ISERME 2024 Proceedings
2nd September 2024 – Sapporo, Japan
https://doi.org/10.31705/ISERME.2024.13

Evaluation of Satellite-Derived Gravity Field Models in Offshore and Coastal Regions of Sri Lanka

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Abstract

To understand many geophysical phenomena, including ocean circulation, tectonic plate movement, and the Earth's interior, it is important to study the Earth's gravity field. During the past three decades, satellites have measured the Earth's static gravity. As a result, high-resolution global gravity field models have been available. This paper aims to examine the appropriateness of the satellite derived gravity field models for the offshore and coastal regions of Sri Lanka.While these eight gravity field models with ID 155-EIGEN-6S4 V2, 168-Tongji-Grace 02K, 171-GO-CONS-GCF2-TIM-R6, 174-ITSG-GRACE 2018S, 178-Tongji-GMMG2021S, 148-EIGN-6C4, 152-GECO, 167-SGG-UGM-1, and 177-SGG-UGM2 were used for the study. The mean difference value, standard deviation value, and Root Mean Square values modeled by each of the model between the observed gravity data and the BGI observed gravity data. The results indicated that 171-GO-CONS-GCF2-TIM-R6 and 177-SGG-UGM2 is the more suited model for the coastal and offshore region of Sri Lanka. The study used the SARAL-Altika satellite Altimetry data to investigate the relationship between Mean see surface height and observed gravity. No significant relationship between Mean sea surface height and marine gravity is indicated by. In addition, the influence of gravity model type on each of the LEO satellite orbit predictions was also studied. The findings of the research demonstrate that the optimal type of gravity model applied for LEO satellite orbit prediction depends on a short-term or long-term predictions. The models JGM3, EGM2008, and GL04C are more appropriate for short-term predictions, while the models JGM3, EGM96, and EIGEN2 are the best for long-term predictions. The gravity order and permanent tides also have to be taken into account for the orbital prediction.In conclusion, this research provides valuable insights into the suitability of various satellite-derived gravity field models for Sri Lanka's coastal and offshore regions. The findings also emphasize the need to consider the impact of gravity models on LEO satellite orbit prediction, particularly for new applications such as LEO navigation, which require real-time precise orbits.

Keywords: Observed Marine Gravity; Mean Sea Surface Height; Satellite Altimetry; Gravity Field Model; Coastal and offshore regions of Sri Lanka