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Ocean model INMOM as an oceanic component of the INM RAS Earth climate model INMCM

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The Institute of Numerical Mathematics Ocean Model (INMOM) is presented as an oceanic component of the INM RAS Earth climate model INMCM. The previous version of the INMCM (3.0) was presented in the IPCC 4th assessment report in the list of IPCC climate models. The new version of INMCM (4.0) is participating in the Coupled Model Intercomparison Project Phase 5 (CMIP5), the results of which are to be used in preparing the IPCC 5th assessment report.

The INMOM is a so-called "terrain following" sigma -coordinate ocean model. It is currently the only OGCM in sigma-coordinates which may be used for long-term integration to simulate ocean climatic circulation. To avoid filtering prognostic variables near the North Pole the INMOM uses a curvilinear orthogonal conformal coordinate system with poles outside the computational domain displaced symmetrically of the geographical Equator. One pole is located on the Taimyr Peninsula, and the second one is placed on Antarctica. The equator in the model coordinate system coincides with the geographical one what is significant to adequately reproduce equatorial wave processes.

The INMOM uses free surface condition with sea surface height computation. For lateral tracer mixing the isopycnal semi-lagrangian diffusion is used with a constant coefficient. The model includes sea ice dynamics and thermodynamics with Hunke-Dukowicz elastic-viscous-plastic (EVP) rheology. Spatial resolution of the INMOM is 1x0.5 degree in longitude and latitude and 40 vertical levels. When coupling the atmosphere and ocean models, heat, fresh water and momentum fluxes are transferred from the atmosphere into the ocean. Vice versa, sea surface temperature and sea ice concentration are transferred from the ocean into the atmosphere. No flux correction is implemented. As well runoff of 48 major rivers is allowed for. Fresh water inflow from Greenland and Antarctica due to coastal ice melting is taken into account.

Two experiments were performed. The first one consisted in running INMOM by using CORE (Coordinated Ocean-ice Reference Experiments) data as atmospheric forcing. It was demonstrated that the oceanic climatic features are well simulated in good agreement with results of OGCMs participating in CORE. The second experiment was carried to simulate the present-day climate. It was shown that the INMCM adequately reproduces the most significant features of the observed atmospheric and oceanic climates.