HIGH-RESOLUTION LIDAR DATA FOR HAINES, SOUTHCENTRAL ALASKA, DECEMBER 8-12, 2020

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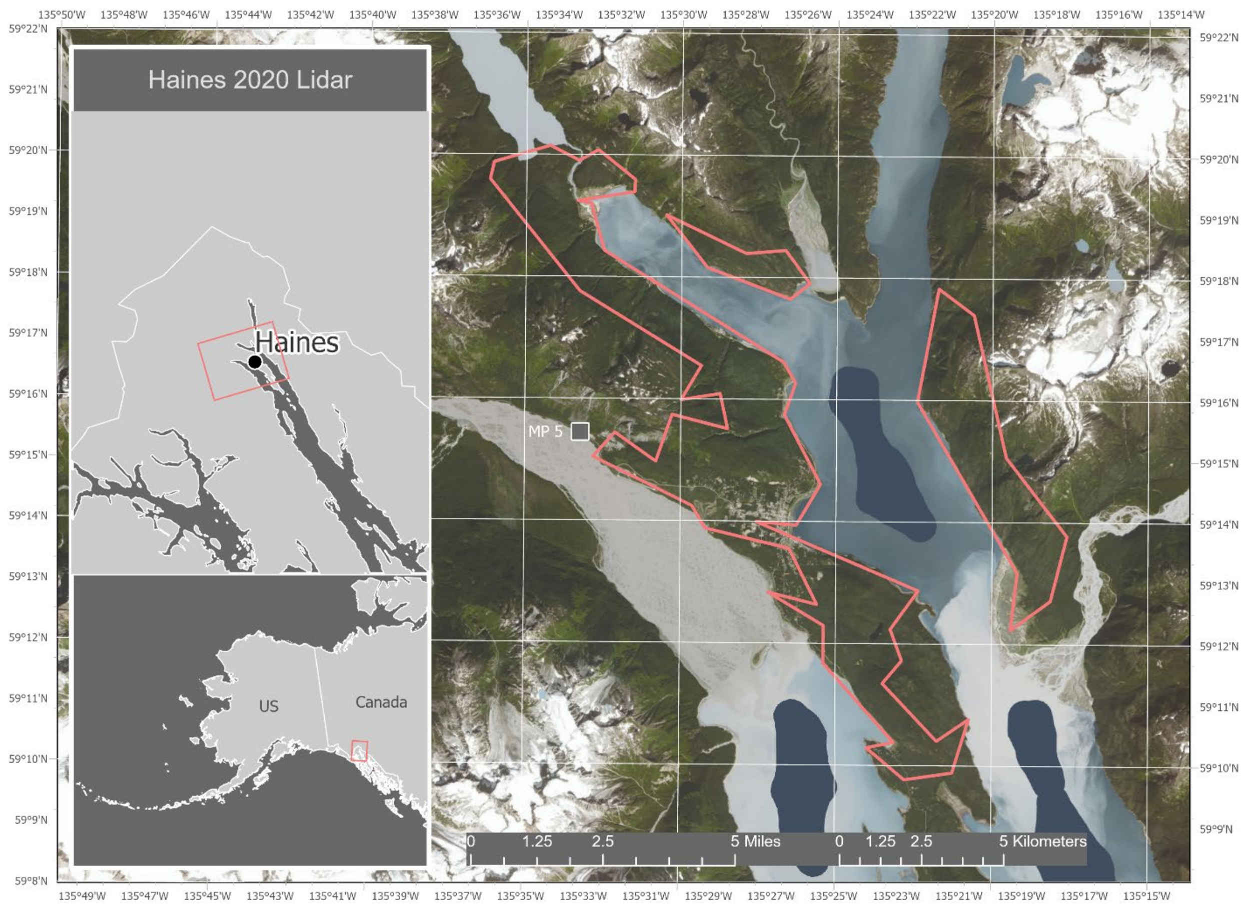
Raw Data File 2021-4



Location map of survey area with orthometric image.

