Block B Champaign County_QL2+ Lidar 2019 Final Report

Report Produced for U.S. Geological Survey

TASK ORDER: G17PC00007

REPORT DATE: 07/01/2020

SUBMITTED FROM:

Aerial Services, Inc.

6315 Chancellor Dr.

Cedar Falls, IA 50613

319.277.0436

SUBMITTED TO:

U.S. Geological Survey

1400 Independence Road

Rolla, MO 65401

573.308.3810

Overview

The original purpose of this project was to develop a consistent and accurate surface elevation dataset derived from high-accuracy Light Detection and Ranging (LiDAR) technology for the USGS IL_8County_PlusChampaign_2019_B19 project Area. The AOI covered approximately 6,337 square miles in total and include the counties of Champaign, Jo Daviess, Stephenson, Carroll, Ogle, Whiteside, Lee, Rock Island, and Henry. Block B allows for an increase in the quality level of the areas over Champaign County (~1049 sq. mi.) of QL2+ (ANPS≤0.5m). Adverse ground conditions during the fall 2019 flight season limited Lidar acquisition to a small portion of the entire project area. Approximately 1049 square miles of Block B referred to as Block B Champaign County_QL2+ Lidar 2019 was acquired in the fall of 2019 and spring of 2020.

The LiDAR data for Block B Champaign County, Illinois was processed and classified according to project specifications. Detailed breaklines, bare earth Digital Elevation Models (DEMs), and Intensity Images were produced for the Block B project area. Data was formatted into tiles with each tile covering an area of 1000 meters by 1000 meters. A total of 2717 LAS files, 2717 DEMs, and 2717 Intensity Images were produced for the project, encompassing the Block B AOI of approximately 1049 square miles and formatted into 2717 total tiles.

PROJECT TEAM

Aerial Services, Inc. (ASI) served as the prime contractor for the project. In addition to project management ASI was responsible for LiDAR acquisition and calibration, LAS classification, LiDAR products, Digital Elevation Model (DEM) production, Intensity Image production, and quality assurance. All follow-on processing was completed by the prime contractor.

Surveying and Mapping, LLC (SAM) completed ground surveying for the project and delivered surveyed checkpoints. SAM was to acquire surveyed checkpoints for the project to use in independent testing of the vertical accuracy of the LiDAR-derived surface model. Please see SURVEY REPORT to view the separate Survey Report that was created for this portion of the project.

SURVEY AREA

The project area addressed by this report falls within the Block B Champaign County, covering Champaign County, Illinois.

DATE OF SURVEY

LiDAR acquisition for Block B Champaign County was conducted between the dates of November 23, to December 7, 2019, with one mission flown March 8, 2020 to fill in a data void.

COORDINATE REFERENCE SYSTEM

Data produced for the project was delivered in the following reference system.

Horizontal Datum: The horizontal datum for the project is North American Datum of 1983 with the 2011 Adjustment (NAD 83 (2011)).

Vertical Datum: The Vertical datum for the project is North American Vertical Datum of 1988 (NAVD88).

Coordinate System: Albers Equal Area.

Units: Horizontal units are in meters, Vertical units are in meters.

Geoid Model: Geoid12B

LIDAR VERTICAL ACCURACY

For the Block B Champaign County QL2+ project, the tested RMSEz of the classified LiDAR data for checkpoints in non-vegetated terrain equaled 0.050 meters compared with the 10 cm specification: The 95% confidence value of NVA of the classified LiDAR data computed using RMSEz x 1.96 and was found to equal 0.098 meters compared with the 0.196 meter specification.

For the Block B Champaign County QL2+ project, the tested VVA of the classified LiDAR data computed using the 95th percentile was equal to 0.106 meters, compared with the 0.294 meter (0.96 ft) specification.

Additional accuracy information and statistics for the classified LiDAR data, raw swath data, and bare earth DEM data can be found in following sections of this report.

PROJECT DELIVERABLES

The deliverables for the project are listed below.

1. Classified Point Cloud Data (Tiled)
2. Bare Earth Surface (Raster DEM – IMG format)
3. Intensity Images (8-bit gray scale, tiled, GeoTIFF format)
4. Breakline Data (File GDB)
5. Independent Survey Checkpoint Data (File GDB)
6. Calibration Points (File GDB)
7. Metadata
8. Project Report (Acquisition, Processing, QC)
9. Project Extent (File GDB)
10. Tile Index (File GDB)
11. Swath Footprint (File GDB)

PROJECT TILING FOOTPRINT

2717 tiles, 2717 LAS files, 2717 DEM tiles, and 2717 Intensity Image tiles were delivered for the project. Each tile's extent is 1000 meter by 1000 meter. (See Appendix A for a complete listing of delivered tiles.)

Block B Champaign County, Illinois QL2+ LiDAR

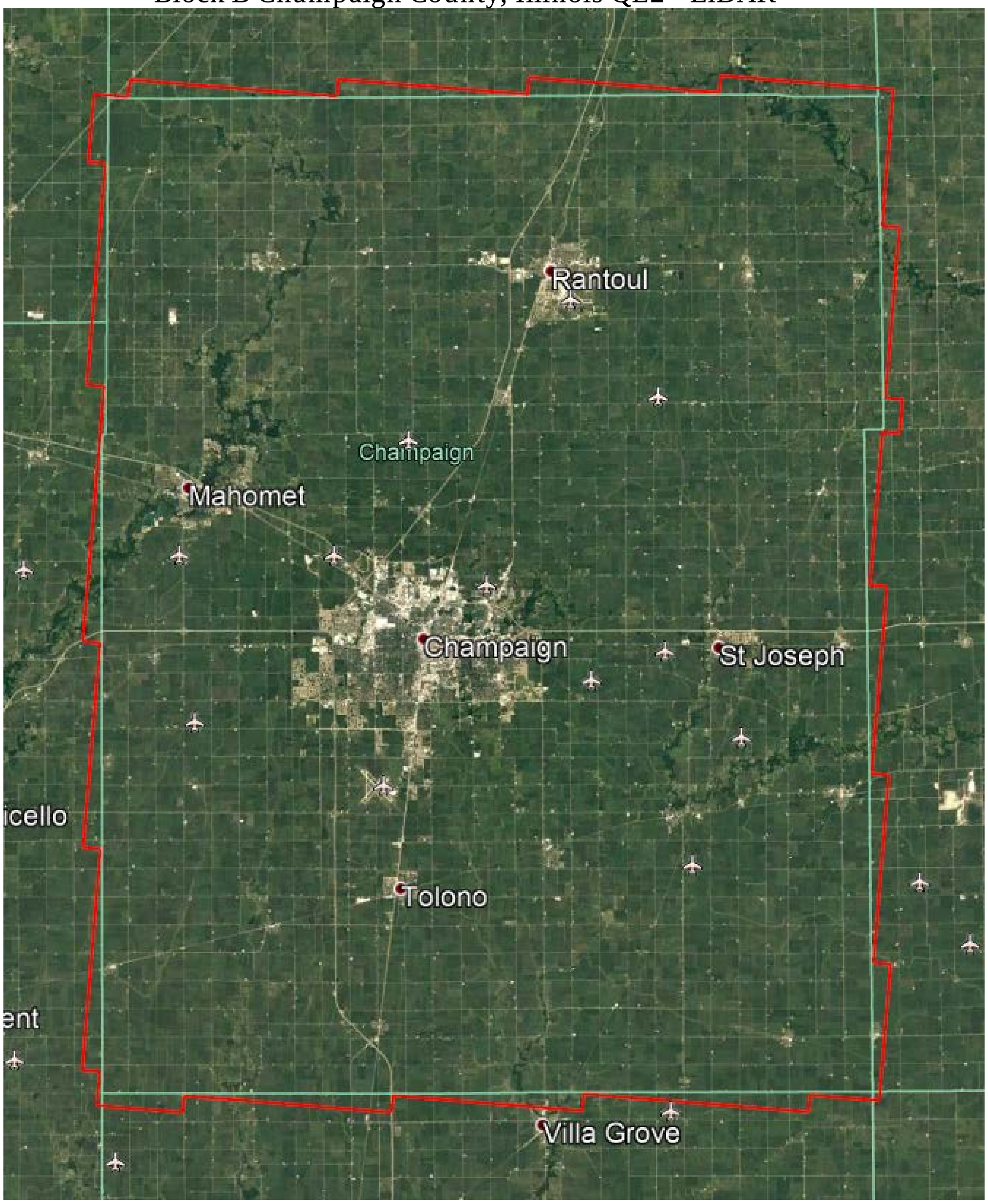


Figure 1 – Block B Champaign County Area of Interest

Lidar Acquisition Details

Aerial Services, Inc. served as prime contractor for the Block B Champaign County QL2+ project and preformed the LiDAR Acquisition and Calibration.

Aerial Services, Inc. planned 60 passes for the project area as well as two additional cross flightlines for the purposes of quality control in our own processing which are not included in delivery. The flight plan included zigzag flight line collection as a result of the inherent IMU drift associated with all IMU systems. In order to reduce any margin for error in the flight plan, Aerial Services, Inc. followed FEMA's Appendix A "guidelines" for flight planning and, at a minimum, includes the following criteria:

- A digital flight line layout using LEICA MISSION PRO flight design software for direct integration into the aircraft flight navigation system.
- Planned flight lines; flight line numbers; and coverage area.
- Lidar coverage extended by a predetermined margin beyond all project borders to ensure necessary over-edge coverage appropriate for specific task order deliverables.
- Local restrictions related to air space and any controlled areas have been investigated so that required permissions can be obtained in a timely manner with respect to schedule. Additionally, Aerial Services, Inc. will file our flight plans as required by local Air Traffic Control (ATC) prior to each mission.

Aerial Services, Inc. monitored weather and atmospheric conditions and conducted lidar missions only when no conditions exist below the sensor that will affect the collection of data. These conditions include leaf-off for hardwoods, no snow, rain, fog, smoke, mist and low clouds. Lidar systems are active sensors, not requiring light, thus missions may be conducted during night hours when weather restrictions do not prevent collection. Aerial Services, Inc. accesses reliable weather sites and indicators (webcams) to establish the highest probability for successful collection in order to position our sensor to maximize successful data acquisition.

Within 72-hours prior to the planned day(s) of acquisition, Aerial Services, Inc. closely monitored the weather, checking all sources for forecasts at least twice daily. As soon as weather conditions were conducive to acquisition, our aircraft mobilized to the project site to begin data collection. Once on site, the acquisition team took responsibility for weather analysis.

Aerial Services, Inc. lidar sensors are calibrated at a designated site located at the Waverly Municipal Airport in Waverly, Iowa and are periodically checked and adjusted to minimize corrections at project sites.

LIDAR SYSTEM PARAMETERS

Aerial Services, Inc. operated a Cessna (Tail # N5531A) outfitted with a LEICA ALS70-HP lidar system during the collection of the study area. Table 1 illustrates Aerial Services, Inc. system parameters for lidar acquisition on this project.

Item	Parameter
System	Leica ALS-70 HP
Maximum Number of Returns per Pulse	4
Nominal Pulse Spacing (single swath), (m)	0.5
Nominal Pulse Density (single swath) (ppsm), (m)	4
Aggregate NPS (m) (if ANPS was designed to be met through single coverage, ANPS and NPS will be equal)	0.5
Aggregate NPD (m) (if ANPD was designed to be met through single coverage, ANPD and NPD will be equal)	4
Altitude (AGL meters)	1300
Approx. Flight Speed (knots)	125
Total Sensor Scan Angle (degree)	50
Scan Frequency (hz)	47
Scanner Pulse Rate (kHz)	394
Did the Sensor Operate with Multiple Pulses in The Air? (yes/no)	Yes
Nominal Swath Width on the Ground (m)	1212
Swath Overlap (%)	30
Max. Point Spacing Along Track (m)	1.37
Max. Point Spacing Across Track (m)	0.84

Table 1: Aerial Services, Inc. Lidar System Parameters

ACQUISITION STATUS REPORT AND FLIGHTLINES

Upon notification to proceed, the flight crew loaded the flight plans and validated the flight parameters. The Acquisition Manager contacted air traffic control and coordinated flight pattern requirements. Lidar acquisition began immediately upon notification that control base stations were in place. During flight operations, the flight crew monitored weather and atmospheric conditions. Lidar missions were flown only when no condition existed below the sensor that would affect the collection of data. The pilot constantly monitored the aircraft course, position, pitch, roll, and yaw of the aircraft. The sensor operator monitored the sensor, the status of PDOPs, and performed the first Q/C review during acquisition. The flight crew constantly reviewed weather and cloud locations. Any flight lines impacted by unfavorable conditions were marked as invalid and re-flown immediately or at an optimal time.

Figure 2 shows the combined trajectory of the flightlines.

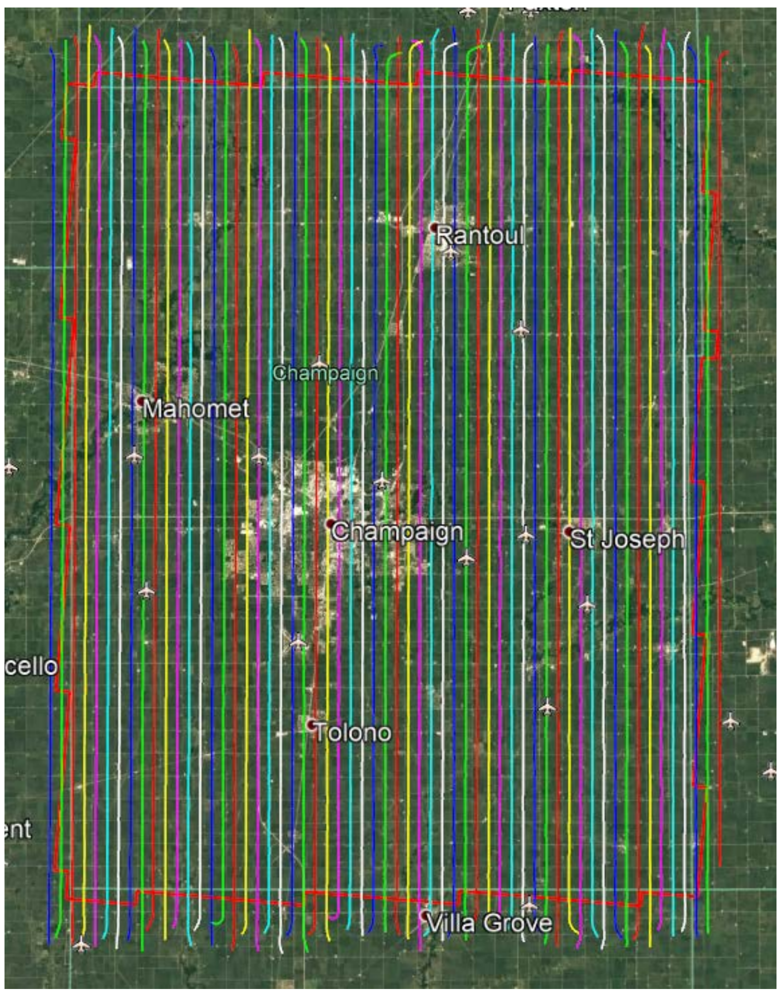


Figure 2: G17PC00007_Block B Champaign County_2019_B19 trajectories as flown by Aerial Services, Inc.

ACQUISITION CONTROL

Aerial Services, Inc. conducted the survey which provided the established base stations used to control the lidar acquisition for the Block B Champaign County project area. The coordinates of the base stations are provided in the table below.

Name	NAD83(2011) Albers		Ellipsoid Ht (WGS84, m)
	Easting X (m)	Northing Y (m)	
ILUC	656696.577	1924964.492	232.663

Table 2 – Base station used to control lidar acquisition for the Project.

AIRBORNE GPS KINEMATIC

Airborne GPS data was processed using Waypoint's Inertial Explorer version 8.60 software suite. All flights were flown with PDOP less than or equal to 3.0 and with at least 6 satellites in common view of both a stationary reference receiver and the airborne GPS. Distances from base station to aircraft were kept to a maximum of 50 km.

For all flights, the GPS data can be classified as excellent, with GPS residuals no larger than 10 cm being recorded.

GPS processing reports for each mission are included in Appendix B.

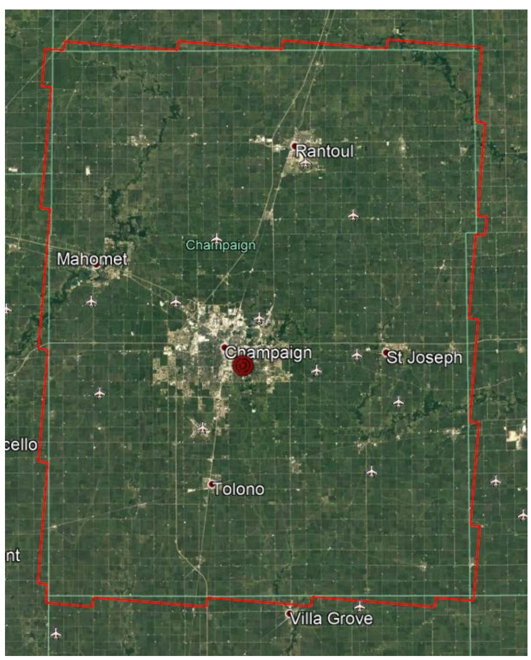


figure 3 – G17PC00007_Block B Champaign County_2019_B19 Base station location

Generation and Calibration of Laser Points (raw data)

After processing the GNSS/GPS and IMU data in Inertial Explorer, the data is then exported to raw LAS files using Leica's CloudPro software. CloudPro combines the raw data collected with the ALS 70 HP sensor, combines it with the airborne trajectory data, applies the sensor's calculated boresight correction angles, and then outputs the point cloud to the specified coordinate reference system and file format.

The initial step of calibration is to verify the complete coverage of the AOI with no internal voids present, as well as ensuring that minimum point density of 4.0 ppsm has been achieved.

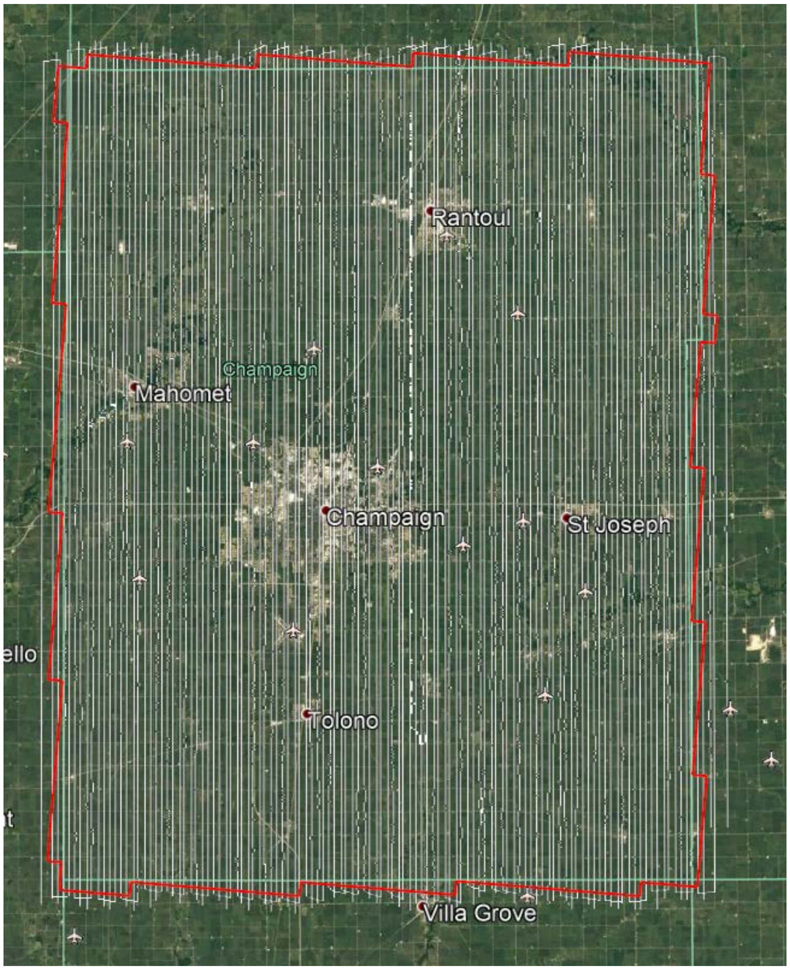


Figure 4 – Lidar swath coverage over AOI.

Boresight and Relative Accuracy

Subsequently, the project's data is then loaded into Microstation/TerraScan for viewing and post-processing of calibration errors. Roll, pitch, and heading corrections are calculated to produce the best relative accuracy that can be achieved, and at minimum 8 cm RMSDz with a 16 cm maximum difference. Tested interswath RMSDz was 0.013 meters.

The relative accuracy of every swath is checked and QC'd at 3 different points along its length. Cross sections are visually inspected across each block to validate point to point, flight line to flight line and mission to mission agreement to verify that the project meet the specifications.

For this project the specifications used are as follow
Relative accuracy <= 6 cm maximum differences within individual swaths and <=8 cm RMSDz between adjacent and overlapping swaths.

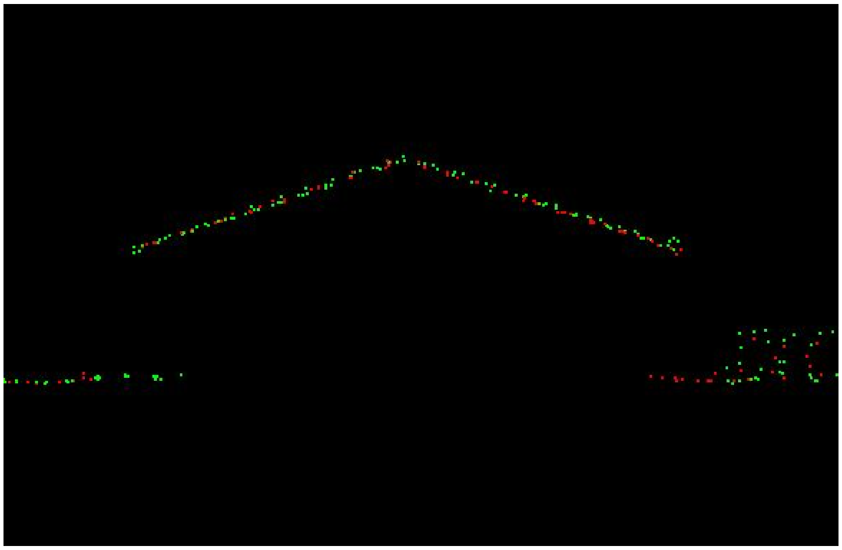


Figure 5 – Profile view showing proper interswath calibration.

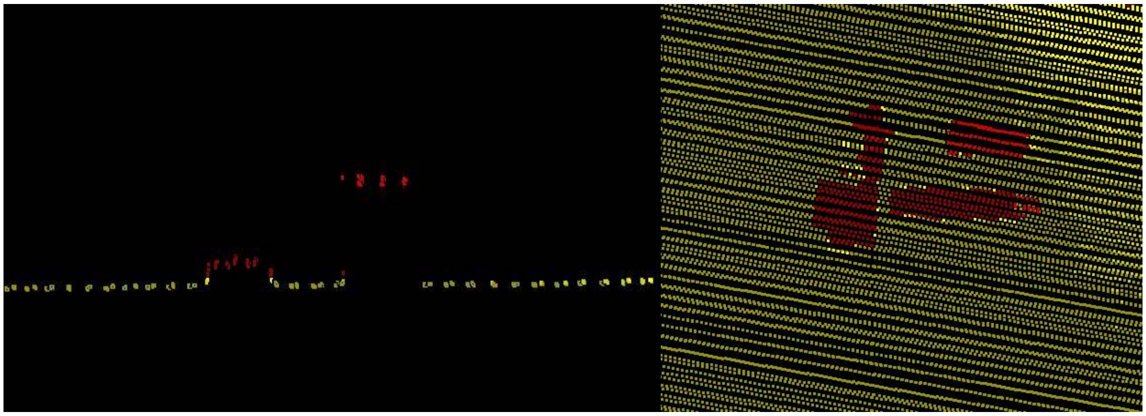


Figure 6 – Top view showing a parking lot with a car and raised feature on a single swath demonstrating intraswath accuracy. Yellow color is scaled to a range of 6 cm in elevation. Points are within 6 cm of variation until the raised curb and car. Also shown is a profile view showing low variability of ranges within the swath.

DELTA-Z ACCURACY ASSESSMENT

Swath-to-swath relative accuracy is assessed by comparing the elevations of overlapping swaths. Delta-z is a raster file representing the differences in elevation of overlapping swaths and is generated from the subtraction of the two raster files created from each swath over the entire area of interest. It is then used to calculate the RMSDz, which in turn is displayed as a visual representation of error distribution.

The image below is a LIDAR "ortho" image created from the laser return intensity, Z (elevation) and swath number. The image is rendered as grayscale where there is no overlap between data from different flight lines (swath). Where two (or more) flight lines overlap, a color rendering is constructed base on the average maximum elevation difference between points in the overlapping swath. The distance (dZ) is indexed into a user-defined color. In the image below, four-color bands were separated into 8 cm increments. Thus green represents dZs from 0 to 8 cm, yellow from 8 cm to 16 cm, orange from 16 cm to 24 cm and red for dZ greater than 24 cm. The dZ image provides a quick method of quickly assessing the relative vertical accuracy of a LiDAR project.

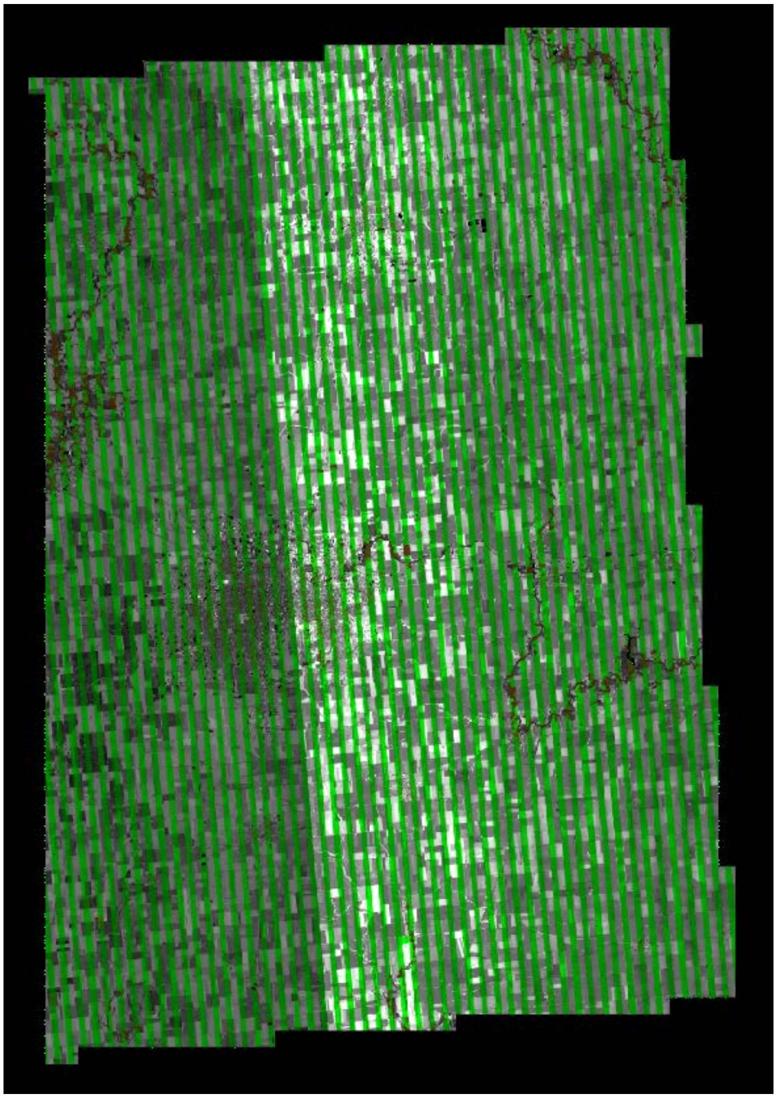


Figure 7: Block B Champaign County, Illinois Project Delta-z raster image.

