Geophysical Research Abstracts
Vol. 20, EGU2018-6138, 2018
EGU General Assembly 2018

Tsunami waves in a rotating ocean

Gulnaz Nurislamova and Mikhail Nosov
Lomonosov Moscow State University, Faculty of Physics, Russian Federation (gulnaz1205@yandex.ru)

The main mechanism of tsunami generation consists in the displacement of water by co-seismic deformation of the ocean bottom resulted from strong earthquakes. In case of very strong seismic event the displaced water volume may amount up to hundred of cubic kilometers. Gravity forces the displaced water volume to be spreaded in the ocean. This process results in a displacement of water particles in horizontal direction. Being affected by the Coriolis force the horizontal motion of water particles leads to the formation of a geostrophic vortex. This is the physical essence of the processes we are investigating. The strict formulation of the research problem is as follows. We consider the problem of tsunami generation by ocean-bottom deformation in a rotating ocean both analytically and numerically. First, under assumption of constant ocean depth, we solve analytically static problems showing the existence of residual hydrodynamic fields in the vicinity of tsunami source. Then, again analytically for the case of ocean of constant depth, we treat dynamic problems analyzing the formation of the residual fields together with tsunami waves. The most astonishing analytical result is that water volume displaced by co-seismic deformation in a tsunami source does not spread throughout the basin but remains inside the geostrophic vortex which radius is about of Rossby radius of deformation. Another result is that the Earth rotation always (slightly) diminishes tsunami wave energy because part of the energy turns out to be trapped in the geostrophic vortex. Finally, making use of numerical simulation we study manifestation of the Earth rotation for some recent tsunami events. This work was supported by the Russian Foundation for Basic Research, projects16-35-00231, 16-05-00053.