Melting dynamics and morphology of floating ice fragments: salinity and confinement effects

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Résumé

Ice melting in contact with seawater occurs across a range of settings, from freely exposed surfaces to partially confined environments where ventilation from ocean currents is limited. Such conditions arise, for instance, for floating ice fragments in dense ice mélange, as well as within localized basal crevasses or cavities beneath grounded or partially floating ice. Despite their potential importance for melt localization and ice weakening, the physical controls on melting in these confined regions remain poorly constrained, in particular the role of salinity in setting melt rates, flow regimes, and the development of morphological instabilities at the ice–water interface. I present idealised laboratory experiments investigating how floating ice fragments melt under varying salinity. Experiments explore both freely moving fragments and fixed ice blocks, and examine the effects of confinement on melt rates, the emergence of morphological instabilities, and local circulation. The results reveal how salinity and confinement can drive distinct convective regimes, from well-mixed conditions to stratified environments where the ice partially self-insulates, shedding light on melting processes in confined configurations.

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