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A new Geodetic Boundary Value Problem approach to high-resolution geoid computations based on relative gravity, geopotential numbers, and Mean Sea Level as the boundary data
Case study: Geoid of Southwest Finland

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In this contribution we are presenting a new Geodetic Boundary Value Problem (GBVP) approach to high-resolution geoid computations based on relative gravity from gravimetry, geopotential numbers from precise leveling, and Mean Sea Level (MSL) from satellite altimetry observations as boundary data. The specifications of the developed GBVP can be summarized as follows:

1. Using relative gravity as the boundary data and estimating the gravity of the reference point along with the geoid's solution.
2. Estimation of the height datum off-set with respect to geoid's potential along with geoid's computations.
3. Using MSL as a complementary boundary data along with other boundary values.

4. Combined solution of the marine and land geoid.

The developed GBVP is numerically tested by computing the high-resolution geoid of Southwest Finland, by using 2936 gravity data on the main land, 195 gravity data on an island, which is included in the solution, 818 geopotential numbers on the main land, 47 geopotential numbers on the island, and 812 MSL points over the Gulf of Bothnia as the boundary values. The computed geoid evaluated at 818 GPS/Leveling points on the main land and 47 GPS/Leveling points on the island. The results of the comparisons revealed the RMS of 12.7 cm for the difference of the computed geoid with the GPS/Leveling geoid on the main land and the RMS of 4.9 cm for the island part of the solution.