

Interactive comment on “Hosed vs. unhosed: global response to interruptions of the Atlantic Meridional Overturning, with and without freshwater forcing” by N. Brown and E. D. Galbraith

Anonymous Referee #1

Received and published: 30 October 2015

The manuscript by Brown and Galbraith explores an important climate question that whether iceberg-melting water is a common trigger for the suppressed AMOCs during Heinrich stadials. The authors conduct ten modelling runs using the CM2Mc Model, and compare the impact of hosing and ocean-sea ice-atmosphere internal variability on AMOC variations and corresponding globally climatic signatures. They imply a dominant effect of ocean–ice–atmosphere dynamics associated with an AMOC weakening on global climate changes, and explain the influence of freshwater input as an unnecessary result of AMOC interruption, rather than a cause. I agree with the authors

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that ‘hosing’ is just a way to surrogate an ‘off’ state of AMOC in the paleoclimate modelling studies, and in comparison the importance of ocean-sea ice-atmosphere internal variability on AMOC variations has not been sufficiently noticed yet. At this point, this manuscript provides a good case study to fill this knowledge gap. However, all the figures only document the changes of basic climatic indexes in their modelling experiments, but their dynamical explanations for the impact of ocean-sea ice-atmosphere internal variability on AMOC variations are far less sufficient. I would like to suggest the author need to do at least a major revision for the manuscript before it can be accepted.

Major comments: (1) This manuscript emphasizes the effect of ocean-ice-atmosphere dynamics on AMOC variations, but no figures have shown the spatial patterns of sea ice cover and the geographic maps of NADW formation in their modelling runs. These issues are missing but important for the authors’ arguments.

(2) In the paragraph Line 18, Page 4676 to Line 5, Page 4677, the authors try to explain the dynamical process in their unhosed experiment. However, the only citation of Glessmer et al. 2014 is far less sufficient to support the complexity of their argument, and in particular no figures of their-own modelling results are shown to corroborate the statement. Therefore, additional figures are requested support this part of the manuscript, at least in the supplementary.

(3) In the right column of Fig. 1, it is hard to read the starting time of the ‘hosing-unhosed’ experiment. Consider a change in the line colours.

(4) In the paragraph Line 10-19, Page 4681, the authors made comparisons of the AMOC-associated global climate changes between the freshwater-forced simulation and the ‘hosing-unhosed’ experiment. In their argument, the relatively smaller climate anomalies in the ‘hosing-unhosed’ experiment are attributed to a slightly weaker AMOC and larger extension of the North Atlantic sea-ice coverage in the prehosing state of the ‘unhosed’ experiment. In fact, the freshwater-forced simulations applied a hosing flux of ‘a preindustrial annual mean plus an additional 0.2 Sv’, but the ‘hosing-unhosed’

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experiment applied a freshwater addition of 0.05 Sv. Therefore, the relatively smaller climate anomalies in the 'hosing-unhosed' experiment maybe a result of such reduced freshwater forcing.

(5) All the supplementary figures have no captions.

Interactive comment on Clim. Past Discuss., 11, 4669, 2015.

CPD

11, C2155–C2157, 2015

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