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

2021
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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HIGH-RESOLUTION LIDAR DATA FOR HAINES, SOUTHCENTRAL ALASKA, DECEMBER 8-12, 2020

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INTRODUCTION

The Alaska Division of Geological & Geophysical Surveys (DGGS) used aerial lidar to produce a digital terrain model (DTM), surface model (DSM), and intensity image for an area in and around the community of Haines, Alaska, as part of emergency operations in response to the December 2, 2020, landslide that claimed the lives of two residents. Airborne data were collected December 8–12, 2020, and subsequently processed in Terrasolid and ArcGIS. Ground control were collected December 15-16, by the DMLW. This data collection is released as a Raw Data File with an open end-user license. All files can be downloaded free of charge from the DGGS website: https://doi.org/10.14509/30595.

LIST OF DELIVERABLES

Classified Points

DSM and DTM

Intensity Image

Metadata

MISSION PLAN

Airborne Survey Details

DGGS operates a Riegl VUX1-LR laser scanner integrated with a GNSS and Northrop Grumman IMU system. The integration was designed by Phoenix LiDAR systems. The sensor is capable of collecting up to 820,000 points per second over a distance of 150 m. This survey was flown with a pulse refresh rate between 200,000 and 400,000 pulses per second at a scan rate between 80 and 150 lines per second. This survey was flown with an average elevation of 400 m above ground level and a ground speed of approximately 40 m/s, using a Bell 206 helicopter. The scan angle was set from 55 to 305 degrees. The total area surveyed was approximately 73 km^2.

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Weather Conditions and Flight Times

The airborne survey was flown December 8–12, 2020, using a Bell 206 helicopter (fig. 1). The weather throughout the survey was sub-optimal, with strong winds, light precipitation, and low-hanging clouds.

