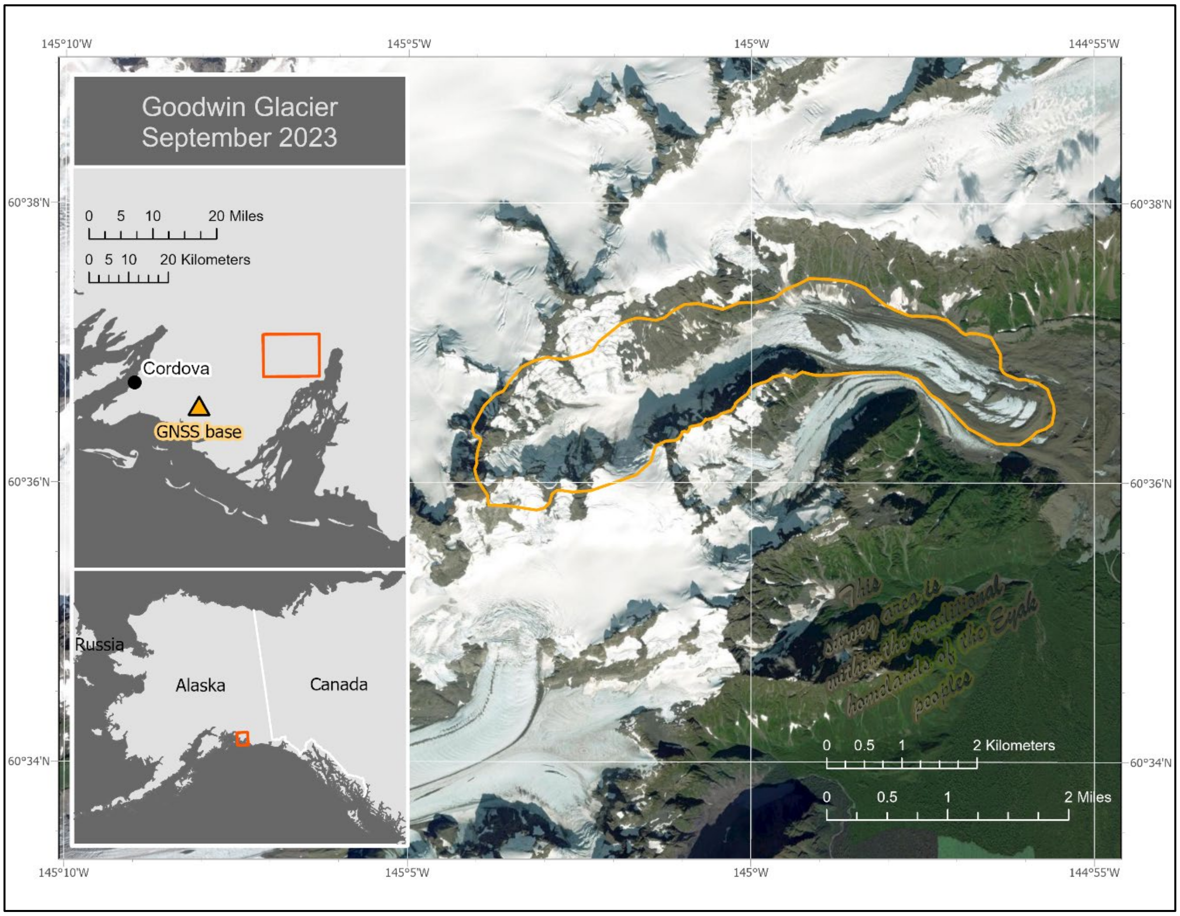
LIDAR-DERIVED ELEVATION DATA FOR GOODWIN GLACIER, SOUTHCENTRAL ALASKA, COLLECTED SEPTEMBER 22, 2023

Jenna M. Zechmann, Gabriel J. Wolken, and Katreen M. Wikstrom Jones

Raw Data File 2025-7



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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Alaska Division of Geological & Geophysical Surveys (DGGS)
3354 College Road | Fairbanks, Alaska 99709-3707
Phone: 907.451.5010 | Fax 907.451.5050
dggspubs@alaska.gov | dggs.alaska.gov

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LIDAR-DERIVED ELEVATION DATA FOR GOODWIN GLACIER, SOUTHCENTRAL ALASKA, COLLECTED SEPTEMBER 22, 2023

Jenna M. Zechmann[1], Gabriel J. Wolken[1], and Katreen M. Wikstrom Jones[1]

INTRODUCTION

The Alaska Division of Geological & Geophysical Surveys (DGGS) used aerial lidar to produce a classified point cloud, digital terrain model (DTM), and an intensity model of Goodwin Glacier, Southcentral Alaska, during minimum snow cover conditions (cover figure). The survey provides snow-free surface elevations for use in change detection following the landslide that occurred on August 10, 2023, covering a large portion of Goodwin Glacier. Aerial lidar data were collected September 22, 2023, and subsequently 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/10.14509/31519.

