Evaluation test of StarFire system as a real-time monitor for GPS positioning during seafloor geodetic observation

Masashi Mochizuki[1]; Koji Kawai[2]; Tadashi Ishikawa[2]; Yoshihiro Matsumoto[2]; Jianxin Li[3]; Zengo Yoshida[1]; Masayuki Fujita[2]; Akira Asada[4]

[1] IIS, Univ. of Tokyo; [2] Hydrogr. and Oceanogr. Dept. of Japan; [3] GNSS Technologies Inc.; [4] IIS

Institute of Industrial Science, University of Tokyo and Hydrographic and Oceanographic Department, Japan Coast Guard have been constructing the geodetic observation network on the seafloor around Japan. The observation network, which consists of eighteen seafloor geodetic reference stations, has been built along the ocean trench regions.

Most of the seafloor reference stations are situated on the landward slope of the ocean trenches, where are 50 - 150km far from the nearest GPS reference sites on land. We employ a kinematic GPS software called IT (Interferometric Translocation), which was developed specially for very long baseline kinematic GPS positioning (Colombo et al, 2000), to achieve centimeter-level precise positioning of the acoustic transducer during transmitting and receiving ranging signals. Even though the IT is high-integrity software, kinematic GPS positioning for very long baseline has to be performed under severe conditions. We need to pay close attentions to obtain the best possible quality data and provide them to the IT in order to get precise positioning stably.

It is not easy for us to understand quality of obtained GPS data in detail till applying the IT to the data, because kinematic GPS analysis is achieved as a post-processing. If we have any method that can detect degradation of received GPS data or monitor the status of the kinematic GPS positioning during our seafloor geodetic observations, we can perform agile management of the observation to obtain much higher quality data.

Commercial satellite DGPS system called as StarFire is one of possible facilities that we regard as a monitor for quality of kinematic GPS observation for our seafloor geodetic measurement. The purpose of this study is to evaluate how the StarFire system performs on the R/Vs that we used for the seafloor geodetic observations.

The StarFire system was developed based on the WADGPS technology provided by NavCom Technology Inc.. The StarFire has transitioned from a set of regional DGPS networks which provided high accuracy service over independent continental areas to a robust unified global network offering unprecedented accuracy. This global network provides uniform sub-decimeter real time service over almost the entire Earth. It is based on technology called Real Time GIPSY developed by the JPL for the NASA (NavCom Tech. Inc. Technical Doc.)

We had a cruise to conduct campaign observations at MYGI and MYGW reference sites from 1st to 17th June, 2005. In this cruise we carried out an evaluation test of the StarFire system on board. Antenna and receiver unit for the StarFire system were installed on the afterdeck, in addition to usual seafloor geodetic observation system. About eight hours long positioning observations were designed and conducted with the StarFire system almost every day in the cruise. As well as recording the real-time coordinates outputted from the StarFire system, we stored raw data received from GPS satellites with the StarFire receiver. The kinematic GPS analyses are applied to the raw data with IT software (and one of the commercial softwares, GrafNav by WayPoint Co.Ltd.). The StarFire solutions are compared to the IT solutions in order to evaluate its performance. Comparisons between two kinds of solutions obtained under various sea conditions that change from day to day will give us idea whether the StarFire system can be used robustly as a real time monitoring system for kinematic GPS positioning or not. Evaluation process is now going on. We will show evaluation results in our presentation.