Ocean Science

Discussions

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Interactive comment on "The impact of melt water discharge from the Greenland ice sheet on the Atlantic nutrient supply to the Northwest European Shelf" *by* Moritz Mathis and Uwe Mikolajewicz

Anonymous Referee #1

Received and published: 22 October 2019

In this study the authors investigated the impact GIS meltwater has on future nutrient supply on the NW European Shelf Seas (NWS). Under RCP8.5, the upper North Atlantic is projected to freshen and warm, with a shoaling MLD, reducing surface nutrient levels. Increased GIS discharge is projected to shoal the MLD further. The NWS shelf edge processes allow some mixing of sub pycnocline water to the surface, which can decouple the NWS nutrient regime from the adjacent surface NE Atlantic. The focus of this paper is to investigate how the varying changes and mechanisms will affect the NWS. I thought the paper was novel, through and would recommend it for publication

with minor corrections.

Review criteria

1. Does the paper address relevant scientific questions within the scope of OS?

Yes.

2. Does the paper present novel concepts, ideas, tools, or data?

As far as I know, yes.

3. Are substantial conclusions reached?

Yes.

4. Are the scientific methods and assumptions valid and clearly outlined?

Yes.

5. Are the results sufficient to support the interpretations and conclusions?

Yes.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Yes, although I have made a few suggestions (location of hosing, figure of model domain etc.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Yes

8. Does the title clearly reflect the contents of the paper?

Yes

9. Does the abstract provide a concise and complete summary?

Yes

10. Is the overall presentation well-structured and clear?

Yes

11. Is the language fluent and precise?

Yes

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Yes

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

No

14. Are the number and quality of references appropriate?

Yes

15. Is the amount and quality of supplementary material appropriate?

Yes

Comments

The authors use a GCM with varying levels of GIS discharge to provide surface boundary conditions for their global ocean model with regional focusing to simulate the response to the GIS discharge. They run a control simulation, a 3-member ensemble under rcp8.5 (from 1920 – 2150) with no hosing, a 3-member ensemble with (a linear increase to) 0.1Sv hosing, and two additional runs with 0.25 and 1Sv. Their methodology is sound, and it good to see they use of (small) ensembles rather than individual

simulations.

There are lots of papers on Atlantic Hosing studies, and I felt this should be discussed more in the introduction. I think this paper needed to have a section comparing your model simulations to these other studies. I am not aware of anyone looking at the impact of hosing on the NWS nutrient supply, so this study is novel, but it would be good to see, for example, that the MLD/AMOC/SSS etc response, is consistent with other studies etc. Through the text you occasionally make statements about this, but I think you should be clear about it at the start. You want the reader to know that your model results are applicable beyond just your model, but to the real world. To do this, you want to show them that your model behaviour is typical (or atypical) – perhaps put into context of Swingedouw et al. 2013 (https://link.springer.com/article/10.1007%2Fs00382-012-1479-9). A couple of other hosing papers that mention changes in marine primary productivity which may be of relevance:

https://link.springer.com/article/10.1007%2Fs10584-009-9561-y

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007GB003118

I think you should have a figure showing the model domain, outlining model cross-sections – even if this is in the additional material. I don't think it's enough to refereeing to M19 for such a fundamental point. I'd even be happy with it in the appendices.

Clarify where the GIS meltwater is added geographically. Equally around the coast of Greenland?

Perhaps refer to MLD anomalies as deeper, deepening/shoaling etc rather than positive/negative?

Figure 10 also looks like the East Atlantic/West Russian Pattern e.g. Roberts et al. 2016 (http://dx.doi.org/10.1175/JCLI-D-15-0886.1).

Line 286 – "... higher SSS on the NWES than in the NE Atlantic." Is this referring to figure A1.b? if so, refer to it. Higher SSS on the NWES or just in the Celtic Sea?

Line 296 near the Celtic shelf break - where? Add to the new model domain figure? Give e.g. lat/lons?

Line 361 – define inner and outer shelf? On new figure??

Lines 428-431 – Either add a figure showing the ensemble overlapping etc,. or point to where this is shown in the figures. I don't think a table is sufficient.

Line 461 – you haven't mentioned ansatz before.

Captions in the Appendices need some work. Figure A2, define vectors. A3, describe how composites are made, add a, b c etc to the subplots. I assume they were the same as figure 10 – if so, say so. Figure A5 & 4, a & b, maybe clarify that the different colours are different ensemble members. A6, what is the contour.

The English in the manuscript is good, although some sentences can be unusual, and could perhaps do with being edited for clarity. A couple of examples are:

"The related decrease in the density strengthens the stratification and reduces the MLD in addition to the climate change signal from the atmosphere." Would be clearer as "In addition to the climate change signal from the atmosphere, the related decrease in the density strengthens the stratification and reduces the MLD."

Lines 292-294 are unclear...

I didn't really focus on typos, but there are a few in the paper, for example: line 49 collapse; line 49 lose; caption for figure 10: pressure... etc.