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Towards the development of a large-scale sea ice model using the finite element method

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In this work, we present a finite element formulation of large-scale sea ice dynamics in the Eulerian description. Our model has representations of both dynamic and thermodynamic sea ice processes, and includes a set of differential equations for node ice velocities, element ice volumes and element ice areas. Sea ice is assumed to behave as a two-dimensional viscous-plastic continuum in dynamical interaction with atmosphere and ocean. The vertical growth/melt rate of the ice is either prescribed from standard tabulated data or computed by the zero-layer model of Semtner (1976). The mass conservation is strictly ensured by using an advection scheme based on the finite volume approach. The model performance is first evaluated through a two-dimensional test problem on a hexagonal domain, and results are compared to those obtained by Wang and Ikeda (2003) with a similar model. A simulation of the Arctic ice pack is carried out on a realistic mesh by using NCEP/NCAR reanalysis of the atmospheric fields to drive our model. We compare the simulated ice velocity patterns with those derived from satellite and buoy measurements. Finally, a study of the grid resolution's influence on the results is presented.

Semnter, A., J., 1976: A model for the thermodynamic growth of sea ice in numerical investigations of climate, *J. Phys. Oceanogr.*, **6**, 379-389.

Wang, L.R., and M. Ikeda, 2003: A Lagrangian description of sea ice dynamics using finite element method, *Ocean Modell.,* **7**, 21-38.