Geophysical Research Abstracts
Vol. 16, EGU2014-16151, 2014
EGU General Assembly 2014

Mathematical modelling of the bottom relief reformation on the basis of the 2D sediment transport model coupled with 3D hydrodynamics model

Alexander Sukhinov (1), Alexander Chistyakov (1), Elena Alekseenko (2), Bernard Roux (3), Paul Gang Chen (3), and Christian Kharif (4)

(1) Southern Federal Univercity, Russia (sukhinov@gmail.com), (2) Université d'Aix-Marseille, Université du Sud Toulon-Var, CNRS/INSU, IRD, MIO, UM 110, (3) M2P2, CNRS, UMR 7340, Aix-Marseille Université, Ecole Centrale Marseille, (4) IRPHE, CNRS, UMR 7342, Aix-Marseille Université, Ecole Centrale Marseille

A special place in terms of complexity and practical significance belongs to the processes associated with transport of sediments in coastal aquatic systems. Coastal dynamics and coastal bottom topography are largely determined by the nature of sediment transport in the coastal zone under the influence of waves and currents. In this work we concider a spatially two-dimensional model of sediment transport, taking into account the following physical parameters and processes: soil porosity, the critical shear stress at which sediment begins moving, turbulent exchange, dynamically changing geometry and function of the bottom elevation level, wind induced currents, bottom shear. Concidered sediment transport model coupled with 2D and 3D models of hydrodynamics Azov3D and implemented on a high performance machine. One of the main feature is that the built discrete model is absolutely stable and completely conservative, in particular, satisfies the law of mass conservation. The coupled model is numerically implemented on the basis of the pressure correction method taking into account nonhydrostatic approximation using the three equations of motion that allows to more adequately describe the hydrodynamic processes near the coastline and on the basis of finite volume method that uses a function of partially filled cells. Results of numerical experiments allow to analyze the dynamics of changes in the bottom geometry, structures and sediment formation, suspension transport, to predict the occurrence of marine ridges and their growth and transformation, to predict the change of the concentration field in the case of emissions from a source, and to predict siltage of navigable channels. The developed on the basis of the parallel programs for high performance system of SFedU model was applied to study the consequences of the naval channel digging in the docks of Arkhangelsk terminal.