Final Calibration Verification

Surveying and Mapping, LLC (SAM) conducted the survey for 34 ground control points (GCPs) which were used to test the accuracy of the calibrated swath data. These 34 GCPs were available to use as control in case the swath data exhibited any biases which would need to be adjusted or removed. The coordinates of all GCPs are provided in table 3 and the accuracy results from testing the calibrated swath data against the GCPs is provided in table 4; no further adjustments to the swath data were required based on the accuracy results of the GCPs. Accuracy of the raw point cloud against GCP: 0.04 meters (0.134 ft.) with a 95% confidence value of 0.078 meters (0.255 ft.).

Point ID	NAD83 (2011 adj) IL_East		NAVD88 (Geoid 12B)		
	Easting X (USft)	Northing Y (USft)	Z-Survey (USft)	Z-LiDAR (USft)	Dz (USft)
GCP43	948968.95	1357947.546	745.449	745.55	0.101
GCP44	1090796.096	1353412.891	721.656	721.76	0.104
GCP45	1034310.121	1325739.357	742.015	741.79	-0.225
GCP46	978660.997	1326857.997	718.698	718.81	0.112
GCP47	962170.781	1287285.742	776.76	776.77	0.01
GCP48	1010357.738	1265131.508	747.422	747.48	0.058
GCP49	1082710.407	1284249.283	681.251	681.31	0.059
GCP50	1008307.158	1233709.014	725.356	725.45	0.094
GCP51	1065651.404	1255316.175	671.096	671	-0.096
GCP52	990063.988	1255221.406	743.837	743.62	-0.217
GCP53	1031180.229	1256526.084	716.202	716.35	0.148
GCP54	1059265.211	1223143.572	673.35	673.43	0.08
GCP55	1095551.842	1181798.995	702.101	702.1	-0.001
GCP56	1005080.85	1208920.208	732.815	732.81	-0.005
GCP57	950014.508	1193196.364	683.242	683.09	-0.152
GCP92	1001502.308	1348654.231	720.117	720.13	0.013
GCP93	1060493.29	1343828.917	775.5	775.7	0.2
GCP94	996552.615	1305978.552	747.99	748	0.01
GCP95	1071400.244	1312096.162	712.786	712.74	-0.046
GCP96	1048337.073	1295831.148	698.173	698.22	0.047
GCP97	1026772.094	1282907.786	730.862	731.19	0.328
GCP98	1011093.982	1256125.515	728.263	728.24	-0.023
GCP99	989709.03	1272434.513	781.665	781.7	0.035
GCP100	1021678.738	1244550.299	735.532	735.7	0.168
GCP101	986738.375	1235029.791	700.212	700.07	-0.142
GCP102	958162.92	1252179.04	705.882	705.83	-0.052
GCP103	969057.741	1217976.28	687.593	687.24	-0.353
GCP104	1036258.972	1213003.028	720.8	720.72	-0.08
GCP105	1079124.6	1207289.037	689.53	689.51	-0.02
GCP106	975788.327	1178091.942	681.231	681	-0.231
GCP107	1027198.712	1196730.034	676.055	675.97	-0.085
GCP108	1060543.304	1172730.65	681.101	681.12	0.019
GCP109	1016694.862	1185890.001	670.267	670.27	0.003
GCP110	1041736.159	1354928.868	772.976	773.03	0.054

Table 3 – Block B Champaign County, Illinois Project surveyed ground control points (GCPs).

This project must meet Non-vegetated Vertical Accuracy (NVA) ≤ 0.64 ft (19.6 cm) at the 95% confidence level based on $RMSE_z$ ≤ 0.33 ft (10 cm) x 1.9600.

100 % of Totals	# of Points	RMSEz NVA (m)	NVA- Non-vegetated Vertical Accuracy ((RMSEz x 1.9600) m	Mean (m)	Median (m)	Skew	Std Dev (m)	Min (m)	Max (m)	Kurtosis
NVA	64	0.050	0.098	-0.022	-0.024	0.167	0.044	-0.134	0.130	2.163

Table 4 – Non-vegetated Vertica Accuracy (NVA) results.

DATA CLASSIFICATION AND EDITING

Once the calibration, absolute swath vertical accuracy, and relative accuracy of the data were confirmed, ASI utilized TerraScan software for data processing. The acquired 3D laser point clouds, in LAS binary format, were imported into the project and tiled according to the project tile grid. Once tiled, the laser points were classified using a proprietary routine in TerraScan. This routine classifies any obvious low outliers in the dataset to class 7 and high outliers in the dataset to class 18. After points that could negatively affect the ground are removed from class 1, the ground layer is extracted from this remaining point cloud. The ground extraction process encompassed in this routine takes place by building an iterative surface model. This surface model is generated using three main parameters: building size, iteration angle and iteration distance. The initial model is based on low points being selected by a "roaming window" with the assumption that these are the ground points. The size of this roaming window is determined by the building size parameter. The low points are triangulated and the remaining points are evaluated and subsequently added to the model if they meet the iteration angle and distance constraints. This process is repeated until no additional points are added within iterations. A second critical parameter is the maximum terrain angle constraint, which determines the maximum terrain angle allowed within the classification model.

Once the ground surface had been deduced through the filtering process a vegetation class was then extracted by distance from ground from remaining class 1. With Building size parameters set, extraction of buildings from the vegetation class occurs. Once building had been deduced the remaining vegetation points were re-filtered by distance into Low Vegetation is 0.5-5 feet, Medium Vegetation is 5-20 feet, High Vegetation is >20 feet.

In TerraScan surface models for each tile was created to examine the ground classification. ASI analysts visually reviewed the ground surface model for artifacts left in the ground classification. Theses artifacts consist of vegetation, buildings, and bridges that were still present in the ground after initial processing. ASI analysts employ 3D visualization techniques to view the point cloud at multiple angles and in profile to ensure that errant points are removed from the ground classification. Bridge decks are manually classified to class 17. Building rooftops were manually reviewed to ensure that proper classification had occurred. Due to moist ground conditions of the 2019 flight season, the ground surface had a rougher appearance. A fence macro was utilized to reduce and mitigate the roughness of the ground surface. Another fence macro was used to smooth the ground surface by removing man-made structures and vegetation. ASI fence macros classified man-made structures to class code 1 (default) and rough below ground surface points to class code 7 (low noise). After the ground classification and building corrections completed, the dataset was processed through a water classification routine that utilizes breaklines compiled by the prime ASI to automatically classify hydro features. The water classification routine selects ground points within the breakline polygons and automatically classifies them as class 9, water. During this water classification routine, ground points that are within 2x NPS or less of the hydrographic features are moved to class 20 ignored ground, due to breakline proximity. Overage points are then identified in TerraScan and used to set the overlap bit for those points. The withheld points identified during the classification routine are used to set the withheld bit. The LiDAR tiles were classified to the following classification schema:

- Class 1 – Default, Processed, but unclassified
- Class 2 – Ground, Bare-earth
- Class 3 – Low Vegetation is 0.5-5 feet
- Class 4 – Medium Vegetation is 5-20 feet
- Class 5 – High Vegetation is >20 feet
- Class 6 – Buildings (Champaign County only)
- Class 7 – Low Noise (low and manually identified)
- Class 9 – Water
- Class 17 – Bridge Decks
- Class 18 – High Noise (high, manually identified)
- Class 20 – Ignored Ground (Breakline Proximity)
- Class 21- Snow (if present and identifiable)
- Class 22- Temporal Exclusion (typically non-favored data in intertidal zones, as necessary)

After manual classification, the LAS tiles were peer reviewed and then underwent a final QA/QC. After the final QA/QC and corrections, the LAS files were then converted from LAS v1.2 to LAS v1.4 using TerraScan software to flag the overlap bit and withheld bit. LP360 64bit was used to deduce the Well Known Text (WKT) and an ASI proprietary software was used to format the LAS to the final LAS v1.4 Format 6 version. LAStools by rapidlasso GmbH, open source, lasvalidate (open source LGPL) and ASI proprietary software was used to perform final analysis to checks on LAS header information, LAS point classes, and LAS timestamps.

LiDAR Qualitative Assessment

ASI's qualitative assessment utilizes a combination of statistical analysis and interpretative methodology or visualization to assess the quality of the data for a bare-earth digital terrain model (DTM). This includes creating pseudo image products such as LiDAR orthos produced from the intensity returns, Triangular Irregular Network (TIN)'s, Digital Elevation Models (DEM) and 3-

dimensional models as well as reviewing the actual point cloud data. This process looks for anomalies in the data, areas where man-made structures or vegetation points may not have been classified properly to produce a bare-earth model, and other classification errors. This report will present representative examples where the LiDAR and post processing had issues as well as examples of where the LiDAR performed well.

VISUAL REVIEW

The following sections describe common types of issues identified in LiDAR data and the results of the visual review for Block B Champaign County project.

Data Voids

Acceptable voids (areas with no LiDAR returns in the LAS files) that are present in the majority of LiDAR projects include voids caused by bodies of water. No unacceptable voids are present in the Block B Champaign County project.

Bridge Removal Artifacts

The DEM surface models are created from TINs or Terrains. TIN and Terrain models create continuous surfaces from the inputs. Because a continuous surface is being created, the TIN or Terrain will use interpolation to continue the surface beneath the bridge where no LiDAR data was acquired. Locations where bridges were removed will generally contain less detail in the bare-earth surface because these areas are interpolated. The DEM in the bottom view shows an area where a bridge has been removed from ground. The surface model must make a continuous model and in order to do so, points are connected through interpolation. This results in less detail where the surface must be interpolated. The profile in the top view shows the LiDAR points of this particular feature colored by class. All bridge points have been removed from ground (orange) and are bridge deck (blue).

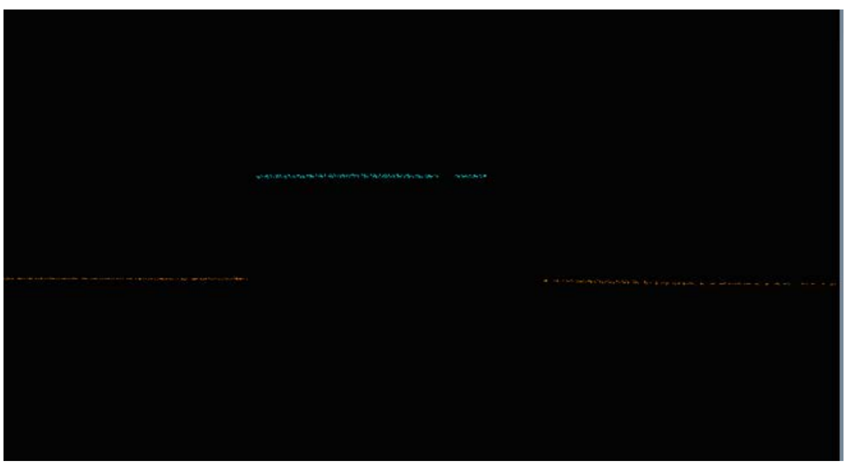


Figure 8: Profile view of a classified bridge deck (blue) and ground (orange).

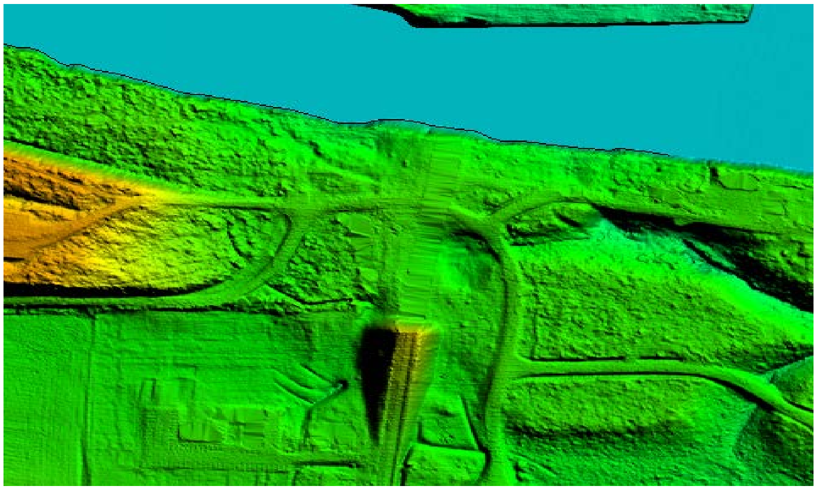


Figure 9: DEM with bridge removed from surface model.

Culverts

Bridges have been removed from the bare earth surface while culverts remain in the bare earth surface. In instances where it is difficult to determine if the feature is a culvert or bridge, such as with some small bridges, ASI erred on assuming they would be culverts especially if they are on secondary or tertiary roads. Below is an example of a culvert that has been left in the ground surface.

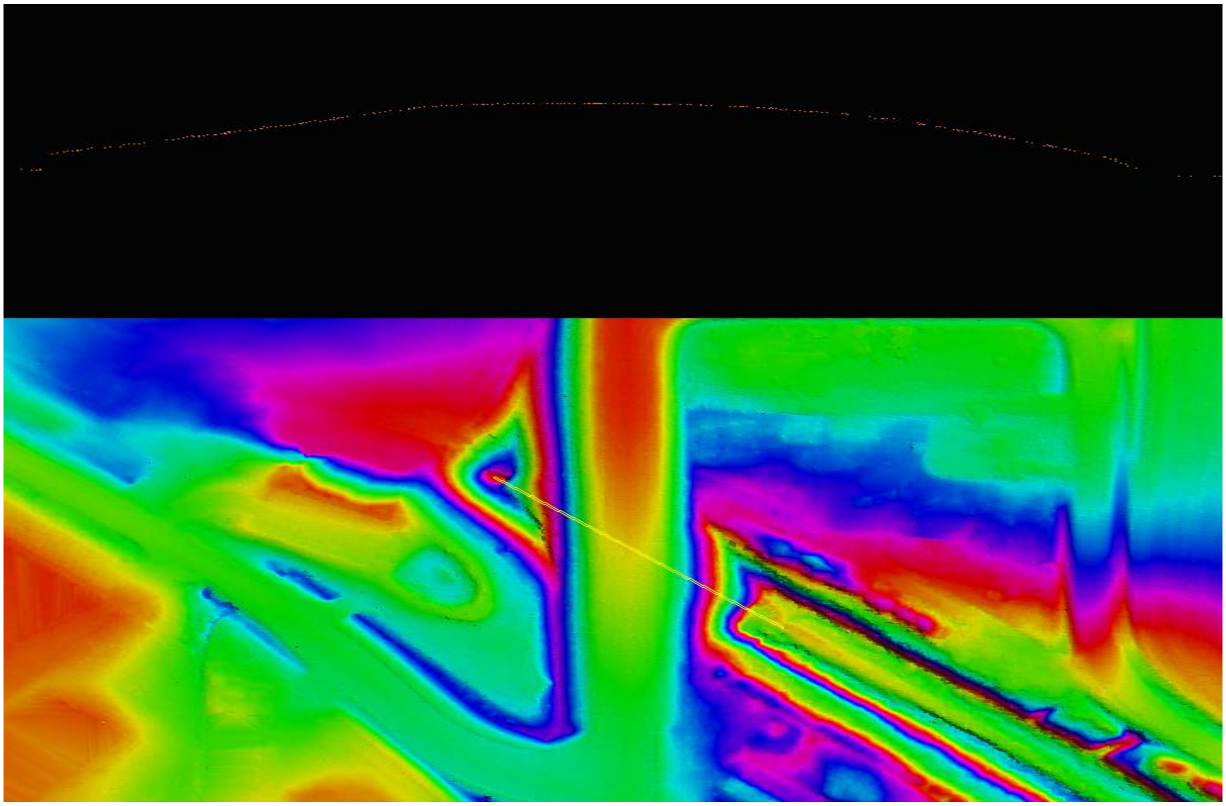


Figure 10: Profile with points colored by class (class 1=white, class 2=orange) is shown in the top view and the DEM is shown in the bottom view. This culvert remains in the bare earth surface. Bridges have been removed from the bare earth surface and classified to class 17.

Dirt Mounds

Irregularities in the natural ground exist and may be misinterpreted as artifacts that should be removed. Hills and dirt mounds are present throughout the project area. These features are correctly included in the ground.

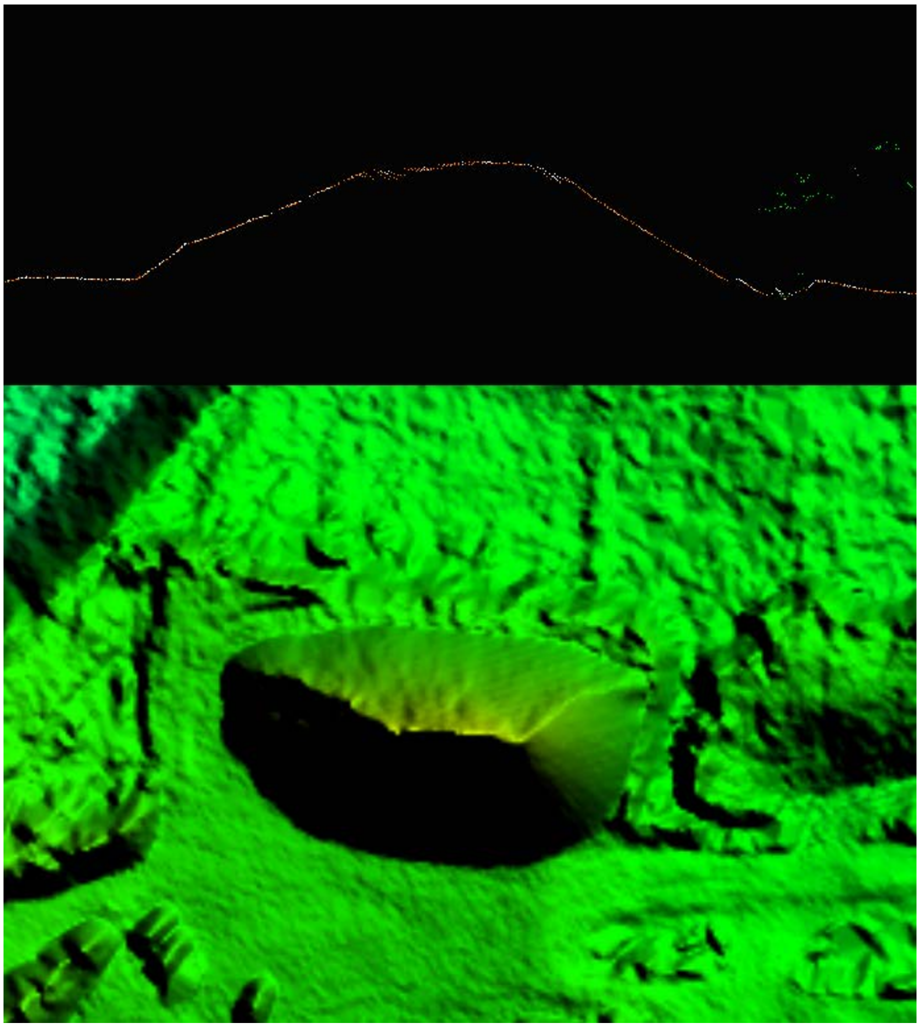


Figure 11 - Profile with the points colored by class (unclassified points are white, ground points are orange) is shown on the right and a DEM of the surface is shown to the left. These features are correctly included in the ground classification.

Flightline Ridges

Ridges occur when there is a difference between the elevations of adjoining flight lines or swaths. Some flightline ridges are visible in the final DEMs but they do not exceed the project specifications and the overall relative accuracy requirements for the project area have been met. An example of a visible flightline ridge that is within tolerance is shown below.

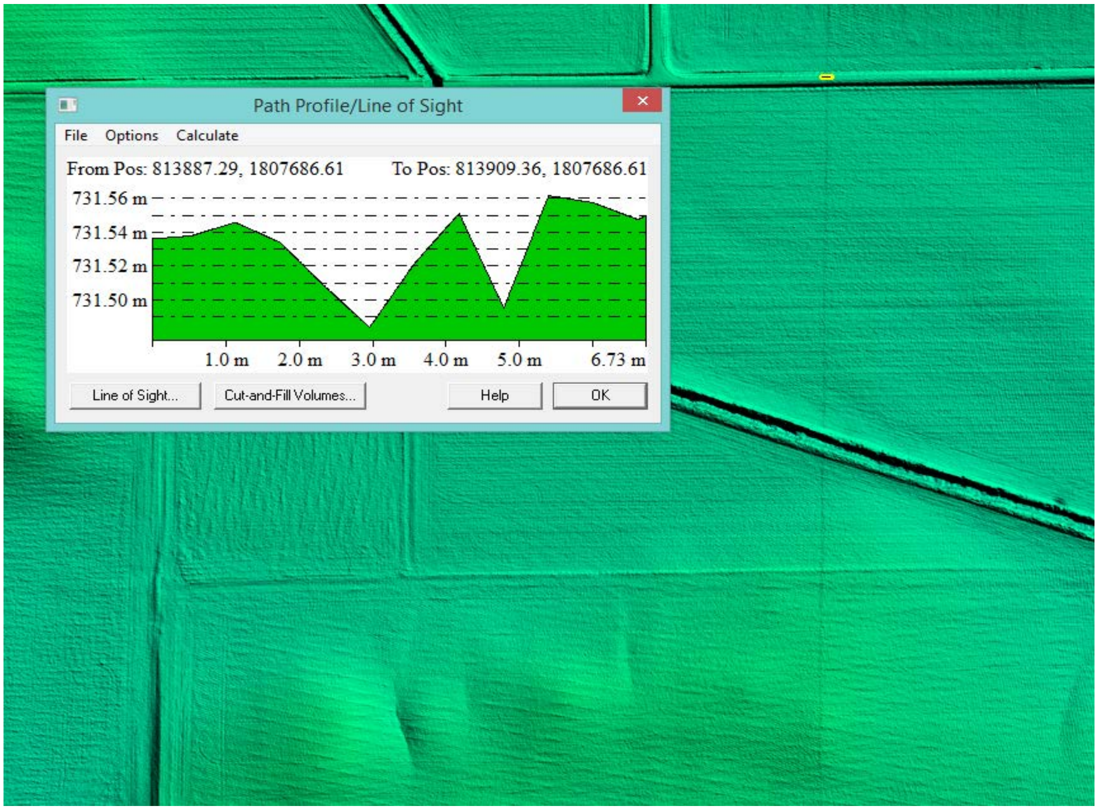


Figure 12 – The flight line ridge is less than 8 cm. Overall, the Block B Champaign County project data meets the project specifications for 8 cm RMSDz relative accuracy requirement.

Dam and Lock system

Irregularities in the natural water flow exist in sections of river affected by Lock and Dam systems. Series of locks enable vessels to “step” up or down a river or canal from one water level to another. There are no Lock systems in the Block B Champaign County Lidar project area.

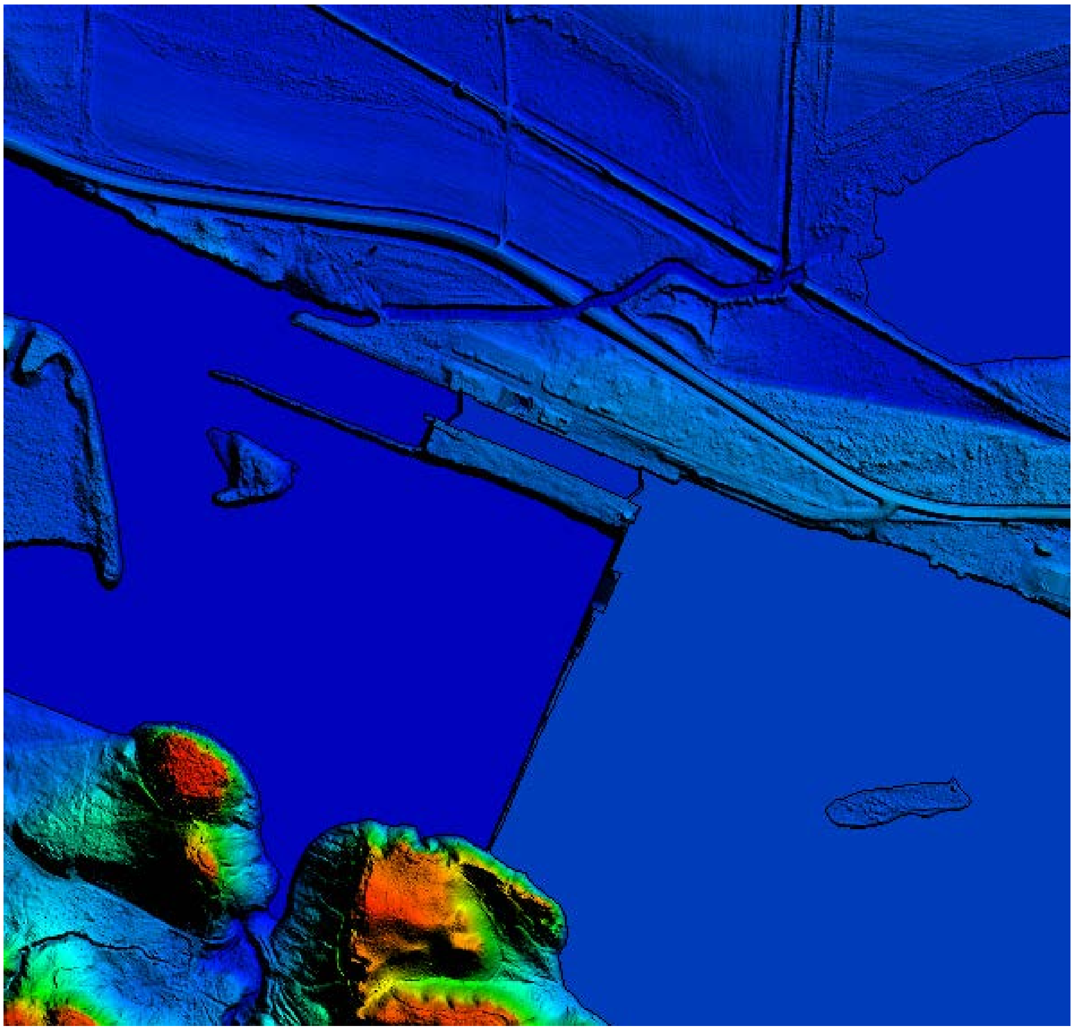


Figure 13 – DEM shows Large Dam structure that disrupts natural monotonic river flow, coupled with a lock system.

