

Future enhancement of geodetic observations in Syowa Station for realization of a GGOS core site

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GGOS (Global Geodetic Observing System) is the observing system of the International Association of Geodesy (IAG) (See <http://www.ggos.org/>). By integrating different geodetic techniques, GGOS provides the observational basis to maintain a stable, accurate and global reference frame for monitoring the Earth system and for global change research. It provides observations of the three fundamental geodetic observables and their variations, that is, the Earth's shape, the Earth's gravity field and the Earth's rotational motion. It directly contributes to the emerging Global Earth Observing System of Systems (GEOSS) not only with the accurate reference frame required for many components of GEOSS but also with observations related to the global hydrological cycle including ice melting, the dynamics of atmosphere and oceans, and natural hazards and disasters.

In order to achieve these tasks, GGOS core sites play the most important role. The basic requirement for the core site is a collocation site with four space geodetic techniques, namely, GNSS (Global Navigation Satellite), SLR (Satellite Laser Ranging), VLBI (Very Long Baseline Interferometry, preferably, VLBI2010), and DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite). It is also required that AG (absolute gravimeter) and SG (superconducting gravimeter) observations are conducted as the reference on the potential level of the Earth's gravity field and meteorological, hydrological and other observations are complementarily conducted. Since it is not an easy task to fill all these requirements, there are only a few GGOS core sites have been realized so far.

Many geodetic observations have been conducted in Syowa Station. Space geodetic observations including VLBI, GNSS and DORIS have been continued for more than fifteen years there (Shibuya et al. 2003). Observations of temporal gravity variation have also been conducted using three SGs since 1993 as well as AG measurements using absolute gravimeter FG-5 at 5 times at IAGBN(A) site in Gravity Hut (Higashi et al. 2013). In addition, ocean tide observation at Nisinoura Cove has been made since 1966 using bottom pressure gauge (Odamaki et al. 1991). Although Syowa Station locates on an island close to Antarctic continent, it is constructed on a stable bedrock and far from Antarctic plate boundary. Artificial noises are also low, because the station is far from civilized nations. Therefore, data qualities derived from the observations are maintained in high level and the observations in the station can provide appropriate data to develop GGOS. We have a plan to introduce VLBI2010 system by renewing the present VLBI system. We also plan to implement satellite tracking by using SLR technique. We can say Syowa Station will be one of the most promising observation sites as a GGOS core site. These further enhancement of geodetic observations in Syowa Station will contribute to realize the objectives of GGOS, and consequently, international collaborations for monitoring the Earth system.

References

- Higashi T, K. Doi, H. Hayakawa, T. Kazama, H. Ohta, S. Osono, T. Hanyu, S. Iwanami, Y. Aoyama, K. Shibuya and Y. Fukuda, Gravity Measurements Using Absolute Gravimeter FG5 and Secular Gravity Changes at Syowa Station, Antarctica. *J Geod Soc Japan*, 59, 2,37-43, 2013 (in Japanese).
- Shibuya K., K. Doi and S. Aoki, Ten years' progress of Syowa Station, Antarctica, as a global geodesy network site, *Polar Geosci.*, 16, 29-52, 2003.
- Odamaki M., Y. Michida, I. Noguchi, Y. Iwanaga and K. Iwamoto, Mean sea-level observed at Syowa Station, East Antarctica, *Proc. NIPR Symp. Antarct. Geosci.*, 5, 20-28, 1991.