Spherical harmonic expansion to ultra-high resolution can be used to transform globally available digital elevation models into the high frequency contribution of Earth’s gravitational potential. It therefore interconnects satellite-based gravity measurements (GRACE, GOCE) with available ground based observations such as height anomalies from GPS-Leveling or dedicated gravity campaigns on terrain.

Besides the numerically stable and efficient method for the harmonic expansion on a sphere of reference also the transfer from geodetic to geographic coordinates and full data restoration to appropriate heights (3D synthesis) have to be considered. Using a series expansion eventually transforms spherical harmonic coefficients into topographic potential or (Bouguer-) anomalies. The used concepts will be discussed and results from ETOPO1 and ACE2 evaluated against Newtonian integration applied to local areas.