UNIVERSITI TEKNOLOGI MARA

EVALUATION THE ACCURACY OF TANDEM-X DEM USING GLOBAL NAVIGATION SATELLITE SYSTEM AND IFSAR

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

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ABSTRACT

A Digital Elevation Model (DEM) is a 3-Dimensional representation of Earth ground surface without any object. The SRTM, ASTER and ALOS are the most well-known DEMs that have been made to general public free of charge and almost global coverage. The very recent release DEMs which is TanDEM-X with great accuracy from German Aerospace Center (DLR), calls for opportunities for the conduct of the localized assessment of the DEM's quality and accuracy to verify their suitability for a wide range of applications in the science studies. Since TanDEM-X vertical datum is referenced to ellipsoid height, this research responsible to investigate into the most suitable geoid model for our region is needed to determine a regional, seamless, and precise geoid model for orthometric height transformation of TanDEM-X. The Geoid Model is a type of spherical harmonic model developed from a complex mathematical modeling process of various sources of data includes satellite gradiometry, satellite altimetry, terrestrial gravity data and elevation data. The EGM96 and EGM2008 are global geoid model while PMGM2014 and MyGEOID are local geoid model has been tested in this research. Each Geoid Model has its own advantages, and the accuracy differs between regions. Therefore, the investigation into the most suitable geoid model for our region is needed to determine a regional, seamless, and precise geoid model for TanDEM-X. In this study, the evaluation of TanDEM-X, SRTM, ASTER and ALOS has been performed with the use of 1277 GPS point at land used area while to analyze the accuracy TanDEM-X was used the 5651 CRM points and IFSAR as a reference data. Meanwhile, the evaluation of the Geoid Model is carried out using 38 GPS/leveling benchmarks (BMs). Based on the statistical analysis, it is shown that highest accuracy of DEM with lowest Root Mean Square Error (RMSE) at agriculture is TanDEM-X 12m (RMSE=0.413m), coastal is TanDEM-X 12m (RMSE=0.655m), flat is TanDEM-X 30m (RMSE=2.107m), urban is SRTM (RMSE=2.216 m), hill is SRTM (RMSE=4.937m) and foothill is TanDEM-X 30m (RMSE= 5.581m). The analyze accuracy of TanDEM-X compared to CRM point was conducted using Confidence Interval (CI) with TanDEM-X 12m shows the better accuracy with RMSE for 68% CI is 0.712m, 95% CI is 1.262m and 99% CI is 1.336m. The accuracy of IFSAR against GPS data are 0.570m for agriculture, 2.411m for urban, 0.499m for flat and 0.841m for hill. The comparison between TanDEM-X and IFSAR shows TanDEM-X 12m performed well at agriculture (RMSE =0.696m) and urban (RMSE=2.314m) while TanDEM-X 30m lead the better accuracy at flat (RMSE=0.797m) and hill (RMSE=3.752m). The suitable Geoid Model for orthometric height transformation of TanDEM-X is MyGeoid because produced the good accuracies are 2.277m (TanDEM-X 12m) and 2.016m (TanDEM-X 30m). The results confirm the outstanding accuracy of the delivered product, which can be now utilized for both scientific and commercial applications.

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