

ABSTRACT

The Computation of A Precise Geoid for Trinidad

Karla R.L. Edwards

The first high resolution gravimetric geoid for Trinidad called TRINUWI99 was computed using the remove-restore technique, Helmert's second method of condensation and the Stokes' formula. Over 70000 edited, atmospherically-corrected land and marine gravity observations in a $5^\circ \times 5^\circ$ block about Trinidad, EGM96 geopotential model, ETOPO5 global DTM and a local DTM were used to derive the undulations.

In order to validate TRINUWI99, 81 GPS/levelling undulations were computed from GPS-heighted stations at which the orthometric heights are known. For this purpose, the national GPS network of Trinidad and Tobago was adjusted. OSU91A and EGM96 (which are both global potential models), as well as, TRINUWI99 and CARIB97 (a Caribbean-wide regional geoid model) undulations were compared against the GPS/levelling geoidal heights and resulted in weighted average discrepancies of $81\text{ cm} \pm 11\text{ cm}$, $-59\text{ cm} \pm 8\text{ cm}$, $7\text{ cm} \pm 7\text{ cm}$ and $20\text{ cm} \pm 7\text{ cm}$ respectively. Based on these results, EGM96 was chosen (instead of OSU91A) as the foundation of TRINUWI99. These results also suggest that TRINUWI99 and CARIB97 are of similar accuracy although TRINUWI99 contains a smaller bias with respect to the GPS/levelling-implied geoid.

The gravimetric data set was subjected to intensive manual and mechanical data editing. All marine ship tracks were crossover adjusted. The local gravimetric solution improved by 1.4m when the raw gravity data was replaced by the edited gravity data.

The results of this study:

- Emphasise the need for the precise establishment and proper documentation of a local vertical datum in Trinidad and Tobago to eliminate datum ambiguities in the geoid solution.
- Reaffirm the necessity for rigorous processing of marine gravity data for precise geoid computations.
- Point to the need for densification of the gravity data set in the Northern Range and marine environment to the southeast of Trinidad to further improve the accuracy of the geoid.

Keywords: Karla R.L. Edwards; geoid; height datum; Stokes' formula and gravity.