Tsunami source parameters versus earthquake magnitude and depth: Monte Carlo simulation

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Studying tsunamis and other oceanic phenomena of seismotectonic origin it is often necessary to know general relationships between parameters of the tsunami source and characteristics of the earthquake such as magnitude and depth. Among all possible parameters of a tsunami source we consider only those parameters which can be unambiguously calculated from the vertical component of co-seismic bottom deformations. There are three of them: double-amplitude of vertical bottom deformation, displaced water volume, potential energy of the initial elevation. Co-seismic bottom deformations we calculate making use of the Okada formulae for a finite rectangular fault. In order to diminish number of the input parameters, we involve the scaling laws by Kanamori and Anderson and the definition of the seismic moment. Specifying a certain values for earthquake magnitude and depth, the rest of the input parameters (dip and rake angles) were chosen randomly. As a result of Monte Carlo simulation we obtain synthetic distributions of the tsunami source parameters which allow us to determine the maximal and the most probable values. Ultimately, we reveal simple relationships between the maximum and the most probable values of tsunami source parameters and earthquake magnitude and depth.