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Developing a coupled ice flow, melt-water plume model to study interactions beneath ice shelves off the coast of West Antarctica.

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Observational studies have shown that ice shelves off the coast of West Antarctica in the Amunsden Sea area have experienced rapid thinning during the 1990s (Shepherd et al., 2002; Shepherd et al., 2004). In particular, it is believed that oceanographic changes in the Amundsen Sea are responsible for the thinning and acceleration of Pine Island Glacier. An earlier study looking at melt rates generated by a plume model beneath the ice shelf in Pine Island Bay suggested that there was a strong feedback mechanism between the plume and topography of the ice shelf underside near the grounding line (Payne et al., 2007).

We will develop a 2D numerical model to investigate possible
connections between ocean properties and ice shelf geometry. The model consists of equations describing the dynamics of a buoyant, melt-water rich plume that includes entrainment of ambient ocean waters and equations governing the ice-shelf dynamics. The plume is constrained by the topography generated by the ice shelf model, which in turn is subject to the melt rate predicted by the plume model. This coupled model will be tested using an idealised geometry with parameter values based on conditions in Pine Island Bay. Results from perturbation experiments conducted to investigate the effects of anomalous changes in ambient temperature and/or salinity will be presented.

Payne, A. J., P. R. Holland, A. P. Shepherd, I. C. Rutt, A. Jenkins and I. Joughin. 2007. Numerical modeling of ocean-ice interactions under Pine Island Bayś ice shelf. J. Geophys. Res., 112, C10019, doi:10.1029/2006JC003733.
Shepherd, A., D. J. Wingham and J. A. D. Mansley. 2002. Inland thinning of the Amundsen Sea sector, West Antarctica. Geophys. Res. Lett., 29(10), 1364, doi:10.1029/2001GL014183
Shepherd, A., D. Wingham and E. Rignot. 2004. Warm ocean is eroding West Antarctic Ice Sheet. Geophys. Res. Lett., 31, L23402, doi:10.1029/2004GL021106