LIDAR-DERIVED ELEVATION DATA FOR BLACKERBY PARCEL, JUNEAU, SOUTHEAST ALASKA, COLLECTED JULY 12, 2023

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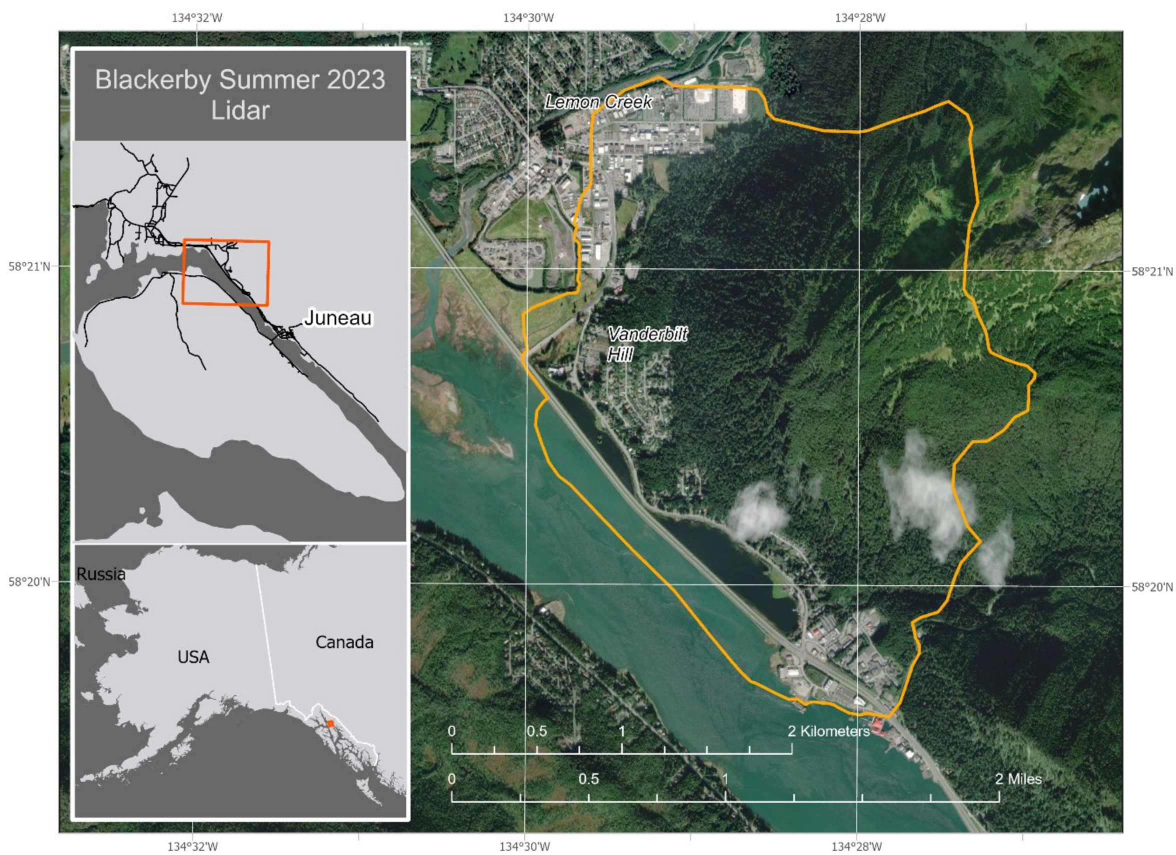
Raw Data File 2024-8



Location map of survey area.

This report has not been reviewed for technical content or for conformity to the editorial standards of DGGS.

2025
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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LIDAR-DERIVED ELEVATION DATA FOR BLACKERBY PARCEL, JUNEAU, SOUTHEAST ALASKA, COLLECTED JULY 12, 2023

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INTRODUCTION

The Alaska Division of Geological & Geophysical Surveys (DGGS) used aerial lidar to produce a classified point cloud, digital surface model (DSM), digital terrain model (DTM), and an intensity model of slopes above the Blackerby Parcel in Juneau, Southeast Alaska, during leaf-on conditions (cover figure). The survey provides snow-free surface elevations for use in landslide hazard assessment, geologic mapping, and slope-stability analysis. Ground control data provided by the Alaska Department of Transportation (DOT) was collected on March 21, 2017. DGGS collected aerial lidar data on July 12, 2023, and subsequently merged and processed using a suite of geospatial processing software. This data collection is released as a Raw Data File with an open end-user license. All files are available to download on the DGGS website at https://doi.org/10.14509/31161.

