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Crustal density structure derived from gravity modelling using results of seismic crustal structure surveys

FUJIOKA, Yukari[1*] ; ISHIHARA, Takemi[2]

[1]Japan Coast Guard, [2]National Institute of Advanced Science and Technology

The Japan Coast Guard (JCG) has conducted marine gravity surveys in Japan's adjacent seas as part of collecting marine-related information to the development and use of the oceans, and possesses enormous amount of marine gravity data. We calculated crustal thickness distribution in the Western Pacific area by applying the gravity inversion method (Ishihara and Koda, 2007) using these data.

Free air anomalies obtained from the satellite altimetry (Sandwell et. al., 2014) were used as a reference in order to correct deviations of marine gravity values of each surveys. In the long wavelength components, gravity data observed and these from the satellite altimetry match well. In the short wavelength components, maritime gravity data were used in preference because gravity data from the satellite altimetry include a few mGal of noises with wavelength of 20-30 km.

The initial density structure model consists of five layers; sea water, sediments, upper crust, lower crust and mantle. The depths of layers of the initial model reflect results of JCG's seismic crustal structure surveys: the depth of basement as boundary between sediments and upper crust is made by interpolation of the depth of the strong reflectors in the reflection cross section obtained from multichannel seismic reflection surveys, and the depths of the top of the lower crust and the Moho are made by interpolation of the depth of area whose velocity gradient of seismic velocity structure cross section obtained from seismic refraction surveys, respectively.

The differences of the observed free air anomalies from the gravity anomalies obtained by model calculation for the initial five layer model were divided into some components by their wavelengths because they include the effects due to the structure such as inhomogeneity in the mantle. The depths of the top of the lower crust and the Moho were obtained by inversion calculation using their anomaly contributions, then the crustal thickness distribution was estimated. According to the results, most of large seamounts are associated with the Moho convex downward, however, some of them have almost no Moho lows below them.

Keywords: gravity, inversion calculation