Future vision of the society for utilizing highly precise three dimensional positioning data by applying crustal deformation and precise gravimetric geoid model

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Global Navigation Satellite System (GNSS) are conventionally used for determining reference positions in Japan by static survey activities following a uniform standard based on the survey low. In recent years, thanks to improvement of satellite positioning techniques, the utilization of GNSS positioning has been expanded to various real-time positioning services such as autonomous driving system, intelligent construction, smart agriculture and drone delivery. This trend would accelerate in the future due to new services like Centimeter Level Augmentation Service (CLAS) offered by Quasi-Zenith Satellite System (QZSS) or Precise Point Positioning (PPP) provided by private companies. Basically those kind of real-time positioning data give us ‘current’ location though most geospatial information, represented by maps, are built based on the certain ‘past’ epoch. The difference between them becomes larger year by year because of active crustal deformation in Japan. The more precise the real-time position are decided, the more careful we should treat this difference.

Therefore GSI has been developing a new system for correcting this difference in order to fully utilize the real-time positioning data by keeping consistency between existed geospatial information. The prototype of the system was offered to public from January to March in 2019 to collect feedbacks from stakeholders. We plan to launch this system officially until 2020.

It is also important to obtain precise elevation for three dimensional positioning. Historically the height system in Japan has been maintained by conducting nationwide split leveling surveys for more than 130 years. However, since it needs a lot of time and cost, it is necessary to prepare a precise geoid model for determining an orthometric height directly from an ellipsoidal height obtained by GNSS data. Hence GSI launched a new airborne gravity survey project in 2018 to collect high quality gravity data all over Japan, which is necessary to construct a new precise gravimetric geoid model within several centimeters precision. It is expected to introduce a new height system based on the new geoid model and GNSS data up to 2014. It will enable users to determine reasonable elevation data by GNSS without leveling surveys.

Through these efforts, GSI will contribute to realize the future society which fully utilize precise three dimensional position data for various geospatial information services. In this presentation, we will review the current actions of GSI and share a future vision derived from them.

Keywords: Crustal deformation model , Gravimetric geoid model, Airborne gravity survey

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