Surface roughness of the Philippine Sea plate at Nankai subduction zone

*Tsutomu Takahashi[1], Ayako Nakanishi[1], Shuichi Kodaira[1], Yoshiyuki Kaneda[2]

1. JAMSTEC, 2. Kagawa University

Seismic fault surfaces have roughness over a broad spatial scale range. In this study, we measured surface roughness of subducting Philippine Sea plate along several seismic survey lines at Nankai trough. Surface geometry of the subducting plate have been estimated by analyzing both the wide-angle refraction and high-resolution seismic-reflection surveys by Nakanishi et al. (2018). They estimated velocity structures from the former data with consideration for travel times of reflected waves from the top of the Philippine Sea plate of the latter data. Uncertainties of their geometry of the Philippine Sea plate can be examined by the uncertainties of velocity structures in the overriding continental plate.
First, we examined the P-wave velocity structures in the continental plate. Power spectra of the velocity fluctuations obey a power-law at small wavenumbers. We also find a clear decrease of power spectral density at larger wavenumbers. Cutoff wavenumber of this change almost corresponds to the inverse of receiver interval. Such decrease of power spectral density is probably caused by a spatial smoothness constraint of velocity estimation. Then, we examined the surface geometries at wavenumbers smaller than the cutoff wavenumber. Power spectra of surface geometries shows self-affine property. We applied bandpass filters for geometry data and mapped the root mean squared amplitudes of filtered geometries as surface roughness. Roughness is large at Hyuga-nada, and becomes small near the trough-axis off south of Shikoku. The small roughness area off Shikoku shows low activity of regular and slow earthquakes. Meanwhile, Hyuga-nada area shows high activity of low frequency earthquakes (Yamashita et al. 2015). Since surface roughness is relevant to a small-scale stress concentration on faults, this result implies an importance of surface roughness for seismicity.

Acknowledgement
This study was supported by “Research Project for Compound Disaster Mitigation on the Great Earthquakes and Tsunamis around the Nankai Trough Region” of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan.

Keywords: surface roughness, Philippine Sea plate, velocity inhomogeneity, self-affine

©2019. Japan Geoscience Union. All Right Reserved.