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A simple one-dimensional model of brine fluxes from sea-ice
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Over the winter growth season, brine within the interstices of sea-ice drains into the ocean owing predominantly to convection within the lower parts of the ice, a small-scale process difficult to model on a regional scale. Traditionally, salt loss from sea-ice has been determined using a combination of historical data and an empirical segregation law applied at the ice-ocean interface. By contrast, we apply a simple relationship between the strength of internal, small-scale convection and a mush Rayleigh number to develop a predictive, one-dimensional model of sea ice, applicable on a regional scale. This model solves the full mushy layer equations for heat and salt conservation within the ice, using a dynamically determined term for the convective transport of salt and heat. Numerical results from this model are presented, predicting the internal structure of the ice and also net salt and heat fluxes from the ice. Prospects for experimental validation and further possibilities for model development are discussed.

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