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Optimally combined regional geoid models for the realization of height systems in developing countries – ORG4heights

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Precise height systems require high-resolution and high-quality gravity data. However, such data sets are sparse especially in developing or newly industrializing countries. Thus, we initiated the DFG-project "ORG4heights" for the formulation of a general scientific concept how to (1) optimally combine all available data sets and (2) estimate realistic errors. The resulting regional gravity field models then deliver the fundamental basis for (3) establishing physical national height systems.

The innovative key aspects of the project incorporate the development of a method which links (low- up to mid-resolution) gravity satellite mission data and (high- down to low-quality) terrestrial data. Hereby, an optimal combination of the data utilizing their highest measure of information including uncertainty quantification and analyzing systematic omission errors is pursued. Regional gravity field modeling via Multi-Resolution Representation (MRR) and Least Squares Collocation (LSC) are studied in detail and compared based on their theoretical fundamentals. From the findings, MRR shall be further developed towards implementing a pyramid algorithm.

Within the project, we investigate comprehensive case studies in Saudi Arabia and South America, i. e. regions with varying topography, by means of simulated data with heterogeneous distribution, resolution, quality and altitude. GPS and tide gauge records serve as complementary input or validation data. The resulting products include error propagation, internal and external validation. A generalized concept then is derived in order to establish physical height systems in developing countries. The recommendations may serve as guidelines for sciences and administration. We present the ideas and strategies of the project, which combines methodical development and practical applications with high socio-economic impact.