Ice-ocean coupled model for operational predictions of sea ice and sea level conditions in the Arctic Ocean marginal seas

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Sea ice conditions and level changes along the Northern Sea Route (shallow arctic marginal the Barents, Kara, Laptev, East Siberian and Chukchi Seas) are influenced significantly by storm surges and tides. These parameters are important for navigation and have been operationally predicted by AARI since later 1980s using a 2-D coupled ice-ocean model with horizontal resolution of 55.5 km. Here we present a new 3-D coupled ice-ocean model with sea levels physics and increased horizontal resolution (13.89 km). This model is forced by winds (ECMWF forecasts) and tidal forcing. The 5-day operational forecasts are provided to all users via internet (http://www.aari.ru/main.php).

The accuracy of the sea level reproduction has been estimated for both diagnostic (based on observed forcing) and predicted (based on 6-day ECMWF forecasts of sea level atmospheric pressure) simulations. The accuracy of sea level calculations depends mostly on the accuracy of external forcing. The Root Mean Square Error (RMSE) of the predicted sea levels is approximately 17 cm for the 3-day predictions and it increases to 22 cm for the predictions between 3 and 6 days in advance.

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Wind stresses at sea surface and sea ice are calculated based on bulk formulas recommended by AOGM and are assumed to be identical. Frictional terms at sea ice and ocean interface are proportional to the second order of sea ice and ocean velocities difference. Sea ice internal interaction forces are calculated in a viscous form proposed by Rothrock (1975). The observed sea ice concentration is used as initial condition at the beginning of predictions. Ocean state parameters (T, S, currents) after long-term model run under climatologic forcing are used as initial conditions for operational forecasts. Sea ice thickness is 2 meters everywhere and does not change in time.

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