# An Operational Thermodynamic-Dynamic Model for the Coastal Labrador Sea Ice Melt Season: Labrador Coastal Ice Melt and Dynamics Model (Version 1)

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**Abstract**

An offshore operations thermodynamic-dynamic prediction model of sea ice break-up and drift is presented for central coastal Labrador in Atlantic Canada, and demonstrated for portions of the 2015 spring break-up of the land-fast ice. The model validation is performed using the data from ice tracking buoys deployed on the land-fast ice, which began drifting after break-up of the land-fast ice. The model uses a one-dimensional thermodynamic parameterization for ice melt and growth, includes snow accumulation and melt, and melt-pond and lead growth and contraction. The dynamic model uses a Smoothed Particle Hydrodynamics (SPH) parameterization for ice motion and changes in ice thickness and concentration. The dynamic forcing parameters include wind and ocean current drag, Coriolis deflection, internal ice stresses, and gravitational forcing due to sea surface gradients. A coastal repulsion force is employed to prevent ice particles from crossing the coastal boundaries. The model is sensitive to the prescribed initial snow depth on the sea ice. In the present work, analysis of results is focused on the offshore regions of Makkovik and Nain, Labrador. The melt of the coastal land-fast ice in these regions can be adequately simulated by the thermodynamic model alone. The model predicts the timing of the local land-fast ice break-up to within 4.6 hours to six days, and can simulate observed ice buoy drift speeds to within 1.5 meters per second.