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Spatial variation in scale length of deep low-frequency tremor inferred from duration-amplitude scaling in western Shiko

HORINO, Kazuki[1*] ; HIRAMATSU, Yoshihiro[2] ; MIZUKAMI, Tomoyuki[2] ; OBARA, Kazushige[3] ; MATSUZAWA, Takanori[4]

[1]Division of Natural System, Graduate School of Natural Science and Technology, Kanazawa University, [2]School of Natural System, College of Science and Engineering, Kanazawa University, [3]Earthquake Research Institute, University of Tokyo, [4]National Research Institute for Earth Sciences and Disaster Prevention

Slip properties on plate interface vary largely along dip direction from seismic to aseismic slip. At the transition zone at depths of 25-35 km, non-volcanic deep low-frequency (DLF) tremor and short-term slow slip event occur in the Nankai subduction zone. Recent detailed studies (e.g. Obara, 2010) reveal along dip and along strike variations in the occurrence and the migration of DLF tremor in the transition zone. We report here an along dip variation in scale length of DLF tremor inferred from duration-amplitude scaling in the western Shikoku.

A physical process of natural phenomena is reflected by scaling law, for example, frequency of occurrence versus size distribution. Watanabe et al. (2007) reported that a duration-amplitude distribution of DLF tremor shows a better fit to the exponential model rather than the power-law model, which is different from regular earthquakes. We investigate the duration-amplitude distribution of DLF tremor using Hi-net data in the western Shikoku. The procedure of analysis is the same as that of Watanabe et al. (2007).

We focus on the slope of the exponential distribution for the duration-amplitude distribution of DLF tremor. The value of the slope is small in the western area and large in the eastern area. Noting along dip direction, we can recognize a weak variation of the value of the slope. Deeper DLF tremor tends to show a larger value of the slope than shallower DLF. A large value of the slope means a small scale length and vice versa.

Beneath the western Shikoku, the configuration and the age distribution of the subducting Philippine Sea plate changes significantly along the strike, generating a large variation in a thermal structure. Such a variation causes various modes of serpentinization in the hanging wall mantle. The resultant structures due to the different modes are the most likely cause of the detected transition of the scale length.

Keywords: deep low-freqency tremor, scaling law, subduction zone, size distribution, serpentinization