A Comparison of DEM Generation from LiDAR Data using LasTools and ArcMap Software

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Abstract: In recent years, many GIS (Geographical Information Systems) software tools are being used in the geospatial industry that offer scripts, and algorithms to process and visualize light detection and ranging (LiDAR) data. However, many of these commercial software packages that offer LiDAR data analysis capabilities are costly, as such only few are freely available and downloadable. Using open source software will reduce cost of processing and increase wide spread knowledge. The open source software allows the user to freely download it through the internet. LasTools is an open source software which is used to process LiDAR data, while the ArcMap as a commercial software is also popularly used to generate digital elevation (DEM) from LiDAR data. The aim of the study is to investigate the accuracy of DEM from LiDAR point cloud generated using LasTools and ArcMap. The accuracy of both software was assessed through comparison with 189 high precision survey points distributed well across six different land cover types. Each land cover type contained at least 30 checkpoints which meet the standard suggested by American Society for Photogrammetry and Remote Sensing (ASPRS) especially on number of checkpoints in each land cover type. Vertical accuracy was tested by both the National Standard for Spatial Data Accuracy, Federal Emergency Management Agency (NSSDA/FEMA) and National Digital Elevation Program (NDEP/ASPRS) methods to ensure that all accuracy specifications were satisfied. Fundamental vertical accuracy (FVA), Supplemental Vertical Accuracy (SVA) and Consolidated Vertical Accuracy (CVA) were calculated according to NDEP/ASPRS method. Various standard statistical calculation (RMSE, Std. Dev, Min, Max, mean) were also applied to assess the accuracy of generated digital terrain model (DTM). FVA for bare land and CVA for all data

were found to be 0.175m and 0.318m, respectively. The RMSE, and standard deviation for bare land was 0.089 and 0.059, respectively. The differences between LasTools and ArcMap is less than 5mm. The LasTools is easy to install and user friendly. Moreover, it is the fastest and most memory efficient solution for batch-scripted multi-core LiDAR data processing. It can also turn billions of point clouds into useful products at a reasonable speed and with low memory requirement. The results showed that LasTools can generate an accurate DTM and digital surface model (DSM) in all land cover types.

Keywords: Digital Elevation Model, LasTools, LiDAR point cloud.