

Direct and precise geodetic measurement across the Japan Trench after the 2011 Tohoku-oki earthquake

*Ryusuke Yamamoto¹, Ryota Hino¹, Motoyuki Kido², Chie Honsho²

1. Graduate School of Science, Tohoku University, 2. International Research Institute for Disaster Science, Tohoku University

The 2011 Tohoku-oki earthquake (Tohoku Earthquake: M_w 9.0) caused over 50 m coseismic slip. After then many geodetic observations such as on-shore GNSS, GPS/Acoustic (GPS/A), and others, have been carried out. Especially, GPS/A played important role to reveal large off-shore coseismic displacement and subsequent postseismic deformation, which can be interpreted by viscoelastic relaxation (Sun et al., 2014, Nature; Watanabe et al., 2014, GRL; Tomita et al., 2015, GRL) and/or afterslip. Because GPS/A observation alone cannot reveal the afterslip of megathrust in the shallow dip of the trench, “direct-path acoustic ranging”, which can measure precise relative distance (e.g., \sim mm/yr precision for 1 km baseline) between two stations, was used across the trench. It periodically measures two-way travel-time and is corrected the calculated sound velocity after the recovery. Prior to this study, the same observations were conducted twice; they were 2013 (\sim 150-days) (Osada et al., 2014, JpGU) and 2014-2015 (\sim 250-days) (Yamamoto et al., 2016, JpGU), respectively. These observations proved the capability to measure as long as \sim 10 km baseline and found no significant relative motion across the trench.

In September 2015, we installed five instruments at the same, the region of large coseismic slip (e.g., linuma et al., 2012, JGR) and recovered in September 2016 (\sim 360-days observation). The result shows no significant movement across the trench axis like as in the previous surveys. This result shows fully locked state and may clarify the absence of postseismic slip in the shallower part in this area and at least 2013-2016.

In March 2017, we plan to install five instruments across the Japan Trench off-Fukushima, where instead large postseismic slip (e.g., Sun and Wang, 2015, JGR; linuma et al., 2016, Nature Comm.). This auxiliary observation may reveal spatial variation of convergence rate along the trench axis.

Acknowledgement: This observation is supported by JSPS KAKENHI (26000002). The installation and recovery of the instruments were carried out during the KAIREI (KR15-15) and SHINSEIMARU (KS-16-14) cruises.

Keywords: 2011 Tohoku-oki earthquake, Tohoku Earthquake, seafloor geodesy, acoustic ranging