

# Metadata Report

Project Name: High-Resolution SfM Topography of Stromboli volcano (Italy),  
24 May 2024.

Summary: Structure-from-Motion point cloud and digital surface model (DSM) of Stromboli Volcano (Italy) produced by photogrammetry from UAS survey. Coverage includes the crater terrace, all vents, and the Sciara del Fuoco.

## Personnel

- Pls: Riccardo Civico, Tullio Ricci (Istituto Nazionale di Geofisica e Vulcanologia, Italy).
- Contributors: Piergiorgio Scarlato (Istituto Nazionale di Geofisica e Vulcanologia, Italy).

Dates of Collection: May 24, 2024

## Site Information

- Site description: Stromboli volcano, Aeolian Islands, Italy
- Site objective: The objective was to document at high resolution the morphological changes of the crater terrace and of the Sciara del Fuoco at Stromboli volcano.
- Site location: 38.795, 15.209
- Site conditions: Volcanic plume affecting, at times, the upper portion of the Sciara del Fuoco and the crater terrace. Mostly sunny. Wind varied between light to strong breeze.

## Survey Results

- Equipment used: DJI Matrice 300 RTK with DJI Zenmuse P1.
- GPS solutions: data on camera position were collected using GNSS-RTK information embedded in the image metadata, with differential corrections sent in real-time by a local RTK network.
- Errors: camera location total error estimate is approximately 5 cm.



## Products

- Date of dataset collection: May 24, 2024.
- Coordinate system of datasets: Horizontal WGS 84 / UTM zone 33N [EPSG: 32633]; Vertical ITALGEO 2005 geoid.
- Spatial resolution: 20 cm/pixel.
- Data formats: .laz point cloud; .tif DSM geotiff.

