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Estimation of velocity discontinuities in and around the swarm seismicity region beneath the Kii Peninsula

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There is a non-volcanic swarm seismicity beneath the Wakayama region, southwest Japan (Mizoue, 1971; Matsunami and Nakamura, 2004). Mizoue (1971) detected the S wave reflection phase from the Conrad discontinuity at depth of ˜20 km. Recent receiver function analyses (e.g. Yamauchi et al., 2003; Shiomi et al., 2008; Ueno et al., 2008; Shibutani et al, 2009) also detected the velocity discontinuity at depth of ˜20 km in the whole Wakayama region. Kato et al. (2010) conducted the dense seismic observation in the southern region of the swarm activity and detected the low Vp/Vs region at depth of ˜8 km through travel time tomography. Though crustal structure has been studied in this region, the mechanism of the swarm activity is not still completely understood.

In this study, we investigated lateral velocity discontinuity distribution in and around the swarm region, using Sp converted waves from deep events. We used waveforms recorded at Hi-net and university stations in the Wakayama region from ˜20 deep events which occurred in the Pacific Plate at depths of 320-420 km beneath the Kinki district. Converted waves from deep events which contain high frequency (˜5 Hz) components enable us to estimate velocity discontinuities with high resolution and even in the region where no crustal earthquakes occur. First, two horizontal components were rotated into radial and transverse ones and picked S time by eye. Then, updown components recorded at each station are arranged at the picked S time by the order of their azimuths to detect the coherent phases. We applied to the waveforms bandpass filters of 1.2-1.5 Hz and 1.2-3.0 Hz in order to estimate the large-scale (e.g the Moho discontinuity) and crustal velocity discontinuities, respectively. Particle motions were drawn to confirm that the detected phases are the converted waves.

As a result, we found velocity discontinuities at every station at depths of ˜20 and ˜40 km. These discontinuities are thought to correspond to the Conrad and the Moho discontinuities from previous studies. We also detected converted waves at depths of ˜10 km in the swarm region, which was located at the lower limit of the seismicity in the crust. In the future work, we will estimate heterogeneous structure with high resolution and discuss its relation to the generation process of the swarm activity.

Keywords: velocity discontinuity, converted waves, swarm activity, the Conrad discontinuity