

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

**Anonymous Referee #2**

Received and published: 5 December 2012

General comments:

The manuscript provides a comparison between two models (CCSM3 and LOVECLIM) and the models and available palaeodata for simulations of the Last Interglacial (LIG), and the anomalies between LIG and the pre-industrial. The two models are of different resolutions and one includes coupled vegetation while the other does not. Examination is made of seasonal and annual temperature anomalies, precipitation (in particular of monsoonal regions), vegetation, and ENSO characteristics. The results are in general interesting in the comparison of two different models and add significantly to the body of modeling studies on the LIG.

There are several scientific details I would like to see modified in the discussion of the results and a large number of formatting modifications, in particular of the figures. I

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would recommend publication of the manuscript following these minor corrections. See below the outlined comments:

I would like the authors to comment on why they chose to compare CCSM3 with LOVECLIM and not any other models available for the LIG through PMIP3.

There is absolutely no significance testing on any of the simulation data. This is essential in order to make more robust conclusions about the patterns of anomalies. Please include this and alter any discussion accordingly, as well as highlighting the areas with significant anomalies in the figures.

The figures are not easy to read and are a bit messy and inconsistent in style. The legends and axes text are too small, the colour bar limits need to be set so that it is easier to see where the anomalies are zero, and make this consistent between figures. E.g. make zero or insignificant areas white or grey. In Figure 11, the higher values in the line plot are off the top of the chart – this also needs changing. There is a title to the plot in figure 1 but not for any of the other figures. I would suggest deleting the title to the first figure.

Page specific comments (general and technical):

Page 5295

Line 17 onwards – I would have said that the reason for compilation of 6kyr, LGM, and LIG is not due to the availability of proxy data – rather that these are time periods concentrated on due to having interesting climatic/environmental features.

Line 26/7 – creating a database is complicated due to large uncertainties in chronology that far back in time (no radiocarbon so have to rely on other dating techniques), but I'm not sure what you mean by climate variability making it difficult. Do you mean regional/spatial variability or temporal variability, and in what sense does this make it difficult – in linking events/wiggles between records? I'd like it to be made clearer here.

Line 5 change 'remains' to 'remain'

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Line 11 change 'featured' to 'featuring'

Line 13 change 'trough' to 'through'

Page 5296

Line 4 'their response to different forcings' – different to what?

Page 5298

Line 1-2 Does the sea-ice model have dynamic and thermodynamic components, multi-category ice etc.? The differences may be important for the different sea-ice responses noted in the results.

Line 5-10 It is not clear exactly what LIG vegetation is prescribed in CCSM3. Do you run BIOME4 from initial CCSM3 climate and then feed the results back in to recalculate the CCSM3 climate again, or is the vegetation prescribed the same as pre-industrial? Please state what the boundary conditions are.

Page 5299

Line 4 Palaeodata from Turney and Jones (2010) suggest 1.9deg warming at the LIG. Are there any quantified uncertainties bounds to put on this figure? In their paper they state it's warmer than 1961-1990 by  $1.5C \pm 0.1C$ . Could you include a quantification of this uncertainty (although I realize it will be larger for LIG-pre-industrial) in the text.

Line 7 Lack of interactive ice-sheets is put forward as a possible reason for discrepancy in global temperatures between model and data. It would be good to see more detail about this in terms of how much it has been proposed that Greenland and possibly WAIS were from other studies and the impacts. E.g. it would be appropriate to reference Otto-Bliesner et al, Science, 2006, Holden et al, 2010 or similar.

Line 10. Lack of interactive vegetation put forward as explanation for why LOVECLIM is warmer than CCSM3. I'd like to see more detailed explanation here as well, and link to the vegetation in LOVECLIM described in a subsequent section and prescribed

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vegetation in CCSM. Are warmer areas where vegetation is significantly altered from pre-industrial?

Line 5-10 From figure 4 it looks like there is a big difference in annual temperature anomalies over Arctic sea-ice regions, which must have a role in the different in global temperature anomalies between CCSM3 and LOVECLIM. Yet sea-ice is not discussed here in this section. I know it is outlined later in discussion of seasonal temperatures but think it may warrant a mention here too.

Page 5300

Line 6 Change to 'North Atlantic, Greenland, and Arctic' – i.e. add a comma

Line 17-20 Indian monsoon region also to some extent shows cooling, but surprised how much larger the cooling is in North Africa

Page 5301 Line 14 'Easther Japan'?

Page 5302 Line 1 change 'though' to 'through'

Page 5303 Line 15-20 If there is a dramatic impact on the AMOC, do you mean on the average state or its stability or both? Why not look at it in this study briefly?

Page 5305

Line 14 and that paragraph – I assume the information here refers to the model and not proxy data – it is not made clear in the text.

Line 22-23 do you mean that there is good agreement between the models in terms of low-level wind, moisture transport and precipitation, or that in each model there is a match between increased wind/moisture and precipitation. If the latter, it seems a bit of an odd way to say basically that wind/moisture transport are important for the precipitation anomalies to occur.

Page 5306

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Line 4 I'm surprised that, if the summer monsoon is stronger (implying increase cloud/rain over India) that the JJA temperatures are described as warmer summers (page 5305 line 27) rather than cooler (as in N Africa). Looking at Figure 2, both models (CCSM3 especially) seem to show some areas of cooling. Why is the response different to N Africa in this sense? Vegetation changes in LOVECLIM counteract any cooling? Level of cloud cover different? Significance testing would also be useful here I think.

Line 28-29 It could be stated somewhere here how you calculated the Indian Monsoon Index briefly (I know you've included a reference). Related to this, in Figure 11 why is there not a plot for LOVECLIM as well as CCSM3?

Page 5308

Line 2 be consistent in use of 'Fig' or 'Figure' here and throughout the paper

Line 5 At the equator the percentage of trees seems similar in LOVECLIM and CCSM3, but away from the equator to 30degN there is a sharper decline in CCSM3 (in favour of grass/shrub and then warm temperature forest) than LOVECLIM.

Line 12 do you mean expansion of vegetated area 'at the LIG'?

Line 1-27 So in tropical areas there is less agreement between the two models than at high latitudes. Does this suggest something about regional differences in importance of feedback processes with the land surface, given the different set-ups of the models? I just wondered if any broader inferences could be made here?

Page 5311

Line 12 'another spectral technique' Can you provide the details/names of the two spectral techniques were used.

Line 10-28. Can you compare modeled ENSO spectra with palaeodata? E.g. Hughen et al, 1999, GRL

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Page 5313 Line 1 and 2 change the 'from one hand' and 'from the other hand' to 'on one hand' and 'on the other hand'

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Interactive comment on Clim. Past Discuss., 8, 5293, 2012.

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