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Regional gravity field refinement for the determination of IHRF coordinates based on spherical basis functions

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The definition of a physical height system is an essential geodetic application of gravity field modeling. It is desirable to get global height systems consistent at a level of a few centimeters or better, for both scientific and practical reasons. To achieve this goal, a high-resolution and high-precision model for regional gravity field refinement is of great importance, especially for mountainous areas where the gravity field varies rapidly or in developing countries where only sparse observations are available.

This study focuses on the gravity field modeling in Colorado, USA, which is regarded as a very challenging study area, due to the rugged terrain, high elevation and varying gravity field. We apply an approach for regional gravity modeling using spherical radial basis functions (SRBF), developed at DGFI-TUM in the last two decades. The very long-wavelength gravity field component as well as the very short-wavelength component are removed by a global gravity model and a detailed terrain model, respectively, following the so-called "Remove-Compute-Restore" (RCR) procedure. The gravity field is calculated by parameter estimation, from which the final quasi-geoid heights are computed.

Two types of real observation data are used in this study. The terrestrial data and the airborne data are combined, and their relative weighting is determined by the method of variance component estimation. Comparisons are made between the combined solution and the solutions of using terrestrial data only as well as using airborne data only. In this presentation, we also include comparisons with other solutions based on different modeling approaches but applied to the same data sets.