



EGUsphere, author comment AC2
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Reply on RC1

Torge Martin and Arne Biastoch

Author comment on "On the ocean's response to enhanced Greenland runoff in model experiments: relevance of mesoscale dynamics and atmospheric coupling" by Torge Martin and Arne Biastoch, EGU sphere, <https://doi.org/10.5194/egusphere-2022-869-AC2>, 2022

We thank the reviewer for their overall positive feedback on our manuscript and the detailed comments, which certainly help to improve the paper. The specific comments on forcing, AMOC, internal variability and overall length of the paper are well taken and we certainly will consider all of them for the revised version. In this first reply we just briefly touch upon the main criticism.

Running the ocean-only experiment with historical (instead of repeated year) forcing but the coupled ones under pre-industrial control conditions was a compromise to have sufficient internal variability in the former and to isolate the impact of fresh water from other global warming signals in the latter.

We agree that AMOC internal variability exists on multi-centennial time scales, of course. Computing trends for various subsections of the reference runs, we found weak AMOC trends for the two coupled reference runs for periods of 100 to 200 years (coupled: 0.025-0.07 Sv/decade, coupled-nested: -0.05 to +0.03 Sv/dec) but a considerably wider distribution when using periods shorter than 80 years. We thus consider a 100-year long reference period as sufficient to limit the imprint of internal variability. Regarding the AMOC strength at the onset of the freshwater experiment, the coupled-nested run starts close to the long-term mean AMOC strength (+0.5 Sv) whereas the coupled experiment presented here starts in a low phase (-2.2 Sv). However, the coupled run is part of a small ensemble discussed in Martin et al. (2022), who show a robust AMOC weakening over the last 50 years independent of the starting condition.

The Appendix is intended to address the issue of distinguishing the response to the freshwater and internal variability and we appreciate the additional suggestions to discuss this in a more comprehensive and convincing way in the revised version. Because of the already extensive main part of the paper, we decided to focus this discussion in an appendix but will reconsider its placement (incl. further reviewer comments currently pending) in the revision process.