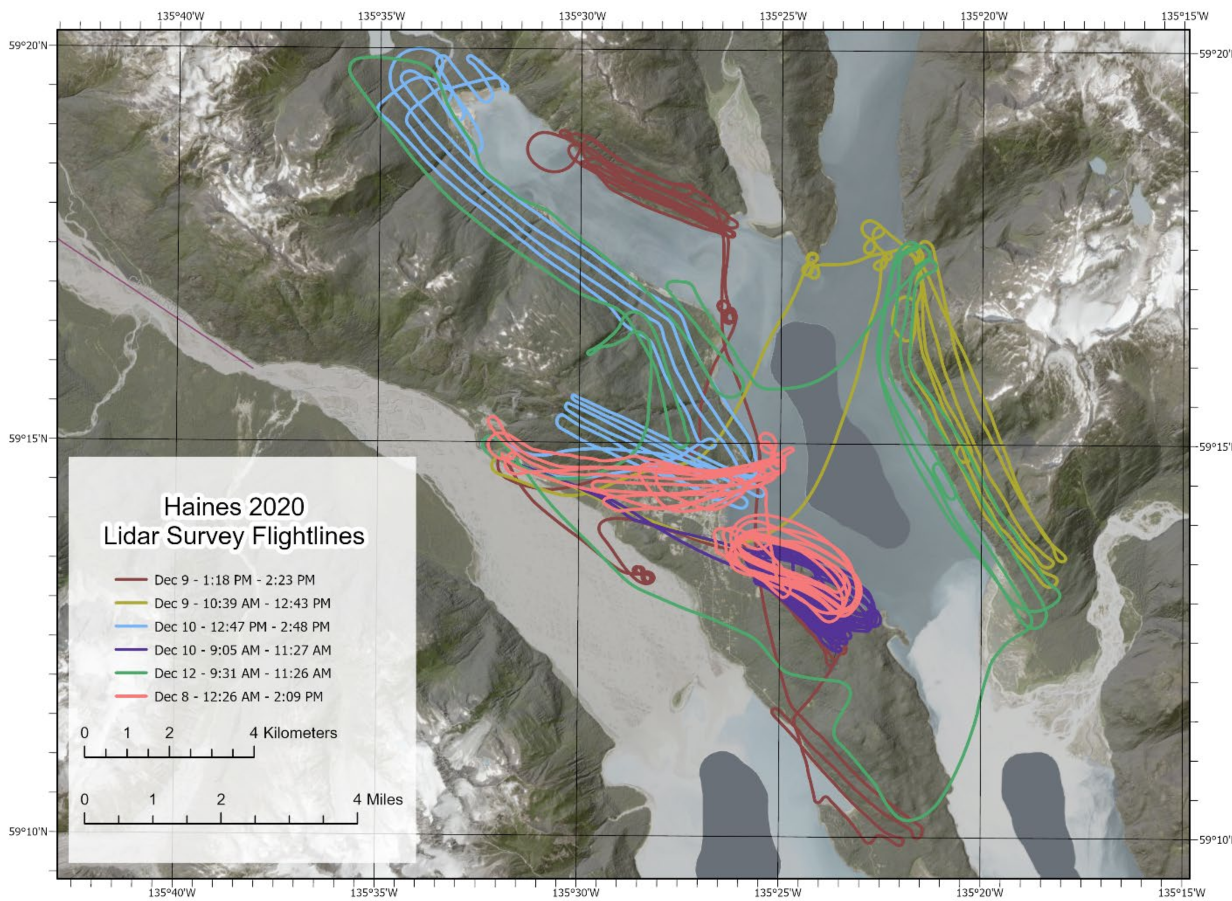

Figure 1. Project flightlines.

PROCESSING REPORT

Lidar Dataset Processing

Point data were processed in SDCimport software for initial filtering and multiple-time-around (MTA) disambiguation. MTA errors, corrected in this process, are the result of imprecise interpretations of received pulse time intervals and occur more frequently with higher pulse refresh rates. IMU and GPS data were used to integrate flightline information with the point cloud in Spatial Explorer software. The point data were calibrated at an incrementally precise scale of sensor movement and behavior, incorporating sensor velocity, roll, pitch, and yaw fluctuations throughout the survey (fig. 2).

Points were classified in accordance with American Society for Photogrammetry and Remote Sensing (ASPRS) 2014 guidelines, using macros designed in Terrasolid software. Careful attention was given to the interpolation of the project's ground surface to compensate for inconsistent penetration through low vegetation as a function of the scan angle. Once classified, points underwent a geometric transformation and were converted from ellipsoidal heights to GEOID12B (Alaska) heights.

Raster products were derived from the point cloud using ArcMap. The DTM was interpolated from all ground class returns using a tin-based method. The DSM was likewise interpolated from only the first returns for all classes. An intensity image was produced in ArcMap, using closest-to-mean binning.

Classified Point Cloud

Classified point cloud data is provided in this collection in compressed LAZ format. Data are classified in accordance with ASPRS 2014 guidelines and contain return and intensity information. The average pulse spacing was 10.67 cm and the average density was 87.75 pts/m^2 (fig. 2). Elevation surfaces interpolated from areas with a point density of fewer than 4pts/m^2 were classified as no data.

Digital Surface Model

The DSM represents surface elevations, including heights of vegetation, buildings, bridges, etc. The DSM is a single band, 32-bit GeoTIFF file, with a ground sample distance of 1 meter. No Data value is set to -3.40282306074e+038.

Digital Terrain Model

The DTM represents surface elevations of ground surfaces, excluding vegetation, bridges, buildings, etc. The DTM is a single-band, 32-bit float GeoTIFF file, with a ground sample distance of 1 meter. No Data value is set to -3.40282306074e+038.

Lidar Intensity Image

The lidar intensity image describes the relative amplitude of reflected signals contributing to the point cloud. Lidar intensity is largely a function of scanned object reflectance in relation to the signal frequency, is dependent on ambient conditions, and is not necessarily consistent between separate scans. The intensity image is a single-band, 32-bit float GeoTIFF file with a ground sample distance of 1 meter. No Data value is set to -3.40282306074e+038 (32-bit, floating-point minimum).

