Clim. Past Discuss., 11, C280–C282, 2015
www.clim-past-discuss.net/11/C280/2015/

Climate of the Past Discussions

Interactive comment on "The simulated climate of the Last Glacial Maximum and the insights into the global carbon cycle" *by* R. J. Matear et al.

Anonymous Referee #3

Received and published: 27 April 2015

Review of 'The simulated climate of the Last Glacial Maximum and the insights into the global carbon cycle' by Matear, Lenton, Etheridge, and Phipps.

The paper aims at simulating various aspects of the LGM biogeochemistry. Some of the biogeochemical results seem to be quite interesting, but the simulation of the LGM climate is highly simplified. The analysis at least of the climate changes appears to be entirely descriptive, The paper needs a major rewriting.

Rather than running a full LGM simulation the authors perform simulations with reduced pCO2 and modified insolation and call this LGM. This simplification is only mentioned very briefly (1096/24-27). The implications of the neglect of ice sheet changes are not discussed at all and the simulation is addressed throughout the paper as 'LGM' and compared to proxy records. All studies investigating the effect of the individual

contributions (pCO2, insolation, ice sheets) agree that the changes in glaciation are important and strongly influence climate especially in the North Atlantic realm. Other modelling studies addressing the LGM are completely ignored in this paper. But as the results from the present paper differ so strongly from the results of the other models, an analysis of the differences and a discussion, why the present results are so different, seems to be essential.

detailed comments

1096/27 Topographic effects of additional ice sheets (Laurentide, Fennoscandian) are ignored. The implications have been studied in several modelling studies before and seem to be substantial. A thorough discussions of the implications of this simplifications is required.

1098 Temperature and Table2. Temperatures are more informative, if differences for certain latitude bands are given. In the present form the rate of polar signal vs. low latitude signal is not easy to assess. An alternative way to display temperatures anomalies would allow a more thorough evaluation of potential temperature biases and may allow an immediate estimate of potential polar amplification.

1100/4 I am not able to find, where the Sarnthein et al. reconstruction shows a reduction of summer ice cover in the Arctic north of Greenland. Please check! On the contrary, they reconstruct extended sea ice cover in the Nordic Seas. I have not seen anything similar in any other LGM simulation. So please clearly give reasons for this special behaviour of your model.

1100/26-27 and Fig. 3. Your figure does not support the numbers shown in the text. For LGM you report an AMOC of 17 Sv, in your plot the 10 Sv isoline is not reached. For present day you report 17 Sv, but the 15 Sv level is not reached. Please plot the figure with more levels, especially for (absolute) low values, so that the strength of the deep ventilation of the Atlantic with AABW can be compared in the different runs. In your figure, some levels are labelled, others not (compare e.g. the 10 Sv isoline in the

different sub-panels).

1101 18-20. Did you really make the analysis that brine release is the dominating factor for the salinification of AABW, or do you know that this has been suggested before and this effect seems to fit to your results?

Table 3. I understood that all model runs started from the same state and the only differences are pCO2 and insolation? Why is then the global mean salinity almost 0.6 higher in your LGM runs compared to your HC simulations? Is your model not conservative? Please explain this effect.

1113. The increased ocean carbon storage is for sure a key feature. However, carbon storage on land is completely neglected in this paper and could modify the atmospheric pCO2 as well. It should at least be mentioned and discussed.

Interactive comment on Clim. Past Discuss., 11, 1093, 2015.