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2D and 3D numerical modeling of Central Kuril Islands tsunamis

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Recently two strong tsunamigenic earthquakes occurred in vicinity of the Central Kuril Islands (15.11.2006, Mw=8.3 and 13.01.2007, Ms=8.2). In summer of 2007, for the first time after the tsunamis, field survey of the Central Kuril Islands was arranged by Institute of Marine Geology and Geophysics of Far Eastern Branch RAS. Until the survey, except just a few records (Yuzhno-Kurilsk, Malokurilskoe, Kholmsk, Starodubskoe, and Magadan; wave height up to 0.5 m), there was a lack of information on the tsunami manifestations on Russian territory. According to the survey data, the maximum run-up height on the Central Kuril Islands reached 20 m. An averaged run-up height on the Simushir and Ketoi Islands which were the closest to the tsunami sources reached 10 m. Exact tsunami modeling, especially in shallow water regions, requires reliable bathymetric data. In our calculations a combined bathymetric grid composed from Digital Atlas (GEBCO, British Oceanographic Data Centre) and data extracted from unclassified nautical charts of Head Department of Navigation and Oceanography, Ministry of Defense of the Russian Federation. 2D numerical modeling of the tsunamis was performed in the framework of the linear long-wave theory. The linearized shallow water equations written in spherical coordinate system were reduced to the wave equation in respect of water surface disturbance. The non-reflective boundary conditions were specified at open-sea boundaries. Along the coast line the normal velocity (i.e. the normal derivative of surface disturbance) is set to zero. Initial water surface elevation we considered to be equal to permanent vertical coseismic bottom deformations calculated from USGS data using the Okada model. 3D numerical model is based on the linear potential theory of ideal homogeneous compressible fluid in the field of gravity. The non-reflective boundary conditions for

acoustic waves are specified at open-sea boundaries. Along the coast line the normal velocity is set to zero. Normal velocity at absolutely rigid bottom is used as disturbance source. Free surface condition is imposed on the top of calculation domain. The model allows calculating water surface displacement and fields of water velocity and dynamical pressure. In this talk results of numerical experiments as well as their comparison with observations data will be presented. Particular features of tsunami generation and propagation within 2D and 3D models will be discussed.