

Detection of postseismic slip after the 2011 Tohoku Earthquake by means of direct path acoustic ranging (DPR)

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The 2011 Tohoku Earthquake caused massive, over ~ 50m, coseismic slip, especially the off-Miyagi region. After the earthquake, large postseismic deformation was detected by GPS-Acoustic (GPS-A) observations and the deformation in the large coseismic slip area was significantly affected by the viscoelastic relaxation after the coseismic deformation. Therefore, it is difficult to identify the contribution of the shallow postseismic slip (after slip) in the seafloor deformation data. In this study, we try to detect the shallow postseismic slip by using direct path acoustic ranging (DPR).

DPR periodically measures two-way travel times between a pair of two stations. We can obtain precise range by calculating the product of travel time and the sound velocity in seawater. The sound velocity in seawater is estimated from temperature, pressure and salinity, so we also measure temperature and pressure. In this presentation, we show the result of two site of observations: the off-Miyagi and the off-Fukushima. The observations at the off-Miyagi were executed three times (2013, 2014-2015, 2015-2016), and at the off-Fukushima is now in progress (2017-). In the off-Miyagi region, no significant shortenings were detected in all the observation periods, from 2013 to 2016.

The results from series of the off-Miyagi observations suggest that shallow postseismic slip did not occurred at least in the period from 2013 to 2016 in the region where the massive coseismic slip had occurred. In off-Fukushima region, we collected the measurement data for about seven months, from March 2017 to October 2017, by an acoustic data transmission. Preliminary analysis to the obtained data suggests noticeable shortening of the baselines across the trench axis in the off-Fukushima, as opposed to the results in the off-Miyagi. The difference in the DPR results made in the two sites along the Japan Trench may represent the spatial heterogeneity of postseismic slip in the shallow portion of the plate boundary near the Japan Trench after the 2011 Tohoku Earthquake.

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