OPTIMUM STRATEGY TO COMBINE GRAVITY DATA IN MODELLING A GEOID OVER PENINSULAR MALAYSIA

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Under - Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Accurate geoid modeling plays a crucial role in precise geodetic computations and geophysical applications. Within geoid computation, several factors influence model accuracy, including the approach used to combine and grid gravity anomalies. In geoid modeling for Peninsular Malaysia, three types of gravity data are commonly utilized: terrestrial gravity, marine gravity, and airborne gravity. These distinct data sources vary in accuracy and can affect geoid model precision. The primary objective of this study is to assess the impact of different combinations of gravity data on geoid accuracy. To achieve this, three gravimetric geoid models were computed using various combinations of gravity data before applying the KTH method. The first geoid model (Geoid 1) incorporates 24,855 airborne gravity, 7,944 terrestrial gravity, and 175,193 satellite altimetry-derived marine gravity anomalies. The second model (Geoid 2) integrates marine and terrestrial data, while the third model (Geoid 3) combines marine and airborne gravity data. All combination and gridding processes employed the 3D Least Square Collocation method. The second objective focuses on identifying the optimal strategy for combining gravity data. Two strategies were implemented: the first involves simultaneous downward combination and gridding of data, while the second strategy prioritizes the downward combination and gridding of airborne gravity data before integrating them with terrestrial and marine gravity data. The performance evaluation of the gravimetric geoid models from the first and second objectives was carried out using 45 Global Navigation Satellite System (GNSS) leveling points. Results from the first objective indicate that the combination of three gravity anomalies (Geoid 1) yields the highest accuracy, with a standard deviation of 0.047 meters, followed by Geoid 3 (marine and airborne), and lastly, Geoid 2 (terrestrial and marine). For the second objective, findings reveal that the difference in accuracy between geoid models derived using different strategies is not significant, with accuracy differences of only 1 millimeter (0.044 meters and 0.045 meters, respectively). The findings underscore the significant impact that varying combinations of gravity data inputs have on geoid model accuracy. Notably, the strategy chosen for combining and gridding data exerts minimal influence on the precise modeling of the geoid. As a result, the crucial task of identifying optimal data combinations persists in ensuring meticulous geoid computations.

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