Pathway of Circumpolar Deep Water into Pine Island and Thwaites ice shelf cavities and to their grounding lines

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Melting of Pine Island and Thwaites ice shelves is caused by Circumpolar Deep Water (CDW) intruding onto the Amundsen Sea continental shelves via submarine glacial troughs located at the continental shelf break. Despite existing works on on-shelf CDW transports with horizontal grid resolutions of ~1-2 km or coarser, it has been difficult to fully resolve sub-ice shelf environments with steep changes in both bathymetry and ice shelf shapes. In this study, we use a regional Amundsen Sea configuration of the Massachusetts Institute of Technology general circulation model (MITgcm) with horizontal and vertical grid spacings of 200 and 10 m, respectively. We calculate time-mean and time-evolving fields of velocity and investigate the mechanisms of how CDW is transported into the ice shelf cavities and to their grounding lines. We find a prominent submesoscale variability in the ice cavity, with scales of motion O(1-5km) and Rossby numbers O(1). Preliminary analysis shows that these submesoscales are formed due to instabilities associated with the positive potential vorticity patches located in the sub ice-shelf mixed layer, particularly near strong topographic features. This study is the first step towards understanding the importance of sub-mesoscale processes for sub-ice shelf circulation and thus transport of warm CDW to the grounding lines and ice shelf bases.