Iowa Statewide Lidar Project

Vertical Accuracy

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DEM Review, LAS review, and initial Vertical Accuracy Assesssment conducted by Eric Jaramillo
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SUMMARY

Vertical accuracy for the state of Iowa was originally required to be 0.185 meters $RMSE_z$ in the Vertical Bare Earth (taken from Iowa Task Order/Contract). There was also a vertical accuracy requirement of 0.37 meters $RMSE_z$ in vegetation land cover categories (taken from Iowa Task Order/Contract). There was no requirement for checkpoint delivery in either Open Terrain or Vegetation Categories, however, all ground control surveys conducted by the contractor were a required deliverable.

Multiple vertical accuracy assessments were conducted for this project, however, due to a lack of checkpoints in vegetated areas, no vertical accuracy check was conducted for the Vegetation landcover category. Originally, the NGTOC was using NGS points of Vertical Order 2 or better in Stability A, B, or C. While these provided an indication of accuracy, there were too few to conduct a viable statistical test on the Statewide Lidar. The state of Iowa agreed to survey checkpoints in open terrain areas. These points were either RTK points or other survey methods. It is important to note that the checkpoints were collected after a significant amount of time had passed from the initial collection of the Lidar data.

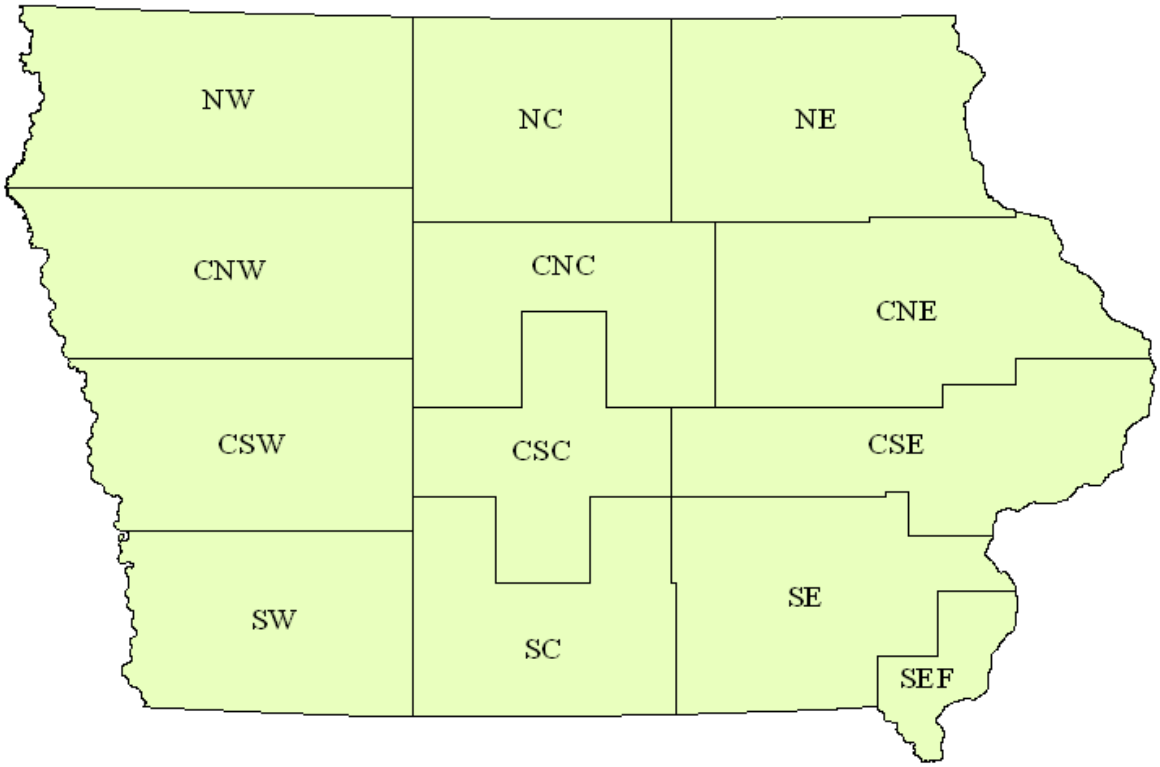
The amounts of surveyed checkpoints delivered to the NGTOC were much greater than expected, even when thinned by the state of Iowa. The reviewers at the NGTOC would select points at random, and manually compared them with elevations from the derived elevation products (in the form of Global Mapper Grids). These values were then entered into an excel spreadsheet, where $RMSE_z$ and $Accuracy_z$ (95% CI) were calculated. This was done for several regions (i.e. CNC), despite the fact that data were delivered in blocks (i.e. CNC 02), due to the time-consuming nature of the process.

New testing methods began in November of 2010. Using ModelBuilder in ArcMap, the reviewers were able to design a test that automatically applied elevation to each checkpoint from the derived product. Additionally, this model automatically calculated RMSE(z) and Accuracy (z) at the 95^{th} confidence level. Using this new testing method, the RMSE(z) and Accuracy (z) were calculated for each block (i.e. CNC 02), and each region (i.e. CNC).

Based off of the results from the new testing methods, blocks that were significantly above the $RMSE_z$ requirement of 0.185 meters (blocks with an $RMSE_z$ of 0.20 meters or more) were returned to Sanborn for rework. The flexibility of the $RMSE_z$ was due to some concern over the accuracy of the provided checkpoints. When the data was returned from Sanborn, (either with fixes or explanations of why they could not be fixed), vertical accuracy was retested first on the LAS points, then on the bare-earth grids. VA testing on the LAS was done in LP 360, the grids in ArcMap using the Vertical Accuracy model. Some blocks (e.g. CNC 02) did not pass the VA assessment individually, but because of the concern over the accuracy of the checkpoints, the data was passed at the NGTOC if the region passed the VA test.

In conclusion, while each region passed the vertical accuracy assessment at the NGTOC, the reviewers feel it is important that users are aware that these tests serve only as an indicator of vertical accuracy in open terrain. As stated above, there has been no assessment of the vertical accuracy in Vegetation land-cover categories. The contractor did checks using NGS points of Vertical Order 1 in several areas, and these indicated passing $RMSE_z$ values. Again though, these tests can only serve as indicators of accuracy, not as a good overall indicator. The $RMSE_z$ for each region in Iowa will be shown below. All shapefiles (points used and points removed) and tests (both LP 360 tests and ArcGIS tests) will be provided with the Iowa LAS and gridded Digital Elevation Models.

IOWA REGIONS



Attributes of Iowa_Regions_RMSE_1_November_2011

Region	PRODUCT	RMSE	Accuracy
SC	Standard	0.139	0.272
SE	Standard	0.165	0.323
SW	Standard	0.161	0.316
SEF	FEMA	0.094	0.184
CSE	FEMA	0.093	0.182
CSC	FEMA	0.121	0.237
CSW	Standard	0.106	0.208
CNE	Standard	0.152	0.298
CNC	Standard	0.189	0.37
CNW	Standard	0.114	0.223
NC	Standard	0.194	0.38
NE	Standard	0.139	0.272
NW	Standard	0.202	0.396