

Precise gravity field determination around Syowa station, Antarctica, by combining satellite and in-situ gravity data

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We reported a preliminary result of the gravity field determination around Syowa Station, Antarctica, by combining GOCE (Gravity field and steady-state Ocean Circulation Explorer) EGM (Earth Gravity Model) and JARE (Japanese Antarctic Research Expedition) in-situ gravity data in the JpGU 2012 meeting. In the previous study, the area concerned was restricted almost same as that of the airborne gravity measurements conducted by JARE-47. Also we only employed limited number of preprocessed shipborne and land gravity data sets to skip bias corrections. And we estimated gravity anomalies and geoid heights by means of LSC (Least Squares Collocation) method using GOCE TIM (time-wise) RL (Release) 3 EGM as the long wavelength gravity fields. In this study, we have expanded the estimation area by including more in-situ gravity data and modified the procedure of the data processing.

Major improvements since the previous study are summarized as follows; 1) expanding the calculation area to 60-80S and 20-60E by including more shipborne and land gravity data, 2) including altimetric gravity data for the area with no shipborne gravity data, and 3) applying bias corrections for the shipborne and land gravity data. The gravity field has been calculated by LSC with the empirical covariance function estimated from the airborne gravity data. The formal errors estimate for the area with enough number of gravity data are several mgals and less than 10 cm for gravity anomalies and geoidal heights, respectively. This means that the accuracy of the gravity field is approaching toward the requirements for the future global height system unification. The airborne gravity data and the GOCE EGM show a good consistency in the long wavelength components and we may not need to apply any bias corrections. On the other hands, we observed clear biases between some of shipborne and land gravity data sets and the estimated gravity fields. Thus we may need careful bias corrections tracing back to the original data sets. Several EGMs including GOCE and other satellite gravity data such as GRACE have already been released and new EGMs calculated from updated GOCE data will be released soon. We plan to evaluate and utilize these EGMs for future improvements of the gravity field determinations in the area.

Keywords: GOCE, Gravity anomaly, Geoid, Syowa Station, Antarctica