



Evaluation of GOCE-based Global Geoid Models in Finnish Territory

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The gravity satellite mission GOCE made its final observations in the fall of 2013. By then it had exceeded its expected lifespan of one year with more than three additional years. Thus, the mission collected more data from the Earth's gravitational field than expected, and more comprehensive global geoid models have been derived ever since. The GOCE High-level Processing Facility (HPF) by ESA has published GOCE global gravity field models annually. We compared all of the 12 HPF-models as well as 3 additional GOCE, 11 GRACE and 6 combined GOCE+GRACE models with GPS-levelling data and gravity observations in Finland. The most accurate models were compared against high resolution global geoid models EGM96 and EGM2008.

The models were evaluated up to three different degrees and order: 150 (the common maximum for the GRACE models), 240 (the common maximum for the GOCE models) and maximum. When coefficients up to degree and order 150 are used, the results of the GOCE models are comparable with the results of the latest GRACE models. Generally, all of the latest GOCE and GOCE+GRACE models give standard deviations of the height anomaly differences of around 15 cm and of gravity anomaly differences of around 10 mgal over Finland. The best solutions were not always achieved with the highest maximum degree and order of the satellite gravity field models, since the highest coefficients (above 240) may be less accurately determined.

Over Finland, the latest GOCE and GOCE+GRACE models give similar results as the high resolution models EGM96 and EGM2008 when coefficients up to degree and order 240 are used. This is mainly due to the high resolution terrestrial data available in the area of Finland, which was used in the high resolution models.