Geophysical Research Abstracts
Vol. 15, EGU2013-7585, 2013
EGU General Assembly 2013

Regional and global gravity models from the analysis of GOCE level-1b data

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ESA's GOCE satellite mission delivers accurate data of high resolution and nearly global coverage. The standard approach is to analyse these observations using the globally defined spherical harmonic functions. However, regional (radial) base functions provide the advantage to be more flexible in modelling data of differing density and variability, which clearly is the case for satellite gravity data. Particularly, a regionally adapted regularisation process enables optimal damping of both, regions featuring rough signal and rather smooth areas, at the same time. This is of special interest for GOCE because of its strength in observing the high frequency part of the gravity field.

The present paper represents the final results of the project GLOREGOCE which is part of the German funded research programme REAL GOCE. The project mainly aims at providing regionally refined gravity field models by applying the short arc approach on GOCE orbit and (pure) gradiometer data. For easy investigation, regional solutions calculated on small patches all over the globe have been merged and transformed to a spherical harmonic expansion by means of quadrature methods. The power of the regional approach is demonstrated by comparison to spherical harmonic models, which are based on exactly the same processing strategy, standards and data time span. We show, that these global models are comparable in accuracy with respect to the official GOCE models published by ESA. Moreover, we will show that regional models perform even better compared to global models in the higher frequencies: In oceanic areas, the regionally adapted regularisation process leads to a noise reduction of about 10%. A more tailored choice of the regularisation areas tested for the South Sandwich Trench reveals improvements that are nearly twice as large.