Data Collection & Product Report for 2017 Seed Project: Point Classification Using Multispectral Lidar and SFM for Earthquake and Volcano Hazards Applications

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Data Collection Summary:

Collection Dates, Flights:	September 22, 2018 (DOY 265) comprising one (1) flight
Aircraft, Equipment:	Piper PA-31 Navajo Chieftain (N640WA) with Optech Titan Lidar (14SEN340)
Flight Plan Parameters:	Flying Height: 700 m (HFL)/1200 m (HCF) AGL, Speed: 130 kt, Swath Width: 810 m (HFL)/465 m (HCF), Overlap: 50%
Equipment Parameters:	PRF: 100 kHz (HFL)/75 kHz (HCF), Scan Frequency: 26 Hz (HFL)/70 Hz (HCF), Scan Angle: ± 60° (HFL)/22° (HCF)
Imagery Flight Plan Parameters:	Collected simultaneously for HCF
Collected Area:	9.4 km^2 (HFL)/14.5 km^2 (HCF)

GNSS Reference Station Summary:

Station Name	Operating Agency	Control Coordinates (NAD83(2011) epoch 2010.00/Ellipsoid)	RMS (OPUS)
KMMH	NCALM	37°37’38.51281” N, 118°50’37.26496” W, 2145.305 m	0.012 m
P630	UNAVCO	37°36’46.91639” N, 119°00’01.53860” W, 2741.233 m	0.011 m
P631	UNAVCO	37°36’19.15499” N, 118°54’57.33004” W, 2660.458 m	0.012 m
P642	UNAVCO	37°35’28.90597” N, 118°48’59.95976” W, 2668.029 m	0.012 m

Data Processing Summary:

Scan Angle Cutoff:	± 1°
Intensity Normalization:	1000 m
Data Adjustments:	Line-by-line/channel-by-channel roll orientation and elevation correction, minimal line-by-line 1-s fluctuation correction, project elevation shift of -13 cm (HFL)/-17 cm (HCF)
Ground Classification:	Two iterations of relaxed ground determination (HFL) and medium ground determination (HCF), manual classification of misclassified ground and declassification of water surface/bathymetry
Elevation Model Generation:	Elevation values calculated from Kriging

Data Accuracy Summary

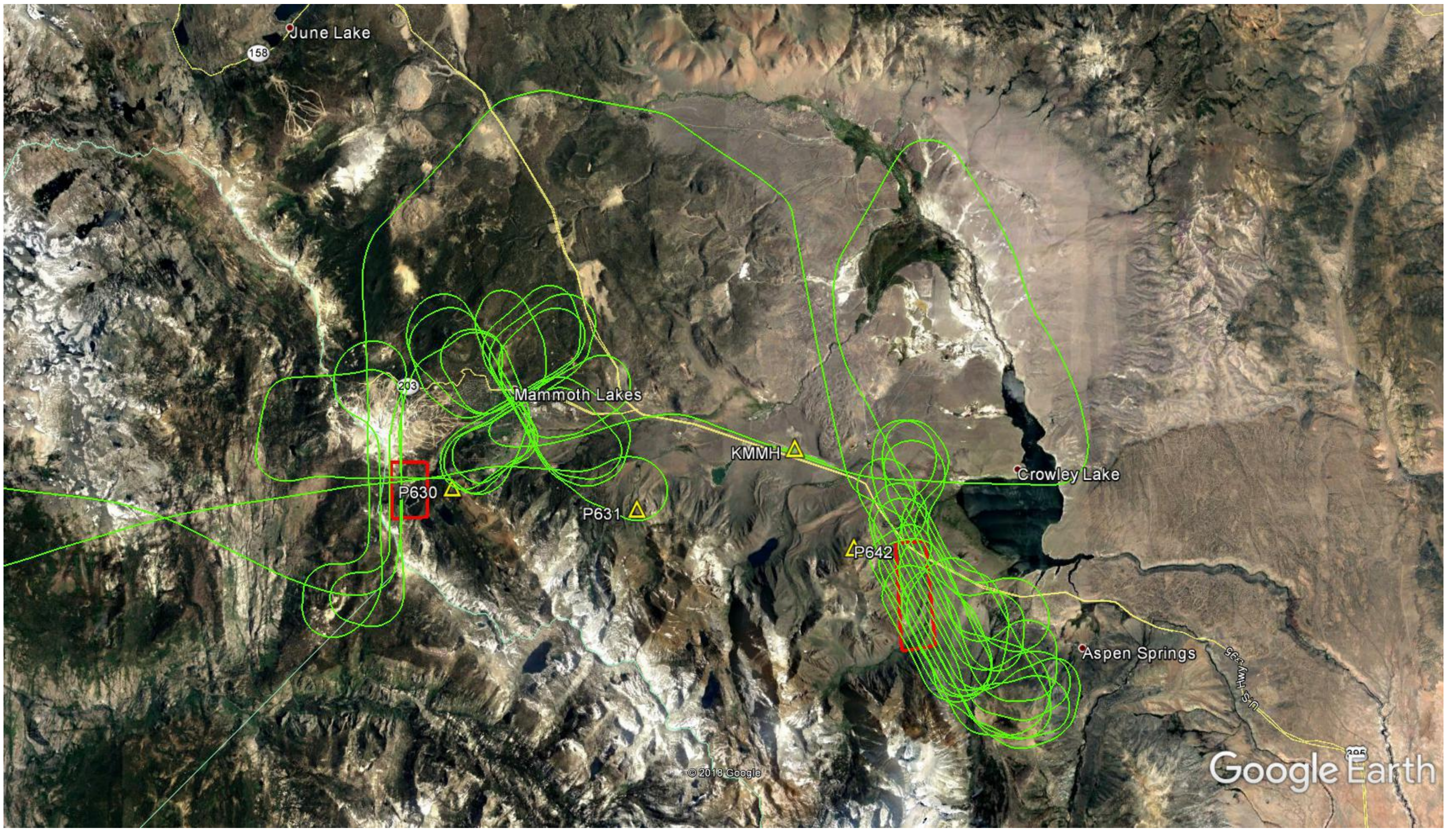
Strip-to-Strip Average	0.064 m (HFL)/0.049 m (HCF)
GCP Residual RMS	0.023 m

