STUDY OF A NEW HYBRID GEOID MODEL OVER PULAU LANGKAWI

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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 Postgraduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

In Malaysia, the Department of Survey and Mapping Malaysia has developed a hybrid geoid model known as the West Malaysia Geoid 2004 (WMGeoid04). This model is fitted to the Peninsular Malaysia Geodetic Vertical Datum (PMGVD), which is referenced to the Mean Sea Level (MSL) observed at Port Klang, boasting an accuracy of approximately ±5cm. However, it's important to highlight that the leveling datum on Pulau Langkawi is still based on the Land Survey Datum 1912 (LSD12), the first official national vertical datum for Peninsular Malaysia. The discordance between the vertical datums of PMGVD and LSD12 raises concerns about the alignment of WMGeoid04 with the land leveling datum on Pulau Langkawi. Therefore, the primary objective of this study is to develop a new hybrid geoid model specifically for Pulau Langkawi.To accomplish this goal, the study employed three distinct gravimetric geoid models: WMG03A, PMGG2020, and PMSGM2014. These models were utilized to assess the performance of the new hybrid geoid, which was derived by integrating various gravimetric geoid models. In developing this novel hybrid geoid, ten GNSS leveling points were utilized to create a corrective surface. Two parametric models, "remove mean" and "remove 4-parameter," were implemented to ascertain the optimal approach for the corrective surface. The gridding of the corrective surface was executed using the LSC method. Furthermore, the correlation length and data noise value were systematically examined within intervals of 5km to 15km and 0.01m to 0.06m, respectively. Evaluation of the newly developed hybrid geoid, known as the Langkawi Hybrid Geoid 2023 (LKGWHG23), was performed alongside existing hybrid geoid models: WMGEOID04, Peninsular Malaysia Hybrid Geoid 2020 (PMHG2020), and Peninsular Malaysia Seamless Geoid Malaysia 2014 (PMSGM2014). This evaluation was based on the analysis of 10 GNSS leveling points. The results indicated that the LKGWHG23, computed using the WMG03A gravimetric geoid model, exhibited higher accuracy with a Root Mean Square Error (RMSE) of ±2.7cm. In contrast, the WMGEOID04, PMHG2020, and PMSGM2014 displayed accuracies of ±0.105m, ±0.077m, and ±0.190m, respectively. In summary, the study successfully introduced the LKGWHG23, a new hybrid geoid model tailored to Pulau Langkawi. Through meticulous evaluation, LKGWHG23 demonstrated enhanced accuracy compared to existing hybrid geoid models, signifying its potential for precise geodetic computations and geophysical applications in the region.

Keywords: hybrid geoid, orthometric height, gravimetric geoid

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