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Spatial distribution of random velocity inhomogeneities around the fault zone of Nankai Earthquake

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The Nankai trough is a convergent margin where the Philippine Sea plate is descending beneath the Eurasian plate. There are some fault segments of large interplate earthquakes that are called Tokai, Tonankai, and Nankai earthquakes. According to the studies on earthquake history, their rupture propagation shows various patterns such as a rupture of one segment and nearly simultaneous rupture of contiguous segments. 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 evaluated the spatial distribution of random velocity inhomogeneities from Hyuga-nada to Kii-channel by using velocity seismograms of small and moderate sized earthquakes.

We applied the peak delay time analyses to investigate the random inhomogeneity distribution. Peak delay time is defined as the time lag from the S-wave onset to its maximal amplitude arrival. This quantity reflects the accumulation of multiple forward scattering due to random velocity inhomogeneities, and is quite insensitive to the inelastic attenuation. Peak delay times are measured from the root mean squared envelopes of horizontal components at 4-8Hz, 8-16Hz and 16-32Hz. This study used the velocity seismograms that are recorded by 495 ocean bottom seismographs and 378 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. Minimal value distribution of the peak delay time (e.g., Takahashi et al. 2007) shows that strongly inhomogeneous regions in Nankai trough are located at Hyuga-nada and Kii-Channel. Significantly strong inhomogeneity at Kii-channel is almost located at the subducted seamount (Kodaira et al. 2002). We also conducted the inversion analysis of the peak delay times to investigate the spatial distribution of power spectral density function (PSDF) of random velocity inhomogeneities (e.g., Takahashi et al. 2009). It is assumed that the random inhomogeneities are represented by the von Karman type PSDF. Preliminary result of inversion analysis shows that spectral gradient of PSDF (i.e., scale dependence of inhomogeneities) are the same overt the Nankai trough, but random inhomogeneities at smaller wavenumber shows large values at the southwestern part of Hyuga-nada and Kii-channel. Anomaly at Hyuga-nada is almost located at the subducted Kyushu Palau ridge. Similar random inhomogeneities are imaged near the remnant of ancient arc in the northern Izu-Bonin arc (Takahashi et al. 2011). We speculate these random inhomogeneities reflect the remnant of ancient volcanic activities. These results imply that random inhomogeneities at Kii-channel are possibly related to the subducted seamount, and that random inhomogeneities are useful to discuss the medium characteristics in subduction zone.