Significance of ocean bottom pressure measurement for detecting interplate slow slip events in the Miyagi-Oki region

Shiori Ii[1]; Takeshi Iinuma[1]; Daisuke Inazu[2]; Ryota Hino[1]; Hiromi Fujimoto[1]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.; [2] Inst. Stat. Math.

In the Miyagi-Oki region, M7.5 class interplate earthquakes are known to occur with a repeating interval of about 40 years. The latest earthquake occurred in 2005. Some studies about the earthquake using onshore GPS data revealed that the postseismic slip expanded with time. However, there is a discrepancy between the direction of rupture propagation estimated by Miura et al. (2006) and that by Miyazaki et al. (2006). This indicates that it is difficult to estimate the slip distribution along the plate boundary below the seafloor only from onshore GPS data.

To improve spatial resolution of the slip distribution in sub-sea area, continuous seafloor observation of crustal movement is the most effective. Ocean Bottom Pressure Gauge (OBPG) is one of methods to observe deformation of seafloor continuously. Assuming that the level of sea surface does not change, we can detect the vertical movement of the seafloor by measuring the pressure, which is proportional to the height of water column above the observing site. In November 2008, we deployed five OBPGs in the Miyagi-Oki region.

In this study, we performed a series of numerical simulations to evaluate the effectiveness of the ocean bottom pressure measurement. We gave an assumed slip on the plate boundary and calculated surface deformations from the slip. Then we estimated slip on the plate boundary from the surface deformations by an inversion analysis. We evaluated the detectability by comparing amount and location of the given with estimated ones. We performed the simulations by assuming different locations of slip to evaluate spatial variation of the detectability for a given station distribution. By changing the network geometry, we further sought optimum geometry of the OBPGs.

The numerical simulation indicated that the detectability of slow slip event is significantly improved by adding the OBPG data as compared to the results using only the GPS data. As to the geometry of OBPG deployments, the longer array extending toward the Japan Trench gives the better detectability in wide area.

To evaluate the detectability in more realistic situation, it is necessary to evaluate 1) how the noise in pressure data affects the inversion performance and 2) how the offshore OBPR (or bottom pressure) observations improve the estimation of rupture process of propagating slip events.