FORMATTING

After the final QA/QC is performed and all corrections have been applied to the dataset, all LiDAR files are updated to the final format requirements and the final formatting, header information, point data records, and variable length records are verified using ASI proprietary tools. ASI routinely reviews for: proper LAS versions, Coordinate Reference System, Global Encoder Bit, Time Stamp, System ID, Multiple Returns, Intensity, Classification, Overlap and Withheld Points, Scan angle, XYZ Coordinates.

LiDAR Positional Accuracy

BACKGROUND

ASI quantitatively tested the dataset by testing the vertical accuracy of the LiDAR. The vertical accuracy is tested by comparing the discreet measurement of the survey checkpoints to that of the interpolated value within the three closest LiDAR points that constitute the vertices of a three-dimensional triangular face of the TIN. Therefore, the end result is that only a small sample of the LiDAR data is actually tested. However there is an increased level of confidence with LiDAR data due to the relative accuracy. This relative accuracy in turn is based on how well one LiDAR point "fits" in comparison to the next contiguous LiDAR measurement, and is verified as part of the initial processing. If the relative accuracy of a dataset is within specifications and the dataset passes vertical accuracy requirements at the location of survey checkpoints, the vertical accuracy results can be applied to the whole dataset with high confidence due to the passing relative accuracy. The nature of lidar data makes it difficult to assess absolute horizontal accuracy as one would with imagery or compiled planimetric data. Guidance on how absolute horizontal accuracy can be estimated and reported based on the error budget of the instrumentation and operational parameters can be found in ASPRS (2014). The horizontal accuracy of each lidar project shall be reported using the form specified by the ASPRS (2014).

SURVEY VERTICAL ACCURACY CHECKPOINTS

For the vertical accuracy assessment of Block B Champaign County project, sixty four check points were surveyed. All of those check points are located within bare earth/open terrain (64 NVA points). Please see provided survey report which details and validates how the survey was completed for this project. Checkpoints were evenly distributed throughout the project area so as to cover as many flight lines as possible using the “dispersed method” of placement. All checkpoints surveyed for vertical accuracy testing purposes are listed in the following table.

Point ID	NAD83 (2011) Albers Equal Area	NAD83 (2011) Albers Equal Area	NAVD88 (Geoid12B)
	Easting (M)	Northing (M)	Elevation (M)
NVA042	641114.007	1955283.019	220.491
NVA043	661757.869	1949739.54	224.357
NVA044	667548.253	1958075.164	229.178
NVA045	639982.725	1933822.037	215.753
NVA046	673733.595	1928352.831	209.238
NVA047	650909.866	1928393.034	233.38
NVA048	655106.949	1924700.919	224.304
NVA049	657866.726	1926939.638	214.841
NVA050	646875.635	1909372.805	208.084
NVA051	663507.225	1903726.764	199.613

NVA052	679402.599	1919532.316	204.664
NVA140	635039.843	1947897.535	227.336
NVA141	649407.221	1949119.713	222.319
NVA142	649785.99	1956493.343	219.394
NVA143	671077.199	1950543.4	240.285
NVA144	661325.999	1954814.276	236.85
NVA145	678316.726	1942220.183	228.275
NVA146	658135.513	1941571.878	223.062
NVA147	644110.441	1947184.223	217.067
NVA148	644021.973	1937128.511	219.407
NVA149	653512.253	1930692.204	227.677
NVA150	648439.747	1923050.665	217.352
NVA151	651062.915	1924668.668	220.314
NVA152	655144.476	1927482.6	223.86
NVA153	655221.329	1919407.989	218.872
NVA154	661626.112	1923926.129	212.215
NVA155	639257.009	1924474.162	213.315
NVA156	665609.479	1935476.194	212.232
NVA157	675945.487	1937208.937	206.915
NVA158	638212.208	1906072.123	208.355
NVA159	654791.987	1912936.511	225.132
NVA160	648096.526	1919656.033	211.972
NVA161	677648.744	1905164.935	207.907
NVA162	669648.759	1916933.604	202.535
NVA163	669291.197	1911170.088	216.369
NVA164	653679.688	1903982.443	217.509
NVA165	646226.512	1901945.024	208.693
NVA166	640036.689	1915351.824	210.899
NVA167	668930.406	1941705.657	208.843
NVA168	649332.791	1943299.71	222.965
NVA169	659362.198	1929565.858	217.87
NVA170	658198.411	1935041.67	220.671
NVA171	658992.937	1949467.758	224.886
NVA172	660911.368	1910668.082	208.5
NVA173	663729.416	1914385.023	219.719
NVA174	679935.454	1913682.922	206.961
NVA175	651285.525	1934550.734	234.233
NVA176	640464.228	1941810.92	222.047
NVA177	661810.248	1926670.814	214.346
NVA178	671768.821	1927101.566	203.285
NVA179	676374.015	1924272.252	201.265

NVA180	678345.892	1928919.581	203.707
NVA181	671919.508	1902158.385	205.928
NVA182	662750.668	1948182.817	221.846
NVA183	644078.011	1933948.424	233.6
NVA184	636637.291	1952867.217	223.347
NVA185	634018.983	1956605.67	227.263
NVA186	661929.299	1957728.371	235.26
NVA187	676149.404	1957993.39	218.554
NVA188	647517.031	1908914.372	210.531
NVA189	677953.576	1950006.726	216.871
NVA190	644143.981	1925020.781	217.12
NVA191	675971.697	1908276.911	209.479
NVA192	658346.094	1940216.373	222.146
VVA93	637009.794	1952866.348	222.832
VVA94	643763.161	1947976.317	221.141
VVA95	660099.170	1946368.031	223.303
VVA96	661698.993	1950511.488	226.773
VVA97	661971.381	1956883.909	233.387
VVA98	675346.966	1958701.663	216.760
VVA99	677638.405	1949501.400	216.285
VVA100	643312.859	1937141.176	216.180
VVA101	637327.879	1933374.493	216.377
VVA102	658475.854	1941141.564	222.634
VVA103	676626.626	1937028.754	207.062
VVA104	668984.945	1941594.356	208.657
VVA105	658985.924	1931640.266	222.866
VVA106	653761.138	1925741.699	233.311
VVA107	657761.795	1925679.091	221.487
VVA108	661362.812	1923647.559	212.445
VVA109	648949.267	1922584.355	219.363
VVA110	672337.650	1927186.817	207.141
VVA111	644032.638	1925013.092	217.332
VVA112	647913.553	1951758.779	218.573
VVA113	639242.588	1924299.653	215.290
VVA114	642100.038	1915532.961	211.445
VVA115	654084.892	1919802.719	226.757
VVA116	662829.448	1915469.939	223.393
VVA117	670459.243	1917874.485	206.298
VVA118	678662.939	1919773.753	204.034
VVA119	677569.501	1904832.300	210.284
VVA120	654396.715	1903867.031	215.326

VVA121	638277.484	1905964.574	208.195
VVA122	653751.508	1912210.180	223.231
VVA123	669259.069	1911385.290	218.952
VVA124	663513.032	1904162.039	199.579
VVA125	646983.591	1909302.230	209.152
VVA126	646178.282	1899752.610	206.267
VVA127	641328.824	1941776.358	213.779
VVA128	655252.523	1948705.628	220.816
VVA129	649834.756	1955748.767	218.926
VVA130	671588.533	1948700.627	237.786
VVA131	670156.366	1955049.228	229.658
VVA132	641163.305	1954804.860	217.182
VVA133	634859.595	1947893.071	226.260
VVA134	646515.634	1931867.668	226.640
VVA135	665632.555	1935482.958	211.936
VVA136	651051.004	1934265.903	234.738
VVA137	661257.576	1910527.410	208.090
VVA138	654697.227	1929823.996	228.121
VVA139	648938.781	1944889.910	219.451
VVA140	674333.648	1908597.686	212.411

Table 5 – Block B Champaign County project LiDAR Checkpoints.

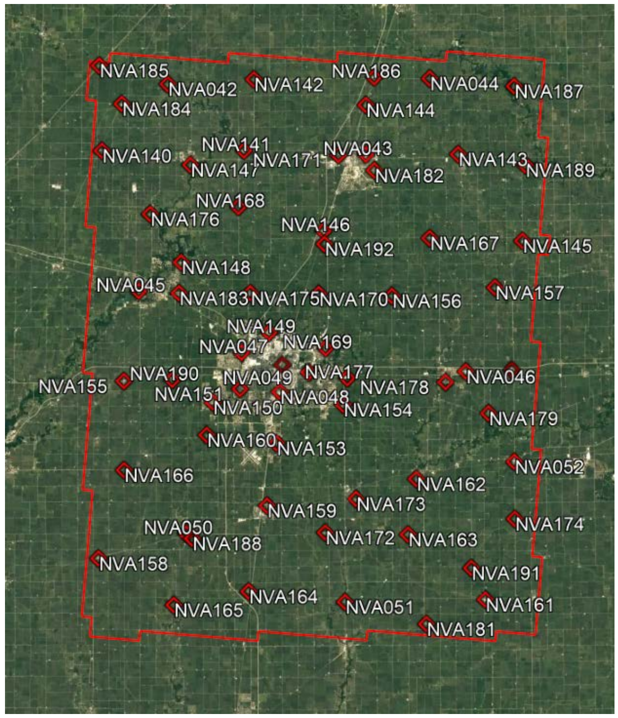


Figure 14 – Location of Block B Champaign County LiDAR NVA Checkpoints

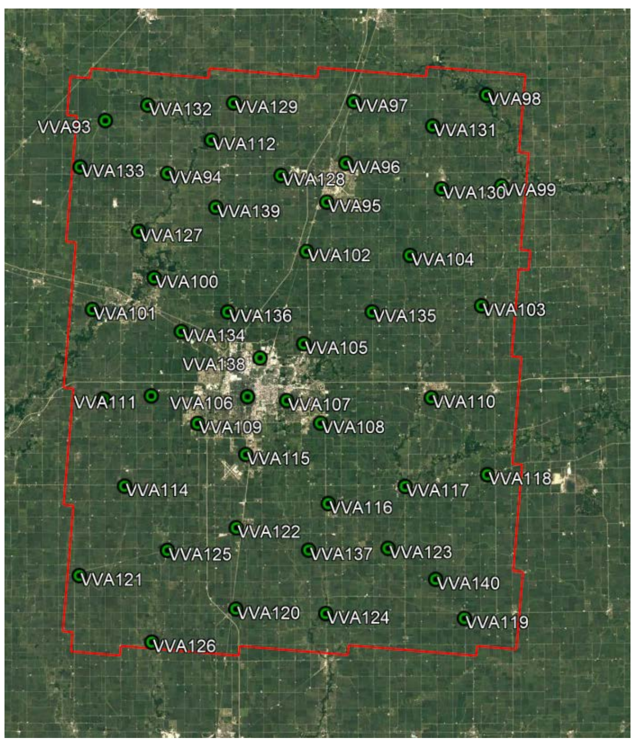


Figure 15- No VVA Checkpoints were located in Block B Champaign County

VERTICAL ACCURACY TEST PROCEDURES

NVA (Non-vegetated Vertical Accuracy) is determined with check points located only in nonvegetated terrain, including open terrain (grass, dirt, sand, and/or rocks) and urban areas, where there is a very high probability that the LiDAR sensor will have detected the bare-earth ground surface and where random errors are expected to follow a normal error distribution. The NVA determines how well the calibrated LiDAR sensor performed. With a normal error distribution, the vertical accuracy at the 95% confidence level is computed as the vertical root mean square error (RMSEz) of the checkpoints x 1.9600. For the Block B Champaign County project, vertical accuracy must be 19.6 cm (0.64 ft) or less based on an RMSEz of 10 cm (0.33 ft) x 1.9600. VVA (Vegetated Vertical Accuracy) is determined with all checkpoints in vegetated land cover categories, including tall grass, weeds, crops, brush and low trees, and fully forested areas, where there is a possibility that the LiDAR sensor and post-processing may yield elevation errors that do not follow a normal error distribution. VVA at the 95% confidence level equals the 95th percentile error for all checkpoints in all vegetated land cover categories combined. The Block B Champaign County Lidar project VVA standard is 29.4 cm (0.96 ft) based on the 95th percentile.

Quantitative Criteria	Measure of Acceptability
Non-Vegetated Vertical Accuracy (NVA) in open terrain and urban land cover categories using RMSEz *1.96	19.6 cm (based on RMSEz (10 cm)*1.96)
Vegetated Vertical Accuracy (VVA) in all vegetated land cover categories combined and at the 95th Percentile error	29.4 cm (based on combined 95th percentile)

Table 6 – Acceptance Criteria.

The primary QA/QC vertical accuracy testing steps used by ASI are summarized as follows:

1. SAM surveyed QA/QC vertical checkpoints in accordance with the project's specifications.

2. Next, ASI interpolated the bare-earth LiDAR DTM to provide the z-value for every checkpoint.

3. ASI then computed the associated z-value differences between the interpolated z-value from the LiDAR data and the ground truth survey checkpoints and computed NVA, VVA, and other statistics.

4. The data were analyzed by ASI to assess the accuracy of the data. The review process examined the various accuracy parameters as defined by the scope of work. The overall descriptive statistics of each dataset were computed to assess any trends or anomalies. This report provides tables, graphs and figures to summarize and illustrate data quality.

VERTICAL ACCURACY RESULTS

The table below summarizes the tested vertical accuracy resulting from a comparison of the surveyed checkpoints to the elevation values present within the fully classified LiDAR LAS files.

Land Cover Category	# of Points	NVA – Non-vegetated Vertical Accuracy (95% confidence)Spec = 0.196 m	VVA – Vegetated Vertical Accuracy (95th Percentile) spec = 0.294 m
NVA	64	0.098	
VVA	48		0.106

Table 7 – Tested NVA and VVA.

HORIZONTAL ACCURACY TEST PROCEDURES

This data set was produced to meet ASPRS “Positional Accuracy Standards for Digital Geospatial Data” (2014) for a 20.8 (cm) RMSEx / RMSEy Horizontal Accuracy Class which equates to Positional Horizontal Accuracy = +/- 40.768 cm at a 95% confidence level.”

Breakline Production Methodology

MicroStation, in conjunction with TerraSolid's TerraScan and TerraModeler was utilized for the collection of hydrologic breaklines, which occurred independently of manual edit. Collection was done using 2D information in the LAS format, intensity format, and ground surface. Breaklines are developed to the limit of the project boundary. Breaklines are in the same coordinate reference system and unit of measure as the LiDAR point delivery. Hydrologic water-surface edges are set at or just below the immediately surrounding terrain. Breaklines are developed to the limit of the project boundary.

Breakline Qualitative Assessment

Completeness and horizontal placement is verified through visual review against LiDAR intensity imagery, and bare earth surface. Breakline features are check for connectivity of features, enforced monotonicity on linear hydrographic breaklines, and flatness on water bodies.

After all corrections and edits to the breakline features, the breaklines are imported into the final GDB and verified for correct formatting.

Feature Definition

Inland Streams and Rivers

Streams and Rivers with a nominal width of 30 meters (100 feet), were collected to best fit the shoreline by using information in the LAS format; intensity format, ground surface TIN, and sometimes "quick guide" contours. Streams and rivers do not break at bridges, but they are closed ended breaks at culvert locations. Steams and Rivers breaklines have been delivered in PolylineZ format in the final GDB.

Inland Ponds and Lakes

Inland ponds and lakes of 2 acres (86,111 square feet/ ~350'/~106 meter diameter for a round pond) or greater were collected. Inland pond and Lakes were collected to best fit the shoreline by using information in the LAS format; intensity format, ground surface TIN, and sometimes "quick guide" contours. Inland pond and Lakes Breaklines have been delivered in PolygonZ format in the final GDB.

Islands

Permanent island 4046m^2 (1 acre) or larger were delineated within all water bodies. Breaklines have been delivered in PolygonZ format in the final GDB

Bridge Breaklines

Breaklines were placed across the bottom of the bridge embankment when triangulation occurred due to bridge deck classification. Breaklines have been delivered in PolylineZ format in the final GDB.

Intensity Imagery Production & Qualitative Assessment

INTENSITY PRODUCTION METHODOLOGY

ASI utilized MicroStation in conjunction with TerraSolid's TerraScan for Intensity production. Global Mapper was used to QC the products. ArcGIS was used finalize the Intensity's projection.

Intensity Images are created for each tile in the tiling schema. The Intensities are reviewed for any issues requiring corrections. Tiles are verified for final formatting and loaded into Global Mapper to ensure there are no missing, or corrupt tiles, and to check for seamlessness across tile boundaries.

INTENSITY QUALITATIVE ASSESSMENT

ASI performed a qualitative assessment of the Intensity deliverables to ensure that all tiled Intensity products were delivered with the proper extents, and contained proper referencing information. This lidar survey was conducted over a span of time consisting of both day and nighttime missions. In this data set Lidar collected during daytime hours tends to have intensity returns of lighter higher range values as opposed to dark lower range value intensity returns of missions flown at night. Lighter daytime and darker nighttime intensity values are evident in the intensities of this dataset.
Figure 16, is an example of an Intensity Image that contains both daytime and nighttime collections of lidar data. The left side of the image contains higher intensity values consistent with a daytime collection, while the darker right side exhibits lower intensity values consistent with a night time collection.

Figure 16 – Intensity Image example.

DEM Production & Qualitative Assessment

DEM PRODUCTION METHODOLOGY

ASI utilized MicroStation Connect in conjunction with TerraSolid's TerraScan and TerraModeler for DEM production. Global Mapper version 21.0 was used to format and QC the products. GDAL version 2.4.0 was used finalize the DEMs projection.

The final bare earth LiDAR points are used to create a terrain. The final 3D breaklines collected for the project are enforced in the terrain. The terrain is then converted to raster format using linear interpolation. DEMs are created for each tile in the tiling schema. The DEMs are reviewed for any issues requiring corrections, including remaining LiDAR ground misclassification, erroneous breakline elevations, poor hydro flattening, and processing artifacts. Tiles are verified for final formatting and loaded into Global Mapper to ensure there are no missing, or corrupt tiles, and to check for seamlessness across tile boundaries.

DEM QUALITATIVE ASSESSMENT

ASI performed a qualitative assessment of the bare earth DEM deliverables to ensure that all tiled DEM products were delivered with the proper extents, were free of processing artifacts, and contained proper referencing information.

The image below shows an example of a bare earth DEM.

Figure 17 – Block B Champaign County project bare earth DEM

DEM VERTICAL ACCURACY RESULTS

The same 64 checkpoints that were used to test the vertical accuracy of the LIDAR were used to validate the vertical accuracy of the final DEM products as well. Accuracy results may vary between the source LiDAR and final DEM deliverable. DEMs are created by averaging several LiDAR points within each pixel which may result in slightly different elevation values at each survey checkpoint when compared to the source LAS. The DEM pixel does not average several LiDAR point's together, it interpolates (linearly) between two or three points to derive an elevation value. The vertical accuracy of the DEM is tested by extracting the elevation of the pixel that contains the x/y coordinates of the checkpoint and comparing these DEM elevations to the survey elevations.

Table 9; summarizes the tested vertical accuracy result from a comparison of surveyed checkpoint to the elevation values present within the final DEM dataset.

Land Cover Category	# of Points	NVA – Non-vegetated Vertical Accuracy (RMSEz x 1.960)	VVA – Vegetated Vertical Accuracy (95^{th} percentile)
NVA	64	0.092	
VVA	48		0.114

Table 9– DEM vertical accuracy summary

DEM datasets were tested to meet ASPRS Positional Accuracy Standards for Digital Geospatial Data (2014) for a 10 cm RMSEz Vertical Accuracy Class. Actual NVA accuracy was found to be RMSEz = 0.047 meters with a 0.092 meters accuracy at 95 % confidence level. Actual VVA accuracy tested 0.114 meters using checkpoints located in forested land cover categories at the 95th percentile, derived according to ASPRS guidelines, tested against the DEM. Based on the vertical accuracy testing conducted by ASI, the DEM dataset for the Block B Champaign County project satisfies the project's pre-defined vertical accuracy criteria.

Appendix A: List of Delivered LAS File

w6330n1953.las
w6330n1954.las
w6330n1955.las
w6330n1956.las
w6340n1940.las
w6340n1941.las
w6340n1942.las
w6340n1943.las
w6340n1944.las
w6340n1945.las
w6340n1946.las
w6340n1947.las
w6340n1948.las
w6340n1949.las
w6340n1950.las
w6340n1951.las
w6340n1952.las
w6340n1953.las
w6340n1954.las
w6340n1955.las
w6340n1956.las
w6350n1925.las
w6350n1926.las
w6350n1927.las
w6350n1928.las
w6350n1929.las
w6350n1930.las
w6350n1931.las
w6350n1932.las
w6350n1933.las
w6350n1934.las
w6350n1935.las
w6350n1936.las
w6350n1937.las
w6350n1938.las
w6350n1939.las
w6350n1940.las
w6350n1941.las
w6350n1942.las
w6350n1943.las
w6350n1944.las
w6350n1945.las
w6350n1946.las
w6350n1947.las
w6350n1948.las
w6350n1949.las
w6350n1950.las
w6350n1951.las

w6350n1952.las
w6350n1953.las
w6350n1954.las
w6350n1955.las
w6350n1956.las
w6350n1957.las
w6360n1913.las
w6360n1914.las
w6360n1915.las
w6360n1916.las
w6360n1917.las
w6360n1918.las
w6360n1919.las
w6360n1920.las
w6360n1921.las
w6360n1922.las
w6360n1923.las
w6360n1924.las
w6360n1925.las
w6360n1926.las
w6360n1927.las
w6360n1928.las
w6360n1929.las
w6360n1930.las
w6360n1931.las
w6360n1932.las
w6360n1933.las
w6360n1934.las
w6360n1935.las
w6360n1936.las
w6360n1937.las
w6360n1938.las
w6360n1939.las
w6360n1940.las
w6360n1941.las
w6360n1942.las
w6360n1943.las
w6360n1944.las
w6360n1945.las
w6360n1946.las
w6360n1947.las
w6360n1948.las
w6360n1949.las
w6360n1950.las
w6360n1951.las
w6360n1952.las
w6360n1953.las
w6360n1954.las
w6360n1955.las
w6360n1956.las
w6360n1957.las

w6370n1900.las
w6370n1901.las
w6370n1902.las
w6370n1903.las
w6370n1904.las
w6370n1905.las
w6370n1906.las
w6370n1907.las
w6370n1908.las
w6370n1909.las
w6370n1910.las
w6370n1911.las
w6370n1912.las
w6370n1913.las
w6370n1914.las
w6370n1915.las
w6370n1916.las
w6370n1917.las
w6370n1918.las
w6370n1919.las
w6370n1920.las
w6370n1921.las
w6370n1922.las
w6370n1923.las
w6370n1924.las
w6370n1925.las
w6370n1926.las
w6370n1927.las
w6370n1928.las
w6370n1929.las
w6370n1930.las
w6370n1931.las
w6370n1932.las
w6370n1933.las
w6370n1934.las
w6370n1935.las
w6370n1936.las
w6370n1937.las
w6370n1938.las
w6370n1939.las
w6370n1940.las
w6370n1941.las
w6370n1942.las
w6370n1943.las
w6370n1944.las
w6370n1945.las
w6370n1946.las
w6370n1947.las
w6370n1948.las
w6370n1949.las
w6370n1950.las

w6370n1951.las
w6370n1952.las
w6370n1953.las
w6370n1954.las
w6370n1955.las
w6370n1956.las
w6370n1957.las
w6380n1898.las
w6380n1899.las
w6380n1900.las
w6380n1901.las
w6380n1902.las
w6380n1903.las
w6380n1904.las
w6380n1905.las
w6380n1906.las
w6380n1907.las
w6380n1908.las
w6380n1909.las
w6380n1910.las
w6380n1911.las
w6380n1912.las
w6380n1913.las
w6380n1914.las
w6380n1915.las
w6380n1916.las
w6380n1917.las
w6380n1918.las
w6380n1919.las
w6380n1920.las
w6380n1921.las
w6380n1922.las
w6380n1923.las
w6380n1924.las
w6380n1925.las
w6380n1926.las
w6380n1927.las
w6380n1928.las
w6380n1929.las
w6380n1930.las
w6380n1931.las
w6380n1932.las
w6380n1933.las
w6380n1934.las
w6380n1935.las
w6380n1936.las
w6380n1937.las
w6380n1938.las
w6380n1939.las
w6380n1940.las
w6380n1941.las

w6380n1942.las
w6380n1943.las
w6380n1944.las
w6380n1945.las
w6380n1946.las
w6380n1947.las
w6380n1948.las
w6380n1949.las
w6380n1950.las
w6380n1951.las
w6380n1952.las
w6380n1953.las
w6380n1954.las
w6380n1955.las
w6380n1956.las
w6380n1957.las
w6390n1898.las
w6390n1899.las
w6390n1900.las
w6390n1901.las
w6390n1902.las
w6390n1903.las
w6390n1904.las
w6390n1905.las
w6390n1906.las
w6390n1907.las
w6390n1908.las
w6390n1909.las
w6390n1910.las
w6390n1911.las
w6390n1912.las
w6390n1913.las
w6390n1914.las
w6390n1915.las
w6390n1916.las
w6390n1917.las
w6390n1918.las
w6390n1919.las
w6390n1920.las
w6390n1921.las
w6390n1922.las
w6390n1923.las
w6390n1924.las
w6390n1925.las
w6390n1926.las
w6390n1927.las
w6390n1928.las
w6390n1929.las
w6390n1930.las
w6390n1931.las
w6390n1932.las

w6390n1933.las
w6390n1934.las
w6390n1935.las
w6390n1936.las
w6390n1937.las
w6390n1938.las
w6390n1939.las
w6390n1940.las
w6390n1941.las
w6390n1942.las
w6390n1943.las
w6390n1944.las
w6390n1945.las
w6390n1946.las
w6390n1947.las
w6390n1948.las
w6390n1949.las
w6390n1950.las
w6390n1951.las
w6390n1952.las
w6390n1953.las
w6390n1954.las
w6390n1955.las
w6390n1956.las
w6390n1957.las
w6400n1898.las
w6400n1899.las
w6400n1900.las
w6400n1901.las
w6400n1902.las
w6400n1903.las
w6400n1904.las
w6400n1905.las
w6400n1906.las
w6400n1907.las
w6400n1908.las
w6400n1909.las
w6400n1910.las
w6400n1911.las
w6400n1912.las
w6400n1913.las
w6400n1914.las
w6400n1915.las
w6400n1916.las
w6400n1917.las
w6400n1918.las
w6400n1919.las
w6400n1920.las
w6400n1921.las
w6400n1922.las
w6400n1923.las

