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Climate of the Past Discussions

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

Anonymous Referee #2

Received and published: 4 April 2014

The study of Loutre et al. investigates the relative impacts of ice sheet configuration (topography and albedo), freshwater forcing, and radiative forcing on climate evolution through the Last Interglacial period (LIG) with the intermediate complexity model LOVECLIM. The aim of the study is to identify the causes for the large discrepancies identified in recent literature between models simulating LIG climate.

The manuscript is well written and includes a detailed description of the LOVECLIM model model results as well as a comparison with available proxy data covering the LIG period. However, the study lacks a description of the dynamics and mechanisms giving rise to the results, as well as an analysis of the differences to the proxy data and to previous model studies (as promised in the abstract). These concerns, as well as the following comments need to be addressed in order to improve the manuscript:

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GENERAL COMMENTS

Several observations described in the paper merit further detail, such as:

1) Why is there increased AMOC variability towards inception?

2) Why is reconstructed EPCA temperature change much larger than what is simulated?

3) Why is amplitude of summer temperature change during LIG much smaller in model than in the proxies?

4) What is difference between figs 6a,b and fig. 4 in Bakker et al. (CP, 2013)? If they show significant differences - why?

5) Why does including NH ice sheets stabilize AMOC and reduce impact of freshwater forcing (e.g. page 251, line1).

6) Why is variability in experiment fwfGR high towards end of LIG (section 4.2)? If there is FWF forcing included in this time period it should be shown clearly in fig. 3.

7) What causes drop in AMOC in experiment IGonly in late LIG (section 4.3)?

8) The importance of changing model configuration is not clear (section 9). Need to give details of main differences between the two model configurations used. Do these span a large parameter space. I.e. is the statement that "external" forcing dominates over internal model uncertainty merited? If so, this needs more documentation.

9) What is the impact of model simplifications used in LOVECLIM on the results (in particular the AMOC)? E.g. what is the impact of simplified low resolution atmosphere + ocean.

10) What is the potential role of Antarctic ice sheets? Would including these change results significantly? Section 7.2 should be expanded.

11) In the freshwater experiments the AMOC is reduced, however convection in the

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Labrador Sea is maintained. Is convection reduced other places, where? Add plot of change in convection for the relevant experiment. 12) Include figure showing core locations (or add to one of the existing figures).

13) The three different time periods described in section 3 should be clearly marked on the figures with the model output (figs. 4 & 5).

SPECIFIC COMMENTS

page 238, line 19: LIG sea level is quoted as up to 6m higher than modern in period 130-116ka BP with references included. Note, however that Kopp et al. (Nature, 2009) estimates a sea level high to be above 6.6m and likely to have exceeded 8.0m. Statement in manuscript should be rephrased accordingly.

page 241, line 12: CO2 in figure 2 is only above 280ppm for a very short period. Should edit statement to match interval described.

page 245, line 13: reference to parameter set 22 is not sufficient. Need to add at least a short summary of what this entails.

page 247, line 3: original reference to seesaw should include Crowley (Paleoceanography, 7, 1992).

page 247, line 12: should refer to figure 4a (not 5a).

page 247, line 20: the recovery at 24.8kyr BP is not clear from figure 4 or 5. What does this refer to?

page 252, line 18: should remind reader how fwfGR differs from allGR. Same goes for topoGR on page 253, line 15.

Figure 4 & 5: should add point/line showing Pre-industrial model values. (also add modern/late Holocene proxy values to fig. 5).

Figure 5: should add caption/heading in each individual figure indicating location of

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temperature record. Also need to add uncertainties to proxy data.

Figure 9: Definition of sign used in this figure is not consistent with description of results in the text (section 4.4, e.g. page 256).

TECHNICAL COMMENTS

page 248, line 15: “less THAN 2C”

page 248, line 4: “CAUTION”

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