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Validation of GOCE gravity gradient grids for geophysical applications

Thomas Fecher, Roland Pail, and Moritz Rexer
Technische Universität München, Institute of Astronomical and Physical Geodesy, München, Germany (pail@bv.tum.de)

In addition to global gravity models parameterized in spherical harmonic coefficients, gravity functionals such as gravity gradients, as they have been measured by the GOCE satellite, are an important data product for many user groups. Exemplarily, in geophysical modelling, the directional information contained in the gravity gradients can further constrain the inversion problem.

Global and regional gravity gradient grids have been computed in the frame of the ESA STSE GOCE+ project GeoExplore in a local north-oriented frame in two altitudes of 225 km and 255 km, basically as a combination of GOCE and GRACE information in a regional combination approach. In parallel, in the frame of the project GOCE High-level Processing Facility (HPF) global grids based purely on GOCE information have been produced by applying the space-wise approach.

Following a recommendation of the ESA GOCE User Workshop (Paris, November 2014), these grids have to be validated externally before they can be reliably used for geophysical applications. In this paper, these grid products are validated against external gravity information, by applying global gravity field models and terrestrial data bases in well-surveyed areas.

By comparing the gravity gradient grid products against reference values computed from the global satellite-only model GOCO05S (both the official as well as an unregularized version of it), it shall be evaluated if systematic effects show up, which might be related to the specific features of the combination strategy. The differences shall be analysed applying statistical test methods, and the error estimates associated with the grid products shall be evaluated. In parallel, it shall be investigated whether the gravity gradient grid product indeed contains more (high-frequency) signals than global models. This shall further be elaborated on by a validation against a combined gravity field model, which also includes terrestrial gravity and satellite altimetry data, as well as against terrestrial data in well-surveyed areas.

In this presentation, the validation method shall be briefly outlined, the evaluation results for the recent global and regional grid products that are available shall be discussed, and a recommendation for the optimum use of these products shall be derived.