w6400n1924.las
w6400n1925.las
w6400n1926.las
w6400n1927.las
w6400n1928.las
w6400n1929.las
w6400n1930.las
w6400n1931.las
w6400n1932.las
w6400n1933.las
w6400n1934.las
w6400n1935.las
w6400n1936.las
w6400n1937.las
w6400n1938.las
w6400n1939.las
w6400n1940.las
w6400n1941.las
w6400n1942.las
w6400n1943.las
w6400n1944.las
w6400n1945.las
w6400n1946.las
w6400n1947.las
w6400n1948.las
w6400n1949.las
w6400n1950.las
w6400n1951.las
w6400n1952.las
w6400n1953.las
w6400n1954.las
w6400n1955.las
w6400n1956.las
w6400n1957.las
w6410n1898.las
w6410n1899.las
w6410n1900.las
w6410n1901.las
w6410n1902.las
w6410n1903.las
w6410n1904.las
w6410n1905.las
w6410n1906.las
w6410n1907.las
w6410n1908.las
w6410n1909.las
w6410n1910.las
w6410n1911.las
w6410n1912.las
w6410n1913.las
w6410n1914.las

w6410n1915.las
w6410n1916.las
w6410n1917.las
w6410n1918.las
w6410n1919.las
w6410n1920.las
w6410n1921.las
w6410n1922.las
w6410n1923.las
w6410n1924.las
w6410n1925.las
w6410n1926.las
w6410n1927.las
w6410n1928.las
w6410n1929.las
w6410n1930.las
w6410n1931.las
w6410n1932.las
w6410n1933.las
w6410n1934.las
w6410n1935.las
w6410n1936.las
w6410n1937.las
w6410n1938.las
w6410n1939.las
w6410n1940.las
w6410n1941.las
w6410n1942.las
w6410n1943.las
w6410n1944.las
w6410n1945.las
w6410n1946.las
w6410n1947.las
w6410n1948.las
w6410n1949.las
w6410n1950.las
w6410n1951.las
w6410n1952.las
w6410n1953.las
w6410n1954.las
w6410n1955.las
w6410n1956.las
w6410n1957.las
w6420n1898.las
w6420n1899.las
w6420n1900.las
w6420n1901.las
w6420n1902.las
w6420n1903.las
w6420n1904.las
w6420n1905.las

w6420n1906.las
w6420n1907.las
w6420n1908.las
w6420n1909.las
w6420n1910.las
w6420n1911.las
w6420n1912.las
w6420n1913.las
w6420n1914.las
w6420n1915.las
w6420n1916.las
w6420n1917.las
w6420n1918.las
w6420n1919.las
w6420n1920.las
w6420n1921.las
w6420n1922.las
w6420n1923.las
w6420n1924.las
w6420n1925.las
w6420n1926.las
w6420n1927.las
w6420n1928.las
w6420n1929.las
w6420n1930.las
w6420n1931.las
w6420n1932.las
w6420n1933.las
w6420n1934.las
w6420n1935.las
w6420n1936.las
w6420n1937.las
w6420n1938.las
w6420n1939.las
w6420n1940.las
w6420n1941.las
w6420n1942.las
w6420n1943.las
w6420n1944.las
w6420n1945.las
w6420n1946.las
w6420n1947.las
w6420n1948.las
w6420n1949.las
w6420n1950.las
w6420n1951.las
w6420n1952.las
w6420n1953.las
w6420n1954.las
w6420n1955.las
w6420n1956.las

w6420n1957.las
w6430n1899.las
w6430n1900.las
w6430n1901.las
w6430n1902.las
w6430n1903.las
w6430n1904.las
w6430n1905.las
w6430n1906.las
w6430n1907.las
w6430n1908.las
w6430n1909.las
w6430n1910.las
w6430n1911.las
w6430n1912.las
w6430n1913.las
w6430n1914.las
w6430n1915.las
w6430n1916.las
w6430n1917.las
w6430n1918.las
w6430n1919.las
w6430n1920.las
w6430n1921.las
w6430n1922.las
w6430n1923.las
w6430n1924.las
w6430n1925.las
w6430n1926.las
w6430n1927.las
w6430n1928.las
w6430n1929.las
w6430n1930.las
w6430n1931.las
w6430n1932.las
w6430n1933.las
w6430n1934.las
w6430n1935.las
w6430n1936.las
w6430n1937.las
w6430n1938.las
w6430n1939.las
w6430n1940.las
w6430n1941.las
w6430n1942.las
w6430n1943.las
w6430n1944.las
w6430n1945.las
w6430n1946.las
w6430n1947.las
w6430n1948.las

w6430n1949.las
w6430n1950.las
w6430n1951.las
w6430n1952.las
w6430n1953.las
w6430n1954.las
w6430n1955.las
w6430n1956.las
w6430n1957.las
w6440n1899.las
w6440n1900.las
w6440n1901.las
w6440n1902.las
w6440n1903.las
w6440n1904.las
w6440n1905.las
w6440n1906.las
w6440n1907.las
w6440n1908.las
w6440n1909.las
w6440n1910.las
w6440n1911.las
w6440n1912.las
w6440n1913.las
w6440n1914.las
w6440n1915.las
w6440n1916.las
w6440n1917.las
w6440n1918.las
w6440n1919.las
w6440n1920.las
w6440n1921.las
w6440n1922.las
w6440n1923.las
w6440n1924.las
w6440n1925.las
w6440n1926.las
w6440n1927.las
w6440n1928.las
w6440n1929.las
w6440n1930.las
w6440n1931.las
w6440n1932.las
w6440n1933.las
w6440n1934.las
w6440n1935.las
w6440n1936.las
w6440n1937.las
w6440n1938.las
w6440n1939.las
w6440n1940.las

w6440n1941.las
w6440n1942.las
w6440n1943.las
w6440n1944.las
w6440n1945.las
w6440n1946.las
w6440n1947.las
w6440n1948.las
w6440n1949.las
w6440n1950.las
w6440n1951.las
w6440n1952.las
w6440n1953.las
w6440n1954.las
w6440n1955.las
w6440n1956.las
w6440n1957.las
w6450n1899.las
w6450n1900.las
w6450n1901.las
w6450n1902.las
w6450n1903.las
w6450n1904.las
w6450n1905.las
w6450n1906.las
w6450n1907.las
w6450n1908.las
w6450n1909.las
w6450n1910.las
w6450n1911.las
w6450n1912.las
w6450n1913.las
w6450n1914.las
w6450n1915.las
w6450n1916.las
w6450n1917.las
w6450n1918.las
w6450n1919.las
w6450n1920.las
w6450n1921.las
w6450n1922.las
w6450n1923.las
w6450n1924.las
w6450n1925.las
w6450n1926.las
w6450n1927.las
w6450n1928.las
w6450n1929.las
w6450n1930.las
w6450n1931.las
w6450n1932.las

w6450n1933.las
w6450n1934.las
w6450n1935.las
w6450n1936.las
w6450n1937.las
w6450n1938.las
w6450n1939.las
w6450n1940.las
w6450n1941.las
w6450n1942.las
w6450n1943.las
w6450n1944.las
w6450n1945.las
w6450n1946.las
w6450n1947.las
w6450n1948.las
w6450n1949.las
w6450n1950.las
w6450n1951.las
w6450n1952.las
w6450n1953.las
w6450n1954.las
w6450n1955.las
w6450n1956.las
w6450n1957.las
w6460n1899.las
w6460n1900.las
w6460n1901.las
w6460n1902.las
w6460n1903.las
w6460n1904.las
w6460n1905.las
w6460n1906.las
w6460n1907.las
w6460n1908.las
w6460n1909.las
w6460n1910.las
w6460n1911.las
w6460n1912.las
w6460n1913.las
w6460n1914.las
w6460n1915.las
w6460n1916.las
w6460n1917.las
w6460n1918.las
w6460n1919.las
w6460n1920.las
w6460n1921.las
w6460n1922.las
w6460n1923.las
w6460n1924.las

w6460n1925.las
w6460n1926.las
w6460n1927.las
w6460n1928.las
w6460n1929.las
w6460n1930.las
w6460n1931.las
w6460n1932.las
w6460n1933.las
w6460n1934.las
w6460n1935.las
w6460n1936.las
w6460n1937.las
w6460n1938.las
w6460n1939.las
w6460n1940.las
w6460n1941.las
w6460n1942.las
w6460n1943.las
w6460n1944.las
w6460n1945.las
w6460n1946.las
w6460n1947.las
w6460n1948.las
w6460n1949.las
w6460n1950.las
w6460n1951.las
w6460n1952.las
w6460n1953.las
w6460n1954.las
w6460n1955.las
w6460n1956.las
w6460n1957.las
w6470n1899.las
w6470n1900.las
w6470n1901.las
w6470n1902.las
w6470n1903.las
w6470n1904.las
w6470n1905.las
w6470n1906.las
w6470n1907.las
w6470n1908.las
w6470n1909.las
w6470n1910.las
w6470n1911.las
w6470n1912.las
w6470n1913.las
w6470n1914.las
w6470n1915.las
w6470n1916.las

w6470n1917.las
w6470n1918.las
w6470n1919.las
w6470n1920.las
w6470n1921.las
w6470n1922.las
w6470n1923.las
w6470n1924.las
w6470n1925.las
w6470n1926.las
w6470n1927.las
w6470n1928.las
w6470n1929.las
w6470n1930.las
w6470n1931.las
w6470n1932.las
w6470n1933.las
w6470n1934.las
w6470n1935.las
w6470n1936.las
w6470n1937.las
w6470n1938.las
w6470n1939.las
w6470n1940.las
w6470n1941.las
w6470n1942.las
w6470n1943.las
w6470n1944.las
w6470n1945.las
w6470n1946.las
w6470n1947.las
w6470n1948.las
w6470n1949.las
w6470n1950.las
w6470n1951.las
w6470n1952.las
w6470n1953.las
w6470n1954.las
w6470n1955.las
w6470n1956.las
w6470n1957.las
w6470n1958.las
w6480n1899.las
w6480n1900.las
w6480n1901.las
w6480n1902.las
w6480n1903.las
w6480n1904.las
w6480n1905.las
w6480n1906.las
w6480n1907.las

w6480n1908.las
w6480n1909.las
w6480n1910.las
w6480n1911.las
w6480n1912.las
w6480n1913.las
w6480n1914.las
w6480n1915.las
w6480n1916.las
w6480n1917.las
w6480n1918.las
w6480n1919.las
w6480n1920.las
w6480n1921.las
w6480n1922.las
w6480n1923.las
w6480n1924.las
w6480n1925.las
w6480n1926.las
w6480n1927.las
w6480n1928.las
w6480n1929.las
w6480n1930.las
w6480n1931.las
w6480n1932.las
w6480n1933.las
w6480n1934.las
w6480n1935.las
w6480n1936.las
w6480n1937.las
w6480n1938.las
w6480n1939.las
w6480n1940.las
w6480n1941.las
w6480n1942.las
w6480n1943.las
w6480n1944.las
w6480n1945.las
w6480n1946.las
w6480n1947.las
w6480n1948.las
w6480n1949.las
w6480n1950.las
w6480n1951.las
w6480n1952.las
w6480n1953.las
w6480n1954.las
w6480n1955.las
w6480n1956.las
w6480n1957.las
w6480n1958.las

w6490n1899.las
w6490n1900.las
w6490n1901.las
w6490n1902.las
w6490n1903.las
w6490n1904.las
w6490n1905.las
w6490n1906.las
w6490n1907.las
w6490n1908.las
w6490n1909.las
w6490n1910.las
w6490n1911.las
w6490n1912.las
w6490n1913.las
w6490n1914.las
w6490n1915.las
w6490n1916.las
w6490n1917.las
w6490n1918.las
w6490n1919.las
w6490n1920.las
w6490n1921.las
w6490n1922.las
w6490n1923.las
w6490n1924.las
w6490n1925.las
w6490n1926.las
w6490n1927.las
w6490n1928.las
w6490n1929.las
w6490n1930.las
w6490n1931.las
w6490n1932.las
w6490n1933.las
w6490n1934.las
w6490n1935.las
w6490n1936.las
w6490n1937.las
w6490n1938.las
w6490n1939.las
w6490n1940.las
w6490n1941.las
w6490n1942.las
w6490n1943.las
w6490n1944.las
w6490n1945.las
w6490n1946.las
w6490n1947.las
w6490n1948.las
w6490n1949.las

w6490n1950.las
w6490n1951.las
w6490n1952.las
w6490n1953.las
w6490n1954.las
w6490n1955.las
w6490n1956.las
w6490n1957.las
w6490n1958.las
w6500n1899.las
w6500n1900.las
w6500n1901.las
w6500n1902.las
w6500n1903.las
w6500n1904.las
w6500n1905.las
w6500n1906.las
w6500n1907.las
w6500n1908.las
w6500n1909.las
w6500n1910.las
w6500n1911.las
w6500n1912.las
w6500n1913.las
w6500n1914.las
w6500n1915.las
w6500n1916.las
w6500n1917.las
w6500n1918.las
w6500n1919.las
w6500n1920.las
w6500n1921.las
w6500n1922.las
w6500n1923.las
w6500n1924.las
w6500n1925.las
w6500n1926.las
w6500n1927.las
w6500n1928.las
w6500n1929.las
w6500n1930.las
w6500n1931.las
w6500n1932.las
w6500n1933.las
w6500n1934.las
w6500n1935.las
w6500n1936.las
w6500n1937.las
w6500n1938.las
w6500n1939.las
w6500n1940.las

w6500n1941.las
w6500n1942.las
w6500n1943.las
w6500n1944.las
w6500n1945.las
w6500n1946.las
w6500n1947.las
w6500n1948.las
w6500n1949.las
w6500n1950.las
w6500n1951.las
w6500n1952.las
w6500n1953.las
w6500n1954.las
w6500n1955.las
w6500n1956.las
w6500n1957.las
w6500n1958.las
w6510n1899.las
w6510n1900.las
w6510n1901.las
w6510n1902.las
w6510n1903.las
w6510n1904.las
w6510n1905.las
w6510n1906.las
w6510n1907.las
w6510n1908.las
w6510n1909.las
w6510n1910.las
w6510n1911.las
w6510n1912.las
w6510n1913.las
w6510n1914.las
w6510n1915.las
w6510n1916.las
w6510n1917.las
w6510n1918.las
w6510n1919.las
w6510n1920.las
w6510n1921.las
w6510n1922.las
w6510n1923.las
w6510n1924.las
w6510n1925.las
w6510n1926.las
w6510n1927.las
w6510n1928.las
w6510n1929.las
w6510n1930.las
w6510n1931.las

w6510n1932.las
w6510n1933.las
w6510n1934.las
w6510n1935.las
w6510n1936.las
w6510n1937.las
w6510n1938.las
w6510n1939.las
w6510n1940.las
w6510n1941.las
w6510n1942.las
w6510n1943.las
w6510n1944.las
w6510n1945.las
w6510n1946.las
w6510n1947.las
w6510n1948.las
w6510n1949.las
w6510n1950.las
w6510n1951.las
w6510n1952.las
w6510n1953.las
w6510n1954.las
w6510n1955.las
w6510n1956.las
w6510n1957.las
w6510n1958.las
w6520n1899.las
w6520n1900.las
w6520n1901.las
w6520n1902.las
w6520n1903.las
w6520n1904.las
w6520n1905.las
w6520n1906.las
w6520n1907.las
w6520n1908.las
w6520n1909.las
w6520n1910.las
w6520n1911.las
w6520n1912.las
w6520n1913.las
w6520n1914.las
w6520n1915.las
w6520n1916.las
w6520n1917.las
w6520n1918.las
w6520n1919.las
w6520n1920.las
w6520n1921.las
w6520n1922.las

w6520n1923.las
w6520n1924.las
w6520n1925.las
w6520n1926.las
w6520n1927.las
w6520n1928.las
w6520n1929.las
w6520n1930.las
w6520n1931.las
w6520n1932.las
w6520n1933.las
w6520n1934.las
w6520n1935.las
w6520n1936.las
w6520n1937.las
w6520n1938.las
w6520n1939.las
w6520n1940.las
w6520n1941.las
w6520n1942.las
w6520n1943.las
w6520n1944.las
w6520n1945.las
w6520n1946.las
w6520n1947.las
w6520n1948.las
w6520n1949.las
w6520n1950.las
w6520n1951.las
w6520n1952.las
w6520n1953.las
w6520n1954.las
w6520n1955.las
w6520n1956.las
w6520n1957.las
w6520n1958.las
w6530n1899.las
w6530n1900.las
w6530n1901.las
w6530n1902.las
w6530n1903.las
w6530n1904.las
w6530n1905.las
w6530n1906.las
w6530n1907.las
w6530n1908.las
w6530n1909.las
w6530n1910.las
w6530n1911.las
w6530n1912.las
w6530n1913.las

w6530n1914.las
w6530n1915.las
w6530n1916.las
w6530n1917.las
w6530n1918.las
w6530n1919.las
w6530n1920.las
w6530n1921.las
w6530n1922.las
w6530n1923.las
w6530n1924.las
w6530n1925.las
w6530n1926.las
w6530n1927.las
w6530n1928.las
w6530n1929.las
w6530n1930.las
w6530n1931.las
w6530n1932.las
w6530n1933.las
w6530n1934.las
w6530n1935.las
w6530n1936.las
w6530n1937.las
w6530n1938.las
w6530n1939.las
w6530n1940.las
w6530n1941.las
w6530n1942.las
w6530n1943.las
w6530n1944.las
w6530n1945.las
w6530n1946.las
w6530n1947.las
w6530n1948.las
w6530n1949.las
w6530n1950.las
w6530n1951.las
w6530n1952.las
w6530n1953.las
w6530n1954.las
w6530n1955.las
w6530n1956.las
w6530n1957.las
w6530n1958.las
w6540n1899.las
w6540n1900.las
w6540n1901.las
w6540n1902.las
w6540n1903.las
w6540n1904.las

w6540n1905.las
w6540n1906.las
w6540n1907.las
w6540n1908.las
w6540n1909.las
w6540n1910.las
w6540n1911.las
w6540n1912.las
w6540n1913.las
w6540n1914.las
w6540n1915.las
w6540n1916.las
w6540n1917.las
w6540n1918.las
w6540n1919.las
w6540n1920.las
w6540n1921.las
w6540n1922.las
w6540n1923.las
w6540n1924.las
w6540n1925.las
w6540n1926.las
w6540n1927.las
w6540n1928.las
w6540n1929.las
w6540n1930.las
w6540n1931.las
w6540n1932.las
w6540n1933.las
w6540n1934.las
w6540n1935.las
w6540n1936.las
w6540n1937.las
w6540n1938.las
w6540n1939.las
w6540n1940.las
w6540n1941.las
w6540n1942.las
w6540n1943.las
w6540n1944.las
w6540n1945.las
w6540n1946.las
w6540n1947.las
w6540n1948.las
w6540n1949.las
w6540n1950.las
w6540n1951.las
w6540n1952.las
w6540n1953.las
w6540n1954.las
w6540n1955.las

w6540n1956.las
w6540n1957.las
w6540n1958.las
w6550n1900.las
w6550n1901.las
w6550n1902.las
w6550n1903.las
w6550n1904.las
w6550n1905.las
w6550n1906.las
w6550n1907.las
w6550n1908.las
w6550n1909.las
w6550n1910.las
w6550n1911.las
w6550n1912.las
w6550n1913.las
w6550n1914.las
w6550n1915.las
w6550n1916.las
w6550n1917.las
w6550n1918.las
w6550n1919.las
w6550n1920.las
w6550n1921.las
w6550n1922.las
w6550n1923.las
w6550n1924.las
w6550n1925.las
w6550n1926.las
w6550n1927.las
w6550n1928.las
w6550n1929.las
w6550n1930.las
w6550n1931.las
w6550n1932.las
w6550n1933.las
w6550n1934.las
w6550n1935.las
w6550n1936.las
w6550n1937.las
w6550n1938.las
w6550n1939.las
w6550n1940.las
w6550n1941.las
w6550n1942.las
w6550n1943.las
w6550n1944.las
w6550n1945.las
w6550n1946.las
w6550n1947.las

w6550n1948.las
w6550n1949.las
w6550n1950.las
w6550n1951.las
w6550n1952.las
w6550n1953.las
w6550n1954.las
w6550n1955.las
w6550n1956.las
w6550n1957.las
w6550n1958.las
w6560n1900.las
w6560n1901.las
w6560n1902.las
w6560n1903.las
w6560n1904.las
w6560n1905.las
w6560n1906.las
w6560n1907.las
w6560n1908.las
w6560n1909.las
w6560n1910.las
w6560n1911.las
w6560n1912.las
w6560n1913.las
w6560n1914.las
w6560n1915.las
w6560n1916.las
w6560n1917.las
w6560n1918.las
w6560n1919.las
w6560n1920.las
w6560n1921.las
w6560n1922.las
w6560n1923.las
w6560n1924.las
w6560n1925.las
w6560n1926.las
w6560n1927.las
w6560n1928.las
w6560n1929.las
w6560n1930.las
w6560n1931.las
w6560n1932.las
w6560n1933.las
w6560n1934.las
w6560n1935.las
w6560n1936.las
w6560n1937.las
w6560n1938.las
w6560n1939.las

w6560n1940.las
w6560n1941.las
w6560n1942.las
w6560n1943.las
w6560n1944.las
w6560n1945.las
w6560n1946.las
w6560n1947.las
w6560n1948.las
w6560n1949.las
w6560n1950.las
w6560n1951.las
w6560n1952.las
w6560n1953.las
w6560n1954.las
w6560n1955.las
w6560n1956.las
w6560n1957.las
w6560n1958.las
w6570n1900.las
w6570n1901.las
w6570n1902.las
w6570n1903.las
w6570n1904.las
w6570n1905.las
w6570n1906.las
w6570n1907.las
w6570n1908.las
w6570n1909.las
w6570n1910.las
w6570n1911.las
w6570n1912.las
w6570n1913.las
w6570n1914.las
w6570n1915.las
w6570n1916.las
w6570n1917.las
w6570n1918.las
w6570n1919.las
w6570n1920.las
w6570n1921.las
w6570n1922.las
w6570n1923.las
w6570n1924.las
w6570n1925.las
w6570n1926.las
w6570n1927.las
w6570n1928.las
w6570n1929.las
w6570n1930.las
w6570n1931.las

w6570n1932.las
w6570n1933.las
w6570n1934.las
w6570n1935.las
w6570n1936.las
w6570n1937.las
w6570n1938.las
w6570n1939.las
w6570n1940.las
w6570n1941.las
w6570n1942.las
w6570n1943.las
w6570n1944.las
w6570n1945.las
w6570n1946.las
w6570n1947.las
w6570n1948.las
w6570n1949.las
w6570n1950.las
w6570n1951.las
w6570n1952.las
w6570n1953.las
w6570n1954.las
w6570n1955.las
w6570n1956.las
w6570n1957.las
w6570n1958.las
w6580n1900.las
w6580n1901.las
w6580n1902.las
w6580n1903.las
w6580n1904.las
w6580n1905.las
w6580n1906.las
w6580n1907.las
w6580n1908.las
w6580n1909.las
w6580n1910.las
w6580n1911.las
w6580n1912.las
w6580n1913.las
w6580n1914.las
w6580n1915.las
w6580n1916.las
w6580n1917.las
w6580n1918.las
w6580n1919.las
w6580n1920.las
w6580n1921.las
w6580n1922.las
w6580n1923.las

w6580n1924.las
w6580n1925.las
w6580n1926.las
w6580n1927.las
w6580n1928.las
w6580n1929.las
w6580n1930.las
w6580n1931.las
w6580n1932.las
w6580n1933.las
w6580n1934.las
w6580n1935.las
w6580n1936.las
w6580n1937.las
w6580n1938.las
w6580n1939.las
w6580n1940.las
w6580n1941.las
w6580n1942.las
w6580n1943.las
w6580n1944.las
w6580n1945.las
w6580n1946.las
w6580n1947.las
w6580n1948.las
w6580n1949.las
w6580n1950.las
w6580n1951.las
w6580n1952.las
w6580n1953.las
w6580n1954.las
w6580n1955.las
w6580n1956.las
w6580n1957.las
w6580n1958.las
w6580n1959.las
w6590n1900.las
w6590n1901.las
w6590n1902.las
w6590n1903.las
w6590n1904.las
w6590n1905.las
w6590n1906.las
w6590n1907.las
w6590n1908.las
w6590n1909.las
w6590n1910.las
w6590n1911.las
w6590n1912.las
w6590n1913.las
w6590n1914.las

w6590n1915.las
w6590n1916.las
w6590n1917.las
w6590n1918.las
w6590n1919.las
w6590n1920.las
w6590n1921.las
w6590n1922.las
w6590n1923.las
w6590n1924.las
w6590n1925.las
w6590n1926.las
w6590n1927.las
w6590n1928.las
w6590n1929.las
w6590n1930.las
w6590n1931.las
w6590n1932.las
w6590n1933.las
w6590n1934.las
w6590n1935.las
w6590n1936.las
w6590n1937.las
w6590n1938.las
w6590n1939.las
w6590n1940.las
w6590n1941.las
w6590n1942.las
w6590n1943.las
w6590n1944.las
w6590n1945.las
w6590n1946.las
w6590n1947.las
w6590n1948.las
w6590n1949.las
w6590n1950.las
w6590n1951.las
w6590n1952.las
w6590n1953.las
w6590n1954.las
w6590n1955.las
w6590n1956.las
w6590n1957.las
w6590n1958.las
w6590n1959.las
w6600n1900.las
w6600n1901.las
w6600n1902.las
w6600n1903.las
w6600n1904.las
w6600n1905.las

w6600n1906.las
w6600n1907.las
w6600n1908.las
w6600n1909.las
w6600n1910.las
w6600n1911.las
w6600n1912.las
w6600n1913.las
w6600n1914.las
w6600n1915.las
w6600n1916.las
w6600n1917.las
w6600n1918.las
w6600n1919.las
w6600n1920.las
w6600n1921.las
w6600n1922.las
w6600n1923.las
w6600n1924.las
w6600n1925.las
w6600n1926.las
w6600n1927.las
w6600n1928.las
w6600n1929.las
w6600n1930.las
w6600n1931.las
w6600n1932.las
w6600n1933.las
w6600n1934.las
w6600n1935.las
w6600n1936.las
w6600n1937.las
w6600n1938.las
w6600n1939.las
w6600n1940.las
w6600n1941.las
w6600n1942.las
w6600n1943.las
w6600n1944.las
w6600n1945.las
w6600n1946.las
w6600n1947.las
w6600n1948.las
w6600n1949.las
w6600n1950.las
w6600n1951.las
w6600n1952.las
w6600n1953.las
w6600n1954.las
w6600n1955.las
w6600n1956.las

