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LIM3, an advanced sea ice model for climate studies

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A new version of the global, large-scale, sea ice model LIM3 (Louvain-la-Neuve Ice Model), coupled to the French ocean model OPA (Ocean Parallelisé) and embedded in the ocean modelling system NEMO (Nucleus for European Modelling of the Ocean) is presented. LIM3 includes a representation of thermodynamic, dynamic processes and of the subgrid-scale distribution of ice thickness.

The thermodynamic component of LIM3 is an energy- and salt-conserving multilayer sea ice model. It computes the local variations in snow depth, ice thickness, temperature and bulk salinity, with an account for the changes in the shape of the salinity profile. Parameterizations of lateral melting and the collection thickness of frazil are also included. The dynamic component is viscous-plastic. The ice thickness distribution is divided into undeformed and deformed ice types. It is redistributed thermodynamically as well as dynamically, accounting for ridging and rafting. The age of the ice is diagnosed.

The model is forced by NCEP-NCAR daily reanalysis (1948-2006) of air temperature and wind velocity. To validate our model, we compare the model time series of Northern and Southern ice extent, and the mean geographical distributions of ice concentration, thickness and snow depth against available observations. The model monthly values of interannual variability of ice coverage are also compared to observations. The sensitivity of the model to internal physics representation is investigated.