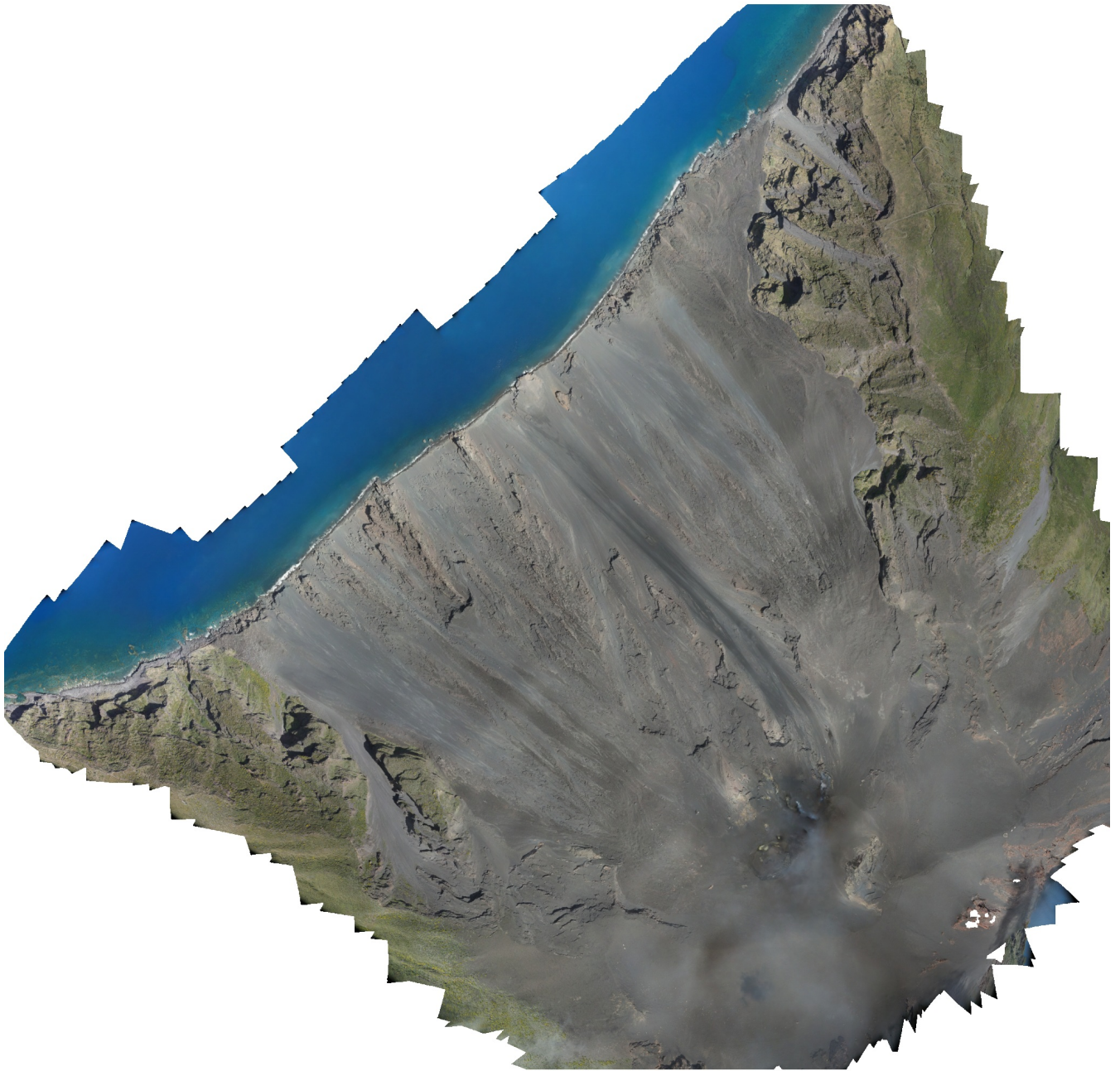
## Misc Notes

Please refer to the Agisoft Metashape report attached for additional information and details on survey and processing.

