Insight into plate interaction in subduction zones from various observed parameters

*Takashi Nishizawa[1], Yukitoshi Fukahata[2]

1. Graduate School of Science, Kyoto University, 2. Disaster Prevention Research Institute, Kyoto University

Subduction zones have characteristic topography: high in the island arc, low in the trench, and high in the outer-rise. Matsu'ura & Sato (1989) demonstrated that steady plate subduction brings about deformation that accumulates at a constant rate by imposing dislocation on the plate interface. Furthermore, Hashimoto et al. (2004) constructed a realistic 3-D plate interface model in and around Japan and applied the dislocation model. The calculated uplift rates are consistent with observed free-air gravity anomaly patterns. Fukahata & Matsu'ura (2016) gave intuitive physical explanation for the formation of the characteristic topography in subduction zones based on the dislocation model.

In this study, we consider the plate interaction in subduction zones based on observed data. We investigate the topography and free-air gravity anomalies in subduction zones all over the world and discuss the characteristics of them quantitatively. Because the topography and free-air gravity anomaly data include short-wavelength anomalies such as seamounts, several pre-processing operations were performed. For example, an ensemble averaging technique in the frequency domain was used to obtain a profile representing each segment (Bassett et al., 2015). For the obtained topography and gravity anomaly data, we investigated the relationship between them and other parameters (e.g., plate velocity, bending moment, strain regime, and plate geometry) potentially related to the formation of topography. Through this study, we aim to understand what kind of parameters are important for the formation of the characteristic topography in subduction zones, which will give some constraints on the formation models.

Keywords: Long-term crustal deformation, Plate interaction, Free-air gravity anomaly