LIST OF DELIVERABLES

Classified Points
DSM and DTM
Intensity Image
Metadata

MISSION PLAN

Aerial Lidar Survey Details

DGGS used a Riegl VUX1-LR[22] laser scanner integrated with a global navigation satellite system (GNSS) and Northrop Grumman LN-200C inertial measurement unit (IMU) designed by Phoenix LiDAR Systems. The sensor can collect a maximum of 1,500,000 points per second at a range of 230 m or a minimum of 50,000 points per second at a range of 1000 m (ranges assume ≥ 20 percent natural reflectance). The scanner operated with a pulse refresh rate of 600,000 pulses per second, with a scan rate of 200 lines per second. We used a Cessna 180 fixed-wing platform to survey from an elevation of approximately 150 m above ground level, at a ground speed of approximately 40 m/s, and with a scan angle set from 80 to 280 degrees. The total survey area covers approximately 7.4 km^2.

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Weather Conditions and Flight Times

The survey area was accessed by air from Juneau International Airport (see fig. 1 for flightlines). Data collection began at 1:40 p.m. (AST) and ended at 2:00 p.m. (AST). The weather was partly cloudy with no wind.

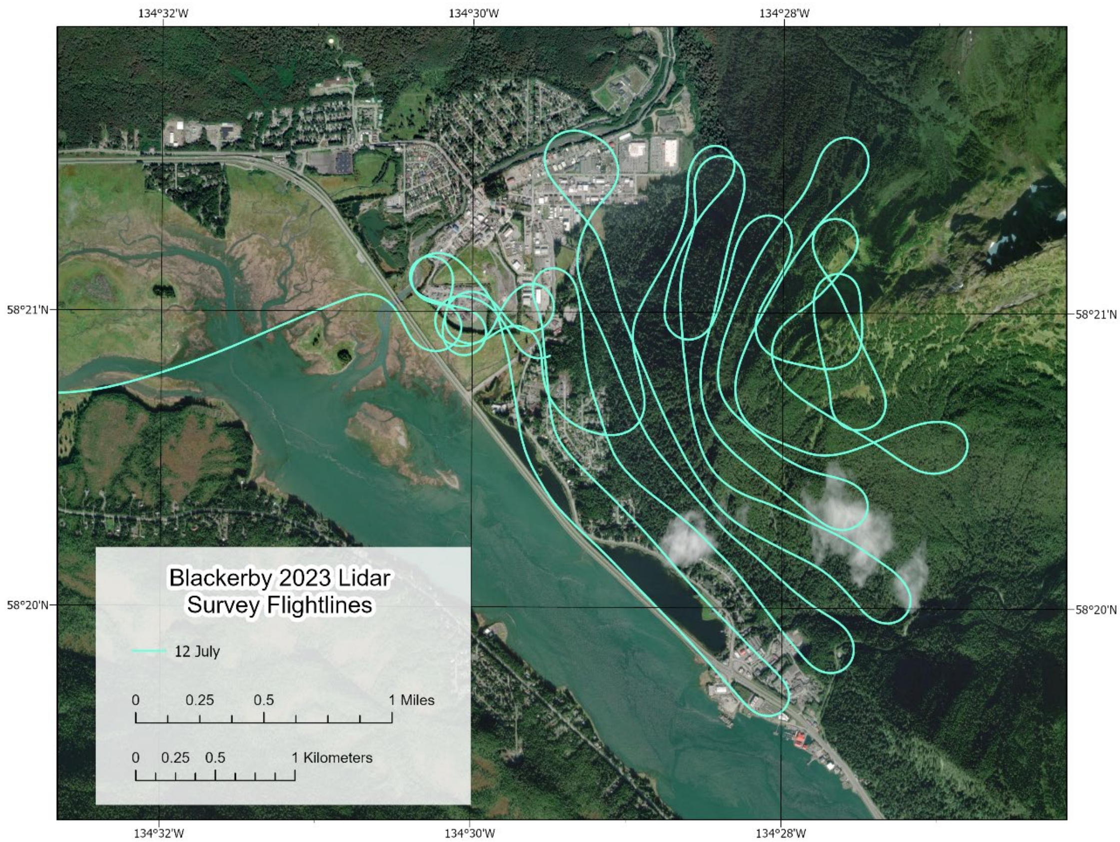

Figure 1. Lidar data-collection flightlines.