# Stromboli Sciara-Terrace 20240524 P1

Processing Report

30 July 2024



# Survey Data

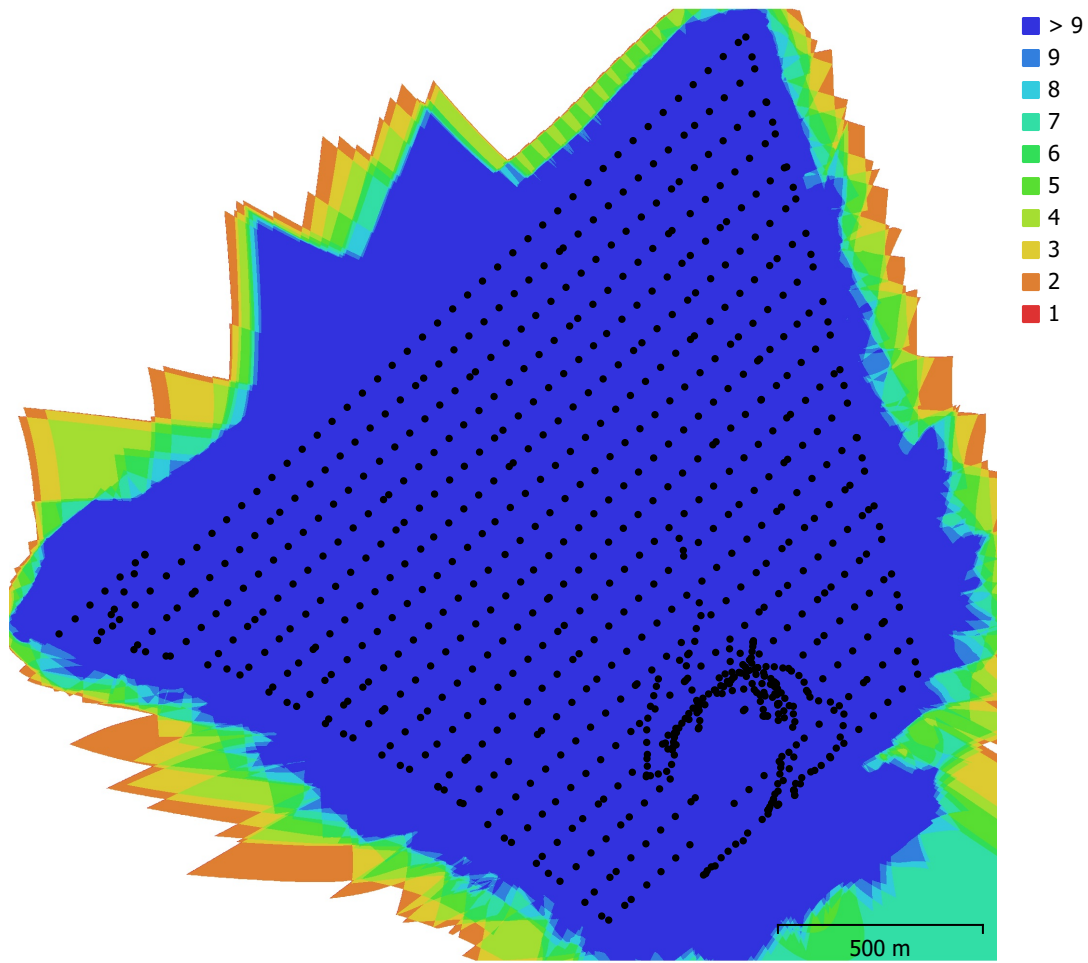


Fig. 1. Camera locations and image overlap.

Number of images:	1,053	Camera stations:	881
Flying altitude:	219 m	Tie points:	2,117,270
Ground resolution:	10 cm/pix	Projections:	6,582,387
Coverage area:	4.1 km <sup>2</sup>	Reprojection error:	0.339 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
ZenmuseP1 (24mm)	8192 x 5460	24 mm	4.39 x 4.39 $\mu$ m	No

Table 1. Cameras.

# Camera Calibration

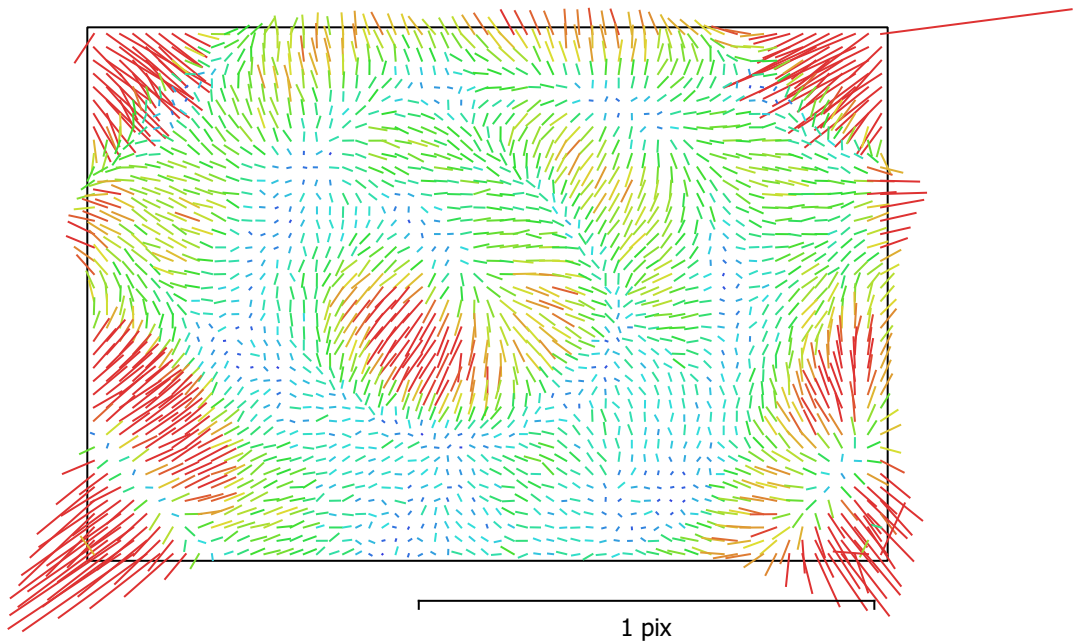


Fig. 2. Image residuals for ZenmuseP1 (24mm).