w6600n1957.las
w6600n1958.las
w6600n1959.las
w6610n1900.las
w6610n1901.las
w6610n1902.las
w6610n1903.las
w6610n1904.las
w6610n1905.las
w6610n1906.las
w6610n1907.las
w6610n1908.las
w6610n1909.las
w6610n1910.las
w6610n1911.las
w6610n1912.las
w6610n1913.las
w6610n1914.las
w6610n1915.las
w6610n1916.las
w6610n1917.las
w6610n1918.las
w6610n1919.las
w6610n1920.las
w6610n1921.las
w6610n1922.las
w6610n1923.las
w6610n1924.las
w6610n1925.las
w6610n1926.las
w6610n1927.las
w6610n1928.las
w6610n1929.las
w6610n1930.las
w6610n1931.las
w6610n1932.las
w6610n1933.las
w6610n1934.las
w6610n1935.las
w6610n1936.las
w6610n1937.las
w6610n1938.las
w6610n1939.las
w6610n1940.las
w6610n1941.las
w6610n1942.las
w6610n1943.las
w6610n1944.las
w6610n1945.las
w6610n1946.las
w6610n1947.las

w6610n1948.las
w6610n1949.las
w6610n1950.las
w6610n1951.las
w6610n1952.las
w6610n1953.las
w6610n1954.las
w6610n1955.las
w6610n1956.las
w6610n1957.las
w6610n1958.las
w6610n1959.las
w6620n1900.las
w6620n1901.las
w6620n1902.las
w6620n1903.las
w6620n1904.las
w6620n1905.las
w6620n1906.las
w6620n1907.las
w6620n1908.las
w6620n1909.las
w6620n1910.las
w6620n1911.las
w6620n1912.las
w6620n1913.las
w6620n1914.las
w6620n1915.las
w6620n1916.las
w6620n1917.las
w6620n1918.las
w6620n1919.las
w6620n1920.las
w6620n1921.las
w6620n1922.las
w6620n1923.las
w6620n1924.las
w6620n1925.las
w6620n1926.las
w6620n1927.las
w6620n1928.las
w6620n1929.las
w6620n1930.las
w6620n1931.las
w6620n1932.las
w6620n1933.las
w6620n1934.las
w6620n1935.las
w6620n1936.las
w6620n1937.las
w6620n1938.las

w6620n1939.las
w6620n1940.las
w6620n1941.las
w6620n1942.las
w6620n1943.las
w6620n1944.las
w6620n1945.las
w6620n1946.las
w6620n1947.las
w6620n1948.las
w6620n1949.las
w6620n1950.las
w6620n1951.las
w6620n1952.las
w6620n1953.las
w6620n1954.las
w6620n1955.las
w6620n1956.las
w6620n1957.las
w6620n1958.las
w6620n1959.las
w6630n1900.las
w6630n1901.las
w6630n1902.las
w6630n1903.las
w6630n1904.las
w6630n1905.las
w6630n1906.las
w6630n1907.las
w6630n1908.las
w6630n1909.las
w6630n1910.las
w6630n1911.las
w6630n1912.las
w6630n1913.las
w6630n1914.las
w6630n1915.las
w6630n1916.las
w6630n1917.las
w6630n1918.las
w6630n1919.las
w6630n1920.las
w6630n1921.las
w6630n1922.las
w6630n1923.las
w6630n1924.las
w6630n1925.las
w6630n1926.las
w6630n1927.las
w6630n1928.las
w6630n1929.las

w6630n1930.las
w6630n1931.las
w6630n1932.las
w6630n1933.las
w6630n1934.las
w6630n1935.las
w6630n1936.las
w6630n1937.las
w6630n1938.las
w6630n1939.las
w6630n1940.las
w6630n1941.las
w6630n1942.las
w6630n1943.las
w6630n1944.las
w6630n1945.las
w6630n1946.las
w6630n1947.las
w6630n1948.las
w6630n1949.las
w6630n1950.las
w6630n1951.las
w6630n1952.las
w6630n1953.las
w6630n1954.las
w6630n1955.las
w6630n1956.las
w6630n1957.las
w6630n1958.las
w6630n1959.las
w6640n1900.las
w6640n1901.las
w6640n1902.las
w6640n1903.las
w6640n1904.las
w6640n1905.las
w6640n1906.las
w6640n1907.las
w6640n1908.las
w6640n1909.las
w6640n1910.las
w6640n1911.las
w6640n1912.las
w6640n1913.las
w6640n1914.las
w6640n1915.las
w6640n1916.las
w6640n1917.las
w6640n1918.las
w6640n1919.las
w6640n1920.las

w6640n1921.las
w6640n1922.las
w6640n1923.las
w6640n1924.las
w6640n1925.las
w6640n1926.las
w6640n1927.las
w6640n1928.las
w6640n1929.las
w6640n1930.las
w6640n1931.las
w6640n1932.las
w6640n1933.las
w6640n1934.las
w6640n1935.las
w6640n1936.las
w6640n1937.las
w6640n1938.las
w6640n1939.las
w6640n1940.las
w6640n1941.las
w6640n1942.las
w6640n1943.las
w6640n1944.las
w6640n1945.las
w6640n1946.las
w6640n1947.las
w6640n1948.las
w6640n1949.las
w6640n1950.las
w6640n1951.las
w6640n1952.las
w6640n1953.las
w6640n1954.las
w6640n1955.las
w6640n1956.las
w6640n1957.las
w6640n1958.las
w6640n1959.las
w6650n1900.las
w6650n1901.las
w6650n1902.las
w6650n1903.las
w6650n1904.las
w6650n1905.las
w6650n1906.las
w6650n1907.las
w6650n1908.las
w6650n1909.las
w6650n1910.las
w6650n1911.las

w6650n1912.las
w6650n1913.las
w6650n1914.las
w6650n1915.las
w6650n1916.las
w6650n1917.las
w6650n1918.las
w6650n1919.las
w6650n1920.las
w6650n1921.las
w6650n1922.las
w6650n1923.las
w6650n1924.las
w6650n1925.las
w6650n1926.las
w6650n1927.las
w6650n1928.las
w6650n1929.las
w6650n1930.las
w6650n1931.las
w6650n1932.las
w6650n1933.las
w6650n1934.las
w6650n1935.las
w6650n1936.las
w6650n1937.las
w6650n1938.las
w6650n1939.las
w6650n1940.las
w6650n1941.las
w6650n1942.las
w6650n1943.las
w6650n1944.las
w6650n1945.las
w6650n1946.las
w6650n1947.las
w6650n1948.las
w6650n1949.las
w6650n1950.las
w6650n1951.las
w6650n1952.las
w6650n1953.las
w6650n1954.las
w6650n1955.las
w6650n1956.las
w6650n1957.las
w6650n1958.las
w6650n1959.las
w6660n1901.las
w6660n1902.las
w6660n1903.las

w6660n1904.las
w6660n1905.las
w6660n1906.las
w6660n1907.las
w6660n1908.las
w6660n1909.las
w6660n1910.las
w6660n1911.las
w6660n1912.las
w6660n1913.las
w6660n1914.las
w6660n1915.las
w6660n1916.las
w6660n1917.las
w6660n1918.las
w6660n1919.las
w6660n1920.las
w6660n1921.las
w6660n1922.las
w6660n1923.las
w6660n1924.las
w6660n1925.las
w6660n1926.las
w6660n1927.las
w6660n1928.las
w6660n1929.las
w6660n1930.las
w6660n1931.las
w6660n1932.las
w6660n1933.las
w6660n1934.las
w6660n1935.las
w6660n1936.las
w6660n1937.las
w6660n1938.las
w6660n1939.las
w6660n1940.las
w6660n1941.las
w6660n1942.las
w6660n1943.las
w6660n1944.las
w6660n1945.las
w6660n1946.las
w6660n1947.las
w6660n1948.las
w6660n1949.las
w6660n1950.las
w6660n1951.las
w6660n1952.las
w6660n1953.las
w6660n1954.las

w6660n1955.las
w6660n1956.las
w6660n1957.las
w6660n1958.las
w6660n1959.las
w6670n1901.las
w6670n1902.las
w6670n1903.las
w6670n1904.las
w6670n1905.las
w6670n1906.las
w6670n1907.las
w6670n1908.las
w6670n1909.las
w6670n1910.las
w6670n1911.las
w6670n1912.las
w6670n1913.las
w6670n1914.las
w6670n1915.las
w6670n1916.las
w6670n1917.las
w6670n1918.las
w6670n1919.las
w6670n1920.las
w6670n1921.las
w6670n1922.las
w6670n1923.las
w6670n1924.las
w6670n1925.las
w6670n1926.las
w6670n1927.las
w6670n1928.las
w6670n1929.las
w6670n1930.las
w6670n1931.las
w6670n1932.las
w6670n1933.las
w6670n1934.las
w6670n1935.las
w6670n1936.las
w6670n1937.las
w6670n1938.las
w6670n1939.las
w6670n1940.las
w6670n1941.las
w6670n1942.las
w6670n1943.las
w6670n1944.las
w6670n1945.las
w6670n1946.las

w6670n1947.las
w6670n1948.las
w6670n1949.las
w6670n1950.las
w6670n1951.las
w6670n1952.las
w6670n1953.las
w6670n1954.las
w6670n1955.las
w6670n1956.las
w6670n1957.las
w6670n1958.las
w6670n1959.las
w6680n1901.las
w6680n1902.las
w6680n1903.las
w6680n1904.las
w6680n1905.las
w6680n1906.las
w6680n1907.las
w6680n1908.las
w6680n1909.las
w6680n1910.las
w6680n1911.las
w6680n1912.las
w6680n1913.las
w6680n1914.las
w6680n1915.las
w6680n1916.las
w6680n1917.las
w6680n1918.las
w6680n1919.las
w6680n1920.las
w6680n1921.las
w6680n1922.las
w6680n1923.las
w6680n1924.las
w6680n1925.las
w6680n1926.las
w6680n1927.las
w6680n1928.las
w6680n1929.las
w6680n1930.las
w6680n1931.las
w6680n1932.las
w6680n1933.las
w6680n1934.las
w6680n1935.las
w6680n1936.las
w6680n1937.las
w6680n1938.las

w6680n1939.las
w6680n1940.las
w6680n1941.las
w6680n1942.las
w6680n1943.las
w6680n1944.las
w6680n1945.las
w6680n1946.las
w6680n1947.las
w6680n1948.las
w6680n1949.las
w6680n1950.las
w6680n1951.las
w6680n1952.las
w6680n1953.las
w6680n1954.las
w6680n1955.las
w6680n1956.las
w6680n1957.las
w6680n1958.las
w6680n1959.las
w6690n1901.las
w6690n1902.las
w6690n1903.las
w6690n1904.las
w6690n1905.las
w6690n1906.las
w6690n1907.las
w6690n1908.las
w6690n1909.las
w6690n1910.las
w6690n1911.las
w6690n1912.las
w6690n1913.las
w6690n1914.las
w6690n1915.las
w6690n1916.las
w6690n1917.las
w6690n1918.las
w6690n1919.las
w6690n1920.las
w6690n1921.las
w6690n1922.las
w6690n1923.las
w6690n1924.las
w6690n1925.las
w6690n1926.las
w6690n1927.las
w6690n1928.las
w6690n1929.las
w6690n1930.las

w6690n1931.las
w6690n1932.las
w6690n1933.las
w6690n1934.las
w6690n1935.las
w6690n1936.las
w6690n1937.las
w6690n1938.las
w6690n1939.las
w6690n1940.las
w6690n1941.las
w6690n1942.las
w6690n1943.las
w6690n1944.las
w6690n1945.las
w6690n1946.las
w6690n1947.las
w6690n1948.las
w6690n1949.las
w6690n1950.las
w6690n1951.las
w6690n1952.las
w6690n1953.las
w6690n1954.las
w6690n1955.las
w6690n1956.las
w6690n1957.las
w6690n1958.las
w6690n1959.las
w6690n1960.las
w6700n1901.las
w6700n1902.las
w6700n1903.las
w6700n1904.las
w6700n1905.las
w6700n1906.las
w6700n1907.las
w6700n1908.las
w6700n1909.las
w6700n1910.las
w6700n1911.las
w6700n1912.las
w6700n1913.las
w6700n1914.las
w6700n1915.las
w6700n1916.las
w6700n1917.las
w6700n1918.las
w6700n1919.las
w6700n1920.las
w6700n1921.las

w6700n1922.las
w6700n1923.las
w6700n1924.las
w6700n1925.las
w6700n1926.las
w6700n1927.las
w6700n1928.las
w6700n1929.las
w6700n1930.las
w6700n1931.las
w6700n1932.las
w6700n1933.las
w6700n1934.las
w6700n1935.las
w6700n1936.las
w6700n1937.las
w6700n1938.las
w6700n1939.las
w6700n1940.las
w6700n1941.las
w6700n1942.las
w6700n1943.las
w6700n1944.las
w6700n1945.las
w6700n1946.las
w6700n1947.las
w6700n1948.las
w6700n1949.las
w6700n1950.las
w6700n1951.las
w6700n1952.las
w6700n1953.las
w6700n1954.las
w6700n1955.las
w6700n1956.las
w6700n1957.las
w6700n1958.las
w6700n1959.las
w6700n1960.las
w6710n1901.las
w6710n1902.las
w6710n1903.las
w6710n1904.las
w6710n1905.las
w6710n1906.las
w6710n1907.las
w6710n1908.las
w6710n1909.las
w6710n1910.las
w6710n1911.las
w6710n1912.las

w6710n1913.las
w6710n1914.las
w6710n1915.las
w6710n1916.las
w6710n1917.las
w6710n1918.las
w6710n1919.las
w6710n1920.las
w6710n1921.las
w6710n1922.las
w6710n1923.las
w6710n1924.las
w6710n1925.las
w6710n1926.las
w6710n1927.las
w6710n1928.las
w6710n1929.las
w6710n1930.las
w6710n1931.las
w6710n1932.las
w6710n1933.las
w6710n1934.las
w6710n1935.las
w6710n1936.las
w6710n1937.las
w6710n1938.las
w6710n1939.las
w6710n1940.las
w6710n1941.las
w6710n1942.las
w6710n1943.las
w6710n1944.las
w6710n1945.las
w6710n1946.las
w6710n1947.las
w6710n1948.las
w6710n1949.las
w6710n1950.las
w6710n1951.las
w6710n1952.las
w6710n1953.las
w6710n1954.las
w6710n1955.las
w6710n1956.las
w6710n1957.las
w6710n1958.las
w6710n1959.las
w6710n1960.las
w6720n1901.las
w6720n1902.las
w6720n1903.las

w6720n1904.las
w6720n1905.las
w6720n1906.las
w6720n1907.las
w6720n1908.las
w6720n1909.las
w6720n1910.las
w6720n1911.las
w6720n1912.las
w6720n1913.las
w6720n1914.las
w6720n1915.las
w6720n1916.las
w6720n1917.las
w6720n1918.las
w6720n1919.las
w6720n1920.las
w6720n1921.las
w6720n1922.las
w6720n1923.las
w6720n1924.las
w6720n1925.las
w6720n1926.las
w6720n1927.las
w6720n1928.las
w6720n1929.las
w6720n1930.las
w6720n1931.las
w6720n1932.las
w6720n1933.las
w6720n1934.las
w6720n1935.las
w6720n1936.las
w6720n1937.las
w6720n1938.las
w6720n1939.las
w6720n1940.las
w6720n1941.las
w6720n1942.las
w6720n1943.las
w6720n1944.las
w6720n1945.las
w6720n1946.las
w6720n1947.las
w6720n1948.las
w6720n1949.las
w6720n1950.las
w6720n1951.las
w6720n1952.las
w6720n1953.las
w6720n1954.las

w6720n1955.las
w6720n1956.las
w6720n1957.las
w6720n1958.las
w6720n1959.las
w6720n1960.las
w6730n1901.las
w6730n1902.las
w6730n1903.las
w6730n1904.las
w6730n1905.las
w6730n1906.las
w6730n1907.las
w6730n1908.las
w6730n1909.las
w6730n1910.las
w6730n1911.las
w6730n1912.las
w6730n1913.las
w6730n1914.las
w6730n1915.las
w6730n1916.las
w6730n1917.las
w6730n1918.las
w6730n1919.las
w6730n1920.las
w6730n1921.las
w6730n1922.las
w6730n1923.las
w6730n1924.las
w6730n1925.las
w6730n1926.las
w6730n1927.las
w6730n1928.las
w6730n1929.las
w6730n1930.las
w6730n1931.las
w6730n1932.las
w6730n1933.las
w6730n1934.las
w6730n1935.las
w6730n1936.las
w6730n1937.las
w6730n1938.las
w6730n1939.las
w6730n1940.las
w6730n1941.las
w6730n1942.las
w6730n1943.las
w6730n1944.las
w6730n1945.las

w6730n1946.las
w6730n1947.las
w6730n1948.las
w6730n1949.las
w6730n1950.las
w6730n1951.las
w6730n1952.las
w6730n1953.las
w6730n1954.las
w6730n1955.las
w6730n1956.las
w6730n1957.las
w6730n1958.las
w6730n1959.las
w6730n1960.las
w6740n1901.las
w6740n1902.las
w6740n1903.las
w6740n1904.las
w6740n1905.las
w6740n1906.las
w6740n1907.las
w6740n1908.las
w6740n1909.las
w6740n1910.las
w6740n1911.las
w6740n1912.las
w6740n1913.las
w6740n1914.las
w6740n1915.las
w6740n1916.las
w6740n1917.las
w6740n1918.las
w6740n1919.las
w6740n1920.las
w6740n1921.las
w6740n1922.las
w6740n1923.las
w6740n1924.las
w6740n1925.las
w6740n1926.las
w6740n1927.las
w6740n1928.las
w6740n1929.las
w6740n1930.las
w6740n1931.las
w6740n1932.las
w6740n1933.las
w6740n1934.las
w6740n1935.las
w6740n1936.las

w6740n1937.las
w6740n1938.las
w6740n1939.las
w6740n1940.las
w6740n1941.las
w6740n1942.las
w6740n1943.las
w6740n1944.las
w6740n1945.las
w6740n1946.las
w6740n1947.las
w6740n1948.las
w6740n1949.las
w6740n1950.las
w6740n1951.las
w6740n1952.las
w6740n1953.las
w6740n1954.las
w6740n1955.las
w6740n1956.las
w6740n1957.las
w6740n1958.las
w6740n1959.las
w6740n1960.las
w6750n1901.las
w6750n1902.las
w6750n1903.las
w6750n1904.las
w6750n1905.las
w6750n1906.las
w6750n1907.las
w6750n1908.las
w6750n1909.las
w6750n1910.las
w6750n1911.las
w6750n1912.las
w6750n1913.las
w6750n1914.las
w6750n1915.las
w6750n1916.las
w6750n1917.las
w6750n1918.las
w6750n1919.las
w6750n1920.las
w6750n1921.las
w6750n1922.las
w6750n1923.las
w6750n1924.las
w6750n1925.las
w6750n1926.las
w6750n1927.las

w6750n1928.las
w6750n1929.las
w6750n1930.las
w6750n1931.las
w6750n1932.las
w6750n1933.las
w6750n1934.las
w6750n1935.las
w6750n1936.las
w6750n1937.las
w6750n1938.las
w6750n1939.las
w6750n1940.las
w6750n1941.las
w6750n1942.las
w6750n1943.las
w6750n1944.las
w6750n1945.las
w6750n1946.las
w6750n1947.las
w6750n1948.las
w6750n1949.las
w6750n1950.las
w6750n1951.las
w6750n1952.las
w6750n1953.las
w6750n1954.las
w6750n1955.las
w6750n1956.las
w6750n1957.las
w6750n1958.las
w6750n1959.las
w6750n1960.las
w6760n1901.las
w6760n1902.las
w6760n1903.las
w6760n1904.las
w6760n1905.las
w6760n1906.las
w6760n1907.las
w6760n1908.las
w6760n1909.las
w6760n1910.las
w6760n1911.las
w6760n1912.las
w6760n1913.las
w6760n1914.las
w6760n1915.las
w6760n1916.las
w6760n1917.las
w6760n1918.las

w6760n1919.las
w6760n1920.las
w6760n1921.las
w6760n1922.las
w6760n1923.las
w6760n1924.las
w6760n1925.las
w6760n1926.las
w6760n1927.las
w6760n1928.las
w6760n1929.las
w6760n1930.las
w6760n1931.las
w6760n1932.las
w6760n1933.las
w6760n1934.las
w6760n1935.las
w6760n1936.las
w6760n1937.las
w6760n1938.las
w6760n1939.las
w6760n1940.las
w6760n1941.las
w6760n1942.las
w6760n1943.las
w6760n1944.las
w6760n1945.las
w6760n1946.las
w6760n1947.las
w6760n1948.las
w6760n1949.las
w6760n1950.las
w6760n1951.las
w6760n1952.las
w6760n1953.las
w6760n1954.las
w6760n1955.las
w6760n1956.las
w6760n1957.las
w6760n1958.las
w6760n1959.las
w6760n1960.las
w6770n1901.las
w6770n1902.las
w6770n1903.las
w6770n1904.las
w6770n1905.las
w6770n1906.las
w6770n1907.las
w6770n1908.las
w6770n1909.las

w6770n1910.las
w6770n1911.las
w6770n1912.las
w6770n1913.las
w6770n1914.las
w6770n1915.las
w6770n1916.las
w6770n1917.las
w6770n1918.las
w6770n1919.las
w6770n1920.las
w6770n1921.las
w6770n1922.las
w6770n1923.las
w6770n1924.las
w6770n1925.las
w6770n1926.las
w6770n1927.las
w6770n1928.las
w6770n1929.las
w6770n1930.las
w6770n1931.las
w6770n1932.las
w6770n1933.las
w6770n1934.las
w6770n1935.las
w6770n1936.las
w6770n1937.las
w6770n1938.las
w6770n1939.las
w6770n1940.las
w6770n1941.las
w6770n1942.las
w6770n1943.las
w6770n1944.las
w6770n1945.las
w6770n1946.las
w6770n1947.las
w6770n1948.las
w6770n1949.las
w6770n1950.las
w6770n1951.las
w6770n1952.las
w6770n1953.las
w6770n1954.las
w6770n1955.las
w6770n1956.las
w6770n1957.las
w6770n1958.las
w6770n1959.las
w6770n1960.las

w6780n1901.las
w6780n1902.las
w6780n1903.las
w6780n1904.las
w6780n1905.las
w6780n1906.las
w6780n1907.las
w6780n1908.las
w6780n1909.las
w6780n1910.las
w6780n1911.las
w6780n1912.las
w6780n1913.las
w6780n1914.las
w6780n1915.las
w6780n1916.las
w6780n1917.las
w6780n1918.las
w6780n1919.las
w6780n1920.las
w6780n1921.las
w6780n1922.las
w6780n1923.las
w6780n1924.las
w6780n1925.las
w6780n1926.las
w6780n1927.las
w6780n1928.las
w6780n1929.las
w6780n1930.las
w6780n1931.las
w6780n1932.las
w6780n1933.las
w6780n1934.las
w6780n1935.las
w6780n1936.las
w6780n1937.las
w6780n1938.las
w6780n1939.las
w6780n1940.las
w6780n1941.las
w6780n1942.las
w6780n1943.las
w6780n1944.las
w6780n1945.las
w6780n1946.las
w6780n1947.las
w6780n1948.las
w6780n1949.las
w6780n1950.las
w6780n1951.las

w6780n1952.las
w6780n1953.las
w6780n1954.las
w6780n1955.las
w6780n1956.las
w6780n1957.las
w6780n1958.las
w6780n1959.las
w6780n1960.las
w6790n1902.las
w6790n1903.las
w6790n1904.las
w6790n1905.las
w6790n1906.las
w6790n1907.las
w6790n1908.las
w6790n1909.las
w6790n1910.las
w6790n1911.las
w6790n1912.las
w6790n1913.las
w6790n1914.las
w6790n1915.las
w6790n1916.las
w6790n1917.las
w6790n1918.las
w6790n1919.las
w6790n1920.las
w6790n1921.las
w6790n1922.las
w6790n1923.las
w6790n1924.las
w6790n1925.las
w6790n1926.las
w6790n1927.las
w6790n1928.las
w6790n1929.las
w6790n1930.las
w6790n1931.las
w6790n1932.las
w6790n1933.las
w6790n1934.las
w6790n1935.las
w6790n1936.las
w6790n1937.las
w6790n1938.las
w6790n1939.las
w6790n1940.las
w6790n1941.las
w6790n1942.las
w6790n1943.las

w6790n1944.las
w6790n1945.las
w6790n1946.las
w6790n1947.las
w6790n1948.las
w6790n1949.las
w6790n1950.las
w6790n1951.las
w6790n1952.las
w6800n1902.las
w6800n1903.las
w6800n1904.las
w6800n1905.las
w6800n1906.las
w6800n1907.las
w6800n1908.las
w6800n1909.las
w6800n1910.las
w6800n1911.las
w6800n1912.las
w6800n1913.las
w6800n1914.las
w6800n1915.las
w6800n1916.las
w6800n1917.las
w6800n1918.las
w6800n1919.las
w6800n1920.las
w6800n1921.las
w6800n1922.las
w6800n1923.las
w6800n1924.las
w6800n1925.las
w6800n1926.las
w6800n1927.las
w6800n1928.las
w6800n1929.las
w6800n1930.las
w6800n1931.las
w6800n1941.las
w6800n1942.las
w6810n1902.las
w6810n1903.las
w6810n1904.las
w6810n1905.las
w6810n1906.las
w6810n1907.las
w6810n1908.las
w6810n1909.las
w6810n1910.las
w6810n1911.las

w6810n1912.las
w6810n1913.las
w6810n1914.las
w6810n1915.las
w6810n1916.las
w6810n1917.las
w6810n1918.las
w6810n1919.las
w6810n1920.las
w6820n1902.las
w6820n1903.las
w6820n1904.las
w6820n1905.las
w6820n1906.las
w6820n1907.las
w6820n1908.las
w6820n1909.las

