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Integrating the Gravimetric Geoid Model Using the Stokes Formula with Local Fitting Points in Palestine

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Abstract

Land and engineering surveying traditionally relied on physical elevations above mean sea level, using methods such as leveling and total stations. However, GNSS techniques have become predominant, providing elevations based on the Earth's ellipsoid. This creates discrepancies between the two systems, known as Geoid Undulation, leading to errors in calculations of elevations, slopes, and volumes. Such inaccuracies can result in engineering issues, including drainage problems and disputes related to road, water line, and sewer design. To integrate the gravimetric geoid model with local fitting points in Palestine. The process involves several steps. First, ground gravity measurements are collected and processed. Second, gravity measurements from global systems are gathered. Third, Digital Elevation Models (DEMs) are obtained. Fourth, corrections are applied to the gravity measurements to adjust them from the ground surface to the geoid level (reduction process). Next, the differences in actual gravity, global models, and gravity derived from elevation are computed, followed by applying Stokes's formula and the Remove-Store Principle to determine the geoid height. Then the geoid is compared with the reference points, and the accuracy and distribution of the differences are assessed before fitting the geoid to the reference points. Finally, the accuracy of the resulting reference system is evaluated. Finally, it has been creating a geoid system that achieves an accuracy level (1-5) cm. The final output will be stored in different file formats as a grid model of the geoid values for application in GIS software and data collectors of field software on different GNSS devices.