## ZenmuseP1 (24mm)

1053 images

Type	Resolution	Focal Length	Pixel Size
<b>Frame</b>	<b>8192 x 5460</b>	<b>24 mm</b>	<b>4.39 x 4.39 μm</b>

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2
<b>F</b>	<b>5610.86</b>	0.0085	1.00	-0.02	0.03	0.10	0.03	-0.39	0.31	-0.28	0.25	-0.02	-0.02
<b>Cx</b>	<b>1.82726</b>	0.0045		1.00	0.06	-0.00	-0.03	0.00	-0.00	0.00	-0.00	0.58	0.03
<b>Cy</b>	<b>24.1543</b>	0.0038			1.00	0.05	-0.01	-0.01	0.00	-0.00	-0.00	0.06	0.67
<b>B1</b>	<b>0.514402</b>	0.0022				1.00	-0.02	0.01	-0.03	0.03	-0.03	-0.00	-0.00
<b>B2</b>	<b>-0.337041</b>	0.002					1.00	-0.01	0.00	0.00	-0.00	-0.04	-0.01
<b>K1</b>	<b>-0.159195</b>	6.9e-06						1.00	-0.97	0.92	-0.87	0.00	0.01
<b>K2</b>	<b>0.054213</b>	2.8e-05							1.00	-0.99	0.96	0.00	-0.01
<b>K3</b>	<b>-0.0380323</b>	4.6e-05								1.00	-0.99	-0.00	0.01
<b>K4</b>	<b>0.0118413</b>	2.5e-05									1.00	0.01	-0.01
<b>P1</b>	<b>-0.000280453</b>	1.4e-07										1.00	0.02
<b>P2</b>	<b>0.00139238</b>	1.5e-07											1.00

Table 2. Calibration coefficients and correlation matrix.



