Effects of bias of reference GPS position on observation for ocean buttom crustal deformation

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Our research group, Nagoya Univ., has conducted the observation of ocean-bottom crustal deformation by using GPS/Acoustic techniques to know the process of subduction of the Philippine Sea plate around the Nankai and Suruga Trough. In this system, we estimate the position of a surveying vessel by Kinematic GPS analysis and measure the distance between the vessel and the benchmark on the sea floor by Acoustic measurements. Next we determine the location of the benchmark. Repeated GPS/Acoustic observation has been conducted at the Kumano Basin and Suruga Bay since 2004 and 2005, respectively. For the repeatability of observation, the location of benchmark is determined within a precision of 2-3 cm at horizontal components at the Kumano Basin (Tadokoro et al., 2006).

We have three continuous GPS sites on land for Kinematic GPS analysis, where a choke ring antenna is mounted on the top of the pillar and each receiver records dual-frequency GPS signals continuously with a sampling interval of 0.2 seconds. However estimated GPS sites velocities are inconsistent with those obtained by GEONET. This difference may be caused by following two factors. The first factor is the difference of observation period. The second factor is annual and semiannual variations of GPS time series. We neglect annual and semiannual variations when we estimate GPS sites velocities. GPS/Acoustic observation is conducted for 2-4 days par one campaign. As for GPS site coordinate, we adopt the average coordinate for about 20 days, which include one-week before and after observational days on the sea, as the reference coordinate for Kinematic GPS analysis. There is a possibility that GPS sites coordinates have some bias, because annual and semiannual variations are contained for about 20 days.

In this study, we investigate how the determination of GPS sites coordinates affects the estimation of the location of benchmark on the sea floor. We use data between November 2005 and October 2006 at the Kumano Basin and estimate GPS sites coordinates using Bernese (Ver 5.0) software. Then we calculate the variation of the location of benchmark according to the bias of GPS sites coordinates through the Kinematic GPS analysis.