Modelling sea ice dynamics

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Sea ice remains one of the frontiers of ocean modelling and is of vital importance for the correct forecasts of the northern oceans. At large scale, it is commonly considered a continuous medium whose dynamics is modelled in terms of continuum mechanics. Its specifics are a matter of constitutive behaviour which may be characterised as rigid-plastic.

The new developed sea ice dynamic module bases on general principles and follows a systematic approach to the problem. Both drift field and stress field are modelled by a variational property. Rigidity is treated by Lagrangian relaxation. Thus one is led to a sensible numerical method.

Modelling fast ice remains to be a challenge. It is understood that ridging and the formation of grounded ice keels plays a role in the process. The ice dynamic model includes a parameterisation of the stress associated with grounded ice keels. Shear against the grounded bottom contact might lead to plastic deformation and the loss of integrity.

The numerical scheme involves a potentially large system of linear equations which is solved by pre-conditioned iteration. The entire algorithm consists of several components which result from decomposing the problem. The algorithm has been implemented and tested in practice.