

The Detection of Tsunami Propagation Path by Using Sensitivity Kernel Distribution

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Predicting the inundation height and arrival time by tsunami propagation analysis are very important in the tsunami disaster prevention. On the other hand, it is also an important issue to elucidate tsunami propagation path. The tsunami propagation path has been commonly calculated by wave ray method, it has used in combination with the tsunami propagation analysis based on linear long wave theory and, shallow water theory. However, in the wave ray method, it's difficult to set an appropriate initial value and boundary conditions consistent with tsunami propagation analysis. So we must pay attention these characteristics in considering the analysis result.

Anyway, applying the sensitivity kernel distribution and adjoint field which used in seismic tomography to the tsunami wave field, we investigated the tsunami propagation path. In this method, it is also possible to detect a propagation path of the specific component extracted from a tsunami waveform by adding a routine for propagating a tsunami waveform in the reverse direction to the general tsunami propagation analysis code.

First, we verified this method whether it is possible to detect tsunami propagation path to the observed point in the ideal space. It was assumed water of constant depth and Gaussian distribution as an initial water level.

In addition, we used this method to detect how the far-field tsunami propagate to the Japan coast. We set the calculation target range that can be covered almost whole Pacific Ocean area whose mesh size is 10 sec, the wave source was the 1960 Chilean tsunami. Analyzing characteristics of tsunami is propagated which comes from Hawaiian island across the north-south, we confirmed the result as same as previous method by wave ray method.

An issue in the future, it's necessary to consider a practical method to extract and propagate specific components of the tsunami waveform, and verify the possibility of applying this method for the tsunami propagation analysis based on dispersive wave theory and shallow water theory. It is thought that they will be expanded the range of application.

Keywords: Tsunami propagation path, Tsunami propagation analysis, Wave ray method, Adjoint method, Adjoint field, Sensitivity kernel distribution