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Closed-loop tests of a regional gravity field modelling approach using radial basis functions

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Since many high-resolution observations, e.g. from terrestrial and airborne gravimetry are only available in regional areas, regional gravity field modelling becomes more and more important as an extension of the traditional global modelling of the Earth's gravitational potential. However, a lot of open questions have to be answered and problems concerning a consistent model combination and application have to be solved.

In contrast to global approaches using spherical harmonic functions, the choice of the set of basis functions for regional analysis is a central question. There exist various possibilities as wavelets, covariance functions, Slepian functions or mascons, whose advantages and disadvantages are not yet fully understood and completely studied.

In the context of inter-comparing different approaches within the ICCT JSG0.3 we tested radial basis functions as one possible method for regional gravity field modelling. We set up a closed-loop computation using simulated gravity field observations for terrestrial, airborne and satellite measurement techniques.

In this study we compute series expansion in terms of radial basis functions for various cases. Hereby we consider different spectral and spatial resolutions, we test different point grids for the location of the functions, we use input data sets from one observation type as well as from different types and we test different weighting procedures for the combined solutions.
All results are compared with validation data sets on geographical grids at topographical height for two different study areas in Europe and South America.

The analyses of the closed-loop tests give information on the internal accuracy of our regional gravity field modelling strategy. This helps to understand the interactions and relationships between different parameterizations and implementations.