

Interactive comment on “The last interglacial (Eemian) climate simulated by LOVECLIM and CCSM3” by I. Nikolova et al.

Anonymous Referee #3

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Nikolova et al. present an analysis of the last interglacial climate as simulated with the LOVECLIM and CCSM3 climate models. Their work provides a necessary and more thorough investigation in addition to previous larger model inter-comparison studies. Where Lunt et al. (2012) focus solely on the temperatures simulated by LOVECLIM and CCSM3 among other models, Nikolova et al. take two of these models and perform a much more in-depth analyses. This is also the main contribution of this manuscript: providing an in-depth investigation of simulated changes in the hydrological cycle, vegetation and ENSO variability. There are however a number of concerns which should be taken away before publication.

Main concern:

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Many aspects of the 127ka BP LOVECLIM and CCSM3 simulations have been published by Yin and Berger (2010), Herold et al. (2012) and Lunt et al. (2012). In my opinion Nikolova et al. should focus on those aspects of their study that are new and complementary to previous work: simulated changes in sea-ice covered areas, monsoon regions, vegetation changes and ENSO variability. Moreover, in this way the main differences between the two simulations can be detailed which was not possible in the study performed by Lunt et al. (2012) because the large number of simulations in their model inter-comparison. The main concern is thus that the manuscript lacks focus and the authors should pick specific aspects of the last interglacial climate to investigate.

Minor comments: (page.line)

1) Title: The title is very general. Maybe the authors could, in line with the focus of the manuscript, make the title more specific.

5295.25 Be more precise about the main problems related to last interglacial proxy-reconstructions.

5296.1 What about the Holocene thermal maximum?

5296.7 Make it more clear what this manuscript adds to the work of Lunt et al. (2012). Maybe refer to questions which could not be answered in their work but which is feasible in this manuscript because the smaller number of models.

5296.11 Start by describing the mechanisms and feature you would be able to investigate not with the fact that you can present more variables.

5296.13 Why LOVECLIM and CCSM3? Is there a specific reason?

5296 Please formulate a specific research question.

5297.17 Is this version of CCSM3 or the boundary conditions different from the one

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used by Otto-Bliesner et al. (2006)? See also the lines 5300.2

5297.25 It is mentioned that the CLM model includes plant types but on line 3 of page 5298 that in the CCSM3 model framework there is no dynamically coupled vegetation module. Please clarify this apparent contradiction in the manuscript.

5298.12 Make clear that the experiments are equilibrium simulations.

5299.1 Use a header to make clear that the results / results and discussion section starts

5299-5311 The structure of the results section could be improved. Maybe base the subsections on specific regions (e.g. sea-ice covered areas, monsoon regions and ENSO regions) instead of the basic climate variables.

5299-5311 Make more clear in the different result sections what the findings from this study are, in which of the models this has been found (or both models), what has been found in earlier model-studies and what has been found in proxy-based reconstructions.

5299.2 What kind of temperature? Surface? 2-meter? And are these numbers global annual means? Please specify.

5299.4 By introducing proxy-data in this section it will be very hard to distinguish between results and discussion.

5299.7 Please specify what you expect that ice-sheets would change.

5301.4 At several places in the manuscript the authors discuss model biases described in previous work. Please clarify how a model bias in the simulated pre-industrial climate affects the presented last interglacial anomalies relative to pre-industrial.

5302.13 Explain why these differences are found.

5305 When presenting the simulated changes in the monsoon systems, the findings

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should be compared with earlier work by for instance Bosman et al. (2012).

5303.15 Please make clear what has been found and presented in previous studies (and which therefore does not have to be detailed in this study!) and what is new in this work.

5306.17 Please refer to the figures in which these aspects of the changes in the monsoon can be seen.

5306.27 Discuss in some more detail what the IMI index is and what it adds to the results.

5311.4 Mention if the 'poor' representation of ENSO in the LOVECLIM model has been discussed before in the literature.

5312.3 Conclusion: In line with earlier comments, focus on those aspect of this study which are new and complementary to previous work.

Technical comments: (page.line)

Please carefully check the spelling and word order in the whole manuscript.

5296.13 through

5296.25 Model descriptions

5298.22 simulations are

5299.11 (2010)

5305.2 Be consistent in the use of JJA or June-July-August

Reference to Lunt et al. (2012) is missing.

The references to Anderson et al. (2006) and to CAPE (2006) are the same articles.

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Tables and figures:

Be more precise and uniform in the captions and layout of the tables and figures:

Some figures centred around 0E and other at 180E.

Some include gridlines while other sdon't.

Table 2: are the temperatures mean 'global' temperatures?

Figure 1: What are the month's corresponding to the true longitudes of the sun?

Figure 2: Is the contrast in Antarctic temperatures between CCSM3 and LOVECLIM discussed?

Figure 3: Is this sea-ice 'coverage'? Why are there no LOVECLIM results in figure 3?

Figure 5: What does the grey shading indicate and why not present in both panels?

Figure 7: Reverse colours, red=drier and blue=wetter.

Figure 9: The caption reads 'Tropical Easterly Jet anomaly' but the figure depicts the whole globe. And what is the height of the wind vectors shown in this figure?

Figure 10: Are the values averages or values for a single latitude?

Figures 12 and 13: Are the values longitudinal averages? Is there a way to compare these two figures since they present vegetation changes in different ways?

Figure 12c: is the difference around 20N discussed? Is this related to feedbacks in the Sahara?

Figure 14: Specify latitude or region over which average is taken.

References: J. H. C. Bosmans, S. S. Drijfhout, E. Tuentner, L. J. Lourens, F. J. Hilgen, C2745

and S. L. Weber: Monsoonal response to mid-holocene orbital forcing in a high resolution GCM, *Clim. Past*, 8, 723-740, 2012

Herold, N., Yin, Q. Z., Karami, M. P., and Berger, A.: Modelling the climatic diversity of the warm interglacials, *Quaternary Sci. Rev.*, 56, 126–141, doi:10.1016/j.quascirev.2012.08.020, 2012.

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., Lohmann, G.,

Otto-Bliesner, B., Park, W., Pfeiffer, M., Prange, M., Rachmayani, R., Renssen, H., Rosenbloom, N., Schneider, B., Stone, E. J., Takahashi, K., Wei, W., and Yin, Q.: A multimodel assessment of last interglacial temperatures, *Clim. Past Discuss.*, 8, 3657-3691, doi:10.5194/cpd-8-3657-2012, 2012. Yin, Q. Z. and Berger, A.: Insolation and CO₂ contribution to the interglacial climate before and after the Mid-Brunhes Event, *Nature Geosci.*, 3, 243–246, 2010.

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