

Transformation of Global to Local Geoid for Regional Geoid Modeling: Results from Enugu State, Nigeria

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Key words: Engineering survey; Geoinformation/GI; Reference frames; Reference systems; Remote sensing; LONG WAVELENGTH GEOID, VERTICAL REFERENCE SYSTEMS(VRS), VERTICAL REFERENCE FRAMES(VRF), TRANSFORMATION OF GLOBAL TO LOCAL GEOID (TGL), ROOT MEAN SQUARE ERROR (RMSE), NIGERIAN GEOLOGICAL AGENCY (NGSA)

SUMMARY

ABSTRACT

Regional geoid modelling is an age-long problem in geodesy. Over the years the gravimetric and geometric methods of geoid modeling stand out as the most preferred and utilized methods. However, due to several factors ranging from lack of sufficient gravity data, poor integrity of available gravity data, parametric inconsistencies in adopted national Vertical Reference Systems, improper definition of national height datum e.t.c, the use of both methods especially in developing countries is equivocal. Recently, the spatial resolution and accuracy of global geoid models (GGM) are improving for all parts of the world thus addressing the problems of availability, consistency and resolution of data. Therefore, this study proposes a low-cost method of geoid modelling, wherein the regional geoid model is obtained by transforming the global geoid to local geoid. The Transformation of Global to Local (TGL) geoid method is based on the concept of transforming ellipsoidal heights and geoidal undulations between various datums. The method was tested in Enugu state of Nigeria and the results obtained were compared with the Geometric and Gravimetric Geoid models. A total of 25 control points with known Orthometric heights and evenly distributed across the study area were used for comparing the results obtained from the three methods. Statistical analysis of the results obtained shows high level of consistency between the three (3) methods. Furthermore, Root Mean Square Errors of ± 0.123 m and ± 0.389 m were obtained between the Geometric method and the TGL then gravimetric methods respectively when compared with known orthometric heights at control points. The TGL method is recommended as a reliable alternative for regional geoid modeling in areas where funds are unavailable for rigorous gravity observations.

Keywords: Long wavelength geoid; Stokes function; GNSS / Levelling geoid; Vertical Reference

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Systems (VRS); Vertical Reference Frames (VRF), Transformation of Global to Local Geoid (TGL), Root Mean Square error (RMSE), Nigerian Geological Surveys Agency (NGSA)

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