Survey Metadata

UAV LiDAR Survey of Volcan Mountain Wilderness Preserve, California, USA

25 October 2024

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SURVEY SUMMARY

Survey area	197 hectares within and adjacent to the Volcan Mountain Wilderness Preserve (Peninsular Range, Southern California)
Elevation range	Approximately 1220 m to over 1675 m
Acquisition date	25 October 2024
Platform and sensor	DJI Matrice 350 UAV equipped with a GeoCue TrueView 540 LiDAR system
GNSS solution	PPK; base station data uploaded to OPUS; OPUS-derived survey nail used during processing
Nominal flight altitude	Approximately 110 m above ground level
Side overlap	33% (between flight lines)
Point density	592 pts/m^2 per flight line; 1185 pts/m^2 within 33% side overlap
Products	LiDAR point cloud; 5 cm DSM; RGB image
Processing software	LP360
Horizontal/vertical accuracy	Not assessed
Point classification	Unclassified
Weather conditions	Clear; no precipitation; 53°F (7:00 AM) to 81°F (2:50 PM); winds calm with gusts up to 9.0 mph; relative humidity 17% to 36%
Access	Access managed by Volcan Mountain Wilderness Preserve authorities

1. OVERVIEW AND PURPOSE

This dataset was collected to provide high-density, contemporary ground-truth data on 3D vegetation structure in the fire-prone montane ecosystems of Southern California. It served as a benchmark for developing and validating deep learning models designed to enhance sparse, historical airborne light detection and ranging (LiDAR) data by fusing it with multi-temporal optical National Agriculture Imaging Program (NAIP) and L-band synthetic aperture radar (UAVSAR) imagery for applications in ecological modeling and land management.

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2. SPATIAL AND TEMPORAL COVERAGE

2.1 Site Description

The survey covers 197 hectares within and adjacent to the Volcan Mountain Wilderness Preserve in the Peninsular Range of Southern California. The site ranges in elevation from approximately 1220 m to over 1675 m and hosts diverse plant communities, including oak woodlands, chaparral, mixed conifer forests, and grasslands.

2.2 Site Conditions During Collection

Weather conditions were clear with no precipitation.

Temperature ranged from 53°F at 7:00 AM to 81°F at 2:50 PM.

Winds were calm to light, starting at 0.0 mph with gusts up to 9.0 mph.

Relative humidity ranged from 17% to 36%.

Access to the site is managed by Volcan Mountain Wilderness Preserve authorities.

2.3 Acquisition Date

25 October 2024

3. SURVEY METHODS

3.1 Collection Platform and Equipment

A DJI Matrice 350 uncrewed aerial vehicle (UAV) equipped with a GeoCue TrueView 540 LiDAR system was used to capture the LiDAR data.

3.2 GNSS / Georeferencing Approach

A post-processed kinematic (PPK) approach was used to correct global navigation satellite system (GNSS) locations and associated LiDAR point positions. Static base station data were uploaded to the

National Geodetic Survey's (NGS) Online Positioning User Service (OPUS) to derive an accurate coordinate for the base station position, and a .txt file was retrieved from OPUS and used to define the base station position during processing in LP360 software.

3.3 Collection Methods

The UAV platform was flown at an altitude of approximately 110 m above ground level, using terrain following and autonomous flight.

3.4 Errors and Strip Alignment

No errors were recorded. The Strip Align tool was used to align the strips of point clouds from each of the three cycles at the site. During alignment, no single one of the three point clouds was fixed as a reference for the others.

4. DATA PRODUCTS AND CHARACTERISTICS

4.1 Data Types

- Point Cloud (LAS format)
- 5 cm digital surface model (DSM, TIF format)
- True color (RGB) image (TIF format)

4.2 Point Density / Resolution

Point density per flight line: 592 pts/m^2.

Within 33% side overlap between flight lines: 1185 pts/m^2.

4.3 Accuracy

Horizontal and vertical accuracy were not assessed for this dataset.

4.4 Point Classification

The point cloud is unclassified.

5. PROCESSING AND QUALITY CONTROL

5.1 Software

The LiDAR data were processed in LP360.

5.2 Workflow Summary

1. Imported the LiDAR system data (including laser scans, raw GNSS observation data, RGB images), base station raw GNSS observation file, and an OPUS-derived base station coordinate into LP360.
2. Performed trajectory processing to map the precise location of the LiDAR sensor throughout the flight and produce trajectory points along the flight path and an initial colorized point cloud.
3. Selected trajectory points along the planned flight path to generate flight lines and exclude data collected in between flight lines.
4. Ran post processing to geocode LiDAR data collected within 40° of nadir, generate a more accurate point cloud along each flight line, and update RGB image EXIF tags.
5. Used the Strip Align tool to ensure alignment between flight lines and cycles in the final point cloud.

5.3 Processing Notes

Trajectory points were used to define flight lines and to remove between-line data prior to post processing. Strip alignment was conducted across the three acquisition cycles without fixing a single cycle as the reference.

6. ACCESS, LICENSE, AND RELATED RESOURCES

6.1 License / Usage Terms

6.2 Related Publication

Attention-Based Enhancement of Airborne LiDAR Across Vegetated Landscapes Using SAR and Optical Imagery Fusion

[DOI: 10.3390/rs17193278](https://doi.org/10.3390/rs17193278)

6.3 External Project Page

https://github.com/mmarks13/geoai_veg_map

6.4 Funding

- California Climate Action Matching Grants, University of California, Office of the President (grant #R02CM708)
- NASA FireSense program (Grant #80NSSC24K0145)
- NASA FireSense Implementation Team (Grants #80NSSC24K1320)
- NASA Land-Cover/Land Use Change program (Grant #NNH21ZDA001N-LCLUC)
- EMIT Science and Applications Team program (Grant #80NSSC24K0861)
- NASA Remote Sensing of Water Quality program (Grant #80NSSC22K0907)
- NASA Applications-Oriented Augmentations for Research and Analysis Program (Grant #80NSSC23K1460)
- NASA Commercial Smallsat Data Analysis Program (Grant #80NSSC24K0052)
- USDA NIFA Sustainable Agroecosystems program (Grant #2022-67019-36397)
- USDA AFRI Rapid Response to Extreme Weather Events Across Food and Agricultural Systems program (Grant #2023-68016-40683)
- California Climate Action Seed Award Program
- NSF Signals in the Soil program (Award #2226649)

6.5 Known Limitations

Horizontal and vertical accuracy were not assessed.

The point cloud is provided unclassified.

Coordinate reference system and additional metadata are provided in the delivered data products (e.g., LAS headers and raster metadata).

6.6 Keywords

UAV LiDAR; high-density point cloud; vegetation structure; forest inventory; canopy structure; Peninsular Range; Southern California; wildfire fuel mapping; montane ecosystem; oak woodland; chaparral