Data Product Summary:

Horizontal / Vertical Datum:	NAD83(2011) epoch 2010.00 / ellipsoid
Projection / Units:	UTM Zone 11N / meters
Point Cloud Tiles:	1000-m × 1000-m tiles in LAS format (Version 1.4) classified by non-ground (1), ground (2), low point (7), and high point (18) returns
Bare-Earth Elevation Model:	ESRI FLT format @ 1-m resolution from classified ground points
Bare-Earth Hillshade:	ESRI-created raster @ 1-m resolution
First-Surface Elevation Model:	ESRI FLT format @ 1-m resolution with canopy, buildings, and water included
First-Surface Hillshade:	ESRI-created raster @ 1-m resolution
Aerial Images:	Radiometrically corrected and rectified 24-bit TIFF files

A detailed summary of the equipment and processing techniques used by NCALM is included in the [Data Collection & Processing Summary](#).

Area of Interest:



Location of survey polygons (in red), aircraft trajectory, and GNSS reference stations (in yellow)

The requested survey area consisted of two polygons located near Mammoth Lakes, CA. The polygons enclose approximately 8.8 km^2 (3.4 mi^2).

Notes:

Due to thick and/or low vegetation, fallen trees, and large rocks in the Horseshoe Lake (HSL) polygon, and rugged peaks, large boulders, and low vegetation in the Hilton Creek Fault (HCF) polygon, some classified ground points may not be true ground. Thick vegetation will not allow the laser to penetrate to the ground. This can cause the ground point algorithm to classify the bottom of the vegetation or tree trunks as ground. Some low vegetation or fallen trees also get classified as ground, as the laser cannot distinguish between true ground and near-ground returns, and the algorithm has an eagerness to classify low points as ground. These factors can cause a rough appearance in the bare-earth elevation models. Boulders and rugged peaks often do not get classified as ground, as the terrain changes are too abrupt for the algorithm to classify successfully while not simultaneously classifying low vegetation as ground, too. The ground point algorithm used in HSL was not aggressive, to maximize the amount of true ground points. The ground point algorithm used in HCF was of medium aggressiveness, to maximize the amount of true ground points near the peaks with minimal vegetation being classified as ground. Manual classification at the peaks was performed to maximize the exposed rock in the ground class.

Water surface and bathymetry points were removed from the ground class, as the PI did not require bathymetry. This original dataset does not include corrected bathymetry points.

No visible imagery was collected over the HSL site because of instrument/software complications.