

Dear Editor,

Thank you for your help during the review process.

The remaining concern was on the length of the paper. As the paper is organized, partly, as a report for FESOM users starting with Arctic simulations, we did in purpose describe the background of the Arctic Ocean topics that we want to address. And then in the main result sections we follow the storyline and showed details of our model results. This leads to a relatively long paper. However, we think such details (background, model results and discussions about future work) are necessary and very useful for some new model users, who are the potential readers of the paper. And this strategy is not against the basic idea of the GMD policy. For other few minor comments, we did the corrections or replied accordingly in the reply letter.

Sincerely
the authors

Dear reviewer,

Thank you very much for your time spent on improving our manuscript.

The remaining concern was on the length of the paper. As the paper is organized, partly, as a report for FESOM users starting with Arctic simulations, we did in purpose describe the background of the Arctic Ocean topics that we want to address. And then in the main result sections we follow the storyline and showed details of our model results. We think such details (background, model results and discussions about future work) are necessary and useful for some new model users, who are the potential readers of the paper. This strategy is not against the basic idea of the GMD policy.

The reply to the few remaining comments:

1. Focus. Whilst some repetition and verbosity has been reduced, as suggested, the authors have chosen to keep a large proportion of the content which appears superfluous, and does not add to the paper.

Reply: see reply to the general comment above.

For the few specific examples you raised:

There are still many sentences that are too general, lack specifics or quantitative backing. e.g. referring to ‘common issues’ with no specifics that are not helpful.

Reply: the 'common issues' have been described in the Introduction Section. To remind this, now we add „as mentioned in the introduction section“ in the first paragraph of the Conclusion Section when we come to the „common issues“ again. (p31, l20)

Another: “with a very reasonable thickness” – how good is the AW modeled? A quantitative statement gives a basis for others to compare to (and improve upon) in the future. Further examples were highlighted in the initial review.

Reply: In the Conclusion Section, this sentence summarizes Section and related figures, where one reads quantitative comparison. Now we add the reference to the Figure in this summary sentence. (p32, l14)

On the advection scheme: Discussion of the FCT scheme still remains. Nothing profound, since it would be unusual to use an advection scheme which does not reduce numerical smoothing as resolution is increased! The discussion here again seems unnecessary. It is accepted higher resolution gives more accurate representation of mixing processes. This is not specific to the FCT scheme mentioned. Moreover, “numerical mixing” is possibly better termed “numerical smoothing” or “diffusive solution”?

Reply: We did remove the discussion about FCT in the model description section already. Only one sentence in the Conclusion Section was left; now we removed this sentence too.

Numerical mixing is an acceptable phrase in ocean modeling.

2. a request for context within FESOM efforts (since the 4.5km mesh has been used elsewhere in another publication) have not been adopted. This would be helpful for not only those following FESOM, but unstructured mesh model contributions to CORE-II.

Reply: We believe that it is better to keep the discussion about unstructured meshes in the discussion section as it is now. In the general introduction section, we already brought up FESOM enough through the review of Arctic simulations in past studies. We prefer to discuss the Arctic Ocean simulation in a context of „ocean general circulation models“ and try to just emphasize the special points about unstructured meshes afterwards (section 5.3). We are not developing a new model code or version here, and rather want to present the paper to general Arctic modelers too.

8. Mesh set-up and reproducibility. Meshes have now been provided. This is good, but a more general prescription of mesh generation, as suggested, would provide a more rigorous foundation for other comparative studies.

Reply: If one wants to generate a new unstructured mesh following the exact resolution we use, it is necessary to look at the mesh we provided, which tells directly the grid size. This is the best practice. We notice that mesh generation itself is a hard and practical task, because it is very generator-specific, and beyond the scope that this single paper can cover.

Also, the point regarding the higher resolution that seems to appear in the Baltic Sea in figure 2(a) has not been addressed.

Reply: We examined it now. This feature is related to the generator setting: the small region/corner in the Baltic Sea is close to the Arctic in distance, so it gets a bit higher resolution. As the mesh files are provided, one can see it from the mesh in case of reproducing a new mesh. Note: this corner with increased resolution on the mesh, however, does not influence the general circulation we are studying.

12. Passive tracer implementation.

Reply: The focus is on the Arctic simulation, so we choose to only show the region that is relevant or where we want to address it. Otherwise we prefer to remove it from the plots to avoid too much distraction. We did it in an easy way by specifying a lon/lat range, so it does not remove all the color outside the Arctic Ocean following the exact complicated Arctic boundary. But it is clear to readers that we only focus on the Arctic Ocean in this work.

A few other minor points

1. Page 1, line 13: “independent on” better replaced by “independent to”?

Reply: *changed*.

2. Page 14, lines 6-9: Two sentences in a single parenthesis. Better to remove and start a fresh sentence: “content (Defined ” → “content. This is defined ”

Reply: *changed*

3. References: JGR Oceans referred to as: “J. Geophys. Res. - Oceans”, “Journal of Geophysical Research-oceans”, “J. Geophys. Res. Oceans”

Reply: *changed to the same abbreviation in the references list*

4. Page 37: “Mcwilliams” → “McWilliams”

Reply: *changed*

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the authors