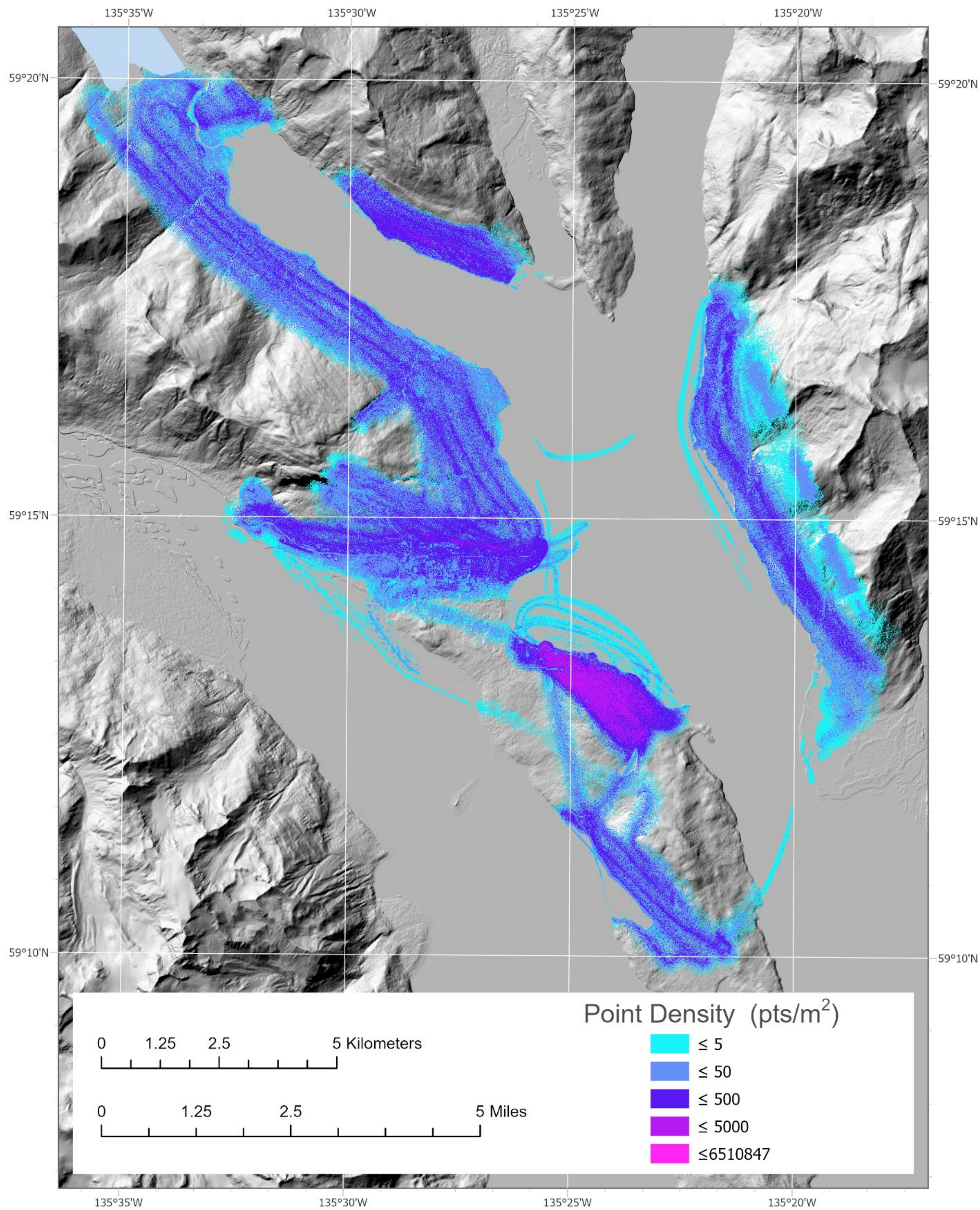

Figure 2. Ground point density for the survey displayed as a 1-meter raster.

SURVEY REPORT

Ground Survey Details

The DMLW collected 67 points using a Trimble R10 GNSS instrument. Of these points, 31 were used as control points, while 36 were used as checkpoints.

Coordinate system and Datum

All data were processed and delivered in NAD83 UTM8N and vertical datum NAVD88 GEOID12B.

Horizontal Accuracy

Horizontal accuracy was not measured for this collection.

Vertical Accuracy

A mean offset of 32.3 cm was measured between 31 control points and the point cloud. This offset was reduced to 0 by performing a vertical transformation of the lidar point data. Thirty-six checkpoints were used to determine the vertical accuracy of the point cloud ground class, using a tin-based approach. The final accuracy was calculated to have a root mean square error (RMSE) of 34.8 cm.

Data Consistency and Completeness

This data release is complete, and there is no over collect, except for the aircraft turns that were eliminated from the dataset. The data quality is consistent throughout the survey.

ACKNOWLEDGMENTS

These data were paid for by the State of Alaska and collected and processed by DGGS.