PROCESSING REPORT

Lidar Dataset Processing

We processed point data in Spatial Explorer for initial filtering and multiple-time-around (MTA) disambiguation. MTA errors, corrected in this process, result from ambiguous interpretations of received pulse time intervals and occur more frequently with higher pulse refresh rates. IMU and GNSS data were processed in Inertial Explorer, and flightline information was integrated with the point cloud in Spatial Explorer. We calibrated the point data at an incrementally precise scale of sensor movement and behavior, incorporating sensor velocity, roll, pitch, and yaw fluctuations throughout the survey.

We created macros in Terrasolid software and classified points in accordance with the American Society for Photogrammetry & Remote Sensing (ASPRS) 2019 guidelines (ASPRS, 2019). Once classified, we applied a geometric transformation and converted the points from ellipsoidal heights to GEOID12B (Alaska) orthometric heights.

Raster products were derived from the point cloud in ArcGIS Pro. A 20-cm DSM was interpolated from maximum-return values from ground, vegetation, bridge deck, and building classes using a binning method and maximum values. A 20-cm DTM was interpolated from all ground-class returns using a binning method and minimum values. We also produced a 20-cm intensity image for the entire area using average binning in ArcGIS Pro, with no normalization or corrections applied.

Classified Point Cloud

Classified point cloud data are provided in LAZ format. Data are classified following ASPRS 2019 guidelines (table 1) and contain return and intensity information. For all ground points (fig. 2), the average point spacing is 48.4 cm, and the average density is 4.27 pts/m^2.

Table 1. Point cloud class code definitions.

Class Code	Description
1	Unclassified
2	Ground
3	Low Vegetation, ≥0.0m, <0.5m
4	Medium Vegetation, ≥0.5m, <3m
5	High Vegetation, ≥3m, ≤60m
6	Building
7	Low Noise
17	Bridge Deck
18	High Noise
30	Noise (manually classified)

Digital Surface Model

The DSM represents surface elevations, including heights of vegetation, buildings, powerlines, bridge decks, etc. It is a single-band, 32-bit GeoTIFF file of 20-cm resolution. No Data value is set to -3.40282306074e+38 (32-bit, floating-point minimum).

Digital Terrain Model

The DTM represents bare earth elevations, excluding vegetation, bridge decks, buildings, etc. The DTM is a single-band, 32-bit GeoTIFF file of 20-cm resolution. No Data value is set to -3.40282306074e+38.

Lidar Intensity Image

The lidar intensity image describes the relative amplitude of reflected signals contributing to the point cloud. Lidar intensity is (1) primarily a function of scanned object reflectance in relation to the signal frequency, (2) dependent on ambient conditions, and (3) not necessarily consistent between separate scans. The intensity image is a single-band, 16-bit unsigned GeoTIFF file of 20-cm resolution. No Data value is set to 0.

