l. 23. Because different models participated in PMIP2 and 3, it should be "difference in global mean annual temperature ANOMALIES is 0.5C"

p. 4313, l. 20-22. This is a questionable argument. Two Antarctic reconstructions used for PMIP3 are so different that at least one of them should be wrong.

p. 4312, l. 23 What is "observation margin"?

Table 1. The longitudinal range for GLAC-1a (347.25, 479.25) is odd. Please change to (-12.75, 119.25).

Fig. 6 caption. "difference in radiative forcing and feedbacks" sounds strange to me. How the difference between feedbacks is measured? Please also specify the units.

Fig. 7 Panel (a) does not show "MAT in the simulation with the CMIP5/PMIP3 composite ice sheet". It definitely shows differences between PMIP2 and PMIP3 but the meaning of "MIROCs" is unclear.

Fig. 8 "where the temperature is higher than -9C" I suppose it should be "where temperature anomalies is smaller than -9C".

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Interactive comment on Geosci. Model Dev. Discuss., 8, 4293, 2015.

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