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Approaches to real-time tsunami wave parameters evaluation

Mikhail Lavrentyev (1), Vasily Titov (2), and Alexey Romanenko (1)

(1) Novosibirsk State University, Novosibirsk, Russian Federation (mmlavrentiev@gmail.com), (2) University of Washington, Seattle, USA (vasily.titov@noaa.gov)

Timely prediction of tsunami wave parameters is still among actual problems for tsunami risk mitigation. After the Great East Japan Earthquake (Mach 11, 2011) it takes only 20 minutes for tsunami wave to approach the cost of Japan after the quake.
Existing models and software applications allow experts to simulate tsunami wave propagation rather fast. However, all the models require knowledge about initial see-face disturbance at tsunami source. Seismic data, available right after the event, provide the information about earthquake magnitude and epicenter location. There are a number of approaches to evaluate the initial see-face disturbance (using knowledge about the trench geo structure, satellite imaging, etc.). One of perspective approaches is to recalculate tsunami wave profiles, recorded by deep-ocean stations like DART buoys or GPS equipment, in terms of initial sea surface displacement.
The so-called preliminary calculation strategy suggests that the targeted subduction zone is covered by a number rectangular “unit sources” 50x100 km. Wave propagation from each unit source, caused by the unified shape (typical for the given subduction zone), is calculated in advance other the entire aquatoria. After real event the wave profile, measure at certain sensor, is approximated as linear combination of model signals from the above unit sources, calculated at the same point. Method was proved to be rather accurate. However, it takes valuable time to recover initial displacement at tsunami source in case of larger zone of disturbance (e.g. about 20 minutes for processing tsunami epicenter covered with six unit-sources).
We suggest new algorithm for above mentioned model. This is based on Fourier theory and involves orthogonal decomposition of simulated profiles, calculated from the unit sources. It takes only about 1 second to recover tsunami source of twenty unit-sources. This allows one to speak about possibility to develop real-time system for evaluating tsunami.