

Interactive comment on “A coupled climate model simulation of Marine Isotope Stage 3 stadial climate” by J. Brandefelt et al.

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Received and published: 3 March 2011

General comments This paper presents simulations from a coupled Global Climate Model to test the agreement between proxy data and modelling, as well for assessing the role of the Atlantic Meridional Overturning Circulation during the GS 12. This study follows on the work of Merkel et al (2010) and Van Meerbeek et al (2008), with changes in the resolution and the time-scale of integration. The authors have chosen constant forcing and boundary conditions, integrated over 1500 model years. They emphasise on the importance to achieve equilibration, that can only be obtained with a long run. The paper is relatively well written and structured. The methodology, although not always written in a language for non-modellers (what is a model year for instance?), is relatively well explained; the choice for constant forcing is based on the

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assumption that certain components of the system vary on longer time scale. One the weakest boundary conditions would be the extent of sea-ice cover, as mentioned by the authors. The overall findings are a 50% reduction of the AMOC, without input of additional freshwater.

Specific comments There are a few points that would need clarification or supported by stronger/better evidence. Page 86, line 10. The paper from Näslund et al (2008) does not imply that there is no ice sheet in Alaska, but that CLIMBER-2 simulates a too thick ice sheet. This is a very weak argument. Proxy data: The database is dated from 2002 (and two other records from 2008 and 2009); there has been many reconstructions of past sea-surface temperatures since then, in particular in the Pacific Ocean. As this paper does integrate an important comparison between simulations and proxy data, it would worth to revise the proxy records, as well to extend to other proxies (dinoflagellate cysts are not included for instance, why? See the MARGO compilation as an example). It is a fact that different proxies in a same sample may not reconstruct the same environmental variables. With regards to the extent of sea ice, as there are very few proxies, in particular for the North Pacific, this is a major issue. The reduction of AMOC is an interesting result, but little is discussed about the mechanisms behind it.

Technical corrections Abstract: Ts should be higher than in the simulated recent past and lower than the simulated LGM. To be corrected. Introduction: line 15, add GS12 in front of stadial. Page 96: I suggest to remove “in the following” in line 20. Correct comparison (without s)

Figure 2: contours for sea ice need be better labelled on the figure, it is not clear which one is -10% or -20%

Interactive comment on Clim. Past Discuss., 7, 79, 2011.

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