Preliminary results of simultaneous determination of topographic mass density and gravity disturbance by using gravity-geoid data

Kyozo Nozaki[1]; Makoto Ando[2]

[1] OYO; [2] Oyo Corporation

http://www.jpgu.org/meeting/

As is well known, there are two types of so-called 'gravity anomaly'. One is 'the geodetic gravity anomaly (typically the free-air anomaly in the Molodensky sense)' that deals mainly with the Earth's geometry such as the figure of the Earth including the geoid, and the other is 'the geophysical gravity anomaly (typically the Bouguer anomaly)' that deals mainly with the Earth's interior such as the subsurface density structures. However, the mutual situation of the two concepts of gravity anomaly is not in co-existence under some theoretical relations but simply in parallel-existence. Nozaki (2006) and Nozaki (2007) have shown a method to remove such defects involved in the current definition of the Bouguer anomaly, i.e. the notion of the generalized Bouguer anomaly (GBA). In the present study, the authors have attempted, based on the notion of GBA, to determin simultaneously the topographic mass density and the gravity disturbance upon the ellipsoid, by applying a method of 'FA vs. Hd diagram (Nozaki, 2006)' to the field data.

The gravity data used is provided by GSJ (Gravity CD-ROM of Japan, Ver. 2, 2004) and the geoid height used is by GSI (GSIGEO2000, gsigeome.ver4) in the area of about 100 km x 100 km around the Mt. Fuji. The results indicate that (1) the density distribution ranges 2,000 - 3,000 kg/(cubic meter) in the mountainous area with high topographic relief, however, the estimated densities often show extremely high/low values; and (2) the gravity disturbance distribution shows relative gravity highs in the areas of Izu Peninsula, Tanzawa, Misaka mountains, etc. demonstrating the consistency with the geological and geophysical evidences.

At the present stage, there exist some problems such as the resolution and stability of the solution. However, it is expected that the estimated topographic mass density distribution will be utilized in the evaluation of the indirect effects of the geoid computation, etc., while the gravity disturbance distribution will be utilized as a new geophysical gravity anomaly, which is consistent with the current framework of the physical geodesy and can be the alternative of the currect Bouguer anomaly.