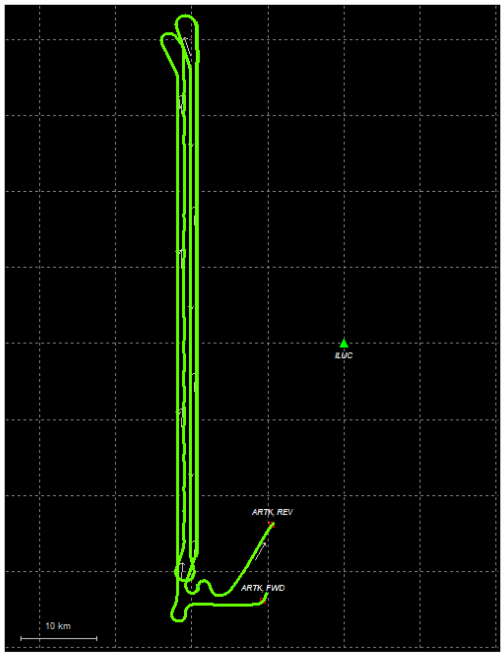
This page intentionally left blank

Appendix B: Mission GPS and IMU Processing Report

Output Results for 3DEP_Illinois_ChampaignCo_20191123_010512

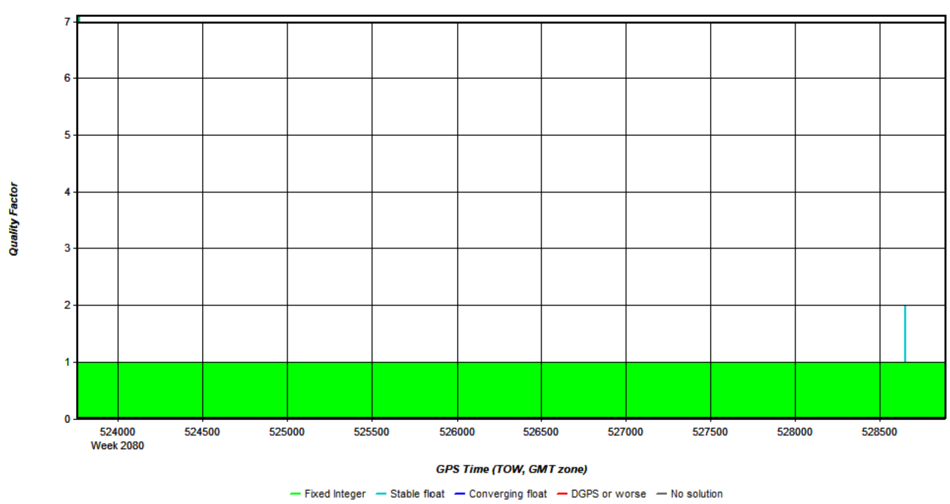
Inertial Explorer Version 8.80.2503
12/17/2019

Figure 1: Smoothed TC Combined - Map



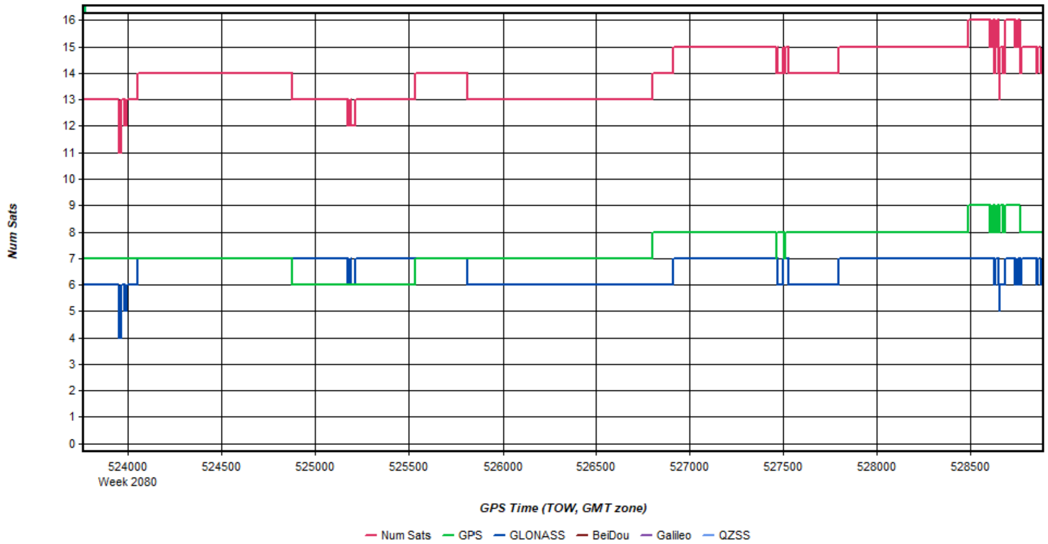
Process	3DEP_Illinois_ChampaignCo_20191123_01051	by Unknown	on 12/17/2019	at 10:00:15

Figure 2: 3DEP_Illinois_ChampaignCo_20191123_010512 [Smoothed TC Combined] - Quality Factor Plot



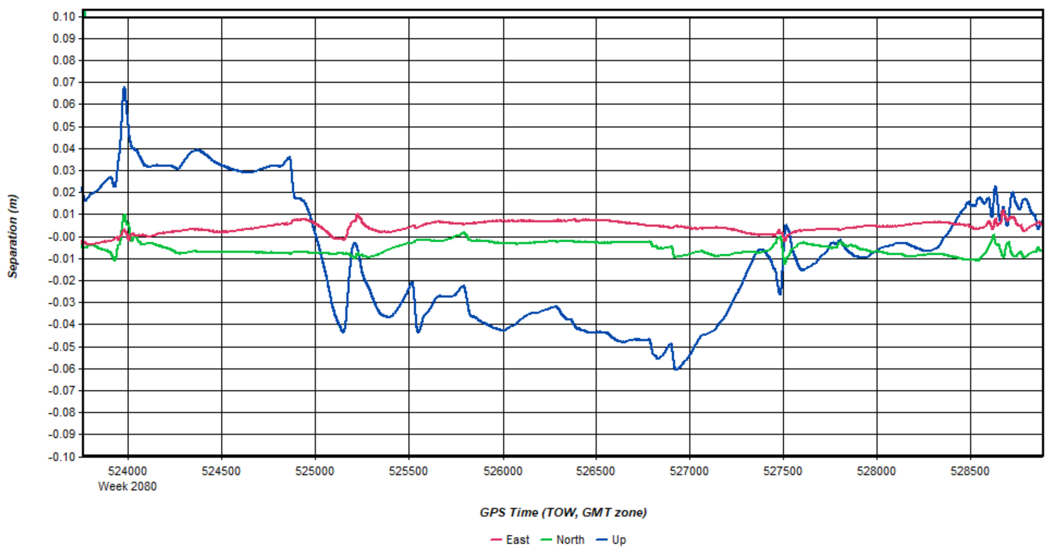
Process	3DEP_Illinois_ChampaignCo_20191123_01051	by Unknown	on 12/17/2019	at 10:00:15

Figure 3: 3DEP_Illinois_ChampaignCo_20191123_010512 [Smoothed TC Combined] - Number of Satellites Line Plot



Process	3DEP_Illinois_ChampaignCo_20191123_01051	by Unknown	on 12/17/2019	at 10:00:15

Figure 4: 3DEP_Illinois_ChampaignCo_20191123_010512 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot



Process	3DEP_Illinois_ChampaignCo_20191123_01051	by Unknown	on 12/17/2019	at 10:00:15

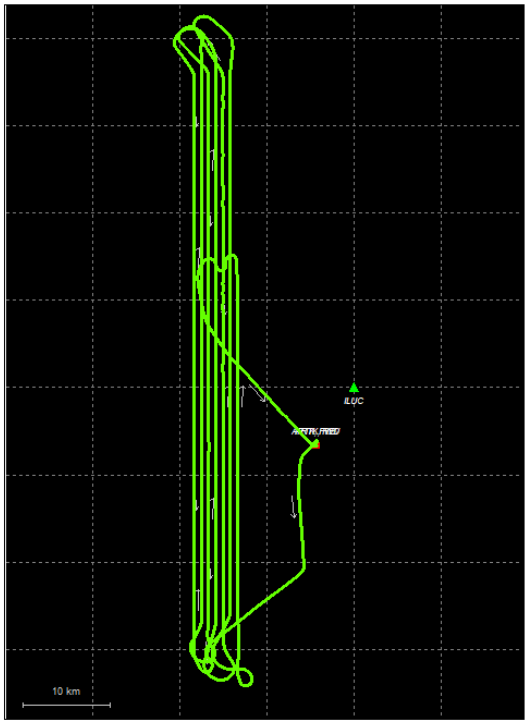
Figure 5: 3DEP_Illinois_ChampaignCo_20191123_010512 [Smoothed TC Combined] - PDOP Plot

Process	3DEP_Illinois_ChampaignCo_20191123_01051	by Unknown	on 12/17/2019	at 10:00:15

Output Results for 3DEP_Illinois_ChampaignCo_20191124_225026

Inertial Explorer Version 8.80.2503
12/17/2019

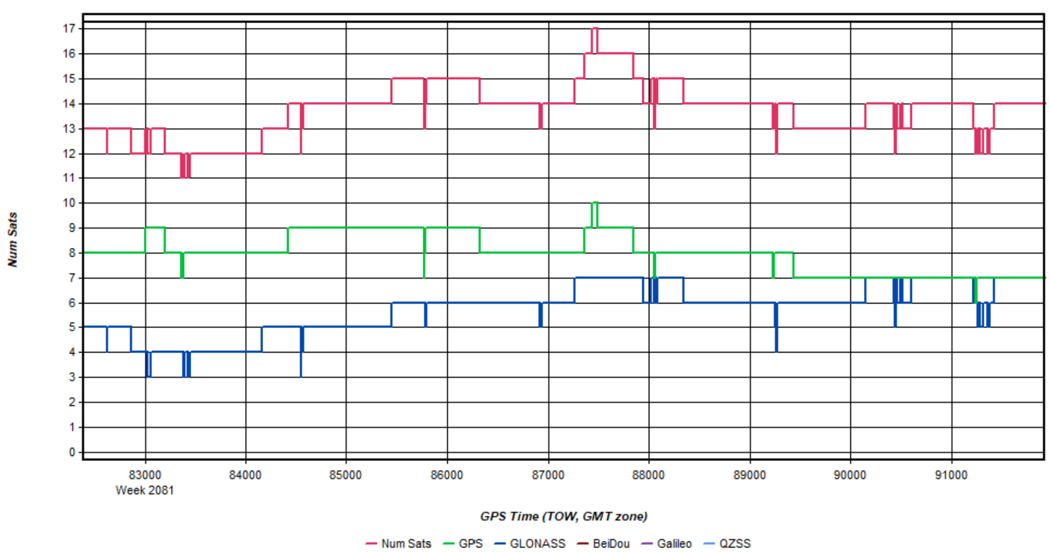
Figure 1: Smoothed TC Combined - Map



Process	3DEP_Illinois_ChampaignCo_20191124_22502	by Unknown	on 12/17/2019	at 10:14:29

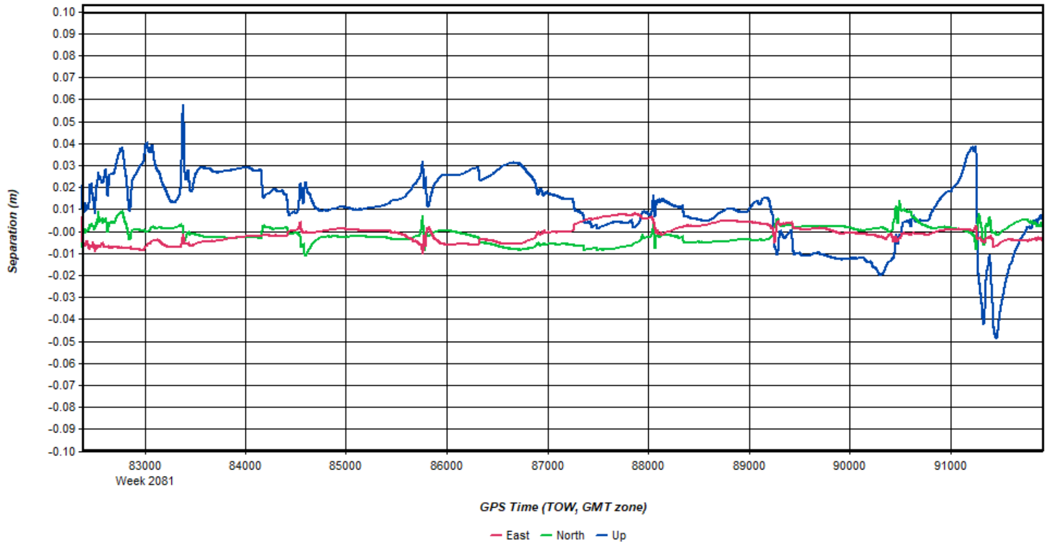
Object 3DEP_Illinois_ChampaignCo_20191124_225026 [Smoothed TC Combined] - Quality Factor Plot failed--NULL bitmap handle

Figure 2: 3DEP_Illinois_ChampaignCo_20191124_225026 [Smoothed TC Combined] - Number of Satellites Line Plot



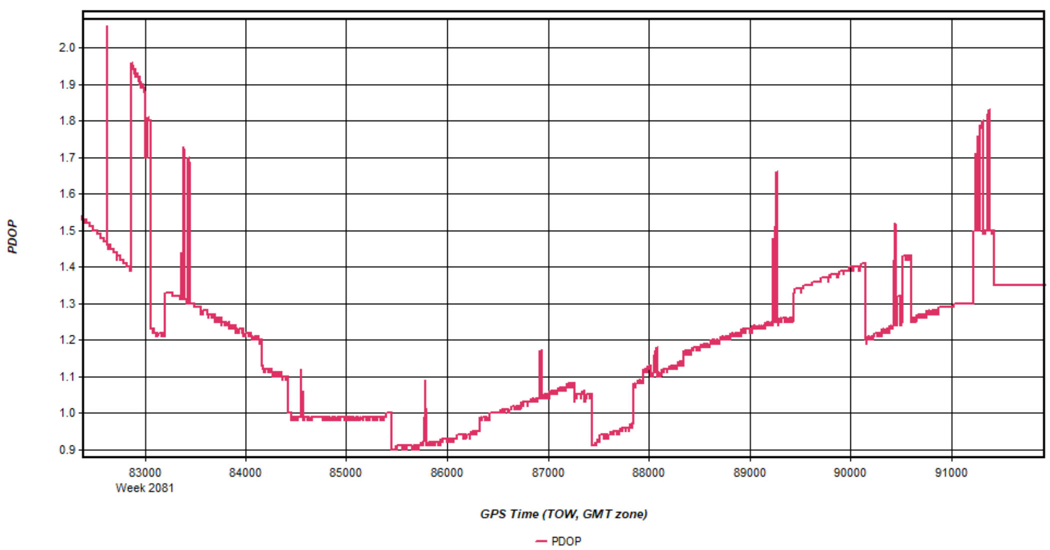
Process	3DEP_Illinois_ChampaignCo_20191124_22502	by Unknown	on 12/17/2019	at 10:14:29

Figure 3: 3DEP_Illinois_ChampaignCo_20191124_225026 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot



Process	3DEP_Illinois_ChampaignCo_20191124_22502	by Unknown	on 12/17/2019	at 10:14:29

Figure 4: 3DEP_Illinois_ChampaignCo_20191124_225026 [Smoothed TC Combined] - PDOP Plot

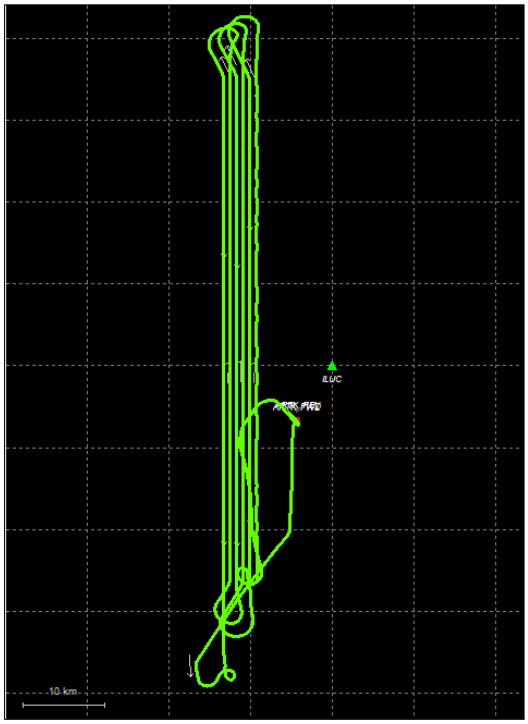


Process	3DEP_Illinois_ChampaignCo_20191124_22502	by Unknown	on 12/17/2019	at 10:14:29

Output Results for 3DEP_Illinois_ChampaignCo_20191125_150902

Inertial Explorer Version 8.80.2503
12/17/2019

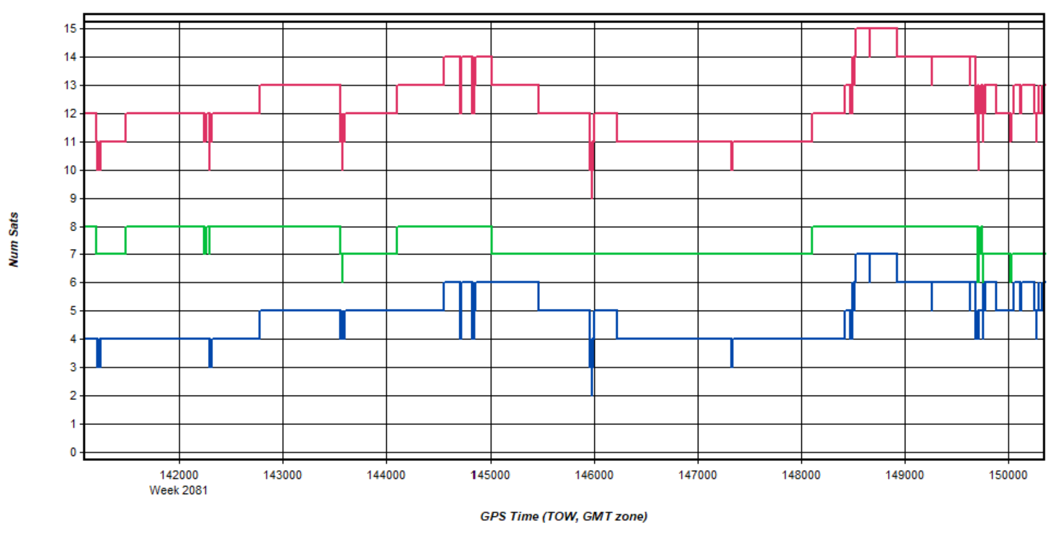
Figure 1: Smoothed TC Combined - Map



Process	3DEP_Illinois_ChampaignCo_20191125_15090	by Unknown	on 12/17/2019	at 11:37:46

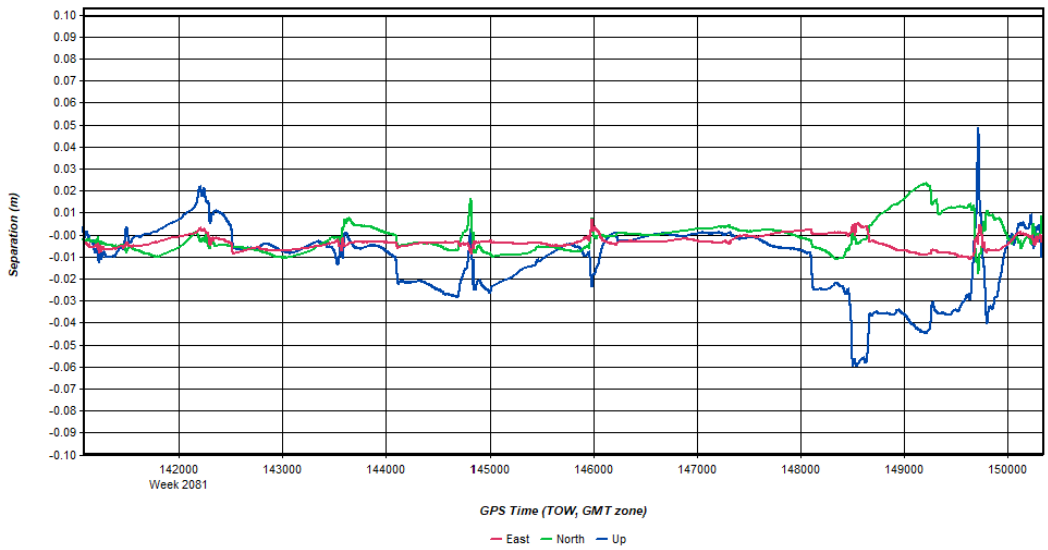
Object 3DEP_Illinois_ChampaignCo_20191125_150902 [Smoothed TC Combined] - Quality Factor Plot failed--NULL bitmap handle

Figure 2: 3DEP_Illinois_ChampaignCo_20191125_150902 [Smoothed TC Combined] - Number of Satellites Line Plot



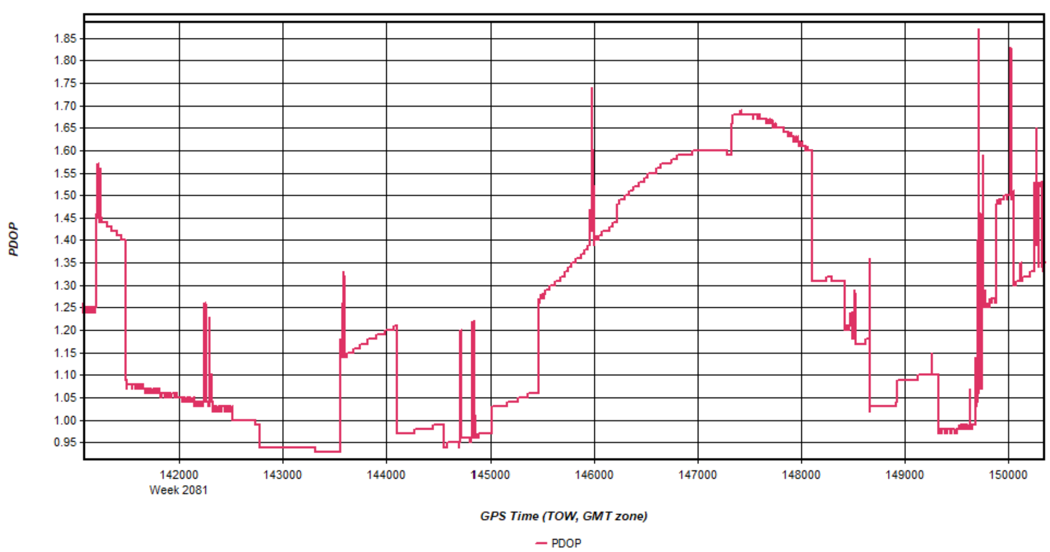
Process	3DEP_Illinois_ChampaignCo_20191125_15090	by Unknown	on 12/17/2019	at 11:37:46

Figure 3: 3DEP_Illinois_ChampaignCo_20191125_150902 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot



Process	3DEP_Illinois_ChampaignCo_20191125_15090	by Unknown	on 12/17/2019	at 11:37:46

Figure 4: 3DEP_Illinois_ChampaignCo_20191125_150902 [Smoothed TC Combined] - PDOP Plot

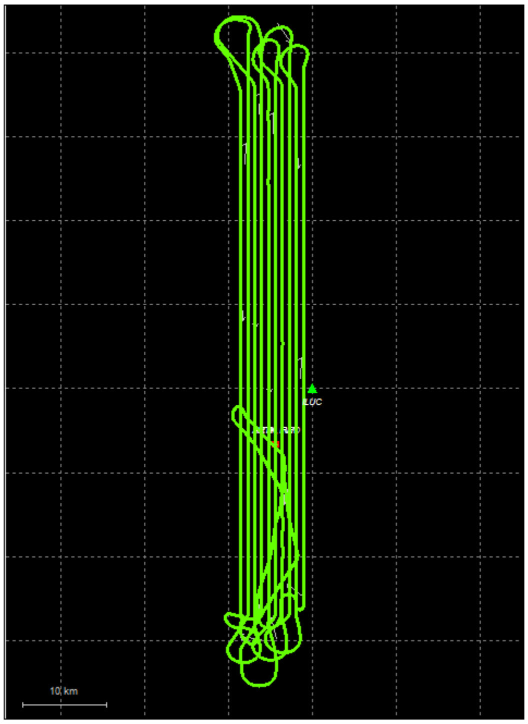


Process	3DEP_Illinois_ChampaignCo_20191125_15090	by Unknown	on 12/17/2019	at 11:37:46

Output Results for 3DEP_Illinois_ChampaignCo_20191125_184223

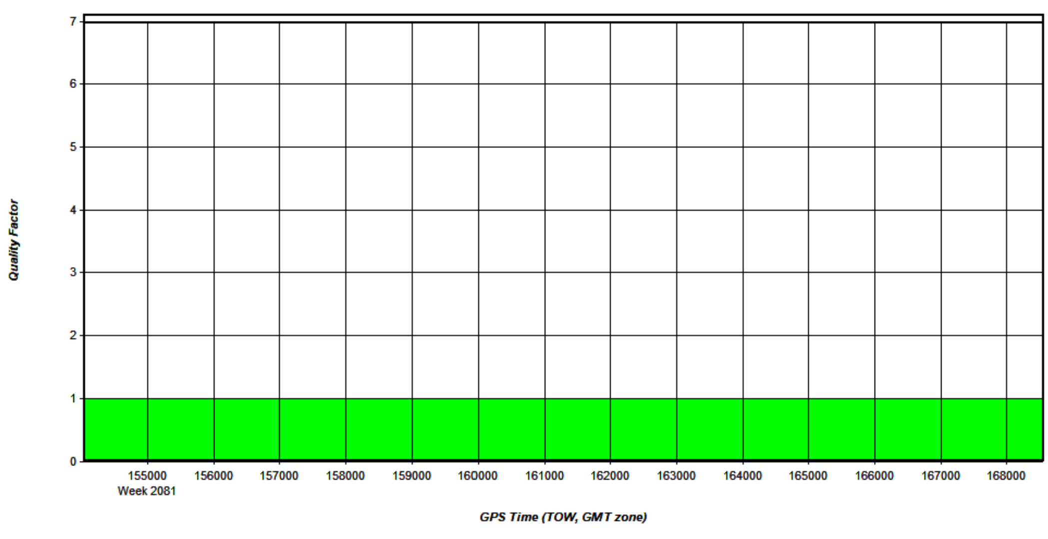
Inertial Explorer Version 8.80.2503
12/17/2019

Figure 1: Smoothed TC Combined - Map



Process	3DEP_Illinois_ChampaignCo_20191125_18422	by Unknown	on 12/17/2019	at 12:31:50

Figure 2: 3DEP_Illinois_ChampaignCo_20191125_184223 [Smoothed TC Combined] - Quality Factor Plot



Process	3DEP_Illinois_ChampaignCo_20191125_18422	by Unknown	on 12/17/2019	at 12:31:50

Figure 3: 3DEP_Illinois_ChampaignCo_20191125_184223 [Smoothed TC Combined] - Number of Satellites Line Plot

