What determines the differences in basal melt between ice shelves in the Amundsen Sea?

Pierre St-Laurent, John M. Klinck, and Michael S. Dinniman

Center for Coastal Physical Oceanography, Old Dominion University, Norfolk VA

The ice shelves of the Amundsen Sea are thinning faster than anywhere else around Antarctica but this mass loss varies substantially from one ice shelf to another. We examine the hypothesis that ice shelf geometry is the main cause of these differences. We employ a high-resolution (1.5km) 3-D ice shelf-ocean numerical model to simulate the mean basal melt rates of the Amundsen sector (interannual variability of the melt is not considered in this study). The model domain includes Cosgrove, Pine Island, Thwaites, Dotson and Getz ice shelves as well as parts of Crosson and Abbot ice shelves. The ocean and ice shelves are thermodynamically-coupled and the ice shelf geometry is assumed constant over the short period of time considered (5years). All ice shelf cavities are initialized with the same water temperature profile. On the continental shelf, the warm slope water is steered by large glacial troughs and circulates in a complex pattern controlled by the sea floor topography. This circulation particularly enhances the melt of Thwaites, Pine Island and Dotson ice shelves. We find however that the location of the glacial troughs plays a smaller role than ice shelf geometry in determining the differences in melt between the ice shelves.