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Computation of spherical harmonic coiefficients from rigorous integration of gridded terrestrial data

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A 2D discrete Hartley transform applied to a regular grid of gravity data allows, in conjunction with the known Fourier expansions of the associated Legendre functions, to compute spherical harmonic coefficients of the Earth's disturbing potential by a rigorous integration. In this presentation, we consider a basic theory and its implementation for parallel computations. Neither usage of approximate quadrature formulas nor any pre-computation of associated Legendre functions is required to derive the spherical harmonic coefficients.

We discuss results of several closed-loop simulation studies performed for practically important cases of the integration of high-resolution point and mean gravity data referred to the sphere, to the mean Earth's ellipsoid, and to the physical surface of the Earth. Special attention is paid to analyze an impact of some possible common mistakes related to violation of geometry and averaging of a grid.