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Climate of the Past Discussions

Interactive comment on "Disentangling the effect of ocean temperatures and isotopic content on the oxygen – isotope signals in the North Atlantic Ocean during Heinrich Event 1 using a global climate model" *by* Marianne Bügelmayer-Blaschek et al.

U. Mikolajewicz (Editor)

uwe.mikolajewicz@mpimet.mpg.de

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The ms. 'Disentangling the effect of ocean temperatures and isotopic content on the oxygen – isotope signals in the North Atlantic Ocean during Heinrich Event 1 using a global climate model ' by M. Buegelmayer-Blaschek, D. Roche, H. Renssen, and C. Waelbroeck has been seen by three reviewers.

I agree with the reviewers that the material presented in this paper has the potential to

form the base of a very interesting paper definitely worth publishing, but the presentation quality clearly needs to be improved substantially.

Other after my opinion rather important issues raised by the reviewers are:

- The comparison between simulations and proxy records needs to be improved. This is especially true for figures 9 and 10 representing key time series from the simulations and proxy records. It is almost impossible to compare model and data. The use of a different orientation of the time axis in these figures is very disturbing.

Please see general answer.

- The rather strong focus on the Baffin Bay is not really motivated. In order to simulate a cooling of 1.5K, Baffin Bay must be seasonally ice free. Is this supported by reconstructions?

We focus on the Baffin Bay because it represents the calving locations.

There is a lack of a clear motivation why only 4 proxy records have been used (none of them in the most interesting region cNA).

Please see general answer.

- It is not clear to me, what is the effect of the duration of the prescribed discharge and what is effect of the total amount discharged. In the paper all effects are attributed to the duration. If it is indeed so, some more evidence is needed that the total amount is of less importance.

We performed an additional experiment of 0.6 Sv over 300 years to test impact on AMOC (reviewer#1).This experiment displays that the same amount of freshwater applied over 300 years or over 900 years causes a different recovery time of the AMOC. If a stronger freshwater flux (0.6 Sv) is applied over a shorter time (300 years) the AMOC recovers quicker than if 0.2 Sv are applied over 900 years.

- The relation used to calculate d18O Calcite from d18O seawater and temperature needs to be given.

We included it.

- The figures clearly need to be improved.

Please see general answer.

Please consider all the points raised by the reviewers and respond carefully to each of them.

additional remarks

Many of the plots are difficult to use due to the insufficient plotting.

I personally found the use of different contour levels for the d18O response for sea water and calcite made it almost impossible to estimate the temperature contribution.

We changed it.

Does it make a significant difference whether SST or subsurface temperature is used for the calculation?

No, we tested it for different depths (surface, 45m, 90m and 220m) and the surface and 45m, and at some locations even 90m, are very similar.

In Fig. 4 are the d18O and SSS plots for the North Atlantic almost useless as the whole North Atlantic is only populated by one isoline. The non-linear contour interval focussing on 0 for d18O may be helpful for anomalies but not necessarily for absolute values. Is annual mean CLD really a relevant property? Would not the climatological annual maximum CLD be more relevant allowing to estimate the depth of convection? The gradient of SSS over the glacial North Atlantic is less than 2, there is only the 35 isoline plotted. Is this realistic?

We changed figure 4.

Fig. 9 The panels are much too small. Plotting 3 experiments into one panel with different colours should allow to more clearly see the differences between the experiments. Are all regions necessary?

Please see general answer.

Only 4 proxy records are selected. Except for neNA they do not match to the designed key regions. This is not particularly helpful for the model/data comparison.

It is important to note that the cores and the model regions were not chosen to fit to each other, instead the model regions represent certain areas and the core locations are due to the high resolution and the available data.

Figures 9 and 10 should be designed in such a way as to make the model/data comparison as easy as possible for the reader.

Please see general answer.

line 280 How sensitive are the results to the choice of the initial year (e.g. 100 years earlier or later). Has the strong anomalous signal during the first 100 years used as reference period a substantial impact on the anomalies presented in Figs. 5 to 7? Would another 100 years from an unperturbed simulation show a completely ice covered Baffin Bay?

We don't expect the results to be substantially different if for example 100 years later were chosen because in Baffin Bay the changes induced by the iceberg discharge are of a much larger magnitude.