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The assessment of the finite-element version of the Los Alamos sea ice model (CICE) coupled with the finite-element model FESOM (AWI, Bremerhaven), adapted in INM RAS.

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The AWI finite-element coupled ice-ocean model FESOM (Wang, et.al., 2008, Sidorenko, et.al., 2011) was tested as the possible prototype for the next generation ocean dynamical core for the Earth System model of the Institute of Numerical Mathematics, Russian Academy of Sciences (INM RAS). Now this model is running as the experimental one to be tested with various global and regional meshes, and to be compared with other INM RAS models, both from physical and numerical points of view.

The current sea ice module is based on the 0-level thermodynamic ice model, similar to Semtner's one (Semtner, 1976). This model gives quite realistic output, but from the theoretical point of view it should be changed to a more sophisticated energy-conserving one, with the possibility to take into account the ice salinity evolution.

As for the dynamical part of sea ice in FESOM, it based on the EVP rheology (Hunke and Dukowicz, 1997) and several thickness gradations with sea ice redistribution and strength estimation, similar to CICE (Hunke and Lipscomb, 2010). Thus, the main task was to implement the energy conserving thermodynamic part of CICE with several ice thickness levels (Bitz and Lipscomb, 1999) and to test the compatibility of ice transport schemes, used in FESOM, with the multilevel sea ice approximation. We discovered that this problem is not trivial and some transport schemes may cause model instability due to unrealistic sea ice surface temperatures at ice edge.

The other task was to assess the effect of several ice thickness levels on the output on the climate time scale and to optimize the number of levels in the frame of FESOM.

The results of global runs of INM RAS version of FESOM with various sea ice models will be presented. Some aspects of possible use of new rheologies and their implementations in FE models are also under discussion, on the example of the standing alone sea ice model.

The new finite-element version of CICE for unstructured triangle meshes may be useful both for climate projections and for weather forecasts, especially in an adaptive mesh mode.

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