

Developments in the implementation and use of Least-Squares Collocation.

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The method of Least-Squares Collocation was developed in the 1960'ties based on theoretical advances by T.Krarup and H.Moritz. The method may be used for the determination of approximations to the anomalous gravity potential (T) and associated parameters like biases or tilts. All gravity field observables which may be related to T through a linear functional may be predicted and error-estimates computed. The method has primarily been used in local or regional applications, due to the fact that a system of equations with as many unknowns as the number of observations need to be established and solved. The problem has been solved due to the use of multiprocessing in the current GRAVSOFTE implementation of GEOCOL.

The method has been implemented using isotropic reproducing kernels fitted to empirical covariance functions. The Kernels are harmonic outside a so-called Bjerhammar-sphere, which must be inside the volume bounded by the location of the used data. This problem has been overcome by initially lifting the data in Polar areas 20 km, thereby enabling global LSC solutions in the form of spherical harmonic expansions.

The theoretical possibility of computing error-estimates does not give good results due to the isotropy of the kernels used. The error estimates primarily shows where good data are located or where data are missing. However due to the advent of global gravity gradient from the ESA GOCE mission it is possible to compute local signal variances which can be used to tune the otherwise uniform estimates.