

## ***Interactive comment on “Factors controlling the last interglacial climate as simulated by LOVECLIM1.3” by M. F. Loutre et al.***

### **Anonymous Referee #1**

Received and published: 3 March 2014

This study assesses the effect of changes in Northern Hemispheric ice sheet configuration and resulting freshwater forcing on last interglacial (LIG) temperatures and Atlantic meridional overturning circulation (AMOC), as simulated by LOVECLIM. The research is timely and the results should be published. However, I do have many (small) comments that I would like to see discussed before publication of the final CP paper. I also would recommend a very thorough English spelling check of the manuscript (see the comments below as a starting point).

#### General comments

1) It is not clear to me if albedo changes due to the changes in ice sheet configuration are also taken into account. Please discuss the impact on the simulated temperatures.

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2) What calendar is used in the model, a fixed-day (like in Bakker et al., 2013; Lunt et al., 2013; Langebroek and Nisancioglu, 2013) or a fixed-angular calendar? Please discuss.

3) How is the scaling of the freshwater fluxes with sea level done? The LR04 stack will give you a global sea level record, not a NH one, or? Please elaborate.

#### Specific and technical comments

(page.line)

236.2: skip “at” before 130 kyr

236.16-17: rewrite sentence, too low compared to reconstructions

236.21: change to “not depending on changes in surface boundary conditions. . .”

237 and several other places: “At last” has a different meaning. You probably mean “Lastly” or similar

239.10-240.15: re-structure. Now it is not clear what is done in transient and what in time slice simulations, and what forcing is applied. Maybe start with Bakker et al (2013) as overview for transient simulations, followed by other transient simulations. In the end discuss the time-slice simulations e.g. Lunt et al. (2013), Langebroek and Nisancioglu (2013).

240.27: skip “in this framework”

241.6: “other” instead of “others”

#### Section 2.1:

- also shortly describe LOCH and AGISM

- give spatial resolution for T21

- Is the PI climate as simulated by LOVECLIM1.3 similar to the PI climate of LOVE-

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CLIM1.2?

242.18 & 243.3: no need for italic

242.10: change to “in contrast”

Section 2.2: how do the GHG concentrations that you used compare to the ones used in the PMIP3 protocol?

243.16: change “conversely” into “In contrast” or similar

Section 2.4: please describe what the difference is between the reference parameter set (std) and parameter set 22

Fig 4: - Please include the corresponding simulated PI

Section 3.1 and fig. 5:

- Please include the corresponding simulated and reconstructed (if possible) PI values in Fig. 5

- Change the yellow lines to a different colour, as they are difficult to read

- Fig 5c: is this JJA (as said in title y-axis) or annual mean (as said in figure caption)

- Change first sentence of figure caption to “Comparison of reconstructed and simulated temperatures in different regions”

- Add a title to every subplot stating the location/region for clarity

Section 3.2: - Until page 249.12 this is not a comparison, but rather a description of the proxy data, and should have its own section. Preferable located already before the start of Section 3.

- change the word “profiles” to “time series”

- include a comparison of the simulated and reconstructed SSTs of Fig. 5a-c. Langebroek and Nisancioglu (2013) also show too small amplitudes in the simulated North

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Atlantic SSTs compared to the reconstructions.

- It is tricky to compare model results to the temperatures reconstructed from NEEM during the early LIG, due to the large uncertainties in the bottom of this ice core. Mention and discuss.

249.25-28: rewrite: comparing simulated to simulated temperatures?

250.9-12: rewrite: are these values giving the timing of the insolation or temperature maxima?

250.13: are you sure MWT means Maximum Warmth Temperature? Not the T for timing?

250.23-25: Don't the tropical oceans show a much later (more than 2-3 kyrs) peak temperature?

Fig 6: - Maybe order the subplots according to mentioning in text (e.g. first c, then b&a)

251.6-7: Why is the Southern Ocean January MWT different? Maybe see Langebroek and Nisancioglu (2013) as they find the same.

252.19: repeat that fwfGR does include freshwater forcing resulting from changes in ice volume

253.4: change “climate” to “AMOC”

255.8: change to “lack of input of freshwater . . .”

255.12: skip “taking into account”

255.14-15: change “reduced the difference. . . and” to “improves the fit to the”

Section 4.4: Is this section really necessary for the manuscript? If kept, please explain better what it means if the synergism is positive or negative.

256.26: explain what allLR entails

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257.11: change “significant” to “large”

257.12: change “virtually perfect” to “good”

257.16: change “agued” to “argued”

Section 5 misses a final statement/conclusion

258.7: skip “[135-115 kyr BP]”

258,14-19: rewrite: are you talking about changes in the difference?

Section 7.1 first 2 sections: you are discussing IGonly and topoGR (both without freshwater forcing), but then continue discussing freshwater forcing. Not making sense to me.

259.27: skip “, compared to a . . .”

260.7: change “strong caution” into “care”

261.7: change “divergences” to “differences”

261.19: “these changes” – which changes? Please rewrite

261.24: skip “Before 130 kyr BP”

261.25: change “speed” to “rate”

262.10-12: change to “timing and magnitude”

262.14: In contrast

Fig 10: Add a title to every subplot stating the location/region

Summary and conclusions: Very vague, please rewrite. Including the effect of the different forcings on the timing and magnitude of the resulting LIG temperatures (and not only the uncertainties) would largely improve the summary.

262.23-25: skip “It is quantified . . . parameter set).”

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263.13-14: which event?

References: The reference to Capron et al. (2014) is quite essential to this manuscript. It would be nice (and maybe necessary?) to have this at least submitted to a journal.

References

Bakker, P., Stone, E. J., Charbit, S., Gröger, M., Krebs-Kanzow, U., Ritz, S. P., Varma, V., Khon, V., Lunt, D. J., Mikolajewicz, U., Prange, M., Renssen, H., Schneider, B., and Schulz, M.: Last interglacial temperature evolution – a model inter-comparison, *Clim. Past*, 9, 605–619, doi:10.5194/cp-9-605-2013, 2013.

Langebroek, P. M. and Nisancioglu, K. H.: Simulating last interglacial climate with NorESM: role of insolation and greenhouse gases in the timing of peak warmth, *Clim. Past Discuss.*, 9, 4449–4473, doi:10.5194/cpd-9-4449-2013, 2013.

Lunt, D. J., Abe-Ouchi, A., Bakker, P., Berger, A., Braconnot, P., Charbit, S., Fischer, N., Herold, N., Jungclaus, J. H., Khon, V. C., Krebs-Kanzow, U., Langebroek, P. M., Lohmann, G., Nisancioglu, K. H., Otto-Bliesner, B. L., Park, W., Pfeiffer, M., Phipps, S. J., Prange, M., Rachmayani, R., Renssen, H., Rosenbloom, N., Schneider, B., Stone, E. J., Takahashi, K., Wei, W., Yin, Q., and Zhang, Z. S.: A multi-model assessment of last interglacial temperatures, *Clim. Past*, 9, 699–717, doi:10.5194/cp-9-699-2013, 2013.

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