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Computation of height anomaly through the Fast Wavelet Transform

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Now, the central place in geodesy has been taken by satellite methods of co-ordinate determination using the signals of the GPS and GLONASS satellite navigation systems. Geodetic heights, however, computed from satellite measurements and normal heights determined by geometric leveling, exist independently from each other. The relationship between geodetic heights in a co-ordinate space and normal heights is executed by height anomalies which should be known with high accuracy. The problem of accurate determination of the gravity field transformants is caused by the fact that the classical methods of solving problems of physical geodesy are based on deriving and resolving some integrated equation. Continuous errorless values of gravity anomalies across the whole surface of the Earth are needed for that. But it is practically impossible to make a continuous gravimetric leveling, and the classical approach is not capable to produce an accurate answer without gravimetric leveling being completed. In practice, the initial information is discrete, with a lot of measuring errors, and known not across the whole surface of the Earth. Notice that Neumann's integral from which it is possible to calculate height anomaly is a convolution integral. Therefore, it is possible to use linear transformations for its calculation, such as the Fast Fourier Transform and wavelet-transform. In computing height anomaly, M.S.Molodensky's combined method is applied; with it, numerical integration is conducted only within a certain "limited area". The influence of the distant field zone is taken into account by expending the gravity anomaly into series by spherical functions. The present paper discusses the algorithm for calculating the height anomaly in the "limited area" in flat approximation. Neumann's integral calculations have been done on the basis of the fast discrete Wavelet-Transform. The results of the research into compressing the Neumann integral kernel that can be performed in calculating this integral by the Wavelet-Transform method are presented. An efficiency comparison of applying the Fast Fourier Transform and Fast Wavelet-Transform to computing the Earth's gravity field transformants has been made.