APPENDIX: CONTROL POINTS

Number	Easting	Northing	Known Z	Laser Z	Dz
1	477820.2	6559602	7.247	7.75	0.503
2	469445.8	6576359	6.577	6.46	-0.117
3	469423.9	6576377	7.898	7.71	-0.188
4	469358.5	6576403	7.549	7.36	-0.189
5	469276.9	6576373	7.441	7.24	-0.201
6	468433.4	6575419	7.457	7.32	-0.137
7	468491.5	6575373	7.492	7.35	-0.142
8	468532.3	6575360	7.469	7.31	-0.159
9	468563.1	6575353	7.417	7.29	-0.127
10	477824.9	6559611	7.107	7.91	0.803
11	477871.5	6559579	7.495	8.34	0.845
12	477922.8	6559534	8.363	9.18	0.817

Number	Easting	Northing	Known Z	Laser Z	Dz
13	477979.8	6559487	8.691	9.47	0.779
14	477990.5	6559478	8.63	9.37	0.74
15	475186.4	6567682	129.898	130.13	0.232
16	475171.8	6567702	132.519	132.78	0.261
17	475147.5	6567758	139.992	140.48	0.488
18	475223.4	6567626	122.044	122.33	0.286
19	475255.9	6567621	118.923	119.19	0.267
20	475260.9	6567590	113.682	113.94	0.258
21	475257.2	6567583	112.502	112.77	0.268
22	476292.8	6565075	17.19	17.46	0.27
23	476300	6565068	18.37	18.64	0.27
24	476317.5	6565052	21.439	21.7	0.261
25	476335.3	6565037	24.028	24.23	0.202
26	473098.2	6567361	72.712	72.78	0.068
27	473037.5	6567362	70.305	69.76	-0.545
28	472999.6	6567360	68.947	69.08	0.133
29	472972.3	6567360	67.588	67.68	0.092
30	472959	6567360	66.978	67.07	0.092
31	476105.5	6564810	113.068	112.81	-0.258
Average dz (m)	0.19				
Minimum dz (m)	-0.545				
Maximum dz (m)	0.845				
Average	0.323				
RMSE dz (m)	0.4				
Std dev dz (m)	0.358				

APPENDIX: CHECKPOINTS

Number	Easting	Northing	Known Z	Laser Z	Dz
1	469399.1	6576389	7.768	7.42	-0.348
2	469332.3	6576397	7.5	7.1	-0.4
3	469316.6	6576391	7.31	6.92	-0.39
4	469308.8	6576387	7.26	6.87	-0.39
5	469301.2	6576384	7.26	6.87	-0.39
6	468427.9	6575443	6.288	6.03	-0.258
7	468452.5	6575398	7.505	7.15	-0.355
8	468460	6575392	7.514	7.14	-0.374
9	468474.3	6575381	7.483	7.15	-0.333
10	468502.8	6575368	7.511	7.16	-0.351
11	468542.9	6575358	7.408	7.06	-0.348
12	477953.3	6559508	8.592	9.15	0.558
13	477970.9	6559494	8.671	9.22	0.549
14	477993.8	6559468	6.47	7.09	0.62
15	477988.8	6559472	6.44	7.21	0.77
16	475209.3	6567629	123.475	123.53	0.055
17	475207.9	6567638	124.535	124.58	0.045
18	475165.3	6567712	133.76	133.82	0.06
19	475155.1	6567735	136.551	136.61	0.059
20	475261	6567614	117.602	117.7	0.098
21	475263.2	6567605	116.232	116.22	-0.012
22	475262.6	6567598	114.962	114.93	-0.032
23	475239	6567638	122.254	slope	*
24	476327	6565044	22.958	22.96	0.002
25	476343	6565032	24.687	24.68	-0.007
26	473193.6	6567374	74.578	74.06	-0.518
27	473071.6	6567362	71.433	slope	*
28	472985.4	6567360	68.197	68.12	-0.077
29	472942.1	6567360	66.489	66.44	-0.049
30	476230.2	6564807	101.632	101.51	-0.122
31	476194.6	6564809	103.724	103.41	-0.314
32	476155.6	6564810	107.806	107.6	-0.206
33	476146.1	6564810	108.826	108.52	-0.306
34	476117	6564810	111.887	111.59	-0.297
35	476095.6	6564810	114.118	113.64	-0.478
36	476076	6564810	116.109	115.58	-0.529
37	476048.5	6564810	118.07	117.63	-0.44

Number	Easting	Northing	Known Z	Laser Z	Dz
38	476056.8	6564814	117.79	117.7	-0.09
Average dz (m)	-0.128				
Minimum dz (m)	-0.529				
Maximum dz (m)	0.77				
Average	0.284				
RMSE dz (m)	0.348				
Std dev dz (m)	0.328				