# Camera Locations

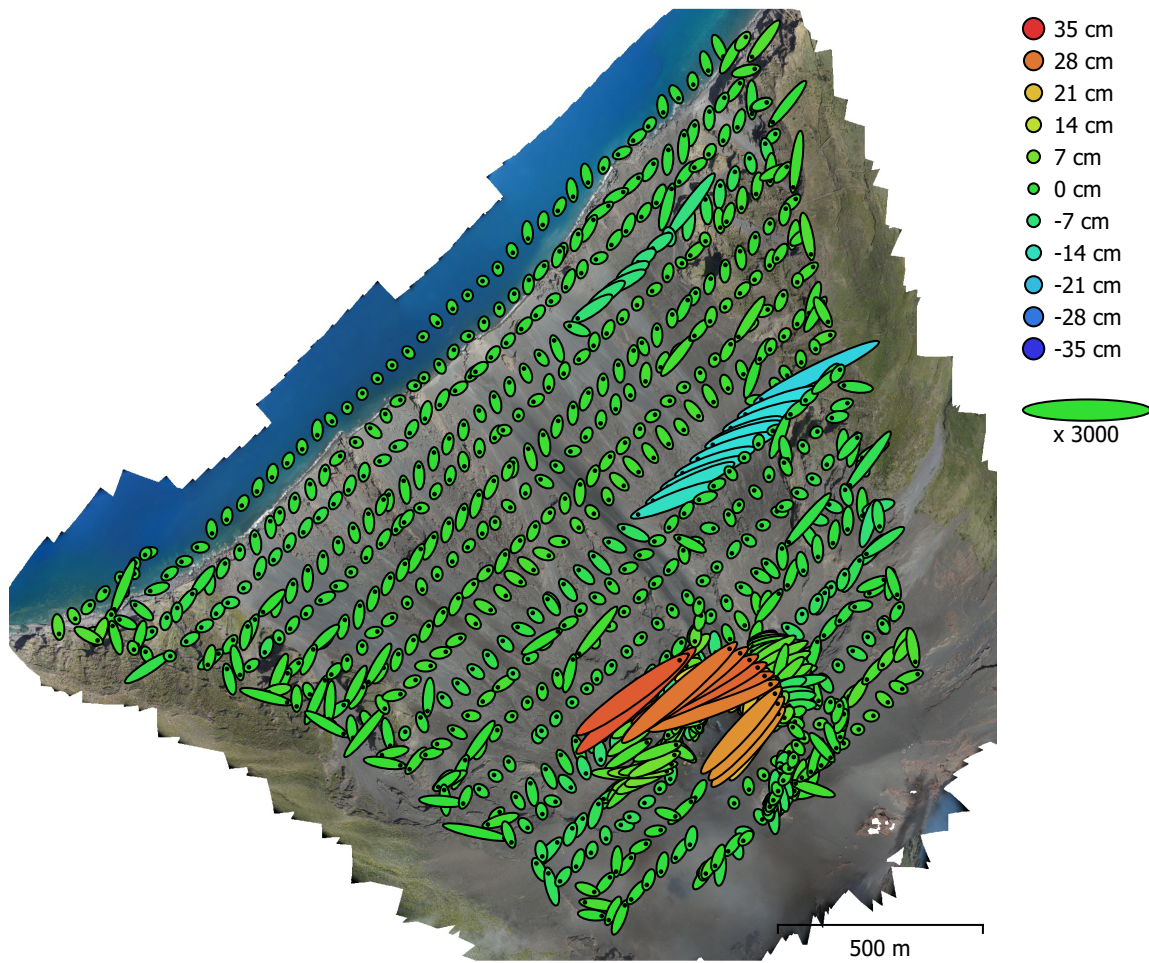


Fig. 3. Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated camera locations are marked with a black dot.

<b>X error (cm)</b>	<b>Y error (cm)</b>	<b>Z error (cm)</b>	<b>XY error (cm)</b>	<b>Total error (cm)</b>
1.44639	1.29108	4.6492	1.9388	5.03726

Table 3. Average camera location error.

X - Easting, Y - Northing, Z - Altitude.

# Digital Elevation Model

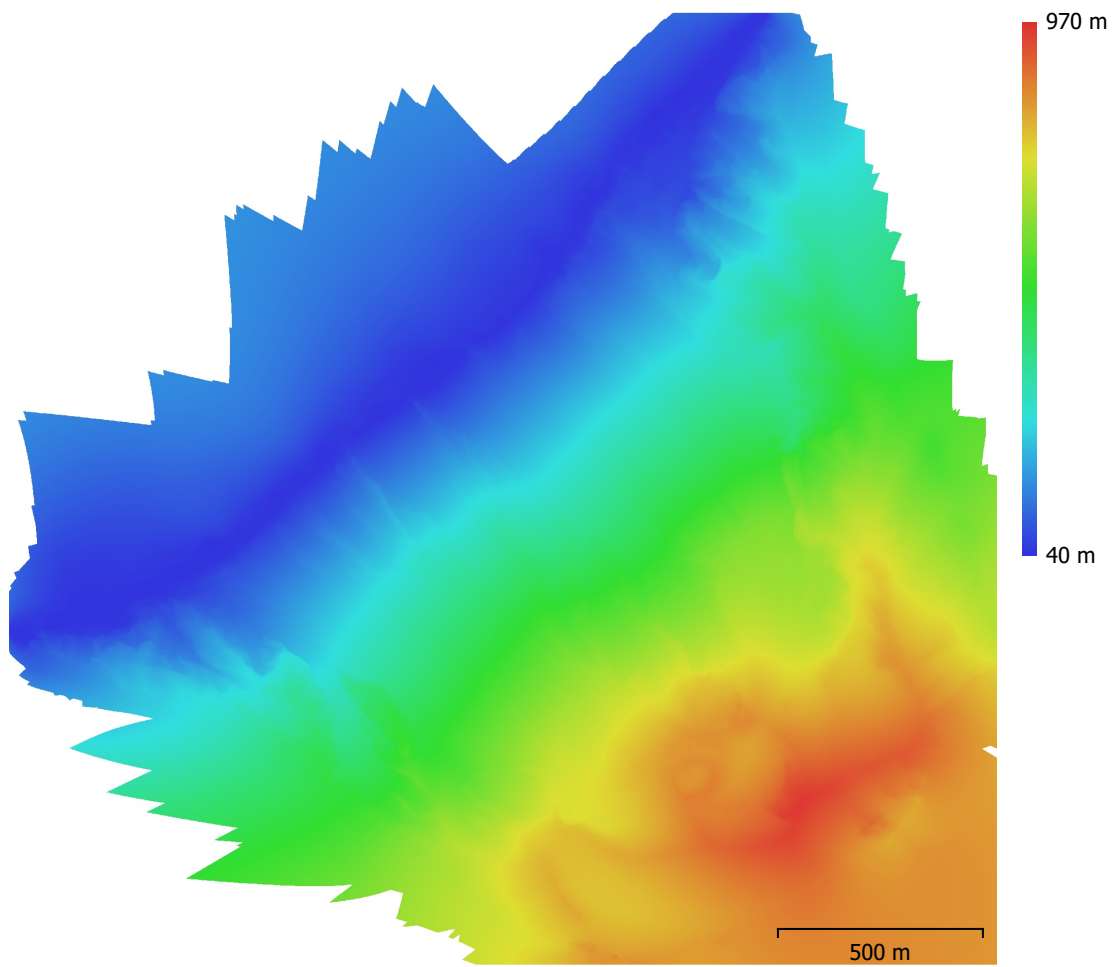


Fig. 4. Reconstructed digital elevation model.

