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Semidiurnal tides in the Laptev Sea Shelf zone

Vera Fofonova (1,2), Alexey Androsov (1), Sergey Danilov (1), Markus Janout (1), and Karen Wiltshire (2)

(1) The Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany, (2) The Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Helgoland, Germany

The topographic features of the south-eastern part of the Laptev Sea make it very sensitive to tidally-induced mixing that dominates over the eastern Siberian Shelf. The south-eastern part of the Laptev Sea, which includes the Lena Delta region, represents a large, shallow, estuarine area with dominant depths of about 10–30 m and complex shape of the coastline. The Unstructured Grid Finite Volume Coastal Ocean Model (FVCOM) is used to simulate the tidal dynamics in the Lena Delta region of the Laptev Sea in ice-free barotropic case. The grid element size is ranging from 400 m to 5 km. The model accurately resolves the irregular coastal topography with a large number of small islands and narrow channels and also bathymetry features of this domain. It reproduces the major semidiurnal tidal waves M_2 and S_2, which are the most important in generating large sea level amplitudes and currents over the considered shallow area. For the domain under consideration a special procedure has been developed for the construction of optimal open boundary conditions (OBC) for tidal elevation for both components. These OBC are based on the results of modeling studies and observations. The observations include both recent mooring data and the standard set of tide gauge measurements used in previous studies. The simulated tidal maps show an improved agreement with observations as compared to other modeling studies performed for a larger area. The residual circulation, energy fluxes and the impact of additional bathymetric information are also discussed. The residuals of the energy budget are small implying that the budget is nearly balanced in the numerical simulations.