

Abstract

Generation and Propagation of Tsunami Wave under the Effect of Stochastic Bottom Topography

We study the nature of the tsunami generation and propagation resulting from unilateral spreading of a stochastic source model driven by a Gaussian white noise. This model is used to study the tsunami amplitude amplification as a function of the noise intensity and rise time. Tsunami waveforms within the frame of the linearized shallow water theory for constant water depth are analyzed analytically by transform methods (Laplace in time and Fourier in space). We derived and analyzed the mean and variance of the random tsunami waves as a function of the propagated uplift length, noise intensity and the average depth of the ocean along the generation and propagation path. The amplification of tsunami amplitudes builds up progressively as time increases during the generation process due to wave focusing while the maximum wave amplitude decreases with time during the propagation process due to the geometric spreading and also due to dispersion. The increase of the normalized noise intensity on the bottom topography leads to an increase in oscillations in the free surface elevation. The mean amplitude and the variance are proportional to the propagation length of the stochastic source model and inversely proportional with the water depth.