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A GOCE-only gravity field model inferred from 6.7 months of data using the direct numerical method

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The objective of GOCE is to map the gravity field of the Earth at high resolution (100 km, i.e. spherical harmonics to degree and order 200) with an accumulated geoid error of less than 2-3 cm at this scale. Three methods (time-wise, space-wise and direct numerical) were selected by the European GOCE Gravity consortium (EGGc) to compute GOCE gravity fields in order to compare and evaluate them. Each method has its advantages and drawbacks.
We use the GOCE precise science kinematic orbit positions as observations instead of the GPS Satellite-to-Satellite (SST) tracking data. This pseudo-SST data contains the long wavelength gravity field signal, whereas the satellite gravity gradients (SGG) provide the high-resolution information. The 3-axes gradiometer (approximately radial, along-track, normal to the orbit plane) provides gravity gradients that are measured with a high accuracy only within the measurement bandwidth (mbw) of approximately 0.005 to 0.1 Hz. Due to this instrumental behavior, the gravity gradient observation equations must be filtered. We use a 100 through 8 seconds pass-band filter. The pseudo-SST and the SGG measurements are processed separately, producing SST and high-resolution SGG normal equations. These matrices are subsequently combined for the GOCE gravity field model adjustment and solved using Cholesky decomposition. Due to the polar gaps in the data, we apply spherical cap regularization.
This poster presents the second model delivered to ESA by means of the direct numerical method of gravity field computation with data from 1 November 2009 through 1 July 2010. This work was done in the framework of EGGc under ESA contract.