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Testing a Sea Ice Model

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SI³ (Sea Ice modelling Integrated Initiative) is the sea ice engine of the NEMO ocean model. It incorporates elements of three sea ice models that have been used with NEMO in the past: CICE, GELATO, and LIM. It takes account of sea ice dynamics, thermodynamics, brine inclusions, and subgrid-scale thickness variations.

A process that has historically been poorly represented in sea ice models is the formation and evolution of melt ponds. These ponds accumulate on the surface of sea ice during the melt season and affect the heat and mass balance in various ways, the most important of which is a reduction in albedo. A melt pond scheme that has a significant impact on surface albedo has recently been added to SI³, based on the ideas of Flocco et al (JGR, 2010). This scheme attempts to represent the influence of ice topography on lateral meltwater transport. We present the results of tests of the grid-level conservation of heat and fresh water in this new scheme. To perform these tests we have incorporated a basic mixed-layer ocean model into SI³ as an intermediate complexity alternative to running with the full ocean model or forcing with saved ocean fields.

We also present a comparison of SI³ with the Los Alamos sea ice model (CICE) in multi-decadal simulations. These comparisons cover the sea ice mass balance (sea ice concentration, extent, and thickness) and the sea ice motion.