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Spatial distribution of random velocity inhomogeneities at western Nankai trough

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Major interplate earthquakes at Nankai trough show various rupture patterns, for example, the individual rupture of one segment or nearly simultaneous or successive ruptures of contiguous segments. Lithosphere structures around the Nankai trough are intensively studied by using active and passive seismic sources to elucidate their relation with seismicity and segment distribution. From 2008, Japan Agency for Marine-Earth Science and Technology (JAMSTEC) conducted seismic surveys at Nankai trough as a part of ”Research concerning Interaction Between the Tokai, Tonankai and Nankai Earthquakes” funded by Ministry of Education, Culture, Sports, Science and Technology, Japan. This study applied the peak delay time analysis [e.g., Takahashi et al. 2009] to estimate the spatial distribution of random inhomogeneities in the crust and uppermost mantle. Peak delay time is defined as the time lag from S-wave onset to the maximal amplitude arrival. This measurement mainly reflects the accumulated effect of multiple forward scattering, and is insensitive to the medium inelasticity. We measured peak delay times from the RMS envelopes of horizontal components at 4-8Hz, 8-16Hz and 16-32Hz. This study used the velocity seismograms that are recorded by 665 ocean bottom seismographs, 20 DONET stations, and 532 onshore seismic stations. Onshore stations are composed of the F-net and Hi-net stations that are maintained by National Research Institute for Earth Science and Disaster Prevention (NIED) of Japan. It is assumed that the random inhomogeneities are represented by the von Karman type power spectral density function (PSDF). Inversion analysis shows that medium at the Nankai trough is characterized by weak inhomogeneities with steep spectral gradient. That means inhomogeneities at smaller wavelength (˜ a few hundred meters) are significantly weak. Long wavelength component of inhomogeneities, meanwhile, shows some anomalies along the Nankai trough. Strong inhomogeneities at large wavelength are imaged at Hyuga-nada and Kii-channel. Similar strong random inhomogeneities are found beneath west Shikoku at 20-60km depth and around the Cape Shionomisaki at 20-60km depth. Strong inhomogeneities at west Shikoku and Cape Sionomisaki are located in non-volcanic tremor zones. Similar random inhomogeneities were found in high-microseismicity area in Hokkaido, and existence fluid was pointed out by velocity structure analysis [Kita et al. 2010]. These results suggest that random inhomogeneity is an important medium property related with seismicity and geofluid distribution.

Keywords: Nankai Trough, random media, scattering