**D058-009** Room: C416 Time: May 28 11:15-11:30

# Evaluation of accuracy and error sources in kinematic GPS analyses for seafloor geodesy

# Satoshi Miura[1], Yukihito Osada[2], Aaron Sweeney[1], Hiromi Fujimoto[3]

[1] RCPEVE,Tohoku Univ., [2] ERI, Univ. Tokyo, [3] School of Sci., Tohoku Univ.

Owing to the densification of GPS observation network on land in this decade, many kinds of crustal deformation due to relative plate motion, earthquake occurrence, volcanic activity, and so on, were observed. Most part of plate boundaries and seismogenic zones of interplate earthquakes exist beneath ocean and our knowledge on spatiotemporal variations in interplate coupling near plate boundaries and on generation processes of those earthquakes are still limited. Seafloor geodesy will consequently play a very important role to improve our understanding for the physical process near plate boundaries. Seafloor positioning using a GPS/Acoustic technique is the one of the potential method to detect the displacement occurring at the ocean bottom. The accuracy of the technique owes to two parts: one from acoustic ranging in the seawater, and the other from kinematic GPS (KGPS) analysis.

First, we carried out an experiment to confirm the capability of the kinematic analysis using GIPSY/OASIS-II for a long baseline of about 310 km. We used two GPS stations on land, one as a reference station in Sendai, and the other in Tokyo as a rover one, whose coordinate can vary from epoch to epoch. GPS receivers, Ashtech Z-12 and Z-surveyor was utilized together with rubidium oscillators to stabilize receiver clock. This baseline length is required for our project because the farthest transponder array is at 280 km east from the nearest coastal GPS station. The 1-cm stability of the kinematic GPS solution was demonstrated in the horizontal components of the 310-km baseline over the course of one day, while the ambiguity-fixed solutions were not derived without the rubidium oscillators. The vertical component showing fluctuation in a few hours period is probably due to unmodeled parameters in the analysis such as multipath and/or trade-off with tropospheric delay.

We joined KT01-11 cruise of the R/V Tansei-maru, Ocean Research Institute (ORI), University of Tokyo, around the Japan Trench in late July 2001 and could allot 4 days to GPS/Acoustic experiments. We deployed three precision acoustic transponders both on the Pacific plate (280 km from the coast, depth around 5450 m) and on the landward slope (110 km from the coast, depth around 1600 m). The seaward site is in a flat basin. The landward site lies near existing seafloor observatories: an ocean bottom seismometer monitored via a fiber-optic and is above a zone where an earthquake is suspected in the near future.

We used a surface buoy with 3 GPS antennas, a motion sensor, a hydrophone, and a computer for data acquisition and control for GPS/Acoustic observations. The buoy was towed about 80 m away from the R/V Tansei-maru to reduce the impact of ship noise on the acoustic measurements. The resolution of the two-way travel time of acoustic signals is preliminarily estimated to be about 1 cm for both the shallow- and deep-water PXP systems (Fujimoto et al., and Osada et al,, presented in this meeting). We have also confirmed the ability of kinematic GPS analysis to resolve a 310-km baseline on land to be better than 1 cm. Operation was monitored and controlled remotely via wireless Ethernet to the ship.

The position of each antenna on the buoy was estimated independently with respect to the reference station in Sendai. Time variations of inter-antenna baseline lengths demonstrate that the short-term repeatability of kinematic GPS analysis on a drifting buoy were stable to less than 10 mm of RMS. We expect that the combined GPS/Acoustic technique will be capable of resolving centimeter-level seafloor displacements over the course of a few months.