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 em-
pirical 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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