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Climate of the Past Discussions

Interactive comment on "Orbital modulation of millennial-scale climate variability in an earth system model of intermediate complexity" *by* T. Friedrich et al.

Anonymous Referee #1

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The authors describe results of climate model simulations focusing on the effect of changes in obliquity on the Atlantic Meridional Overturning Circulation (AMOC). For present day (interglacial) boundary conditions the model exhibits centennial to millennial time scale oscillations for low obliquity values. These model oscillations are analyzed in some detail, leading to the conclusion that freshwater fluxes from Hudsons Bay into the Labrador Sea are important. For glacial boundary conditions, presumably due to the removal of Hudsons Bay, these oscillations are not observed. The authors conclude therefore that these model oscillations could not represent the millennial oscillations observed in the paleoclimate record (Dansgaard/Oschger oscillations). Obviously this conclusion is correct. I also think that this conclusion is one of the few

useful aspects of this paper that might be publishable. As a reader of the manuscript, however, one is disappointed and has the impression of having wasted time by going through all the model analysis of these oscillations only to learn that they have no relation to the real climate system and are pure model fiction. The analysis of the impacts of these oscillations on global temperature, precipitation, oxygen and carbon cycles is cursory at best. Many recent studies analyzing the impact of AMOC changes are not cited.

I'm also concerned about the freshwater flux correction the authors are using. This suggests that an important process affecting the AMOC is not (or not adequately) represented in the model. The usefulness of such a model for AMOC studies is therefore questionable. The authors do not seem to be worried about this because I find no discussion about it in the manuscript. An easy way to address this would be to repeat the simulations without the freshwater flux correction.

Overall the paper is substandard and I recommend rejection.

I could see a much shorter paper possibly publishable, concentrating on the analysis of the oscillations that have already been found by other users of that particular model and showing that they go away for glacial boundary conditions. The impact section should be completely left out.

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