

**Review, round 2, of *Southern Ocean polynyas and dense water formation in a high-resolution, coupled Earth System Model* by Jeong et al.**

I thank the authors for thoroughly addressing each comment from my previous review. I only have very few minor comments aimed to further improve the manuscript. I recommend accepting the manuscript for publication after the minor comments have been addressed.

Minor comments

L51-57: Solodoch et al. 2022 analyse simulated AABW formation in a global ocean-sea ice model. The study should be mentioned in the introduction.

L223: Please elaborate on the comparison between the model and Pellichero et al. 2018: Do the results 'compare well' in magnitude, pattern or both?

L279: Please use ASF acronym.

Section 2.1 and discussion (L325): Regarding the horizontal resolution of E3SM-HR and resolving the mesoscale. Multiple modelling studies have shown that a resolution of 1-2 km is required to adequately simulate mesoscale eddy activity over the Antarctic continental shelf and slope (e.g., Nost et al. 2011, Dinniman et al. 2012, St-Laurent et al. 2013, Hattermann et al. 2014, Stewart and Thompson 2015; ). E3SM-HR is with 8 km far from eddy-resolving at this part of the ocean. Please incorporate a sentence or two on the fact E3SM-HR might be 'high-resolution' in terms of Earth System models, but not in terms of resolving the mesoscale in the high latitudes.

Literature mentioned above

Solodoch, A., Stewart, A. L., Hogg, A. M., Morrison, A. K., Kiss, A. E., Thompson, A. F., et al. (2022). How does Antarctic Bottom Water cross the Southern Ocean? *Geophysical Research Letters*, 49, e2021GL097211. <https://doi.org/10.1029/2021GL097211>

Nøst, O. A., M. Biuw, V. Tverberg, C. Lydersen, T. Hattermann, Q. Zhou, L. H. Smedsrud, and K. M. Kovacs, 2011: Eddy overturning of the Antarctic Slope Front controls glacial melting in the eastern Weddell Sea. *J. Geophys. Res. Oceans*, 116, C11014, <https://doi.org/10.1029/2011JC006965>.

Dinniman, M. S., J. M. Klinck, and E. E. Hofmann, 2012: Sensitivity of Circumpolar Deep Water transport and ice shelf basal melt along the West Antarctic Peninsula to changes in the winds. *J. Climate*, 25, 4799–4816, <https://doi.org/10.1175/JCLI-D-11-00307.1>.

St-Laurent, P., J. M. Klinck, and M. S. Dinniman, 2013: On the role of coastal troughs in the circulation of warm Circumpolar Deep Water on Antarctic shelves. *J. Phys. Oceanogr.*, 43, 51–64, <https://doi.org/10.1175/JPO-D-11-0237.1>.

Hattermann, T., L. H. Smedsrud, O. A. Nøst, J. M. Lilly, and B. K. Galton-Fenzi, 2014: Eddy-resolving simulations of the Fimbul Ice Shelf cavity circulation: Basal melting and exchange with open ocean. *Ocean Modell.*, 82, 28–44, <https://doi.org/10.1016/j.ocemod.2014.07.004>.

Stewart, A. L., and A. F. Thompson (2015), Eddy-mediated transport of warm Circumpolar Deep Water across the Antarctic Shelf Break, *Geophys. Res. Lett.*, 42, 432–440, doi:10.1002/2014GL062281.