EGU2020-20463
https://doi.org/10.5194/egusphere-egu2020-20463
EGU General Assembly 2020

Modeling ocean eddies and their effects on ice shelf basal melt rate in the Ross Sea

Stefanie Mack[1], Mike Dinniman[2], John Klinck[2], Dennis McGillicuddy, Jr.[3], and Laurie Padman[4]
[1]British Antarctic Survey, Cambridge, United Kingdom (steck@bas.ac.uk)
[2]Old Dominion University, Norfolk, VA, United States
[3]Woods Hole Oceanographic Institution, Falmouth, MA, United States
[4]Earth & Space Research, Seattle, WA, United States

Ice shelf basal melt rates around Antarctica are affected by the advection of warm Circumpolar Deep Water (CDW) onto the continental shelf and under the ice shelf. In ocean models, resolving mesoscale eddies is necessary to capture eddy fluxes of CDW and estimate basal melt rates of ice shelves. Where and when (not if) eddies are resolved in an ocean model depends on the baroclinic Rossby radius and thus on stratification and latitude. The Ross Sea presents some interesting scientific questions in two regards: first, it is weakly stratified in winter conditions, lowering the radius of deformation; and second, the Ross Ice Shelf melts mainly from dense shelf water at the grounding line and from light surface water at the ice shelf front, rather than CDW. An investigation using a ROMS (Regional Ocean Modelling System) model of the Ross Sea reveals that portions of the domain (48% in well-mixed winter conditions, and 33% in stratified summer conditions) do not resolve mesoscale eddies even at a horizontal grid spacing of 1.5 km. We find that smaller grid spacing (1.5 km versus 5 km) leads to increased eddy generation in the model, and eddies that cross the ice shelf front in both directions. However, there is no significant change in basal melt between low and high resolution simulations. While even higher resolution is needed to fully represent eddies in the Ross Sea, the processes that control basal melt of the Ross Ice Shelf may not be strongly affected by these eddies.