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Comparing fixed and dynamic-salinity models of sea ice DAVID REES JONES, GRAE WORSTER, University of Cambridge — The bulk salinity of sea ice has long been poorly represented in climate models. We have incorporated a physically-derived parameterization of ice desalination by gravity drainage in terms of a convective upwelling velocity into a one-dimensional thermodynamic sea-ice model of the kind currently used in coupled climate models. Our parameterization allows us to determine salt fluxes from sea ice corresponding to the evolution of the bulk salinity of the ice, in contrast to current, established models that prescribe the ice salinity. This improves the predictive power and responsiveness of climate models in terms of buoyancy fluxes to the polar oceans, and also the thermal and mechanical properties of sea ice, which depend on its salinity. We discuss and compare our parameterization to other recent parameterizations of gravity drainage, as well as existing fixed-salinity models, both in terms of laboratory experiments and deep ocean mixed layer calculations in the case of growing first-year ice. These comparisons explain why the direct effect of ice salinity on growth is relatively small (though not negligible), and highlight substantial differences in salt fluxes into the polar oceans.

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