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2-D Polynya flux model solutions incorporating a new parameterisation for the collection thickness of consolidated new ice

I. A. Walkington, A. J. Willmott

Keele University, Keele, Staffs. ST5 5BG. UK (i.a.walkington@keele.ac.uk)

Previous polynya flux models have either specified a constant value for the collection thickness of frazil ice, H, at the polynya edge, or parameterised the collection thickness in terms of the depth of the frazil ice arriving at the polynya edge aggregated to the component, normal to the polynya edge, of the frazil ice velocity relative to the consolidated new ice velocity. Neither parameterisations are robust when incorporated into models for determining the evolving polynya area. A new parameterisation for the collection thickness is developed based upon the average thickness of ice consolidated against the pack edge, viewed as a collection of ice floes, using the collection thickness parameterisation of Biggs *et al.* (2000). This new parameterisation is robust throughout the entire region of climatically relevant parameter space.

An unsteady 2-D polynya flux model is developed using this new parameterisation. Analytical solutions are developed for the semi-infinite and finite length coastline. Comparisons of characteristic opening times and steady-state areas with other 2-D polynya flux models using different collection thickness parameterisations are presented.