Airborne gravity survey for establishment of a new precise gravimetric geoid model

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The vertical datum of Japan has been maintained by the Geospatial Information Authority of Japan (GSI) since more than 130 years ago. Basically it has been realized by conducting periodical leveling surveys in order to determine orthometric height of benchmarks, which are installed at approximately 2 km intervals along main national highways, based on the mean sea level of the Tokyo Bay. However, since this method takes much time and costs a lot, it is quite difficult to reflect vertical land movements quickly caused by such as plate motions and big earthquakes.

In order to tackle this situation, the GSI established a geoid model, called GSIGEO2011+2000, in April 2013 and also implemented a new manual for utilizing the model for public surveys in order to obtain orthometric height from GNSS data. It in fact played a certain role in improving the efficiency of surveying. Geoid models released by the GSI so far are all hybrid, which are constructed of a gravimetric geoid model and geoid heights directly measured by GNSS/leveling surveys, in order to compensate the lack of precision of the gravimetric geoid model. However, since the GNSS/leveling data are based on results of the leveling surveys, they are unavailable once crustal deformation occurs until the leveling surveys are conducted again. In order to improve the precision of the gravimetric geoid model, it is necessary to prepare high quality gravity data all over Japan. But current gravity data contain some problems such as blank areas in both mountainous areas and coastal waters , age of data and inaccuracy of location information decided by topographic map.

In order to solve these problems and make it possible to measure precise orthometric height more quickly, the GSI has been carrying out a new airborne gravity survey project since FY2018. First, we will collect high quality nationwide gravity data using aircraft, then calculate a new precise gravimetric geoid model combined the airborne gravity data with other ones such as terrestrial, marine and satellite gravity data. We are planning to introduce a new height system based on this new geoid model and ellipsoidal heights obtained from GEONET by 2014. Since the geoid model is basically very stable against the crustal deformation, it is expected to update the orthometric height immediately by GNSS data even if crustal deformation occurs.

In this presentation, we will review our future vision of the new height system and report the progress of GSI’ s airborne gravity survey project.

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