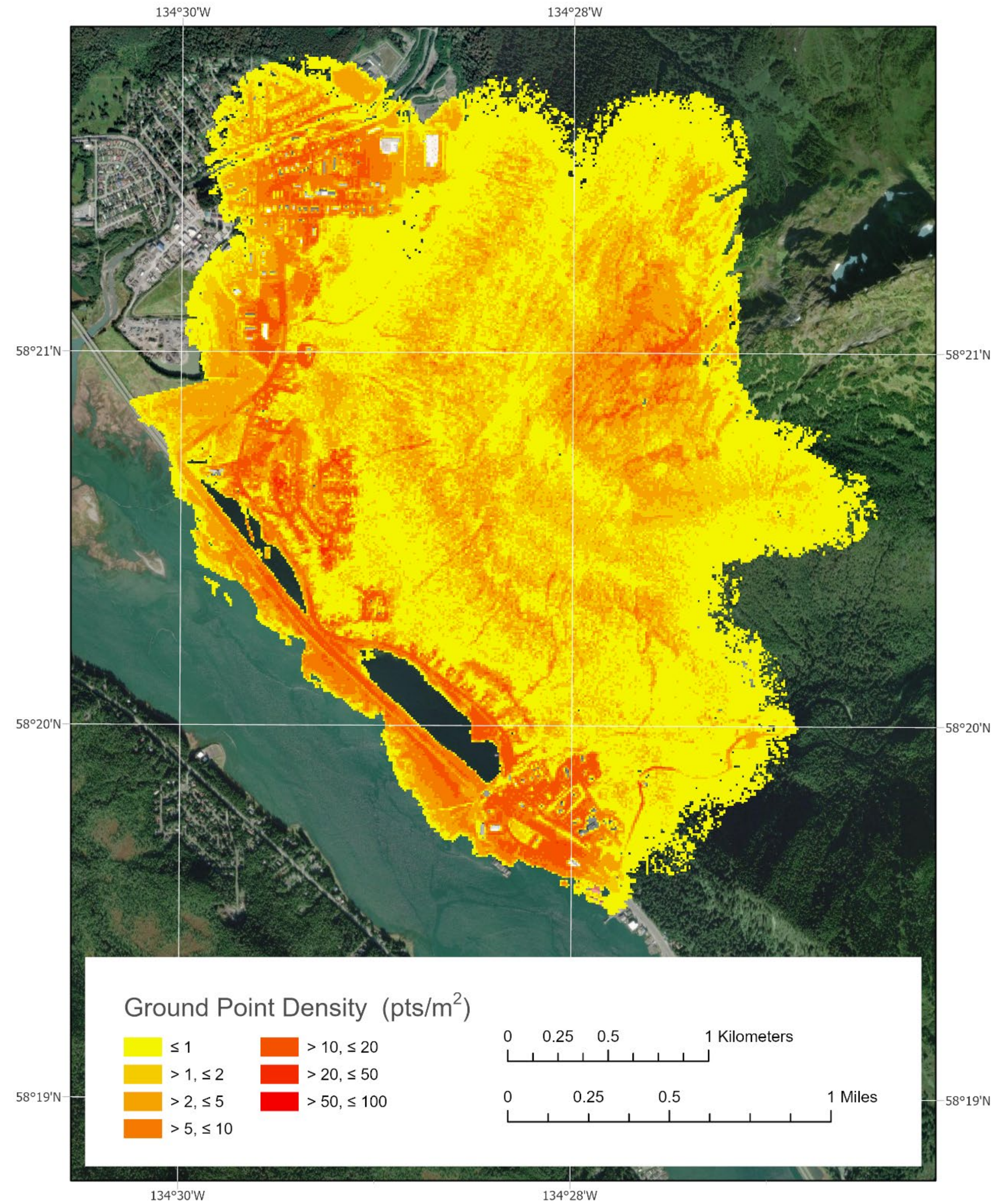

Figure 2. Ground point density for the survey displayed as a raster.

SURVEY REPORT

Ground Survey Details

The Alaska Department of Transportation collected ground control points along the centerline of Glacier Highway in Juneau on March 21, 2017. They deployed a Leica GS-15 for static GPS control for points they surveyed with a Leica TS15 total station. DOT collected 36 ground control points and checkpoints (all located on paved surfaces), which we use for calibration and to assess the vertical accuracy of the point cloud.

Coordinate System and Datum

We processed and delivered all data in NAD83 (2011) UTM8N and vertical datum NAVD88 GEOID12B.

Horizontal Accuracy

Horizontal accuracy was not measured for this collection.

Vertical Accuracy

We measured a mean offset of +68.3 cm between 23 control points and the point cloud (app. 1). This offset was reduced to +0.1 cm (app. 2) by applying a static vertical correction to the lidar point data. We used 13 checkpoints to determine the vertical accuracy of the point cloud ground class using a Triangulated Irregular Network (TIN) approach. The project vertical accuracy has a root mean square error (RMSE) of 3.9 cm (app. 2). We evaluated the relative accuracy for this dataset as the interswath overlap consistency and measured it at 8.4 cm RMSE.

