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GOCE Gravity fields established by the Celestial Mechanics Approach

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After successful application to CHAMP and GRACE data the Celestial Mechanics Approach was adapted to the GOCE mission. The colored noise of the band-limited gradiometer observable is modeled by piecewise linear parameters. Constraints on the second derivative allow for a flexibel resampling and smoothing of the piecewise linear parameters to avoid the absorption of gravitational signal to the extent possible.
Eight months of GOCE level 1b data were analyzed with the Celestial Mechanics Approach and different gravity fields were computed for test purposes with a reduced resolution of the spherical harmonic coefficients up to degree 160. The contribution from GPS hl-SST data gives better results than eight year CHAMP gravity field AIUB-CHAMP03S beyond degree 60, apart from the zonal and near zonal coefficients which are degraded due to the polar gap caused by the sun-synchronous GOCE orbit. In combination with GOCE gradiometer data the GPS part dominates the solution up to degree 35 and its influence is visible to degree 70. A GOCE-only combined GPS and gradiometer solution to a maximum degree and order of 160 is better than the six year GRACE only GPS plus K-Band solution AIUB-GRACE03S beyond degree 120, whereas resonant orders of the combined GRACE/GOCE field significantly benefit also at longer wavelengths. In the combined field no degradation due to the polar gap of the GOCE orbit is visible – thanks to the inclusion of GRACE data. Evaluation of the combined field with EGM2008 reveals an noise level over the oceans significantly below 1 mGal (up to lmax=160), major discrepancies over the continents can be attributed to terrestrial data of poor quality assimilated in EGM2008. Our first results encouraged us to set up the GOCE gradiometer normal equations up to a maximum degree of 200. The results of this effort will be presented as well.