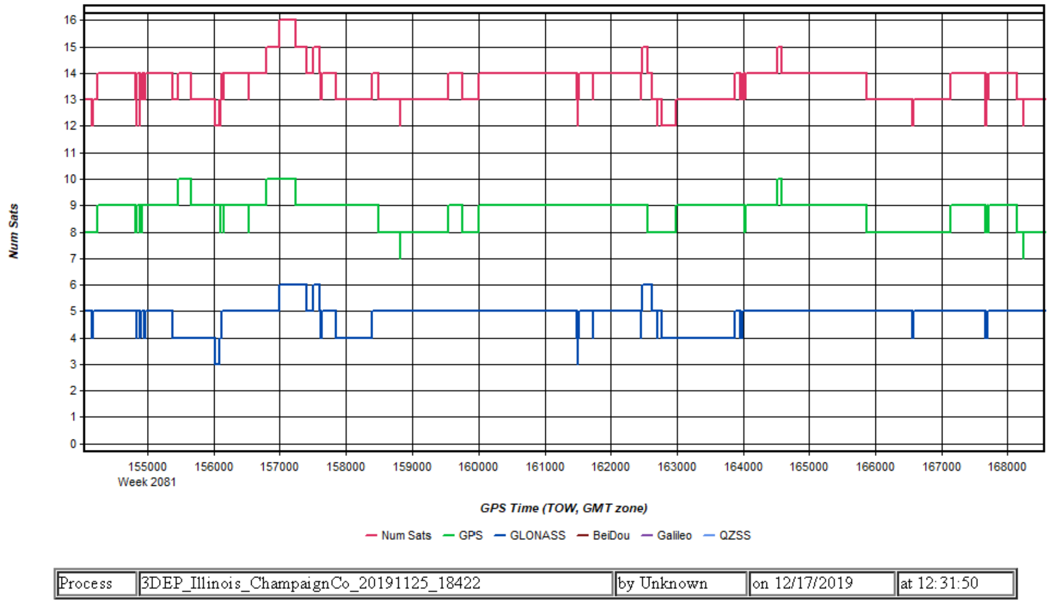


Figure 4: 3DEP_Illinois_ChampaignCo_20191125_184223 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot

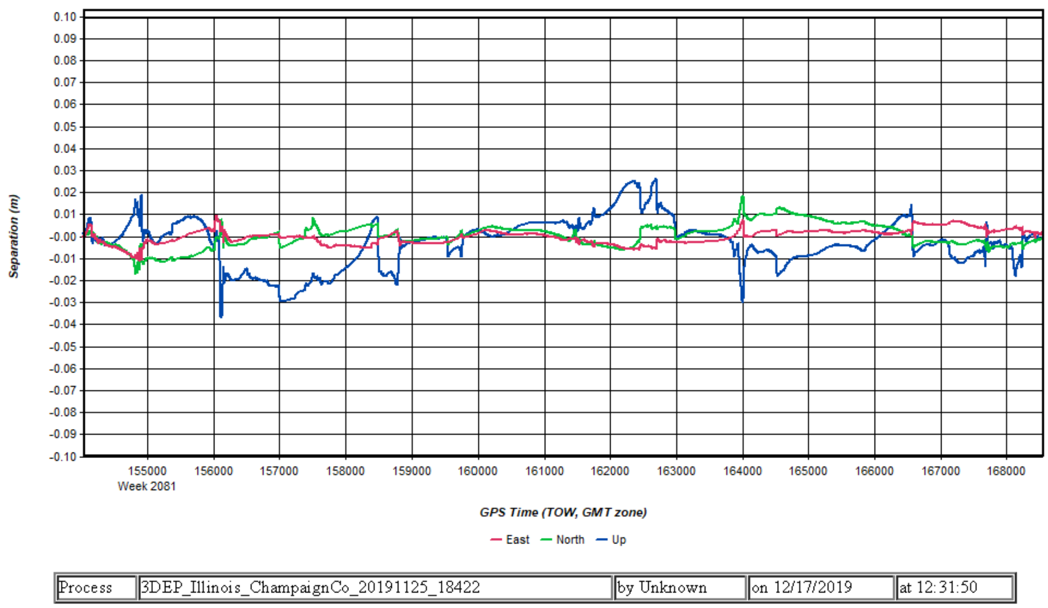
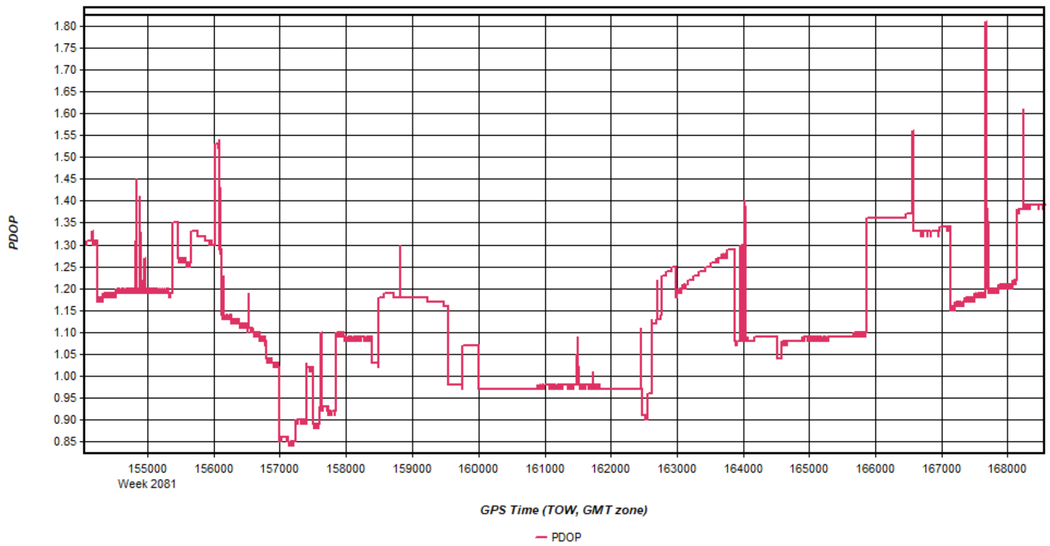


Figure 5: 3DEP_Illinois_ChampaignCo_20191125_184223 [Smoothed TC Combined] - PDOP Plot

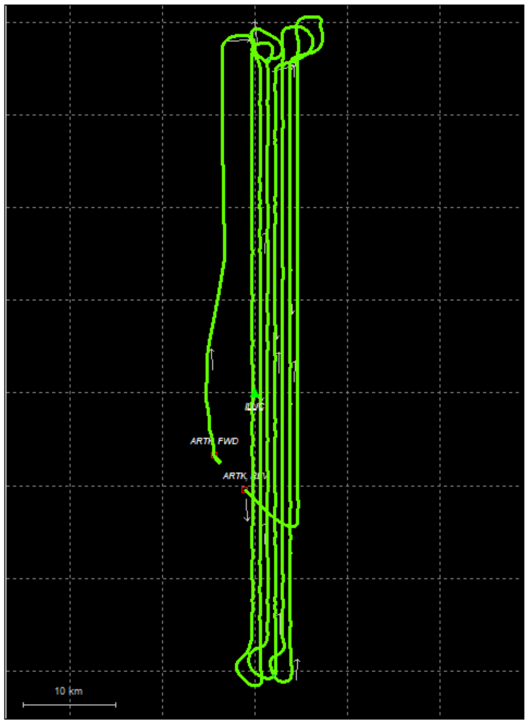


Process	3DEP_Illinois_ChampaignCo_20191125_18422	by Unknown	on 12/17/2019	at 12:31:50

Output Results for 3DEP_Illinois_ChampaignCo_20191204_203038

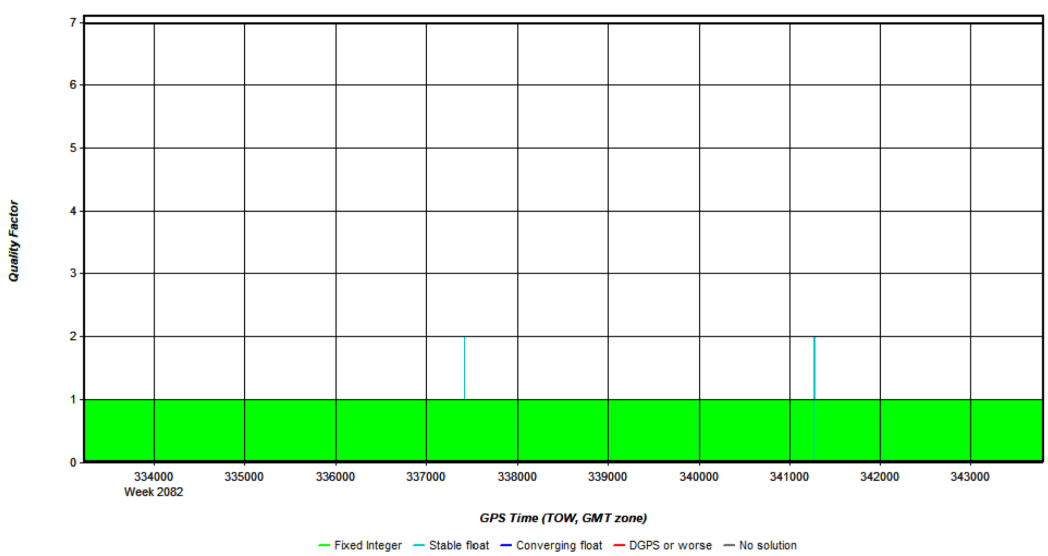
Inertial Explorer Version 8.80.2503
12/20/2019

Figure 1: Smoothed TC Combined - Map



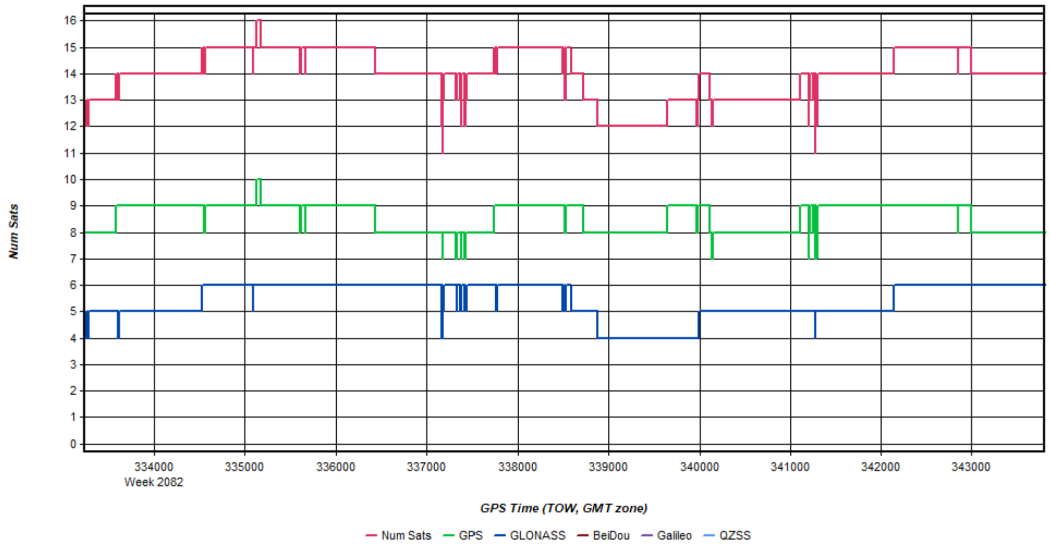
Process	3DEP_Illinois_ChampaignCo_20191204_20303	by Unknown	on 12/20/2019	at 16:16:19

Figure 2: 3DEP_Illinois_ChampaignCo_20191204_203038 [Smoothed TC Combined] - Quality Factor Plot



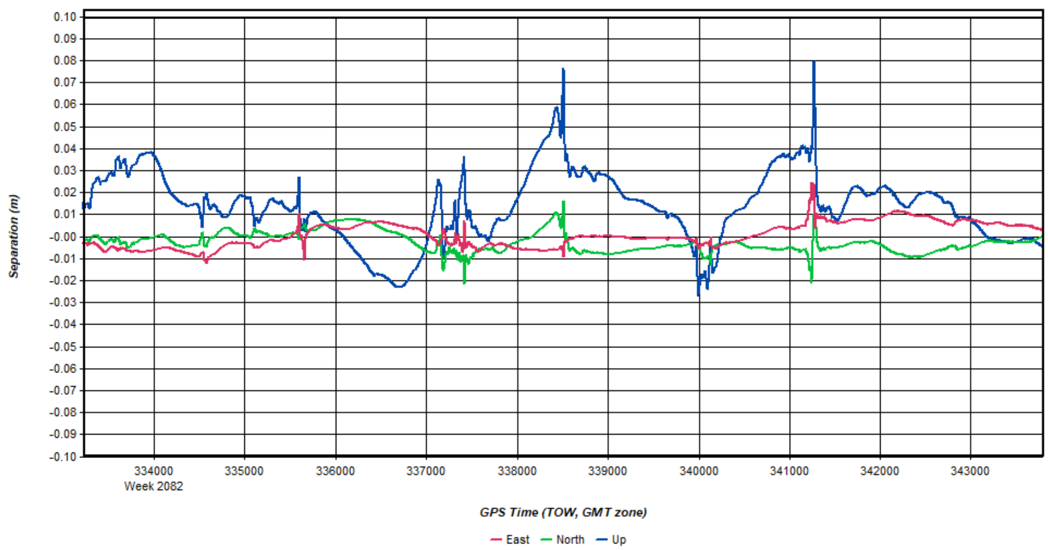
Process	3DEP_Illinois_ChampaignCo_20191204_20303	by Unknown	on 12/20/2019	at 16:16:19

Figure 3: 3DEP_Illinois_ChampaignCo_20191204_203038 [Smoothed TC Combined] - Number of Satellites Line Plot



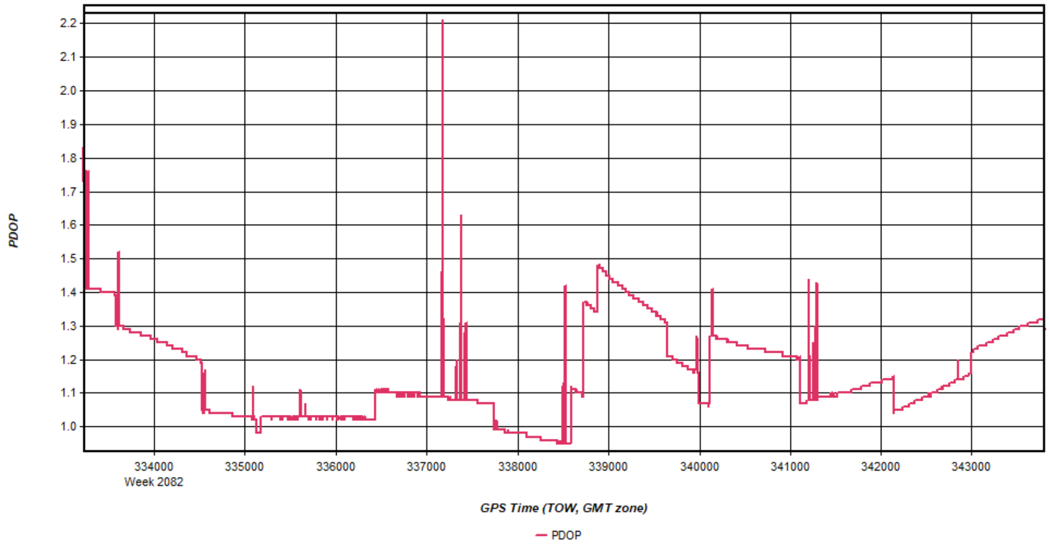
Process	3DEP_Illinois_ChampaignCo_20191204_20303	by Unknown	on 12/20/2019	at 16:16:19

Figure 4: 3DEP_Illinois_ChampaignCo_20191204_203038 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot



Process	3DEP_Illinois_ChampaignCo_20191204_20303	by Unknown	on 12/20/2019	at 16:16:19

Figure 5: 3DEP_Illinois_ChampaignCo_20191204_203038 [Smoothed TC Combined] - PDOP Plot

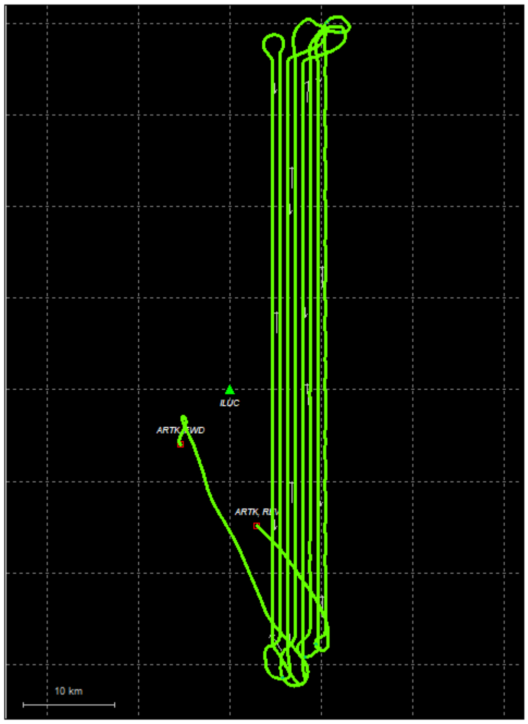


Process	3DEP_Illinois_ChampaignCo_20191204_20303	by Unknown	on 12/20/2019	at 16:16:19

Output Results for 3DEP_Illinois_ChampaignCo_20191205_001845

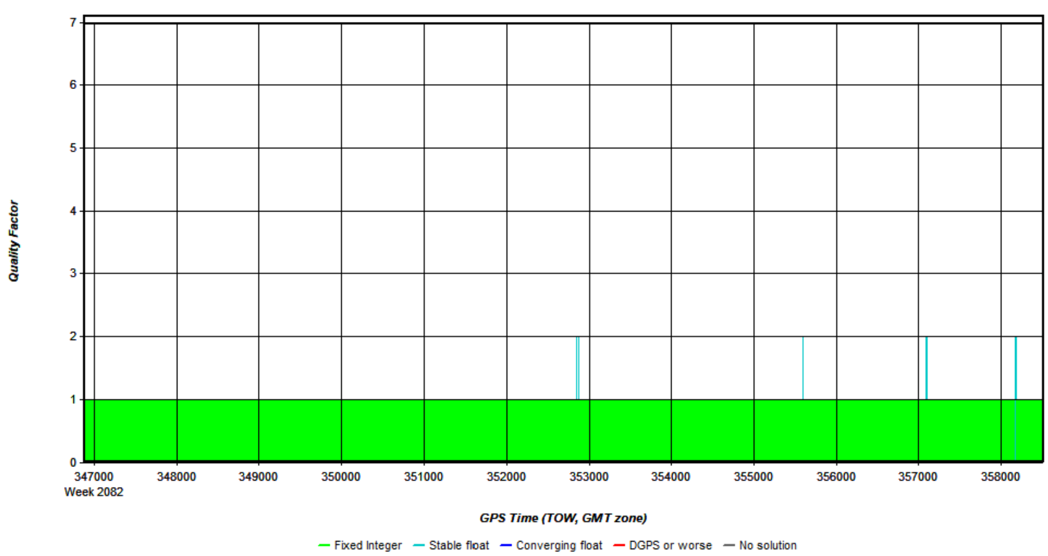
Inertial Explorer Version 8.80.2503
12/20/2019

Figure 1: Smoothed TC Combined - Map



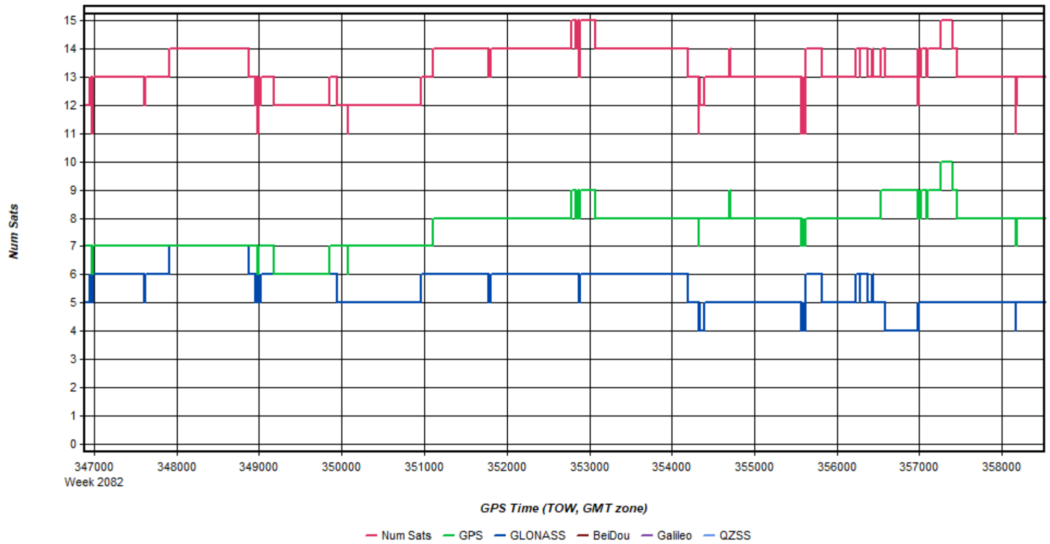
Process	3DEP_Illinois_ChampaignCo_20191205_00184	by Unknown	on 12/20/2019	at 16:32:38

Figure 2: 3DEP_Illinois_ChampaignCo_20191205_001845 [Smoothed TC Combined] - Quality Factor Plot



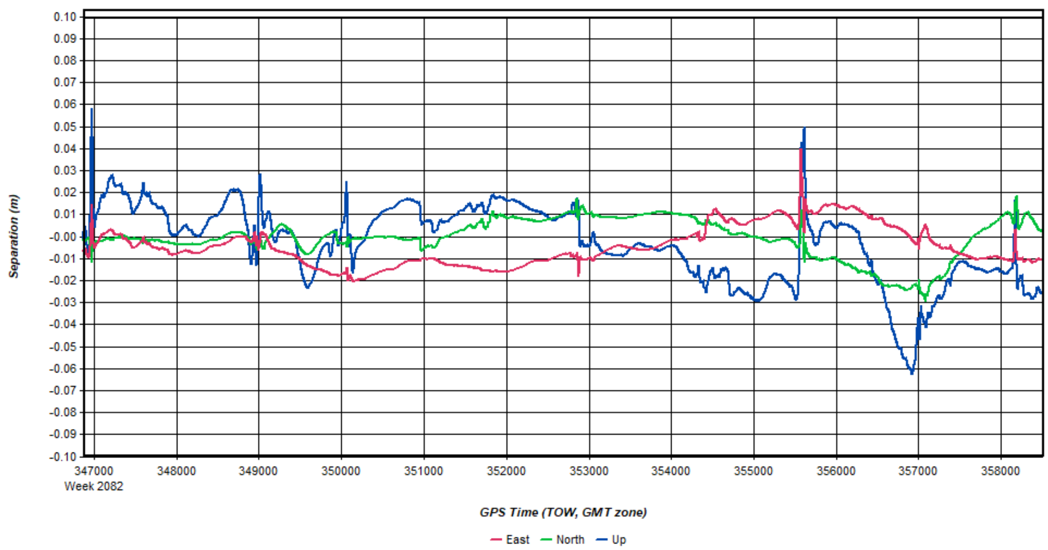
Process	3DEP_Illinois_ChampaignCo_20191205_00184	by Unknown	on 12/20/2019	at 16:32:38

Figure 3: 3DEP_Illinois_ChampaignCo_20191205_001845 [Smoothed TC Combined] - Number of Satellites Line Plot



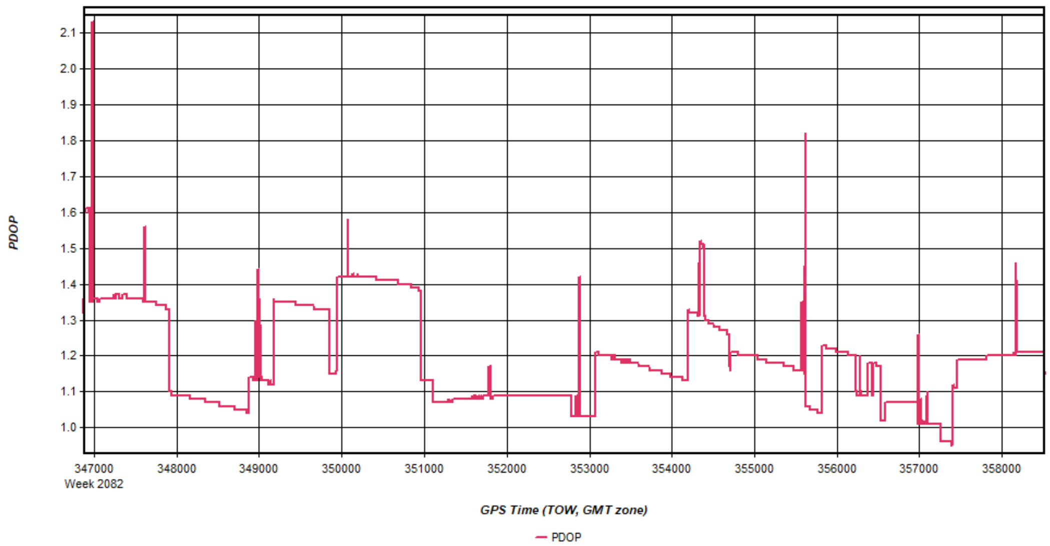
Process	3DEP_Illinois_ChampaignCo_20191205_00184	by Unknown	on 12/20/2019	at 16:32:38

Figure 4: 3DEP_Illinois_ChampaignCo_20191205_001845 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot



Process	3DEP_Illinois_ChampaignCo_20191205_00184	by Unknown	on 12/20/2019	at 16:32:38

Figure 5: 3DEP_Illinois_ChampaignCo_20191205_001845 [Smoothed TC Combined] - PDOP Plot

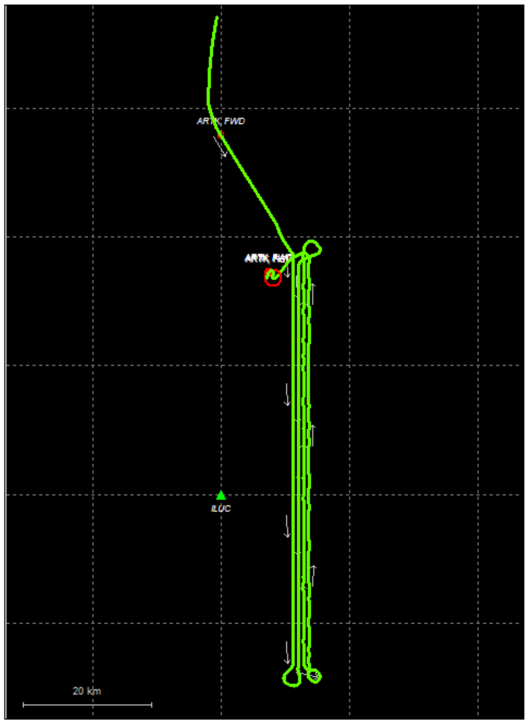


Process	3DEP_Illinois_ChampaignCo_20191205_00184	by Unknown	on 12/20/2019	at 16:32:38

