

Establishment of a new integrated geodetic observation system in Syowa Station for mm Global Geodetic Reference Frame (GGRF)

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Syowa Station has three independent techniques for space geodetic observation, namely, Very Long Baseline Interferometry (VLBI), Global Navigation Satellite System (GNSS), Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS). Observations by the three techniques have been continued for more than 15 years. Hence Syowa Station is one of the most critical geodetic sites in southern hemisphere for maintaining the current International Terrestrial Reference Frame (ITRF). In addition to these space geodetic observations, continuous gravity observation with superconducting gravimeters have been carried out for more than 20 years as well as repetitive absolute gravity measurements. This means that Syowa Station is a promising site to realize and maintain the GGRF with mm accuracy which is an integrated geodetic reference frame incorporating the ITRF, the International Celestial Reference Frame, the International Height Reference Frame and the Global Absolute Gravity Reference System.

To accomplish mm accuracy of the position coordinates of Syowa Station, we plan the following actions; (1) Replacement of the current VLBI system to the next generation VLBI system, (2) New installation of a next generation Satellite Laser Ranging (SLR) system, (3) Implementation of co-location survey between the space geodetic observation sites and the absolute gravity measurement site with an accuracy of 1 mm, and (4) Realization of gigabit data communication between Syowa Station and Japan.

Establishment of the new space geodetic site can provide co-located position coordinates of 1 mm accuracy combined with the absolute gravity value. The coordinates and gravity value will contribute to realization and maintenance of the mm GGRF. At the same time, the provided temporal variations of the coordinates and the gravity value allow us to investigate solid Earth deformation induced by Glacial Isostatic Adjustment (GIA), plate motion and current change in cryosphere, ocean and atmosphere.

Keywords: GGRF, space geodetic observation, GIA