The examination of a hybrid geoid model for Yakushima and Nansatsu areas based on an improved gravimetric geoid model, JGEOID2000

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To combine the gravimetric geoid model, JGEOID2000(Kuroishi,2001) with the geoid undulation data by GPS/Leveling, we precisely constructed a new hybrid geoid model, GSIGEO2000(Kuroishi et al.,2002). It covered the Japanese mainland and their major surrouding island, and we replaced the island in the original model with the geoid model for isolated island. We made an examination of a hybrid geoid model for isolated islands of Yakushima, Tanegashima and Nansatsu areas(Kagoshima, Kaseda, and Ohsumi Peninsula), where were located on extensive tectonic stress field bordered on volcanic front and the north part of the Ryukyu trench. They would be expected to have large geoid gradient. Moreover, the Kuroshio Current, one of the strongest oceanic currents, runs around those areas, causing hight sea surface variability. For determination of geoid model for isolated islands, it differed from island to island. Consequently, we are new conducting GPS/Leveling surveys on major isolated island and created geoid model of those islands by considering the characteristic of the individual island self. In addition, the gravimetoric geoid model for isolated island is dominated by marine gravity data of shallow sea areas around island, which trend to be contained bias errors. So, the gravimetric geoid model for isolated islands can have comparatively large systematic errors.

Therefore, improvement of the gravimetric geoid modeling, JGEOID2000 (Kuroishi,2004) was made by a newly supplement of land gravity data in Yakushima and Tanegashima. And, marine gravity errors of JGEOID2000 were simultaneously corrected for the detection of bias errors compared with a global marine altimetric gravity model. Moreover, we conducted denser GPS/Leveling survey (GPS measurement at benchmarks) to use the geoid undulation data by GPS/Leveling surveys for Yakushima, Satsuma-Iwojima, Kuchinoerabujima, Koshikijima and the Tokara Islands in addition to Nansatsu areas.

As we fitted the improved gravimetric geoid model, JGEOID2000, with GPS-derived geoid undulations data, analyses for net of GPS at benchmark were performed in terms of GPS-derived ellipsoidal heights and leveling heights. The analyses for baseline-analysis were done by GAMIT software, network adjustment of GPS baseline analysis was applied by GLOBK software with tighter constraints to the continuous GPS stations in the nationwide GPS array of Japan, GEONET (the GPS Earth Observation Network of the GSI) in ITRF94 (epoch1997.0) frame. For the leveled height, Helmert orthometric heights were adopted from leveling survey carried out.

With regard to a hybrid geoid modeling for isolated island, we divid islands into two categories, that is, for the island near the mainland and located on continental self, and for the island far from the mainland and/or divided by steep sea floor topography, according to the surrounding sea floor topography and the distance to the mainland. This time three methods have been chiefly carried out as being stated the following. First, a hybrid geoid model was constructed by the only GPS/Leveling data. Second, for the former island of categories, the geoid-difference-grid was created by Least-squares Collocation (LSC) with the geoid difference data of the mainland. Third, for the latter the geoid difference between the geoid undulation and JGEOID2000 were gridded by spline interpolation in tension to create the corrector model for gravimetric geoid. Finaly, the precise hybrid geoid models based on an improved gravity field models were statistically evaluated with the geoid undulation data by GPS/Leveling surveys.