Data Consistency and Completeness

This is a full-release dataset. There was no over-collect. Data quality is consistent throughout the survey.

ACKNOWLEDGMENTS

This survey area is located within the traditional homelands of the A'akw Kwáan and T'aaḵu Ḵwáan Tlingit peoples. This work was funded by the Alaska Division of Mining, Land, and Water (Reimbursable Services Agreement-IPO 230001027). We thank Clearwater Air for their aviation expertise and contribution to these data products and the Alaska Department of Transportation for providing ground control points. The views and conclusions contained in this document are those of the authors. They should not be interpreted as necessarily representing the State of Alaska's official policies, either expressed or implied.

REFERENCES

The American Society for Photogrammetry & Remote Sensing (ASPRS), 2019, LAS Specification 1.4 - R15. https://www.asprs.org/wp-content/uploads/2019/07/LAS_1_4_r15.pdf

APPENDIX 1: GROUND CONTROL POINTS

GCP	Easting (m)	Northing (m)	GCP Z (m)	Pointcloud Z (m)	Elevation Difference (Pointcloud Z-GCP Z) (m)
1	529618.742	6467473.536	7.647	8.234	0.587
2	529595.704	6467411.473	8.071	8.712	0.641
3	529584.731	6467364.989	8.812	9.406	0.594
4	529568.892	6467293.279	11.101	11.751	0.650
5	530693.259	6466096.148	8.665	9.383	0.718
6	530743.869	6466058.199	8.821	9.500	0.679
7	530781.669	6466026.365	9.004	9.724	0.720
8	530669.295	6466113.884	8.763	9.470	0.707
9	530455.953	6466271.921	8.675	9.342	0.667
10	530506.940	6466234.315	8.793	9.496	0.703
11	530561.738	6466193.559	9.010	9.720	0.710
12	529893.904	6466655.350	9.272	9.910	0.638
13	529922.816	6466559.875	9.217	9.928	0.711
14	529963.232	6466437.456	8.669	9.414	0.745
15	529999.318	6466402.099	8.480	9.189	0.709
16	530080.980	6466368.828	8.729	9.416	0.687
17	530155.472	6466358.947	8.736	9.445	0.709
18	530240.103	6466350.283	8.647	9.337	0.690
19	530278.412	6466345.300	8.812	9.485	0.673
20	530387.702	6466311.319	9.001	9.680	0.679
21	530930.983	6465791.509	7.748	8.464	0.716
22	530881.173	6465921.908	8.601	9.314	0.713
23	530843.203	6465962.878	8.894	9.568	0.674
Average dz (m)	0.683				
Minimum dz (m)	0.587				
Maximum dz (m)	0.745				
Average magnitude error (m)	0.683				
Root mean square error (m)	0.685				

GCP	Easting (m)	Northing (m)	GCP Z (m)	Pointcloud Z (m)	Elevation Difference (Pointcloud Z-GCP Z) (m)
Standard deviation	0.040				

APPENDIX 2: CHECK POINTS

Check Point	Easting (m)	Northing (m)	Checkpoint Z (m)	Corrected Pointcloud Z (m)	Elevation Difference (corrected pointcloud Z-checkpoint Z) (m)
1	529631.617	6467545.600	7.227	7.141	-0.086
2	529605.781	6467443.674	7.855	7.814	-0.041
3	529577.450	6467332.054	9.674	9.656	-0.018
4	530704.907	6466087.447	8.659	8.699	0.040
5	530805.883	6466002.265	9.031	9.056	0.025
6	530485.591	6466250.194	8.705	8.717	0.012
7	529881.537	6466681.591	9.141	9.126	-0.015
8	529933.903	6466504.340	9.007	9.082	0.075
9	530020.893	6466389.165	8.531	8.534	0.003
10	530219.359	6466352.418	8.623	8.619	-0.004
11	530312.966	6466338.011	9.007	8.983	-0.024
12	530922.474	6465854.358	8.092	8.106	0.014
13	530851.708	6465953.899	8.845	8.876	0.031
Average dz (m)	0.001				
Minimum dz (m)	-0.086				
Maximum dz (m)	0.075				
Average magnitude error (m)	0.030				
Root mean square error (m)	0.039				
Standard deviation (m)	0.040				