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The calculation of height anomaly with accuracy of the zero approach of the Molodensky's theory on the basis of the spherical 1D FFT

Elena Mazurova (1), Irina Ganagina (2), and Denis Goldobin (3)

(1) Siberian State Academy of Geodesy (SSGA), Novosibirsk, Russian Federation, (e_mazurova@mail.ru), (2) Siberian State Academy of Geodesy (SSGA), Novosibirsk, Russian Federation, (gam0209@yandex.ru), (3) Siberian State Academy of Geodesy (SSGA), Novosibirsk, Russian Federation, (phis.geo.sgga@gmail.com)

At present, the method of discrete linear transformations, based on two-dimensional fast algorithms like Fast Fourier Transform (FFT), Fast Hartley Transform (FHT), Fast Wavelet Transform (FWT), and others, is widely used to determine the transformants of the Earth's gravitational field in flat approximation. These algorithms are especially effective if the original information (such as gravity anomaly) is known at the grid points. Thanks to the GOCE mission, there were obtained the discrete values of gravity anomalies over the entire surface of the Earth, so it is possible to calculate the height anomaly of large areas or even across the whole surface of the Earth.
The paper presents the results of calculation of the Stokes' integral using 1D spherical FFT technique. In the method presented, the one-dimensional Fourier transform is applied to the kernel of the integral specified and application in the east-west direction, combined with the summation over the parallels. Stokes' kernel presents singularities at the origin. In order to deal with this problem, a value of zero is forced at the origin when we are using FFT, and after the computations are done, the value for the origin has to be restored.
For arrays of large-size data, this method requires more computer time than the two-dimensional spherical FFT, but it is much faster than pointwise integration. Besides, this method allows substitution calculations to be done, which saves considerably the computer memory.
Keywords: Stokes' integral, 1D spherical FFT