Resolution: 8.93 cm/pix  
Point density: 125 points/m<sup>2</sup>

# Processing Parameters

## General

Images 1053  
Aligned images 881

## Shapes

Coordinate system WGS 84 / UTM zone 33N (EPSG::32633)  
Coordinate system WGS 84 / UTM zone 33N (EPSG::32633)  
Camera coordinate system WGS 84 (EPSG::4326)  
Rotation angles Yaw, Pitch, Roll

## Tie Points

Points 2,117,270 of 2,562,523  
RMS reprojection error 0.118371 (0.339021 pix)  
Max reprojection error 0.568681 (6.84609 pix)  
Mean key point size 2.6208 pix  
Point colors 3 bands, uint8  
Key points No  
Average tie point multiplicity 3.33669

## Alignment parameters

Accuracy High  
Generic preselection Yes  
Reference preselection Source  
Key point limit 40,000  
Key point limit per Mpx 40,000  
Tie point limit 10,000  
Filter points by mask Yes  
Mask tie points No  
Exclude stationary tie points No  
Guided image matching No  
Adaptive camera model fitting No  
Matching time 6 minutes 42 seconds  
Matching memory usage 1.00 GB  
Alignment time 13 minutes 57 seconds  
Alignment memory usage 2.88 GB

## Optimization parameters

Parameters f, b1, b2, cx, cy, k1-k4, p1, p2  
Adaptive camera model fitting No  
Optimization time 9 seconds  
Date created 2024:05:25 18:02:50  
Software version 2.1.1.17821  
File size 186.38 MB

## Depth Maps

Count 881

## Depth maps generation parameters

Quality High  
Filtering mode Aggressive  
Max neighbors 16  
Processing time 1 hours 33 minutes  
Memory usage 11.14 GB  
Date created 2024:05:25 20:47:55  
Software version 2.1.1.17821  
File size 12.60 GB



**Point Cloud**

Points 435,804,361  
Coordinate precision 2.23 cm

**Point attributes**

Color 3 bands, uint8  
Normal  
Confidence 4 - 152

**Point classes**

Created (never classified) 435,804,361

**Point cloud generation parameters**

Processing time 3 hours 41 minutes  
Memory usage 33.79 GB  
Date created 2024:05:26 00:29:54  
Software version 2.1.1.17821  
File size 6.34 GB

**DEM**

Size 26,965 x 25,984  
Resolution 8.93 cm/pix  
Coordinate system WGS 84 / UTM zone 33N (EPSG::32633)

**Reconstruction parameters**

Source data Point cloud  
Interpolation Enabled  
Processing time 7 minutes 17 seconds  
Memory usage 319.11 MB  
Date created 2024:05:26 08:49:07  
Software version 2.1.1.17821  
File size 2.21 GB

**Orthomosaic**

Size 48,121 x 46,370  
Resolution 5 cm/pix  
Coordinate system WGS 84 / UTM zone 33N (EPSG::32633)  
Colors 3 bands, uint8

**Reconstruction parameters**

Blending mode Mosaic  
Surface DEM  
Enable hole filling Yes  
Enable ghosting filter Yes  
Processing time 2 hours 24 minutes  
Memory usage 53.00 GB  
Date created 2024:07:29 18:02:57  
Software version 2.1.2.18358  
File size 20.67 GB

**System**

Software name Agisoft Metashape Professional  
Software version 2.1.2 build 18358  
OS Windows 64 bit  
RAM 63.71 GB  
CPU Intel(R) Core(TM) i9-14900HX  
GPU(s) NVIDIA GeForce RTX 4080 Laptop GPU