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: a review

This study exmaines how the simulated delta 18O of calcite varies in a climate model when different time durations of Heinrich Events are simulated. Its results are interesting and present a novel way to think about the signal that is in the available data. It was let down, however, by its poor figures and rather superficial analysis.

I had to work really hard to relate what was going on in the text with what was shown in the figures. Many of the figures (e.g. fig. 10) don't really support the claims that are made in the text: the claims may be true, but I can't satisfy myself that they are from the figures. There are more detailed crticisms later but I urge the authors to think when preparing their figures: how can I make it as easy as possible for a reader to understand my figures. At present I feel that the figures have been prepared with what is easiest for the authors in mind. If your figures are hard to decipher readers won't bother to read the paper, so it really is in your interests to think about this.

There are a number of times in the text (for example the last line of the m/s) where claims are made that the simulated calcite is a “reasonable” fit or other such vague phrases. Simple statistics do exist that can quantitatively define how well series relate to one another. These should be used rather than qualitative claims of “reasonableness”. That palaeoclimatology is rife with such vagueness is no excuse for this.

Specific Comments/questions:

Motivation:
It would be good to see the motivation for why it was chosen to test the sensitivity of the model to the duration of the simulated Heinrich Events rather than the size. Why vary the duration of the events and not the size? The size (that is flux of ice) and duration are to a certain extent constrained by the total volume of ice that can be released from the Laurentide Ice Sheet, therefore would not a better test to have been to keep the total ice volume constant and thus for the longer duration events have a small flux of ice?

Model description:
Unless I have missed it there is no description of how delta 18O calcite is calculated within the model. This needs to be included along with discussion on how this model quantity relates to the calcite that you might find in forams. For example, is calcite calcuated in a water depth in which *bulloides* lives?

Section 4:
Section 4 could be a very nice section but is currently weak. More effort to link the observations back to the model runs would strengthen this. You are, I think, hindered by the currently horrible figure 10 in doing this.

It would be helpful to make some comments on how well you feel your model could in a perfect world simulate the calcite in forams (see above).

Line 402: “Overall, we see some similarities between the simulated and measured δ 18 Ocalcite curves and we find that the set-up of an iceberg forcing of 0.2 Sv over 300 years yields the most

reasonable results compared to the proxy data considered”

If I am honest I do not think that I can judge this because comparing the simulated and proxy calcite is near impossible. See my comments on fig. 10.

The phrase “most reasonable” is unacceptably vague.

The regional abbreviations e.g. stNA, neNA, BB etc. are not necessary and detract considerably from the clarity of the manuscript. Please just use the full description.

Other comments

line 475: “From the comparison of simulated sea surface temperatures and δ 18 Ocalcite with proxy data, we find the best agreement between model output and data is reached when the iceberg discharge is stopped after 300 years.”
I'm not sure I know what figure/metric shows this.

Figure comments.

Fig 1. Are the calving locations really those weird shapes? Why not use a pseudocolour plot rather than a contouring one to show the location, then one will be able to see what the model grid resolution is.

Figs 5/6/7. These figures should be split up so that all of the panels (a) are on one figure all the (b)s on another etc. In the text the comparisons are always framed in terms of the variable (e.g SST) not the model run (e.g. ICE 600). At present you have to flip between 3 figures for each variable. This is really difficult to do. You shold also make the panels larger: the numbering on the colour scale is invisible.

Fig 8 please put the names of the core on the map.

Fig 9/10. In figure 9 time goes from left to right, in 10 it goes from right to left. So when trying to relate the modelled delta 18O calcite to the proxy delta 18O, not only do you have to flip between figures but you also have to mentally flip them through 180 degrees. Please chose one direction for time and stick to it.

The panels in fig 9 are tiny. On full zoom my nose is about 2cm from the screen when I look at them!! Please make them bigger. The axes are also missing from the leftmost panels.

You must add the simulated calctie 18O curves into fig. 10 so that it is easier to follow the text. Again I have to flip between figure to work out what is happening: this is really hard.

Fig 10. The core that is in panel (a) is the core that is numbered 2 in fig.8. Panel (b) has core one. This is random. Please have panel (a) as core 1, panel (b) core 2 etc. Also as well as the core name put the number in the title.

To correctly interpret fig 10, I have to:

(1) Look at fig8 to work out the number/location of the core,
(2) read the caption to work out what the core name is.
(3) look at fig 9 to find the modelled calcite
(4) look at the title of the plot to find the region
(5) refer back to fig 8 caption because the region names on the fig8 map and in fig9 are different
(6) mentally flip the time axis of the panel in Fig.9
(7) refer back to caption of fig. 10 because I have forgotten which core was which.....

This is **7 steps** before I can even look at what the data says.

On the axis in Fig 10 please change the axis label txt to be the same colour as the line to which it refers.