Numerical simulation of earthquake generation cycles along the Japan Trench

*Ryoko Nakata[1], Takane Hori[2], Seiichi Miura[2], Ryota Hino[1]

1. Graduate School of Science, Tohoku University, 2. Research Institute for Marine Geodynamics, Japan Agency for Marine-Earth Science and Technology

Seismic, geodetic and paleoseismological studies have demonstrated that the large coseismic slip in the shallow area which caused the 2011 Tohoku-Oki earthquake was limited to the middle segment of the Japan Trench [e.g., Iinuma et al., 2012; Ikehara et al., 2016]. In contrast, in the shallow area off the coast of Fukushima Prefecture, i.e. the southern segment of the trench, postseismic slips were predominant [Iinuma et al., 2016; Tomita et al., 2017]. The observed negative residual gravity anomaly area [Bassett et al., 2016] in the southern segment corresponds to the postseismic slip area. At the southern segment, slow earthquakes include low-frequency earthquakes, tectonic tremors, and very-low-frequency earthquakes, which are distributed complementary to the coseismic slip and overlapping the postseismic slip area of the Tohoku-Oki earthquake [Matsuzawa et al. 2015; Nishikawa et al., 2019; Ohta et al., 2019]. In the northern segment, slow-slips [Uchida et al., 2016] and tsunami earthquakes [Tanioka & Satake, 1996; Satake et al., 2017] occurred. We conducted numerical simulation of earthquake generation cycles along the Japan Trench. In the southern segment, we assumed evident frictional heterogeneity caused by a thick low-velocity channel layer in the shallow part of the off Fukushima [Tsuru et al, 2002; Miura et al., 2003; 2005]. Then, we efficiently reproduced M9 earthquakes recurring only in the middle, followed by evident postseismic slips in the south. In the northern segment, we are conducting the simulations to reproduce a situation in which the 2011 M~9 earthquake and the 1896 M~8 Meiji-Sanriku earthquake have occurred independently even though their source areas are adjacent to each other. In our presentation, we will discuss the factors that control these complementary spatial distributions of slips along the Japan Trench.

