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Regional approximation of gravity data sets with local base functions

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A large number of different geodetic applications require a gravity model or gravity information. Examples are GNSS-leveling, navigation based on inertial systems, orthorectification of aerial photographs or hydrological issues.
Recent and in particular current satellite gravity missions provide important contributions for global Earth gravity models, and these global models can be refined by airborne and terrestrial gravity observations. The most common representation of a gravity field model in terms of spherical harmonics has the disadvantage that it is difficult to represent small spatial details. An adequate modeling using a multi-scale representation is necessary in order to exploit the highest degree of information out of all these mentioned measurements.

The expansion of a signal given on or in the exterior of a sphere in spherical base functions such as spherical scaling and wavelet functions allows for such a multi-scale representation, which basically means a decomposition of the signal into a number of detail signals each related to a specific frequency band. Since different measurement types (terrestrial, airborne, spaceborne) cover different parts of the frequency spectrum, it seems reasonable to calculate the detail signals of the lower levels mainly from satellite data, the detail signals of medium levels mainly from airborne data and the detail signals of the higher levels mainly from terrestrial data. In this presentation we study the multi-scale approach by using input data from given spherical harmonic gravity models such as EGM2008 for different regional test areas. Thus, this presentation depicts the principal ideas for modeling and developing regional high resolution gravity models.