LIST OF DELIVERABLES

Classified Points
DTM
Intensity Image
Metadata

MISSION PLAN

Aerial Lidar Survey Details

DGGS used a Riegl VUX1-LR[22] laser scanner with a global navigation satellite system (GNSS) and Northrop Grumman LN-200C inertial measurement unit (IMU) integrated 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 1000 m (ranges assume ≥ 20 percent natural reflectance). The scanner operated with a pulse refresh rate of 50,000 pulses per second at a scan rate of 16 to 30 revolutions per second. We used a Cessna 180 Skywagon fixed-wing platform to survey from an elevation of approximately 300–800 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 10.5 km^2 (cover figure).

Weather Conditions and Flight Times

The survey area was accessed by air from Cordova Municipal Airport (fig. 1). Data were collected from 1:24 pm to 1:54 pm (AKST). The weather was partly cloudy with no wind. A Trimble R10-2 GNSS base station was deployed at Merle K Mudhole Smith Airport (cover figure) during the survey and used later to correct lidar survey flight lines.

[1] Alaska Division of Geological & Geophysical Surveys, 3354 College Road, Fairbanks, AK 99709

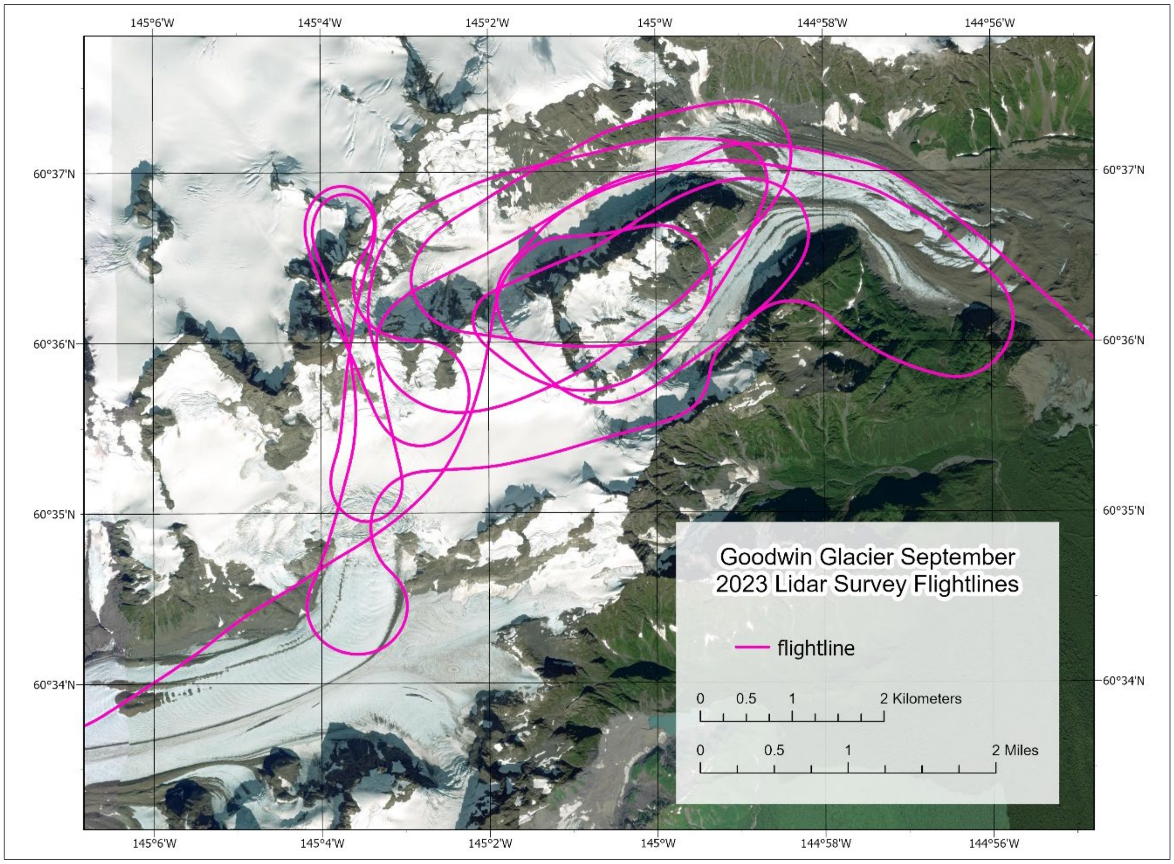

Figure 1. Lidar data collection flight line.

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 flight line 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. For the lidar data collection, the average pulse density is 0.792 pulses/m^2, and the average pulse spacing is 112.4 cm.

We created a macro (an ordered list of point classification commands tailored to this dataset) 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 50-cm DTM was interpolated from all ground-class returns using a binning method and minimum values. We also produced a 50-cm intensity image 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 classified ground points, the average point density (fig. 2) is 0.788 pts/m^2, and the average spacing is 112.6 cm.

