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Analyses of transverse component of teleseismic P-waves recorded at Hi-net stations

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Short-wavelength heterogeneities of the structure beneath Japan has been recently well studied by many kinds of analyses such as coda-Q, multi lapse time window analyses, peak time delay analyses and so on. In the present study, we evaluate the heterogeneity by analyzing transverse component amplitudes of teleseismic P-waves. Using teleseismic P-wave has a merit in that the structure of all Japan are evaluated almost at once, using the same earthquake. Radiation patterns are not necessarily considered. We analyze the data from 2002 to 2009 recorded at Hi-net station by NIED. We measure the ratio of the energy in transverse component to the total energy of the P-waves, which is theoretically related to the strength of short-wavelength heterogeneity (Kubanza et al., 2006). The earthquakes with a magnitude of 5.5-6.6 at depth > 300 km are analyzed, and signals of P-waves from these earthquakes are band-pass filtered at 0.25-0.5, 0.5-1.0, 1.0-2.0, 2.0-4.0, 4.0-8.0 Hz. We select the data with a large signal to noise ratio (more than 5), and average the ratios for each station at the five frequency bands. The results obtained at these frequency bands show the following characteristics: Large ratios, which represent strong heterogeneity, are recognized mainly at around the Fossa Magna in the central Japan and the Kanto region. The western boundary of the large ratio to small ratios almost correspond to the Itoigawa-Shizuoka tectonic line. We also find large ratios along the volcanic front in the Tohoku region, and around active volcanoes in Kyushu regions. Small ratios representing weak heterogeneity are observed mainly at the northern part of Hokkaido, along the Sanriku coast. The western Japan such as Chugoku and Shikoku districts are mostly characterized by weak heterogeneity. Slightly large ratios may be recognized along the Median tectonic line in the Shikoku island. The spatial changes of the ratios, which reflect the generation of transverse component in P-wave, are well matched with the geological settings of Japan island.

Keywords: P-wave, transverse component, scattering, heterogeneous structure