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Towards improvement of geoid model in Japan by GOCE data: Case study of Shikoku area

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The performance of the recently released global geopotential models (GGMs) based on 2, 8 and 12 months of data collected by the Gravity field and steady-state Ocean Circulation Explorer (GOCE) is evaluated using geoid undulations and free-air gravity anomalies over Japan. The evaluated GOCE and related GGMs include; direct solution (DIR, release 1, 2 and 3), time-wise solution (TIM, release 1, 2 and 3), space-wise solution (SPW, release 1 and 2) and Gravity Observation Combination (GOCO, release 1 and 2). Further evaluations are carried out in each of the four Japanese main islands. The performance of EGM2008 and GOCE-related GGMs over Japan is generally comparable indicating possible improvement of geoid model in Japan by GOCE data at the end of the mission. The comparisons over the four main islands reveal that EGM2008 performs better than GOCE and related GGMs in Hokkaido, Honshu and Kyushu. However, GOCE and related GGMs perform better than EGM2008 in Shikoku. GOCO02S, GOCE-DIR3 and GOCE-TIM3 have the best and similar performance in Shikoku. Given that GOCE-TIM relies exclusively on GOCE data, it is considered for geoid determination in Shikoku for further assessment. To evaluate the actual improvement of the geoid model in Shikoku area by GOCE-TIM3, the geoid over Shikoku is determined from EGM2008 and a combination of GOCE-TIM3 with EGM2008 (GOCE-TIM3/EGM2008). In both cases the same terrestrial gravity data sets are used and all the necessary reductions are applied. The Stokes-Helmert scheme in a modified form is adopted for the computations. The first improvement of geoid model over Japan by GOCE data is evident in Shikoku.

Keywords: Geoid model, Gravity, EGM2008, GOCE, Shikoku