Dense water production and downslope flow off Cape Darnley reproduced by a realistic numerical model

*Vigan Mensah[1], Yoshihiro Nakayama[1], Masakazu Fujii[2], Yoshifumi Nogi[2], Kay I. Ohshima[1]

1. Institute of Low Temperature Science, 2. National Institute of Polar Research

The ability of the Massachusetts Institute of Technology general circulation model (MITgcm) to reproduce dense water production and its downslope outflow through a complex topography is evaluated through a series of simulations at different horizontal and vertical resolutions. The study domain is the region off Cape Darnley in East Antarctica, where intense sea ice production from March to October leads to the formation of Dense Shelf Water, previously observed to outflow periodically as a downslope current. Our experiments are based on a hydrostatic parametrization, using a coupled ocean-ice-atmosphere model for realistic forcing and sea ice production. Different vertical and horizontal resolutions are used to evaluate the relative importance of the model vertical grid and of the topography on the production of dense water and its outflow, and the model output is compared with the mooring observation data for evaluation purposes. The bottom topography data around the main canyon (Wild Canyon) are based on multibeam echo-sounder observations. While the outflow of dense shelf water is seen in the model outputs at the mooring location for each vertical and horizontal resolution, increasing the horizontal resolution leads to a start of the outflow and a periodicity more consistent with the observations. This suggest the dominant role of horizontal resolution for the accurate reproduction of dense shelf water production and outflow. We then proceed to determine the optimal setting allowing for reproduction of these phenomena at the lowest possible computational cost.

Keywords: Ocean-ice modelling, East Antarctica, Dense Water production, Sea ice

