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Fast method to calculate tsunami arrival times

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Exact arrival time of tsunami wave at coast or/and sensor is among important parameters for tsunami risk mitigation. Among the existing methods we mention: simulation of synthetic tsunami wave propagation from the given source; permanent data check at sensor system. Both approaches require extended CPU time or data transfer. Here we suggest alternative method based only on kinematics computation.

The method is based on kinematic calculation of tsunami wave front line. Precise algorithms to move the points at the front line and, in case of necessity, to add new points, have been proposed. To start with, this method was successfully tested in an area with constant depth. Then the model bathymetry with parabolic and sloping bottom relief, in which cases exact analytical solutions are available, were studied. New algorithm was proved to be precise.

The method gives possibility to compute not only tsunami travel times but also the wave rays. Tsunami amplitude can be estimated by wave-ray's divergence and depth change along wave route. The wave amplitude was estimated and then compared to results of numerical tests, obtained within the shallow-water numerical modeling of tsunami propagation using the MOST software package. For the model (slope-like) bathymetry the results differs by only a few percent. The advantage of proposed method is rapidness and low computer resources requirement.