

Interactive comment on “Short-term impacts of enhanced Greenland freshwater fluxes in an eddy-permitting ocean model” by R. Marsh et al.

Anonymous Referee #1

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A) General Comments

As a fine-resolution ocean modelling study of the regional oceanographic response to freshwater flux anomalies, this manuscript is a welcome contribution to Ocean Science. I have a few comments that I would like the authors to address before publication.

First, I think the paper as written gives the (wrong) impression that, compared to previous modelling studies cited in the paper, a different local and large-scale response is found due to the oceanic resolution, and therefore a better representation of boundary currents, whereas I think is mostly due to the location of the anomalous freshwater flux applied to the ocean model and its magnitude. I think this should be stated more clearly in the Abstract and/or the Discussion. Second, the authors should provide some comparison with observations and/or a coarse resolution version of their model to assess

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the fidelity of their simulation and justify the use of a fine-resolution ocean model.

B) Specific Comments

- Abstract:

it is stated that 'the impact on large-scale circulation is very slight'. But, as noted later in the text by the authors, this is mostly due to the short time period considered and the modest anomalous freshwater flux (FWF) applied. Compared to previous studies, I believe the text gives the wrong impression that is the oceanic resolution that changes the results, while I think is mostly a different magnitude of FWF and its location (see below for more on this).

- Section 2.1:

the authors should provide some comparison with observations, and ideally the same ocean model at 1 or 2 degree resolution, of the surface flow in the region. I cannot tell from Fig.1 if your model is closer to obs and if it is any better than a coarse resolution version of NEMO. For example, line 28 of page 2914 you say 'this improves the simulation of sea ice and upper ocean dynamics' but don't show this or reference any work. Also, could you add the units to Fig.1?

line 13 page 2915: 'the relaxation substantially reduces the actual FWF imposed'. You should quantify this here (it is stated in the Discussion Section in point 3 of the conclusions).

- Section 2.2:

line 6 page 2916: the reference to Stammer 2007 should probably be Stammer 2008. What Stammer used is not a 'simpler' prescriptions of FWF, but a different one.

line 9 page 2916: '...coastal distribution of more recent and future melting'. I wonder what is the sensitivity of your results to the location and magnitude of the FWF anomaly. Is it really the resolution of your simulation or the location on the west side of Greenland

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that gives you such a different response in the circulation? or again the magnitude of the anomaly? The difference between your Fig.2 and Fig.1 in Stammer, 2008 is striking in both location and magnitude.

line 13 page 2916: do you know why the peak has shifted from June to July in Fig.4?

- Section 3.1:

line 5 page 2918: 'there is little influence on the MOC'. Again, this might be due to time scales and magnitude issues. Or not.

- Section 3.2:

line 1 page 2920: The authors should show the anomalous circulation around Greenland in a new plot.

- Section 4:

Point 3 of conclusions: is this really a conclusion? Shouldn't a more appropriate conclusion be a cautionary note on the effective anomaly felt by the ocean due to the strong (unrealistic) relaxation? In other words, are you really simulating the '90s freshwater fluxes?

line 10 and onwards page 2921: Can you look at satellite altimetry data to infer some of the properties of the local flow during the period considered in this study?

Interactive comment on Ocean Sci. Discuss., 6, 2911, 2009.