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Icebergs Melting in Uniform and Vertically Sheared Flows.[1]
CLAUDIA CENEDESE, Woods Hole Oceanographic Institution, ANNA FITZ-MAURICE, Princeton University, FIAMMETTA STRANEO, Scripps Institution of Oceanography — Icebergs calving into Greenlandic Fjords frequently experience strongly sheared flows over their draft, but the impact of this flow past the iceberg on the melt plumes generated along the iceberg sides is not fully captured by existing melt parameterizations. A series of novel laboratory experiments showed that side melting of icebergs subject to relative velocities is controlled by two distinct regimes, which depend on the melt plume behavior (side-attached or side-detached). These two regimes produce a nonlinear dependence of melt rate on velocity, and different distributions of meltwater in the water column. Iceberg meltwater may either be confined to a thin surface layer, when the melt plumes are side-attached, or mixed down to the iceberg draft, when the melt plumes are side-detached. In a two-layer vertically sheared flow, the average flow speed in existing melt parameterizations gives an underestimate of the submarine melt rate, in part due to the nonlinearity of the dependence of melt rate on flow speed, but also because vertical shear in the velocity profile fundamentally changes the flow splitting around the ice block and consequently the velocity felt by the ice surface. Including this nonlinear velocity dependence in melting parameterizations applied to observed icebergs increases iceberg side melt in the side-attached regime, improving agreement with observations of iceberg submarine melt rates.

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