Performance Evaluation of Low-cost GNSS Antenna and Receivers for Geodetic Applications

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Geospatial Information Authority of Japan (GSI) manages GNSS Earth Observation Network System (GEONET) composed by more than 1,300 Continuously Operating Reference Stations (CORS) throughout Japan, and maintains the Japanese horizontal datum reference system by providing collect GNSS data and the accurate positions of GNSS CORSs based on the reference system. The average distance between each CORS is now about 20 km, and it is enough density to maintain the reference system and to monitor large-scale crustal deformation such as plate-motions and trench type earthquake. However, it might not be enough to monitor small-scale crustal deformation such as inland earthquake or slow-slip event with the current density of the CORSs.

Although improvement of the density of CORS in GEONET is required to monitor the smaller scale crustal deformation, it is difficult to increase the number of CORS in GEONET because it might involve a significant cost to establish and maintain CORSs composed of high-end GNSS antenna and receiver for surveying. At the same time, today there are several GNSS antennas and receivers on the marker at relatively low costs ($10s- $100s). The number of CORS with the low-cost GNSS devices, which is established by private company or individual, is expected to increase in near future.

In this fiscal year, GSI has been promoting consideration to utilize the private CORS in the field of Survey, Positioning and Monitoring of crustal deformation etc, and conducting performance evaluation of the low-cost GNSS devices, which might be used in the private CORS. In the evaluation, we used some low-cost GNSS antennas and u-blox receiver module (ZED-F9P), and implemented the performance comparison between the low-cost devices and high-end devices for surveying. Preliminary estimation of phase center offset and variation of the GNSS antennas and several-months continuous observation with the low-cost setups was also conducted in the evaluation.

In this presentation, we will report the result of the performance evaluation and continuous observation.

Keywords: GNSS, Low-cost, Antenna, Receiver, Performance Evaluation