Evaluating the Vertical Accuracy of the City of Cape Town's LiDAR EGL Dataset using GNSS RTK: A Comparative DEM Generation Case Study at the CPUT Bellville Campus

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SUMMARY

Accurate elevation data is crucial for urban planning and engineering design. This study evaluated the vertical accuracy of the City of Cape Town's (CoCT) 2019 LiDAR-derived Existing Ground Level (EGL) dataset, whose fitness-for-use at local scales was previously unverified. The research compared elevations derived from the EGL data against 2,616 high-precision GNSS RTK checkpoints collected across the varied terrain of the CPUT Bellville Campus (Flat, Sloped, Built-up). Two distinct DEM generation methodologies were tested: Method A (subsampled point cloud via LAStools) and Method B (full-density point cloud via CloudCompare Rasterize with interpolation). Vertical residuals (Delta Z = Z_{DEM} - Z_{GNSS}) were calculated and analyzed using standard statistical metrics (RMSE, ME, SD). Data voids and temporal ground changes were identified and excluded. Method A yielded poor results in Built-up areas (RMSE = 34.36 cm) due to subsampling. Method B proved vastly superior, achieving an excellent Overall RMSE of 8.27 cm. Accuracy was consistently high across Flat (8.98 cm), Sloped (6.02 cm), and crucially, Built-up (8.02 cm) terrains using Method B. A minor overall negative bias (ME = -4.04 cm) was noted. The study concludes that the CoCT EGL dataset is highly accurate, provided an appropriate DEM generation workflow using the full point cloud density is applied (Method B). The choice of processing methodology impacts accuracy immensely, especially around infrastructure. When processed optimally, the EGL data is suitable for high-precision engineering applications.
