**Determination of Orthometric Heights by GNSS Observations through an Accurate Geoid Undulation Model for Sri Lanka**

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***ABSTRACT***

This study presents the development of a Geoidal Undulation Model for Sri Lanka, aiming to enhance the accuracy of orthometric height calculations derived from GNSS observations. Orthometric height, which reflects true elevation above the geoid and accounts for variations in the Earth's gravitational field, is crucial for applications in construction, surveying, and infrastructure development. Traditional methods, such as differential leveling, are time-consuming and less efficient compared to GNSS surveying. This research addresses the need for an effective way to convert ellipsoidal heights obtained through GNSS into practical orthometric heights.To achieve this, geoidal undulation data from 750 strategically distributed control points were analyzed using a polynomial surface fitting method, complemented by the least-squares adjustment for model parameter determination. The model was checked for the same data points in the model and for a independent data set which was consisted 75 data points. The findings of geoid model was revealed that 64.1% of the modeled dataset and 61.3% of independent dataset achieved an accuracy of ± 0.30m when compared to othometric height determined through leveling techniques. The model was further developed by integrating gravity measurements from EGM2008 to develop a hybrid geoid model, which enhanced the accuracy and reliability of the geoidal undulation model for Sri Lanka. The results of the hybrid model was verified that 96.1% of the modeled dataset and 98.6% of independent dataset achieved an accuracy of ± 0.30m compared to orthometric height determined through leveling techniques. These results were underscored the model's potential to streamline orthometric height calculations, making GNSS observations more applicable for real-world applications such as topographical mapping, engineering surveying etc. In future, the accuracy and the reliability of the hybrid model will be increased by incorporating terrestrial gravity data.

**Keywords:** Geoid undulation, Hybrid Geoid model, Least-square adjustment, Orthometric height, Polynomial Fitting