Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SCG062-12 Room:IC Time:May 27 15:00-15:15

Integrated velocity model of shallow and deep subsurface structure in Niigata region for strong-motion evaluation

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1. Introduction

The deep (between seismic bedrock and engineering bedrock) and shallow subsurface structures are individually modeled in the most of strong-motion evaluation. Now we are studying the method integrating shallow subsurface structure with deep structure in Niigata region to improve the accuracy of the strong-motion evaluation.

2. Initial model

We use the ”Subsurface Structure for Deep Sedimentary Layers of Japan for Strong-motion Evaluation” for ”National Seismic Hazard Maps for Japan” as the deep subsurface structure. In this model, the improvement by the H/V spectrum ratio of the observed records at the strong-motion station had been applied for the ground motions in period of 1 second or more. In addition, improvements based on ground motion simulations for aftershocks of the 2004 Mid Niigata prefecture earthquake had been also applied for Niigata region in this model.

For modeling the shallow subsurface structure, we collected the borehole data as much as possible. We modeled the shallow subsurface structure in every 250m mesh based on geological features by using about 10,000 borehole data in the Niigata region. Here the physical properties necessary for the strong-motion evaluation are given from empirical relations with N value. Therefore, the validity is not verified at this stage.

3. Upgrade of the model

The upgrade of the subsurface structure model by integrating shallow structure with deep structure so that ground motion can be duplicated in broad period range (0.1-10 seconds) is necessary to improve the accuracy of strong-motion evaluation. In order to overcome the above problem, we executed high-density microtremor measurements in and around the sedimentary basins. And we are studying the upgrade of the integrated subsurface structure model by using the phase velocities of the Rayleigh waves and H/V spectrum ratio obtained from the microtremor measurements together with the establishment of the technique itself.

Keywords: Integrated structure model, strong-motion, borehole data, microtremor measurements