Table 1. Point cloud class code definitions (ASPRS, 2019).

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

Digital Terrain Model

The DTM represents bare earth elevations, excluding vegetation. It is a single-band, 32-bit GeoTIFF file of 50-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, 32-bit GeoTIFF file of 50-cm resolution. No Data value is set to -3.40282306074e+38.

SURVEY REPORT

Ground Survey Details

Ground control points were not collected as part of this survey.

Coordinate System and Datum

We processed and delivered all data in NAD83 (2011) UTM6N and vertical datum NAVD88 GEOID12B.

Horizontal Accuracy

Horizontal accuracy was not measured for this collection.

Vertical Accuracy

Vertical accuracy was not determined for this survey. We evaluated the relative accuracy for this dataset as the interswath overlap consistency and measured it at 8.2 cm root mean square deviation (RMSE).

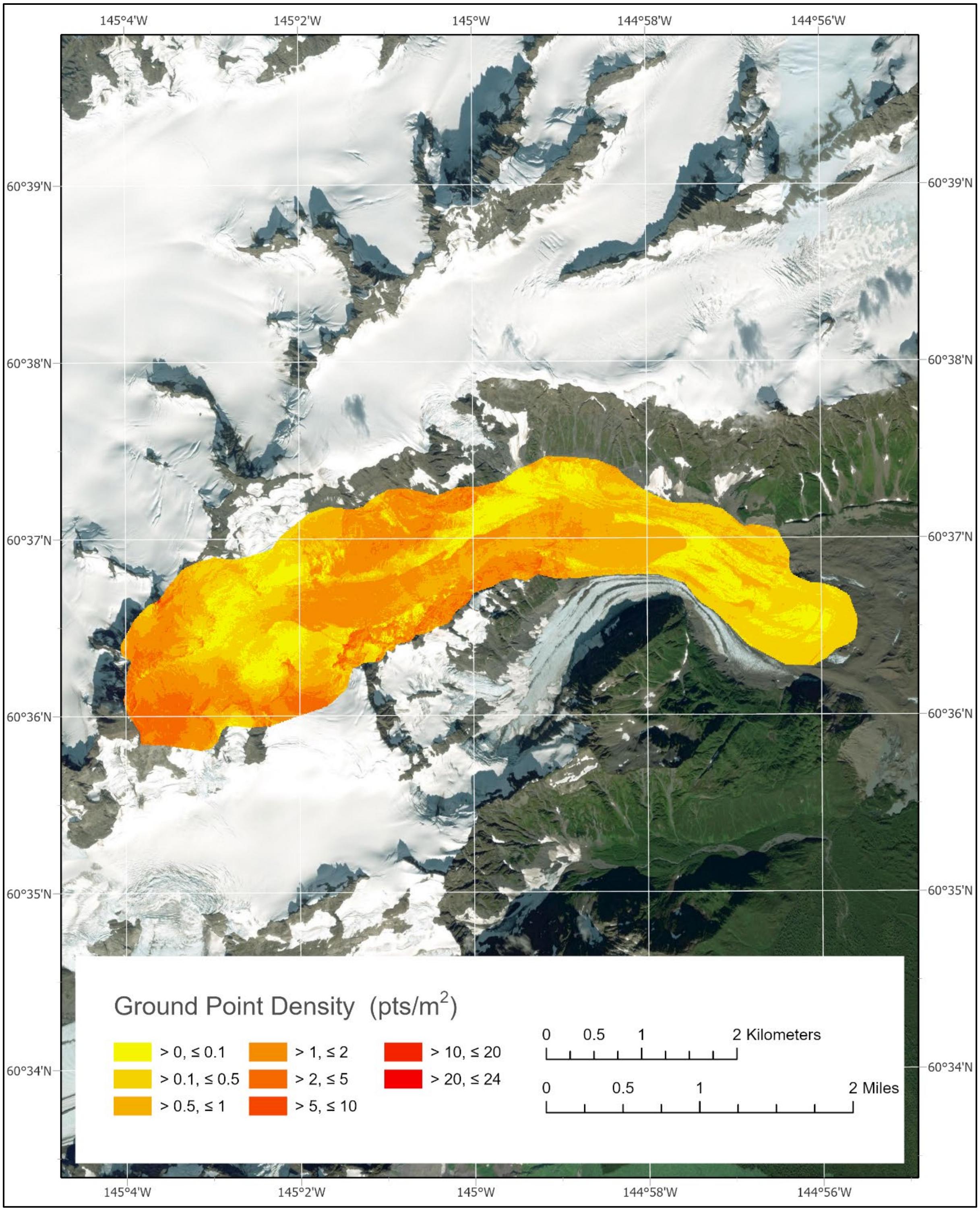

Figure 2. Ground point density for the survey, displayed as a raster.

Data Consistency and Completeness

This is a full-release dataset. There was no over-collect. Data quality is consistent throughout the survey, save for gaps over areas of snow and ice.

ACKNOWLEDGMENTS

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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