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# Under-ice melt ponds in the Arctic

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In the summer months, melt water from the surface of the Arctic sea ice can percolate down through the ice and flow out of its base. This water is relatively warm and fresh compared to the ocean water beneath it, and so it floats between the ice and the oceanic mixed layer, forming pools of melt water called under-ice melt ponds.

Double diffusion can lead to the formation of a sheet of ice, which is called a false bottom, at the interface between the fresh water and the ocean. These false bottoms isolate under-ice melt ponds from the ocean below, trapping the fresh water against the sea ice. These ponds and false bottoms have been estimated to cover between 5 and 40% of the base of the sea ice. [Notz et al. Journal of Geophysical Research 2003]

We have developed a one-dimensional thermodynamic model of sea ice underlain by an under-ice melt pond and false bottom. Not only has this allowed us to simulate the evolution of under-ice melt ponds over time, identifying an alternative outcome than previously observed in the field, but sensitivity studies have helped us to estimate the impact that these pools of fresh water have on the mass-balance sea ice. We have also found evidence of a possible positive feedback cycle whereby increasingly less ice growth is seen due to the presence of under-ice melt ponds as the Arctic warms.

Since the rate of basal ablation is affected by these phenomena, their presence alters the salt and freshwater fluxes from the sea ice into the ocean. We have coupled our under-ice melt pond model to a simple model of the oceanic mixed layer to determine how this affects mixed layer properties such as temperature, salinity, and depth. In turn, this changes the oceanic forcing reaching the sea ice.