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Validation of GOCE global gravitational field models by comparison with regional geoid and gravity anomaly surfaces

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The satellite gravitational gradiometry mission GOCE provides various products related to the Earth's gravitational field. One of these products is a global gravitational field model, i.e. representation of the Earth's gravitational field in terms of spherical harmonic coefficients. Such a model is used in realizing vertical reference frames in geodesy, exploring the interior of the Earth in geophysics and geology, studying the behavior of currents in oceanography, or discovering sea level rise and ice-melting in climatology.

Numerous Earth's gravitational field representations have already been derived from GOCE. These representations differ according to the time span of GOCE measurements and the theoretical approach used in the harmonic analysis. To assess the quality of the GOCE models validation by independent knowledge of the gravitational field has to be performed.

Global gravitational field models with limited spectral/spatial resolution are validated by terrestrial data. In this case, spectral inconsistency between the two sources of data has to be treated properly. An intuitive approach to perform the validation in a consistent way is offered by an adequate filtering. Transformation of the regional data into the spectral domain is performed firstly. Then a low-pass filter is applied to generate a smoothed version of the regional model with the same spectral content as the global GOCE model. Subsequently, the filtered signal is transformed back into the space domain where comparison with a GOCE geoid surface is performed.

Despite its conceptual simplicity, the development of an optimal filtering procedure is still challenging. In this contribution we address some aspects of the filtering method. Firstly, a simulation study based on EGM2008 is performed to investigate the accuracy of the direct transformation from space to frequency domain and its inverse. Moreover, various mathematical filters are considered to filter out the short wavelengths. Secondly, the most accurate filtering procedure is applied in validation of real GOCE models. The validation experiment is performed with respect to gravity anomalies and geoid undulations over the territory of Scandinavia.