Improvement of method that makes Japanese old and dense gravity data consistent with Japan gravity standardization net 2016

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Geospatial Information Authority of Japan (GSI) have established a new gravity standardization network of Japan, named the Japan Gravity Standardization Net. 2016 (JGSN2016) that is constituted of about 30 absolute measure stations and 200 relative measure station, from the latest land gravity measurements covering the whole country. The accuracy of JGSN2016 is evaluated around 10 micro Gal for absolute measurement and 20 micro Gal for relative measurement in standard deviation. GSI also had conducted relative gravity measurements at benchmarks and some of triangular control points from 1967 to 1993 in order to obtain dense spatial distribution of surface gravity and also utilize them for orthometric height correction of levelling survey. The data obtained by the measurements comes to 14,000 in total, refers JGSN75 and has been utilized for calibration of measurement devices etc. as nationally authorized gravity standard. But these dense gravity data are not consistent with recent measurements referring JGSN2016 and the difference sometimes exceeds range of the measurement error. The maximum difference between JGSN75 and JGSN2016 at the gravity station of GSI is over some 100 micro Gal.

GNSS-derived orthometric height determination has been recently developed. As a result, the importance of land gravity data densely covering the whole country has been gradually increasing because the data has been increasingly utilized as fundamental data for modeling of geoid, a reference surface for orthometric height. The latest, Highly-reliable land gravity data covering the country are essential for improving accuracy and reliability of geoid model. However, it is almost impossible to obtain new data referring JGSN2016 with in short period by newly conducting time- and cost-consuming land gravity measurement for the whole country.

To resolve these problems, we have developed a method that makes Japanese old and dense gravity data consistent with JGSN2016. We reported a solution for that problem in JpGU2016 and JpGU2017. In the method, we estimated uplift/subsidence displacement of observation station due to crustal deformation, mass redistribution caused by earthquake event and system offset that has existed since establishment of each gravity reference individually. Consequently, we achieve to convert old gravity data to new gravity data in about 40 micro Gal precision. We will report contribution for geoid modeling and application of this method for gravity data of other institutions.

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