

Topical editor's decision – gmd-2021-293  
An evaluation of the E3SMv1-Arctic Ocean/Sea Ice Regionally Refined Model,  
by Veneziani et al

Dear Author,

Thank you for your revised manuscript. Before considering your paper for publication I would like you to address the following remarks. In general, I think you answered the reviewers' remarks satisfactorily but that you should add some text in the manuscript about the issues raised (and not only reply to the reviewer).

Reviewer #1

- Major comment #1
  - Thank you for adding Table 1. In the legend, can you be more specific about the two columns for « This paper » (I suppose the left one is for E3SM-Arctic-OSI and the right one for E3SM-LR-OSI) and about the two columns for Petersen et al. 2019 (I don't know what the two columns refer to).
  - Why isn't the RASM simulation described in this table ?
  - Also in the text where you introduce Table 1, L112-113, please give a short written description of the differences so to help the reader understanding Table 1.
- Major comment #2 : Please provide some details about how parameterizations other than GM vary with resolution ; if they don't please specify that.
- Major comment #3 :
  - Please add details in the text to justify the use of 3 cycles only.
  - Furthermore, for me a « trend » is a variation of a quantity per unit of time. I think you should change on L141 « a cooling trend by up to 0.5°C » by « a cooling persistent anomaly of up to 0.5°C ».
  - Why is the upper ocean freshening more concerning than the other, especially more than the OHC 0-700 one ?
- Major comment #4 : I understand that you better resolve the stratification in those regions of the subpolar gyre where North Atlantic water masses are formed because you do not activate GM in the Arctic and subarctic in E3SM-Arctic. If this is the case, I think L.175 «current GM implementation in MPAS-Ocean » is confusing. Maybe replace «current GM implementation in MPAS-Ocean » with « activation of GM in MPAS-Ocean ».
- Major comment #7 : Please add in the text some of your conclusions reported to the reviewer, even if you don't add Figures 1 and 2 from your reply.
- Major comment #8: Currently, you just added « In addition, E3SM- Arctic-OSI results are also shown for years 48-59 (end of first JRA55 cycle), in order to compare the stratification from the third and first cycles (solid and dashed dark red lines in Figs 14-15). » but you don't draw any conclusion. Please add in the text some of your conclusions reported to the reviewer, i.e. the fact that the drift affects the stratification over the whole Arctic and locally over the Canada Basin only ».

- Major comment #9: Is the fact that salt/fresh water fluxes assume that sea ice has salinity of 4 psu mentioned somewhere in the text ? If not do so, as the reviewer explicitly asked for that information.
- Major comment #11: Can you add something about this in the text ?
- Major comment #12: I don't see anywhere in the text that you version v1.3 of the JRA55-do data set, can you add this and also something about the fact that you don't do any correction over ice ?
- Minor comments #2 and #3 : Can you clarify these details somewhere in the text ?
- Minor comment #12: Thanks for adding the profiles for the last 12 years of the first JRA cycle as dark red dashed lines in Figures 14, 15. In your reply, you write « They give a good idea of how the stratification changes from cycle to cycle over the whole Arctic and locally over the Canada Basin only. » ; can you explicitly detail your observations on this in the text ?

#### Reviewer #2

- Comment #4 : These are interesting remarks ; please add something about this in the text.

#### My additional comments :

- Table 2 : The captions mention E3SM-Arctic-OSI, E3SM-LR-OSI and observations but not RASM, which is indeed included in the Table; please modify the captions.
- L 409 : remove « they » at the end of the line