Response to minor revisions from the editor

We thank the editor for their valuable comments. Our responses are provided in blue text. Line numbers refer to the new manuscript.

p.9 : reference to the different panes of Fig 4 are mixed up:

- “total meltwater flux (Fig. 4e)”, but 4e is mean ocean temperature
- “mean ocean temperature (Fig. 4g)” but 4g is total meltwater flux
- “domain-average salinity and temperature at the beginning of a coupling period to the final state of the previous coupling period (Fig. 4e and 4f)”, should be (Fig. 4f and 4e)

We have corrected this mistake.

In section 3.3: you did not change anything in the text regarding the reviewer’s remark on volume conservation although you answer : “FESOM only incorporates the meltwater as a virtual salinity flux, while the ocean volume changes only according to the change in cavity geometry. Therefore, both concerns about volume conservation do not apply for our setup. We do acknowledge the fact though that on long time scales and for big excursions of the grounding line position an accurate computation of sea-level evolution would require an assessment of other, smaller potential inaccuracies caused by our approach.” Wouldn’t you add one or two sentences in the text to clarify this aspect?

We agree and have added information about potential sea level adjustment to the text. We also have expanded on the potential smaller sources for mass conservation violations.

Before:

L215 ff.(old manuscript): *Conservation inaccuracies are small compared to the forcing signal. Úa-FESOM is not strictly mass conserving locally, as different grounding line definitions are used in the ice and ocean components and melt rates are interpolated between grids (described above). We calculate mass conservation deviations using the freshwater flux in FESOM and the basal mass balance in Úa. We find that differences in total mass flux at any given time of the experiment are an order of magnitude smaller compared to the forcing signal (Fig. 4g). More ice mass is lost in the ice model than gained in the ocean model and this discrepancy accumulates to about 3% of the total mass lost at the end of the experiment (Fig. 4h). This number could potentially be reduced in future studies by tuning the grounding line definition used in the Úa-to-FESOM step, that is choosing a value smaller than 0.5 to define the grounding line in Úa’s grounding/floating mask.*

After:

L240 ff.: *Conservation inaccuracies are small compared to the forcing signal. No sea level adjustments had to be applied, as FESOM incorporates the meltwater as a virtual salinity flux, while the ocean volume changes only according to the change in cavity geometry (adjustments are recommended for other approaches, see Asay-Davis et al., 2016). Nevertheless, Úa-FESOM is not strictly mass conserving locally. Inconsistencies arise from the temporal lags between updating melt rates in Úa and cavity geometry in FESOM and from interpolating the communicated quantities between different grids and masks using non-conservative methods (also see Gladstone et al., 2021). We calculate mass conservation deviations using the salinity flux in FESOM and the basal mass balance in Úa. We find that differences in total mass flux at any given time of the experiment are an order of magnitude smaller compared to the forcing signal (Fig. 4g). More ice mass is lost in the ice model than gained in the ocean model and this discrepancy accumulates to about 3% of the total mass lost at the end of the experiment (Fig. 4h). Currently, Úa's grounding zone extends into regions slightly upstream of FESOM's grounding line and melt rates are extrapolated into these regions (see Sec. 2.4). We expect this issue to explain most of the discrepancy in mass flux. Future studies could potentially improve the behaviour by tuning the grounding line definition used in the Úa-to-FESOM step, that is choosing a value smaller than 0.5 to define the grounding line in Úa's grounding/floating mask.*

Please note that during these revisions, we have corrected a detail and changed *virtual freshwater flux* to *virtual salinity flux (L245),* which is the precise formulation (see, e.g. Wang et al., 2014).

References

Gladstone, R., Galton-Fenzi, B., Gwyther, D., Zhou, Q., Hattermann, T., Zhao, C., Jong, L., Xia, Y., Guo, X., Petrakopoulos, K., Zwinger, T., Shapero, D., and Moore, J.: The Framework For Ice Sheet–Ocean Coupling (FISOC) V1.1, Geoscientific Model Development, 14, 889–905, https://doi.org/10.5194/gmd-14-889-2021, publisher: Copernicus GmbH, 2021

Wang, Q., Danilov, S., Sidorenko, D., Timmermann, R., Wekerle, C., Wang, X., Jung, T., and Schröter, J.: The Finite Element Sea IceOcean Model (FESOM) v.1.4: formulation of an ocean general circulation model, Geoscientific Model Development, 7, 663–693, https://doi.org/https://doi.org/10.5194/gmd-7-663-2014, publisher: Copernicus GmbH, 2014