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# Modeling of sedimentation and resuspension processes induced by intensive internal gravity waves in the coastal water systems with the use of the advection-diffusion equation for sediment concentration

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Intensive internal gravity waves influence bottom topography in the coastal zone. They induce substantial flows in the bottom layer that are essential for the formation of suspension and for the sediment transport. It is necessary to develop a mathematical model to predict the state of the seabed near the coastline to assess and ensure safety during the building and operation of the hydraulic engineering constructions. There are many models which are used to predict the impact of storm waves on the sediment transport processes. Such models for the impact of the tsunami waves are also actively developing. In recent years, the influence of intense internal waves on the sedimentation processes is also of a special interest. In this study we adapt one of such models, that is based on the advection-diffusion equation and allows to study processes of resuspension under the influence of internal gravity waves in the coastal zone, for solving the specific practical problems.

During the numerical simulation precomputed velocity values are substituted in the advection - diffusion equation for sediment concentration at each time step and each node of the computational grid. Velocity values are obtained by the simulation of the internal waves' dynamics by using the IGW Research software package for numerical integration of fully nonlinear two-dimensional (vertical plane) system of equations of hydrodynamics of inviscid incompressible stratified fluid in the Boussinesq approximation bearing in mind the impact of barotropic tide.

It is necessary to set the initial velocity and density distribution in the computational domain, bottom topography, as well as the value of the Coriolis parameter and, if necessary, the parameters of the tidal wave to carry out numerical calculations in the software package IGW Research. To initialize the background conditions of the numerical model we used data records obtained in the summer in the southern part of the shelf zone of Sakhalin Island from 1999 to 2003, provided by SakhNIRO, Russia. The process of assimilation of field data with numerical model is described in detail in our previous studies.

It has been shown that process of suspension formation is quite intense for the investigated condition. Concentration of suspended particles significantly increases during the tide, especially on naturally uneven bottom relief as well as on the right boundary of the computational domain (near shoreline). Pronounced nepheloid layer is produced. Its thickness is about 5.6 m. At the phase of low tide, the process of suspension sediment production stops, and suspended particles are beginning to settle because of the small vertical velocities. Thickness of nepheloid layer is actively reduced. Obviously, this should lead to a change in the bottom relief.

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