Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A laboratory examination of the three-equation model of ice-ocean interactions[1] CRAIG MCCONNOCHIE, Woods Hole Oceanographic Institution, ROSS KERR, The Australian National University — Numerical models of ice-ocean interactions are typically unable to resolve the transport of heat and salt to the ice face. As such, models rely upon parameterizations that have not been properly validated by data. Recent laboratory experiments of ice-saltwater interactions allow us to test the standard parameterization of heat and salt transport to ice faces - the 'three equation model'. We find a significant disagreement in the dependence of the melt rate on the fluid velocity. The three-equation model predicts that the melt rate is proportional to the fluid velocity while the experimental results typically show that the melt rate is independent of the fluid velocity. By considering a theoretical analysis of the boundary layer next to a melting ice face we suggest a resolution to this disagreement. We show that the three-equation model assumes that the thickness of the diffusive sublayer is set by a shear instability. However, at low flow velocities, the sublayer is instead set by a convective instability. This distinction leads to a threshold velocity of approximately 4 cm/s at geophysically relevant conditions, above which the form of the parameterization should be valid. In contrast, at flow speeds below 4 cm/s, the three-equation model will underestimate the melt rate.

[1]ARC DP120102772

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Date submitted: 17 Jul 2017 Electronic form version 1.4