

A multi-grid algorithm for transpacific and regional tsunami modeling

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The material presented in this paper can be divided into two parts. The first is the implementation of algorithms for generating tsunamis in the course of numerical experiments as a result of the initial ellipsoidal water surface displacement or by boundary conditions. In the second part, the realization is described of *the multi-grid algorithm for tsunami computations*.

Tsunami sources are usually located in deep-water areas. So, if we want to estimate tsunami parameters near the coastline the computational domain must include both deep and shallow-water areas. A standard stability condition for numerical algorithms used for modeling requires the wave advancement at one time step be less than a spatial grid-step. In this case, we should use a small enough time step (for the computation stability in deep-water areas of the domain), which makes computations on a shallow shelf with an unreasonably small time step be too long.

The multi-grid algorithm for the tsunami propagation computations from the initial source to the coastline that uses scale switching has been developed. Computations are carried out on a sequence of grids with various resolutions where one is embedded into another. Tsunami wave parameters are transferred from the larger domain to the embedded smaller one by means of the boundary conditions. Using the method proposed the numerical modeling of tsunami generated by a model ellipsoidal source located in the middle of the Pacific was carried out. We are demonstrating that the proposed method effectively works in case of poor correlated gridded bathymetries with different resolutions as well as in using the pipeline computational scheme.

Keywords: Tsunami Numerical Modeling, Shallow-Water Model, Computational Grid, Grid Step, Boundary Conditions, Pipelined Computing