Output Results for 3DEP_Illinois_ChampaignCo_20191205_205908

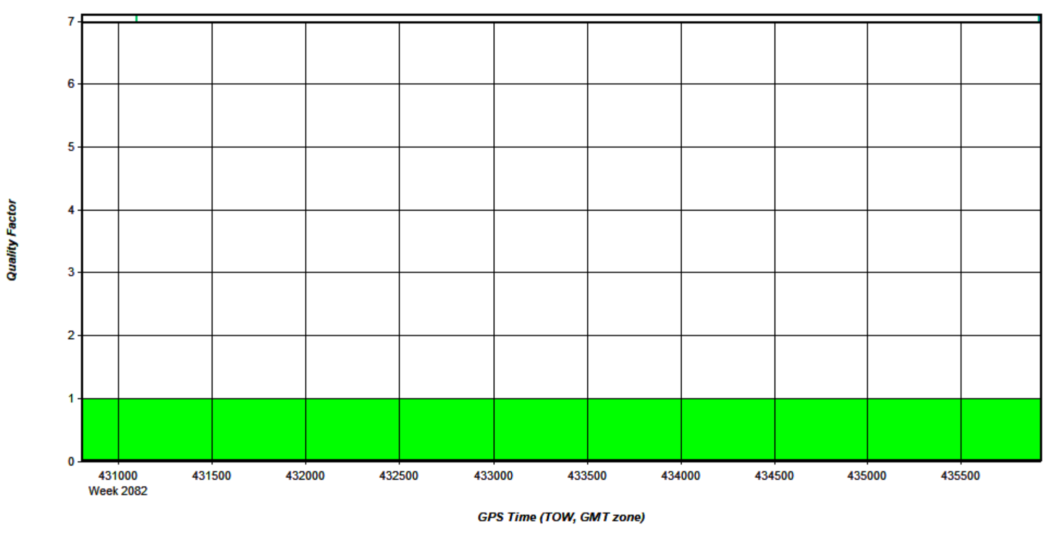
Inertial Explorer Version 8.80.2503
12/17/2019

Figure 1: Smoothed TC Combined - Map



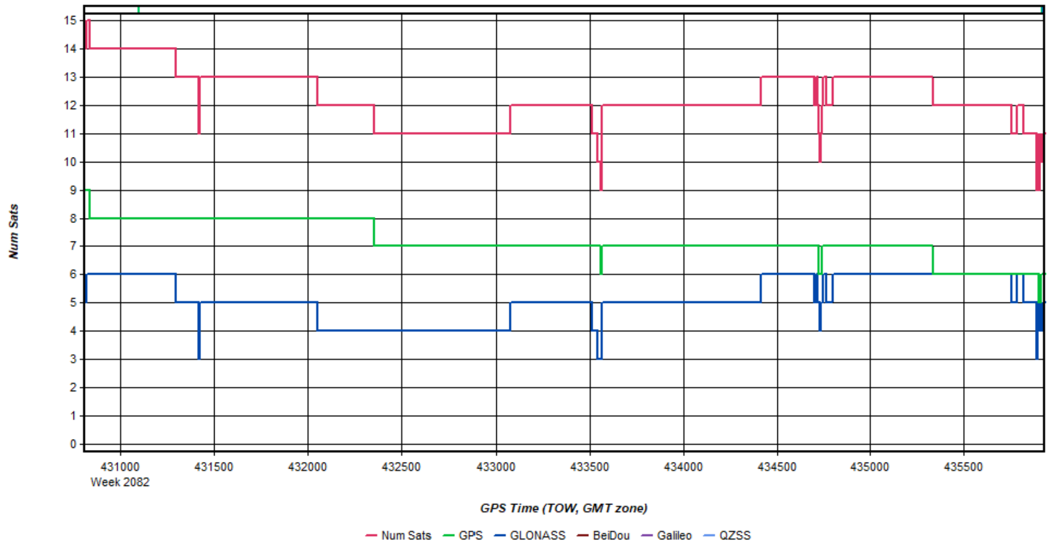
Process	3DEP_Illinois_ChampaignCo_20191205_20590	by Unknown	on 12/17/2019	at 12:50:21

Figure 2: 3DEP_Illinois_ChampaignCo_20191205_205908 [Smoothed TC Combined] - Quality Factor Plot



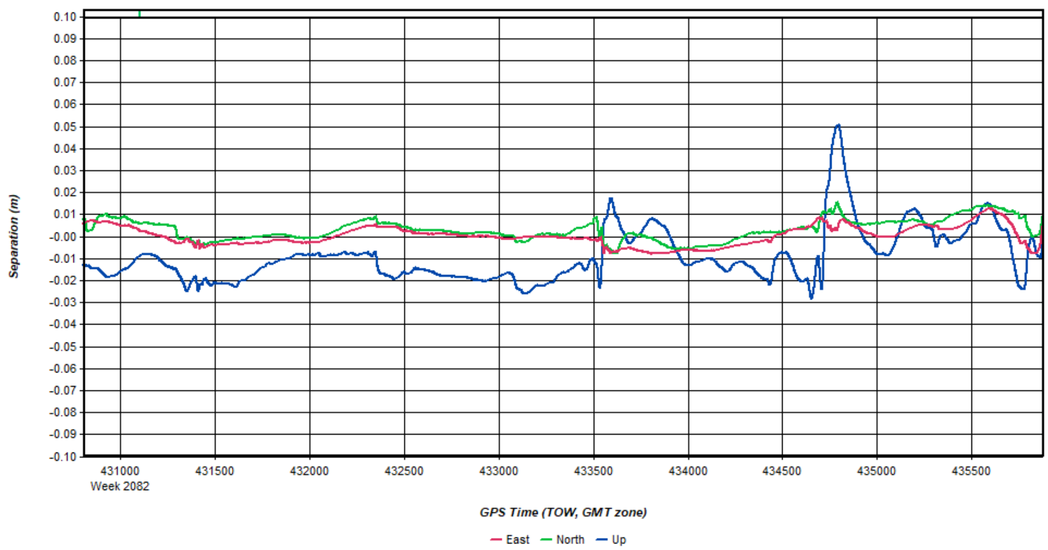
Process	3DEP_Illinois_ChampaignCo_20191205_20590	by Unknown	on 12/17/2019	at 12:50:21

Figure 3: 3DEP_Illinois_ChampaignCo_20191205_205908 [Smoothed TC Combined] - Number of Satellites Line Plot



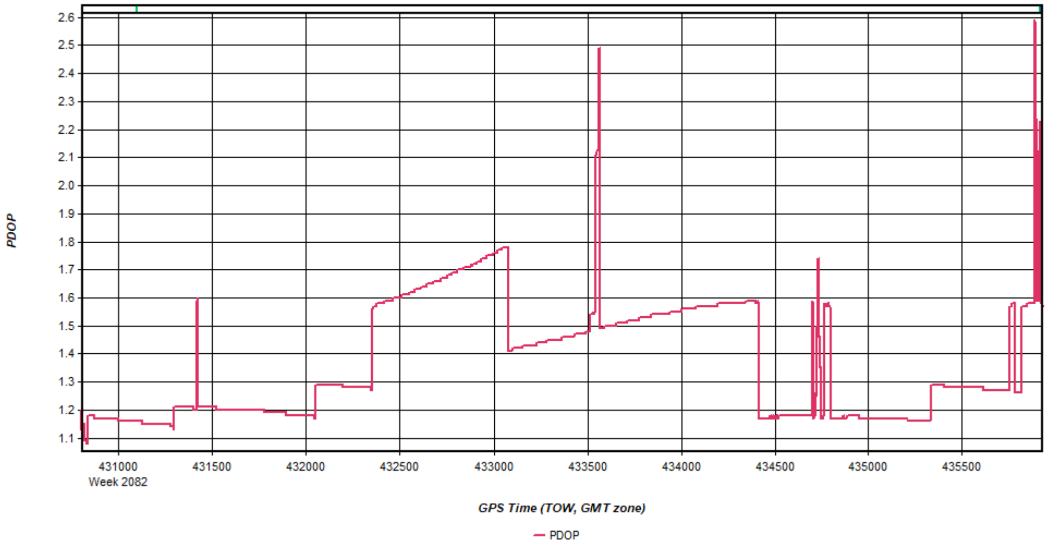
Process	3DEP_Illinois_ChampaignCo_20191205_20590	by Unknown	on 12/17/2019	at 12:50:21

Figure 4: 3DEP_Illinois_ChampaignCo_20191205_205908 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot



Process	3DEP_Illinois_ChampaignCo_20191205_20590	by Unknown	on 12/17/2019	at 12:50:21

Figure 5: 3DEP_Illinois_ChampaignCo_20191205_205908 [Smoothed TC Combined] - PDOP Plot

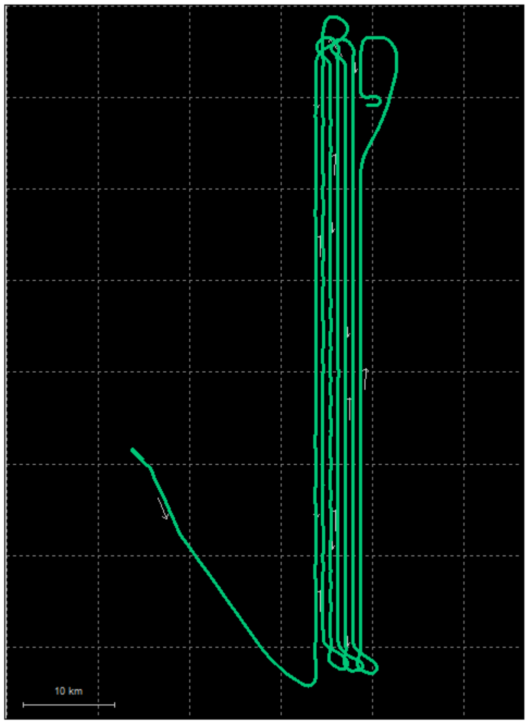


Process	3DEP_Illinois_ChampaignCo_20191205_20590	by Unknown	on 12/17/2019	at 12:50:21

Output Results for 3DEP_Illinois_ChampaignCo_20191206_024156

Inertial Explorer Version 8.80.2503
12/17/2019

Figure 1: Smoothed TC Combined - Map

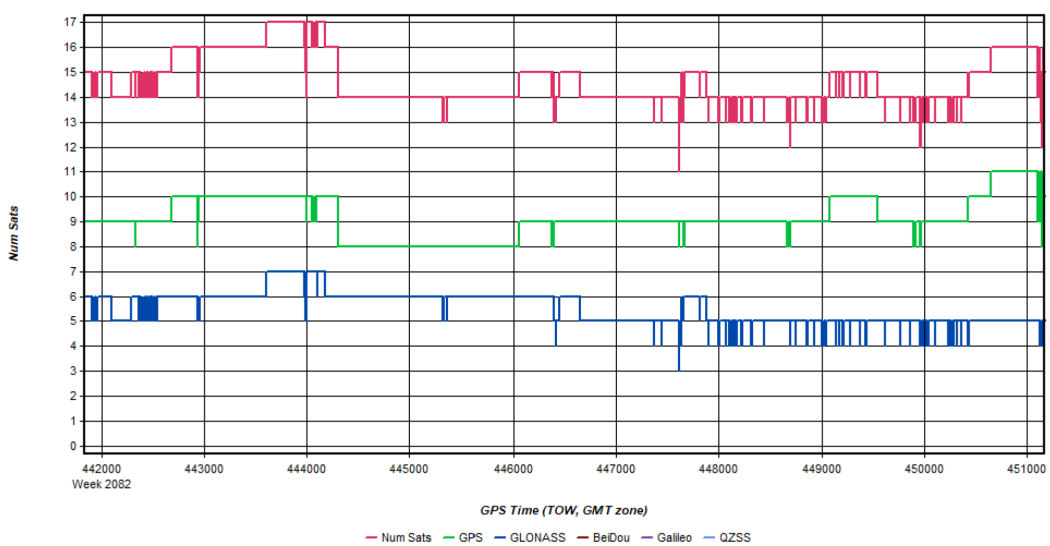


Process	3DEP_Illinois_ChampaignCo_20191206_02415	by Unknown	on 12/17/2019	at 15:20:52

Object 3DEP_Illinois_ChampaignCo_20191206_024156 [Smoothed TC Combined] - Quality Factor Plot failed--NULL bitmap handle

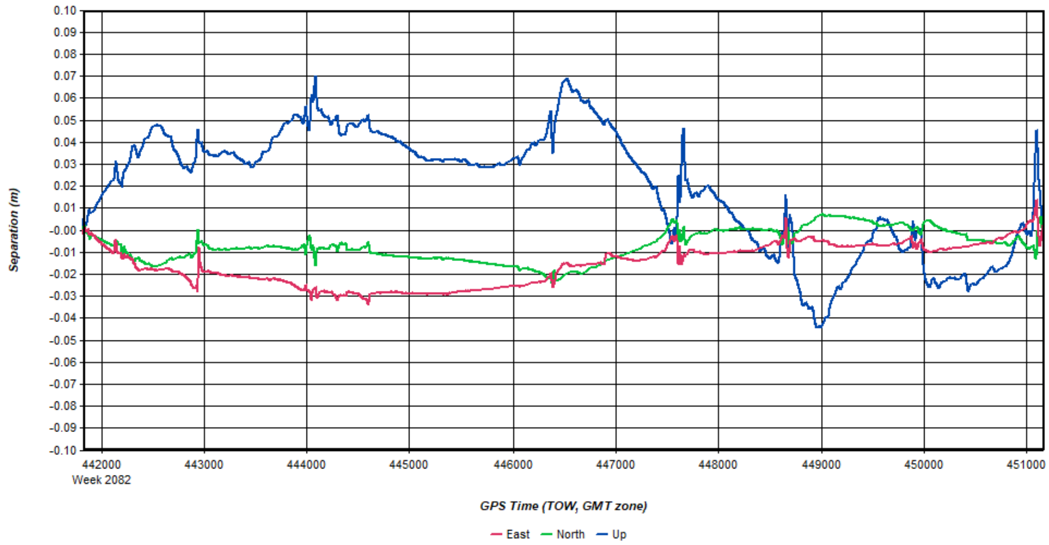
---

Figure 2: 3DEP_Illinois_ChampaignCo_20191206_024156 [Smoothed TC Combined] - Number of Satellites Line Plot



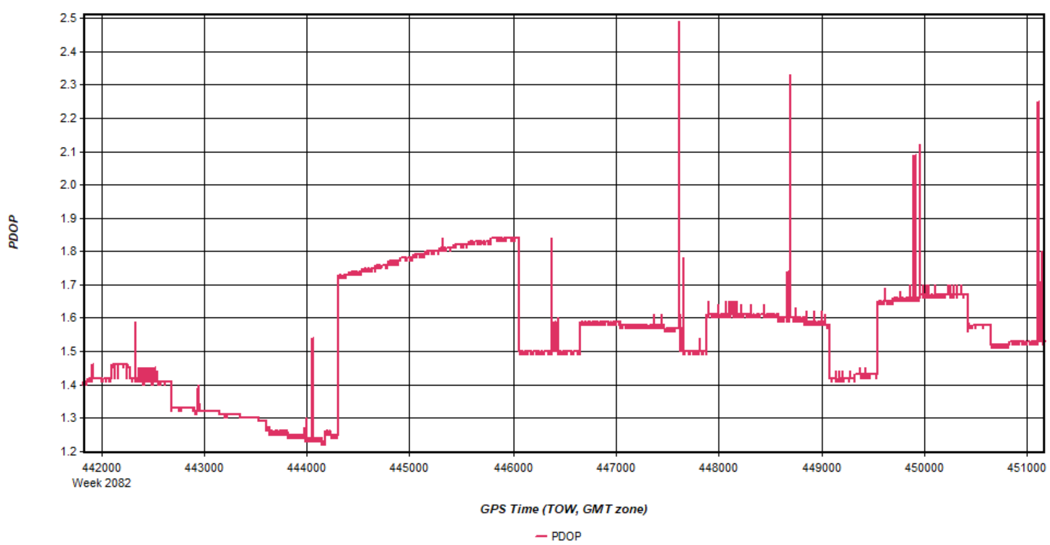
Process	3DEP_Illinois_ChampaignCo_20191206_02415	by Unknown	on 12/17/2019	at 15:20:52

Figure 3: 3DEP_Illinois_ChampaignCo_20191206_024156 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot



Process	3DEP_Illinois_ChampaignCo_20191206_02415	by Unknown	on 12/17/2019	at 15:20:52

Figure 4: 3DEP_Illinois_ChampaignCo_20191206_024156 [Smoothed TC Combined] - PDOP Plot

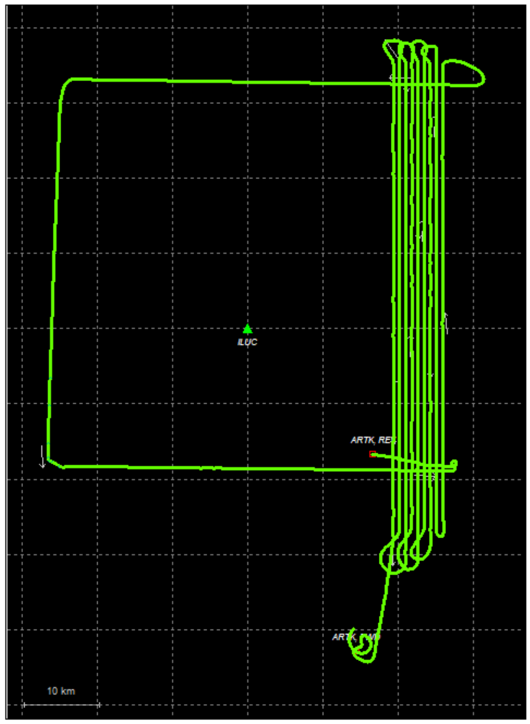


Process	3DEP_Illinois_ChampaignCo_20191206_02415	by Unknown	on 12/17/2019	at 15:20:52

Output Results for 3DEP_Illinois_ChampaignCo_20191206_221016

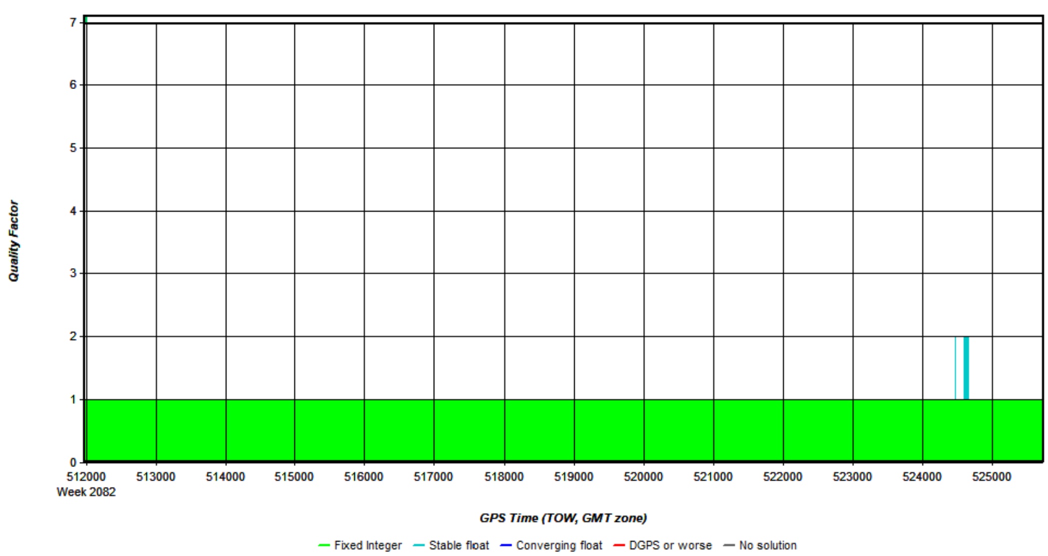
Inertial Explorer Version 8.80.2503
12/17/2019

Figure 1: Smoothed TC Combined - Map



Process	3DEP_Illinois_ChampaignCo_20191206_22101	by Unknown	on 12/17/2019	at 14:42:19

Figure 2: 3DEP_Illinois_ChampaignCo_20191206_221016 [Smoothed TC Combined] - Quality Factor Plot



Process	3DEP_Illinois_ChampaignCo_20191206_22101	by Unknown	on 12/17/2019	at 14:42:19

Figure 3: 3DEP_Illinois_ChampaignCo_20191206_221016 [Smoothed TC Combined] - Number of Satellites Line Plot

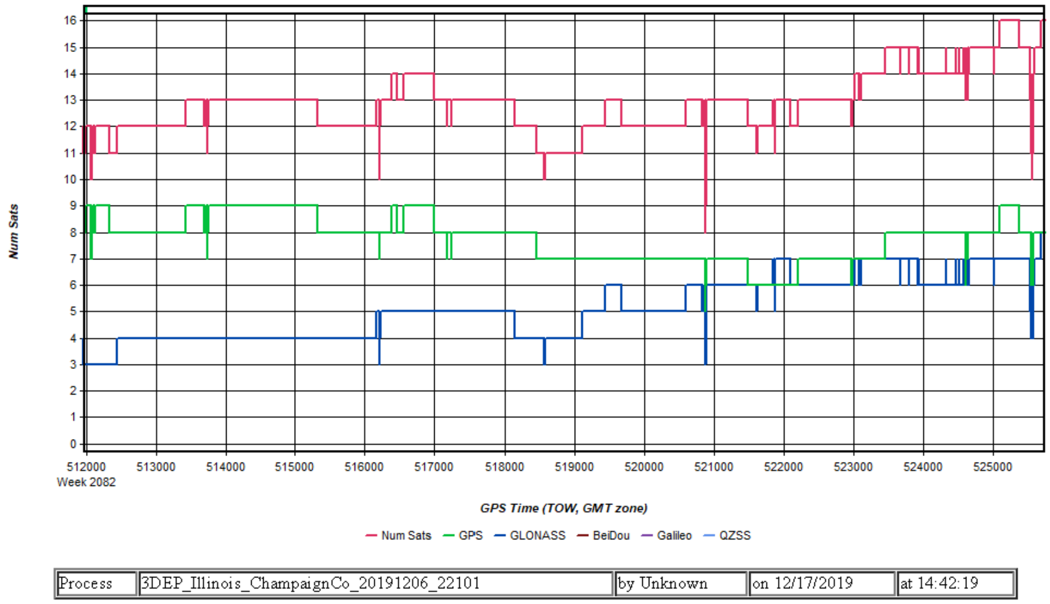


Figure 4: 3DEP_Illinois_ChampaignCo_20191206_221016 [Smoothed TC Combined] - Forward/Reverse or Combined Separation Plot

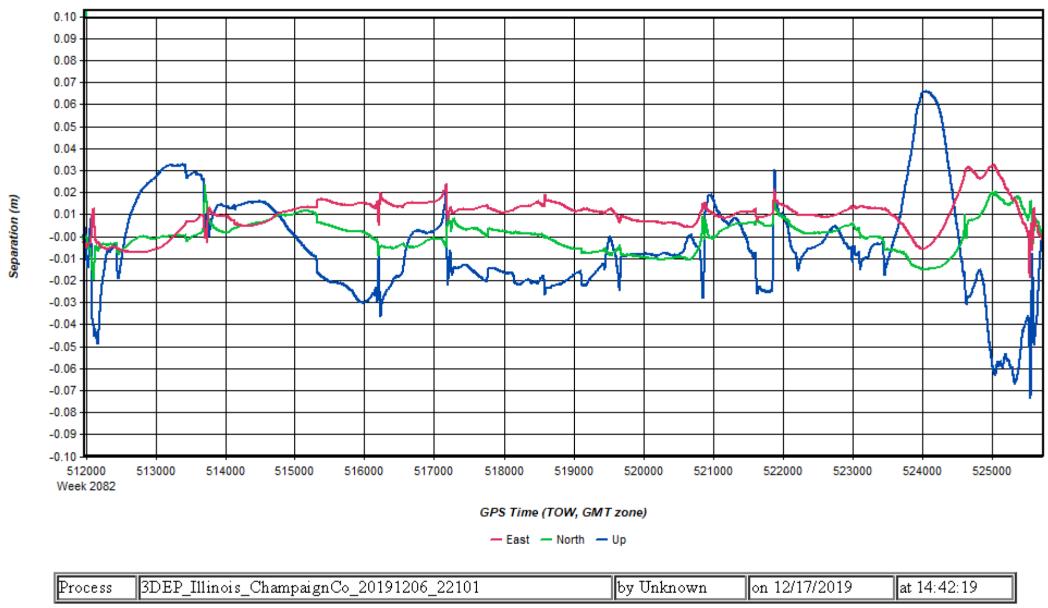
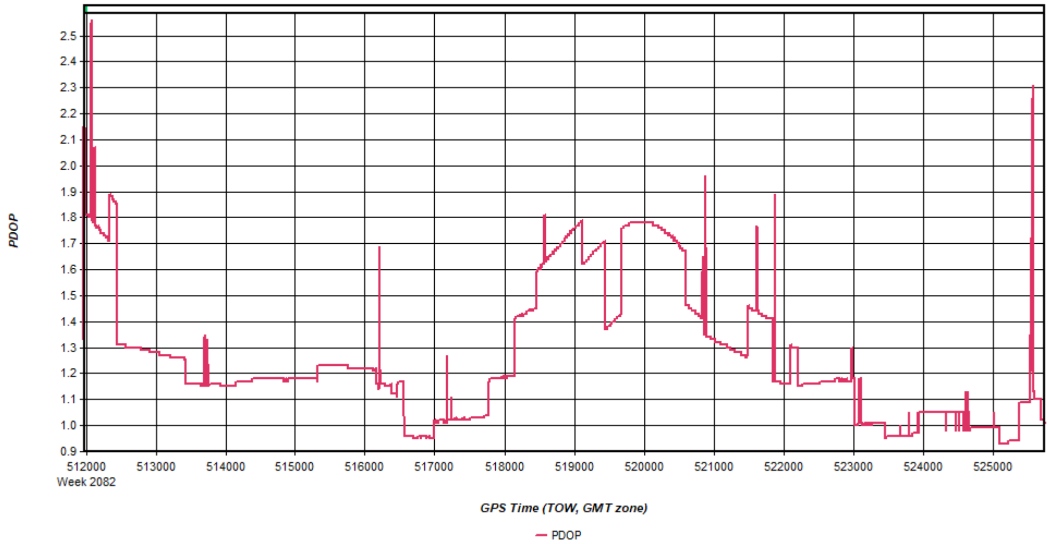


Figure 5: 3DEP_Illinois_ChampaignCo_20191206_221016 [Smoothed TC Combined] - PDOP Plot



Process	3DEP_Illinois_ChampaignCo_20191206_22101	by Unknown	on 12/17/2019	at 14:42:19