Numerical modelling of ocean-ice interactions under the Pine Island Glacier ice shelf

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A two-dimensional numerical model is used to simulate the dynamics of the buoyant water plume believed to underlie the ice shelf occupying much of Pine Island Bay, West Antarctica. Recent studies have shown that this ice shelf, along with all others fringing the Amundsen Sea, is thinning at an anomalously high rate [Shepherd et al., 2004]. Forcing the numerical model with observed temperature and salinity profiles [Jacobs et al., 1996] yields an average melt rate of 20.2 m/yr, which is in good agreement with several data-based estimates. The model suggests that the observed thinning rates are consistent with a 0.3 to 0.5 deg. C warming of the Amundsen Sea; a value that has been observed for Circumpolar Deep Water in the nearby Ross Sea [Jacobs et al., 2002]. Results suggest that both the Coriolis effect and sub-shelf topography are important in controlling plume dynamics and the spatial distribution of ice melt.