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Nonlinear Internal Waves and their influence on the seabed off the Sakhalin Shelf: Numerical Study

Ekaterina Rouvinskaya (1), Andrey Kurkin (1), Oxana Kurkina (1,2,3), Tatiana Talipova (1,3)

(1) Nizhny Novgorod State Technical University n.a. R.E. Alekseev, Department of Applied Mathematics, Nizhny Novgorod, Russian Federation (aakurkin@gmail.com), (2) Department of Mathematics, Faculty of Business Informatics and Applied Mathematics, National Research University Higher School of Economics, Nizhny Novgorod, Russia (okurkina@hse.ru), (3) Institute of Applied Physics, Department of Nonlinear Geophysical Processes, Nizhny Novgorod, Russia

We present several examples of modelling of internal waves in the Sea of Okhotsk, on the Sakhalin island shelf. The considered region is characterized by strong tidal currents and strong gradients of underwater relief.

Usually analyzing long-wave processes (such as internal waves) in the ocean researchers first of all pay attention to the amplitude of isopycnal (isothermal, isohaline) displacements. But while long waves propagate, the motion of particles takes place through all the water column – it means that these waves have considerable influence upon bottom processes. For example, it's well-known that when internal waves pass through, water particle velocities are maximal exactly on the bottom and surface of fluid.

To analyze the velocities of currents induced by nonlinear internal gravity waves we used the results of numerical simulations in the framework of code IGWResearch: the 2.5D (vertical plane) full nonlinear governing equations for incompressible stratified ideal fluid in Boussinesq approximation on a rotating f-plane. The computations were carried out for the conditions approximating Sakhalin island shelf. The barotropic tidal forcing was defined in the model as a superposition of different tidal components whose amplitudes were chosen on a base of observations for the considered region.

It is shown that internal nonlinear long-wave processes induce near-bed currents whose velocities are comparable and can even exceed the typical velocities of barotropic tidal flows and large-scale currents in the ocean. The calculated velocity field can be further used in the models describing bottom boundary layer.