Airborne Gravity Measurement and New Gravimetric Geoid Model of Japan

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SUMMARY

Geospatial Information Authority of Japan (GSI) has been developing a highly accurate new gravimetric geoid model of Japan in order to shift from the current vertical datum based on geodetic leveling to the new one based on an accurate gravimetric geoid. In order to develop the accurate gravimetric geoid model covering the main islands of Japan, dense and precise gravity dataset covering wide wavelength range are essential. Satellite gravity missions such as GOCE etc. provides the long wavelength part of the earth's gravity field. As for the short wavelength part, we have already collected more than 300,000 land gravity data in Japanese territory which mainly covers the plain areas. However, there are still data gaps in some areas, especially coastal and shallow marine areas and high mountain regions. Therefore, we are planning to conduct airborne gravity measurements which cover the main islands of Japan including both the coastal zones and mountain regions. Airborne gravity measurement data are extremely useful to cover the middle wavelength part of the gravity field, which is essential to complement a spectral gap between the long wavelength satellite gravity data and the short wavelength terrestrial gravity data. We will prepare TAGS airborne gravimeter in FY 2018, and will conduct the airborne gravity survey from 2019 to 2022. Along with the measurements, we will develop and evaluate sub-regional prototypes of the gravimetric geoid model with the collected airborne gravity data in each year, and would open them to the public in order to promote its usefulness to potaintial users. In addition, we will continue to improve the methods for computing the gravimetric geoid model. We have already achieved approximately 5cm accuracy in standard deviation in comparison with GNSS/leveling geodetic data by adopting several improvements in modeling process including 1) improvement of method for modifying Stokes integral kernel, 2) determination of Stokes parameters based on GNSS/leveling data, 3) optimal combination of each gravity data by weighted least squares collocation, 4) introduction of residual terrain model, 5) adoption of the latest data as inputs for computation(GGM, marine gravity model and DEM) . The final target accuracy of the model is 2 to

3 cm in standard deviation. By utilizing the finalized geoid model with the new data and methods, we plan to shift to the new geoid-based vertical datum by the end of 2024.