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Use of GOCE radial gravity gradients for direct spherical harmonic coefficient estimation

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Regular (1^o, 40' and 30 ' equal-area) distributed GOCE radial gravity gradients with ground gravity at the poles have been used to compute estimates of spherical harmonic coefficients and associated error-covariances from degree 37 to degree 200. The optimal linear, minimum norm method of Least-Squares Collocation (LSC) was used with a reproducing kernel harmonic outside a Bjerhammar-sphere with radius 6369 km. This required that the gravity data at the poles was "lifted" to and altitude of 15 km above the ellipsoid using LSC.

The error-estimate at degree 100 are 0.60x10^{-9}, 0.42x10^{-9} and 0.34x10^{-9} for the 3 data-sets, respectively. The GOCE coefficient solution DIR_3 has coefficient standard deviation of 0.3x10^{-11}at this degree. The LSC error-estimate became to equal the signal degree standard deviation at degree 170, 180 and 190 for the 3 data-sets, respectively.

It is planned to used GRID-computing in order to use more than one of the gradient components. With one extra component a full system of nearly 350000 unknowns will have to be solved