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Estimation of S-wave velocity structure in focal area of the 2003 Northern Miyagi Prefecture Earthquake.

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In 2003 Northern Miyagi Prefecture Earthquake, damage of wooden houses was observed in the focal area. The ground motion characteristics in the focal area are not clearly understood, because there are a few seismic stations near the focal area. It is expected that the ground motions in the area were affected by the sediments with low S-wave velocity near the surface. Actually, the record of the main shock observed at Ishinomaki in the area shows a 1-sec period dominant peak of later phases. In order to clarify the mechanism of the characteristics, we tried to estimate the underground structure by waveform inversion of S-wave of the aftershock data observed by Yamanaka et al. [2004].

Estimate of S-wave velocity structure is made with analysis method based on Suzuki (2009) focusing on the initial of S-wave. Velocity waveform of seismic record is represented by a simple source time function in the method. The incident plane wave in the bottom of the horizontally-layered ground model is assumed, The response is calculated using the method of Haskell (1960). Then, an S-wave velocity structure is determined so as to fit the waveform after the initial S-wave. In inversion, we use a genetic algorithm in Yamanaka and Ishida [1995] to minimize the sum of squares of difference between the calculated waveform and observed waveform.

Estimated Underground structure represents locality according to surface geology, Therefore, we made a 3D subsurface structure model from the inversion results with gravity anomaly [GSJ, 200 0].We, then, simulate ground motion by finite difference method, using the subsurface structure model.

In the 2D simulations, we used the plane wave incident that is short duration Ricker wavelet and actual ground motion. We found the significant later phases in the synthetic motions and concluded that the later phases in the 2003 Northern Miyagi Prefecture Earthquake is surface waves converted from S-wave by the irregularity of sediment.
We will be trying to simulate wave propagation in the 3D model.

Keywords: ground surface, S-wave, S-wave velocity structure, genetic algorithm, waveform inversion, simulation of earthquake ground motion