

Estimating body wave velocity using group velocity of surface waves in the Chugoku Region

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1. Introduction

Doi et al. (2003) estimated the distribution of the S wave reflectors in the source region of the 2000 Western Tottori Earthquake by reflection method using waveform data of Group for the Dense Aftershock Observations of the 2000 Western Tottori Earthquake. They found that the thickness and the depth of the lower crust change beneath the source region. Now analyses for crustal structure are conducted in various fields and the relationship between the earthquake generating process and crustal structure is discussed. However, it is rarely done in a wide region such as the entire Chugoku Region (e.g. Zhao et al., 2000). The damaged M6-7 class earthquakes occur in northern Chugoku Region such as 1943 Tottori Earthquake and 2000 Western Tottori Earthquake. We think that it is suitable for comparison between crustal structure and the region where earthquakes occur.

2. Method

In order to estimate the crustal structure in Chugoku Region, various approaches are taken such as reflection method (e.g. Doi et al., 2003; Nishida et al., 2002), refraction method, travel time tomography and receiver function analysis (e.g. Ueno et al., 2005; Yamauchi et al., 2003). However, two dimensional analysis are take in many cases for reflection and refraction analysis, so it is difficult to estimate the crustal structure in a broad way. Receiver function analysis enables us to image the crustal structure in a broad way but its resolution is about 5-10 km. In this analysis, we used surface waves (especially Rayleigh waves) from local earthquakes (with the epicentral distance 100-300 kilometers) and estimate the body wave velocity in the crust from the group velocity of the surface waves.

3. Analysis and results

We used triggered waveform data recorded at the K-NET stations in the Chugoku Region. The procedures are following. First, we identify the Rayleigh wave from record section plot. Next, we applied the Gaussian filter with the central frequency 0.2Hz (frequency band width is 0.1Hz). Then, we read the time when the envelope of the Rayleigh wave reaches largest. We set analysis area as 132-134 E and 33.5-35.5 N and took grids at the interval of 0.1 degree in this analysis area. Assuming the surface wave as a plane wave, we estimated the group velocity at the grid using the stations within 40 km from that grid. We analyzed the 2005 West off Fukuoka Prefecture Earthquake. Group velocities of the Rayleigh waves show almost the same direction and their magnitudes are 2.5-4.4 km/sec. However, this estimation contains much misfit because of inaccuracy in reading the phase and of the distribution of the stations. Moreover, obtained group velocity reflected the body wave velocity in the shallow depth (at 0-5 km deep), so more analyses are necessary to estimate the velocity in the crust and the depth of the velocity discontinuity.

Acknowledgement: we used K-NET waveform data.