GPS/Acoustic seafloor positioning off the northeastern Japan

Yukihito Osada[1]; Motoyuki Kido[1]; Tomoko Mizukami[1]; Satoshi Miura[1]; Hiromi Fujimoto[1]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.

Large earthquakes occurred around northeastern Japan associated with subduction of oceanic plates such as the Pacific plate. Spatial distribution of the seismic coupling into he subduction zone of the Japan Trench has been estimated based on GPS observation (ex. Suwa et al., 2006). This result shows the strong coupling in the area off Miyagi. In this study, however, the lack of data in sea area limits the resolution and repeatability of back slip estimation on the undersea plate boundary. Therefore it is important to extend the geodetic observation into the seafloor. GPS/Acoustic (GPS/A) observation, which combined kinematic GPS and acoustic ranging technique, can be the most probable method for monitoring seafloor crustal movement.

We present the results of experiments carried out off northeastern Japan in the Japan Trench subduction among 2003 and 2006. We deployed an array of three PXPs at GJT4 (142 50'E, 38 25'N) in August 2003 during KT-03-12 cruise of the R/V Tansei-maru. We then estimated the position of each PXP using data collected while the buoy shifted around the PXP. We had little time during the cruise to precisely locate the center of the PXP array. We revisited this site in August 2004, June 2005, August 2005, November 2005 and November 2006 for precise positioning of the PXP array center using the data collected with the buoy above the array center. Throughout the observation epochs, shore stations at SNR and AOB were maintained as the GPS reference stations. Sampling interval was 1second for logging both on land and at sea. The baseline length for KGPS positioning was about 110km. We estimate the slip vector associated with the plate motion to be about 5cm NW between August 2004 and June 2005. This slip vector roughly agrees with that estimated from GPS observation on land (Suwa et al., 2006). However, it is necessary to improve it to the analysis after 20005 Miyagi-oki earthquake. We introduced 10HzGPS receiver (PolaRx2@) into the observation after 2006 June, and tried the accuracy improvement. As a result, the improvement was seen about the random scatter of short period (November 2006).

At other sites, we started the observation in 2003. We estimate the position of the array center to be below 10cm in longitude and latitude of the standard deviation. In next step we relocate the center of the PXP array using the data collected near the array center at a cruise between 2003 and 2006.

This research was done as part of RR2002 and DONET projects.