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Climate of the Past Discussions

Interactive comment on "A multi-model assessment of last interglacial temperatures" *by* D. J. Lunt et al.

Anonymous Referee #1

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*** General Comments:***

This paper tests the ability of many different OAGCMs and EMICs to simulate correct atmospheric and sea surface temperatures during the Last Interglaciation (∼130 - 116 kyrs BP). Results show that the mean annual signal simulated by all those models is not significantly different from each other while, on the contrary, the seasonal patterns exhibits a strong spread between all the models. The authors conclude that including some of the missing feedbacks, and in particular here vegetation, could improve the misfit between the recently published compilation of observations and the models. Similarly, the authors suggest that improving the spatial resolution would also improve the computation of the processes. This paper is well written and is designed for Climate of the Past. However there are some weaknesses in the discussion/conclusions

that should be slightly strengthen. That is why I recommend this paper for publication after minor revisions detailed below.

*** Major comments: ***

Some of the models account for dynamical vegetation or not and have different horizontal/vertical resolutions. Some have part of the physical processes that are simplified, and some not. The authors conclude that including vegetation feedback, could improve the misfit between the observations and the models. Similarly, the authors suggest that improving the spatial resolution would also improve the misfit. First of all, since this paper consider twelve different models, I strongly suggest that the authors include two figures, similar to Figure 6 for example, on which they can develop and strengthen the discussion:

one figure showing the difference between the models including dynamical vegetation and the models with stead-state/prescribed vegetation. In the final part of the discussion, the authors suggest that this could be important, however, part of the answer might already be included in the simulations considered in this paper. Since for some models, dynamical vegetation is also very resources-consuming to use/implement, it could give an idea on how this feedback is important for this particular time period. Personally, I am not convinced that this is the cause of majors discrepancies between the models at this particular time. That is why I just suggest to include such a figure, to show the importance of that perspective.

one figure showing the difference in simulated temperatures between high and low resolution models. This can generate some large differences. I know quite well CCSM4 and I know that at low resolution for example, there is lack of oceanic heat transport towards the high latitudes generating a negative atmospheric temperature bias and a reduction in precipitation (Shield et al. 2012).

Since both of these points are discussed, I think those figures could sharpen your discussion.

Finally, since the title is “assessment of last interglacial temperatures” a last synthetic graph bars could be included, in the IPCC-like style, showing the range of seasonal temperature for each models. It could also makes Figure 5 more clear. All those points are only suggestions and I let the authors free to include them or not.

*** Minor comments: ***

page 3662 - line 13-15: this sentence contradict the main perspective of the paper suggested by the author: include dynamics vegetation feedback...consequently, this cannot be a “minor forcing” of the experiments

page 3666 - line 25-27: I am not sure I agree with this sentence. Most of the atmospheric variables at T31 or T42 horizontal resolution reach equilibrium after 100 to 200 years of simulations. This statement might be true for intermediate and deep ocean, but after a while, they do not influence significantly the atmospheric state. Therefore, the difference observed in Figure 4 may not be due entirely to the different in the length of simulations.

page 3666 - line 15-19: I think this statement is obvious since all the models are highly different. Also the fact that all the models exhibit a “similar behaviour” independently from which snapshot is used between 130k - 125k is quite obvious from Figure 1: precession does not vary much during this interval, the same for obliquity and eccentricity...

page 3667 - line 5: may be due “to” models - add “to”

page 3667 - line 7-8: can you quantify the spread of the models and clarify what does “similar” mean for you?

page 3668 - line 8-9: do you mean that insolation forcing is negative relative to pre-industrial?

page 3672 - line 6-12: see Shield et al. (2012) about the low versus high resolution CCSM4, as example of improvements of processes and resolutions

page 3674 - line 3-6: I don’t agree with this statement because MIS 11 and MIS 5 are very warm interglacial according to data, while observation suggest that MIS 7 is cooler than those two. I think that no particular interglacial can be considered for a specific calibration of the process. Also because the last interglacial during the Holocene was warm, but not as warm as during MIS 5. In that sense, it is very difficult to base models tuning and calibration on one specific interglacial.

Table 1: there are some missing values for CLIMBER LSCE

Table 2: missing values for IPSL_LSCE

Figure 5: This figure is actually very hard to appreciate. The scale is cut at half, and one has to zoom in very much to see the dots from Turney and Jones (2010). Even in full screen, this figure is difficult ti analyse. You should remove the data from Turney and Jones (2010) since it’s not visible. Maybe in landscape format, the figures would be more visible

Figure 6: How significant are those anomaly relative to Pre-industrial?

Interactive comment on Clim. Past Discuss., 8, 3657, 2012.