Geophysical Research Abstracts,
Vol. 11, EGU2009-6702, 2009
EGU General Assembly 2009

Truncation of Spherical Harmonic Series and its Influence on Gravity Field Modelling

T. Fecher, T. Gruber, and R. Rummel

Institute of Astronomical and Physical Geodesy Technische Universität München Germany

Least-squares adjustment is a very common and effective tool for the calculation of global gravity field models in terms of spherical harmonic series. However, since the gravity field is a continuous field function its optimal representation by a finite series of spherical harmonics is connected with a set of fundamental problems. Particularly worth mentioning here are cut off errors and aliasing effects. These problems stem from the truncation of the spherical harmonic series and from the fact that the spherical harmonic coefficients cannot be determined independently of each other within the adjustment process in case of discrete observations. The latter is shown by the non-diagonal variance-covariance matrices of gravity field solutions. Sneeuw described in 1994 that the off-diagonal matrix elements - at least if data are equally weighted – are the result of a loss of orthogonality of Legendre polynomials on regular grids.

The poster addresses questions arising from the truncation of spherical harmonic series in spherical harmonic analysis and synthesis. Such questions are: (1) How does the high frequency data content (outside the parameter space) affect the estimated spherical harmonic coefficients; (2) Where to truncate the spherical harmonic series in the adjustment process in order to avoid high frequency leakage?; (3) Given a set of spherical harmonic coefficients resulting from an adjustment, what is the effect of using only a truncated version of it?