OpenTopography

Metadata Report

Project Name: High-Resolution SfM Topography of Stromboli volcano (Italy), 07-08 October 2023.

Summary: Structure-from-Motion 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

- PIs: Riccardo Civico, Tullio Ricci (Istituto Nazionale di Geofisica e Vulcanologia, Italy).

Dates of Collection: October 07-08, 2023

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 the upper portion of the Sciara del Fuoco and the crater terrace. Partly cloudy to 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 2.9 cm.

Products

- Date of dataset collection: October 07-08, 2023.
- Coordinate system of datasets: Horizontal WGS 84 / UTM zone 33N [EPSG: 32633]; Vertical ITALGEO 2005 geoid.
- Spatial resolution: 20 cm/pixel.
- Data formats: .tif DSM geotiff.

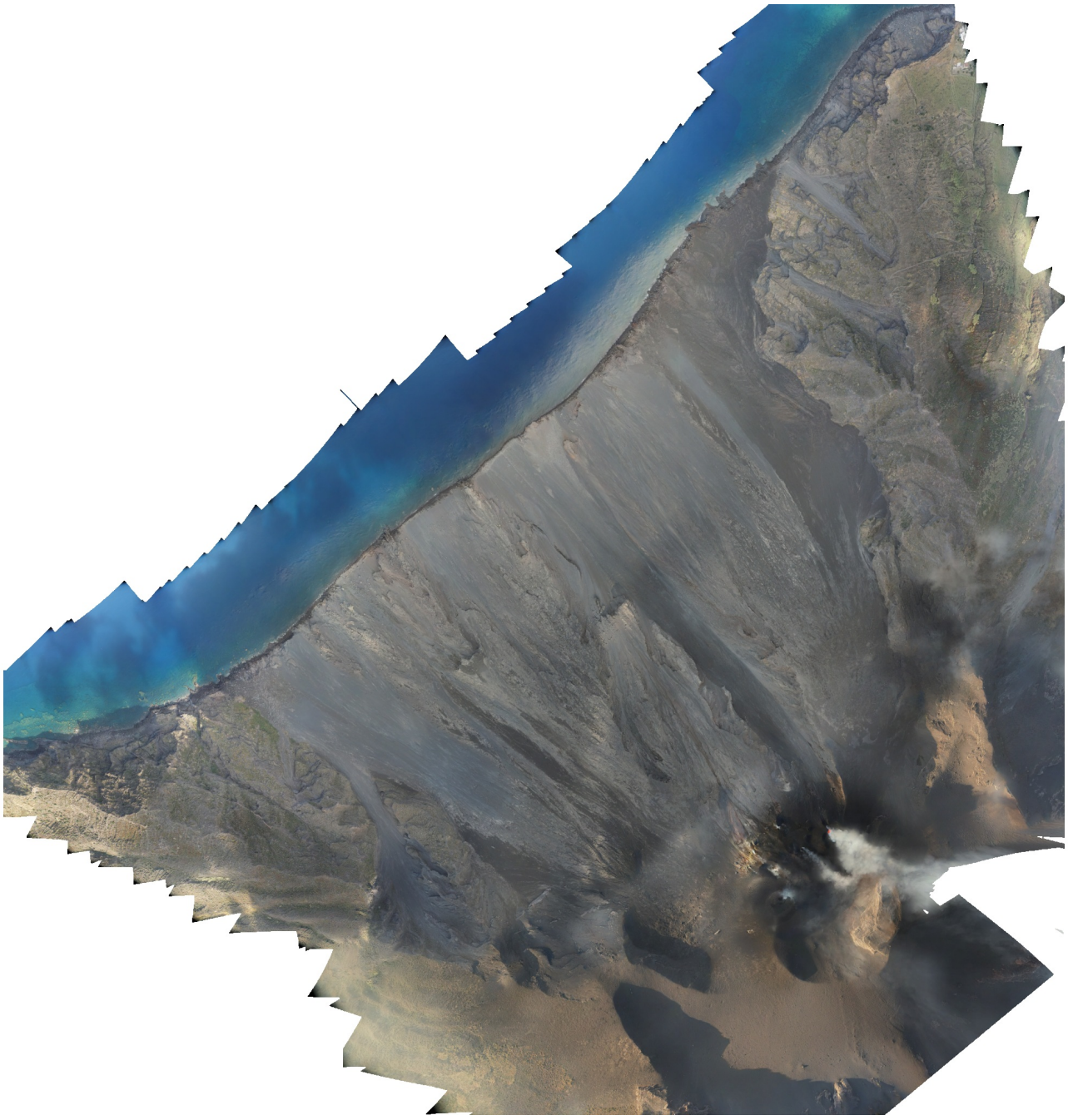
Misc Notes

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

Stromboli Sciara-Terrace 20231007-08 P1

Processing Report

18 September 2024



Survey Data

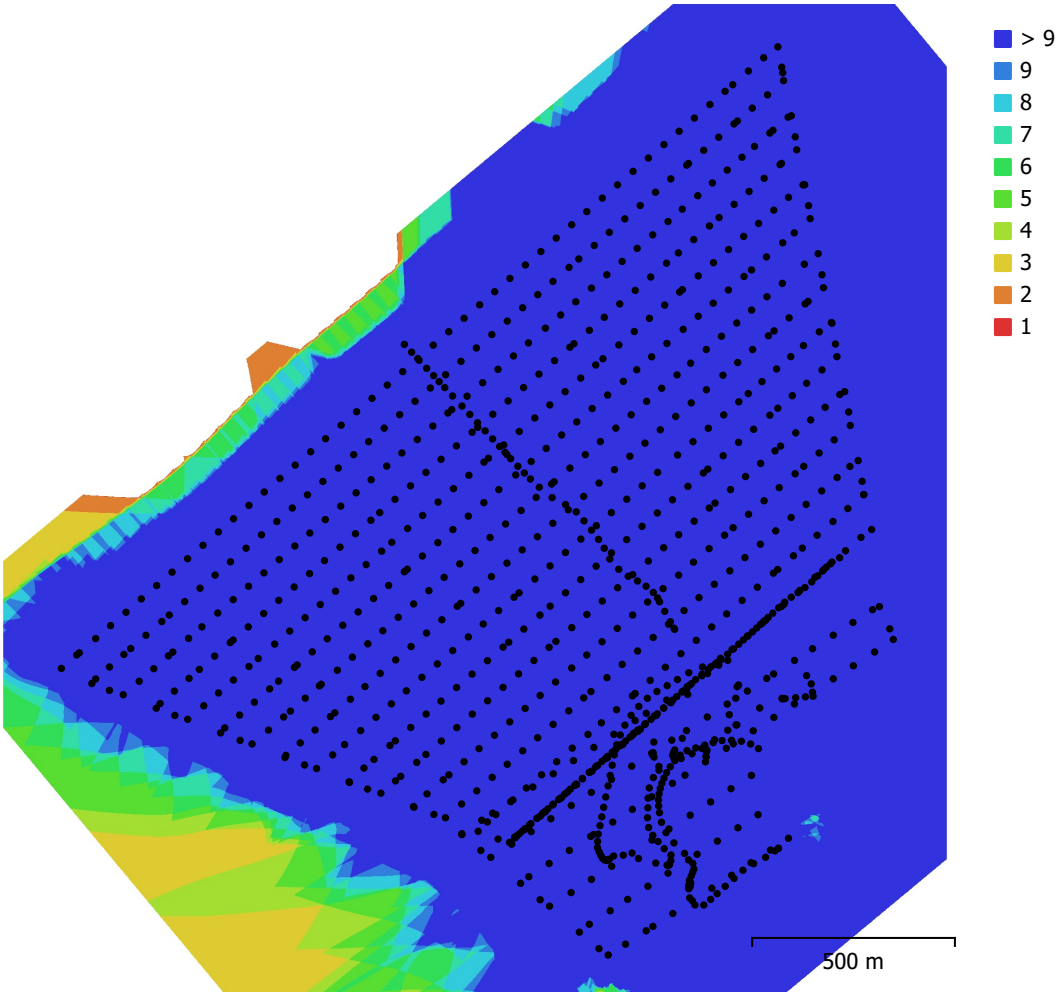


Fig. 1. Camera locations and image overlap.

Number of images:	992	Camera stations:	974
Flying altitude:	223 m	Tie points:	2,071,046
Ground resolution:	4.6 cm/pix	Projections:	7,388,916
Coverage area:	4.21 km²	Reprojection error:	0.525 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
ZenmuseP1 (24mm)	8192 x 5460	24 mm	4.39 x 4.39 µm	No

Table 1. Cameras.

Camera Calibration

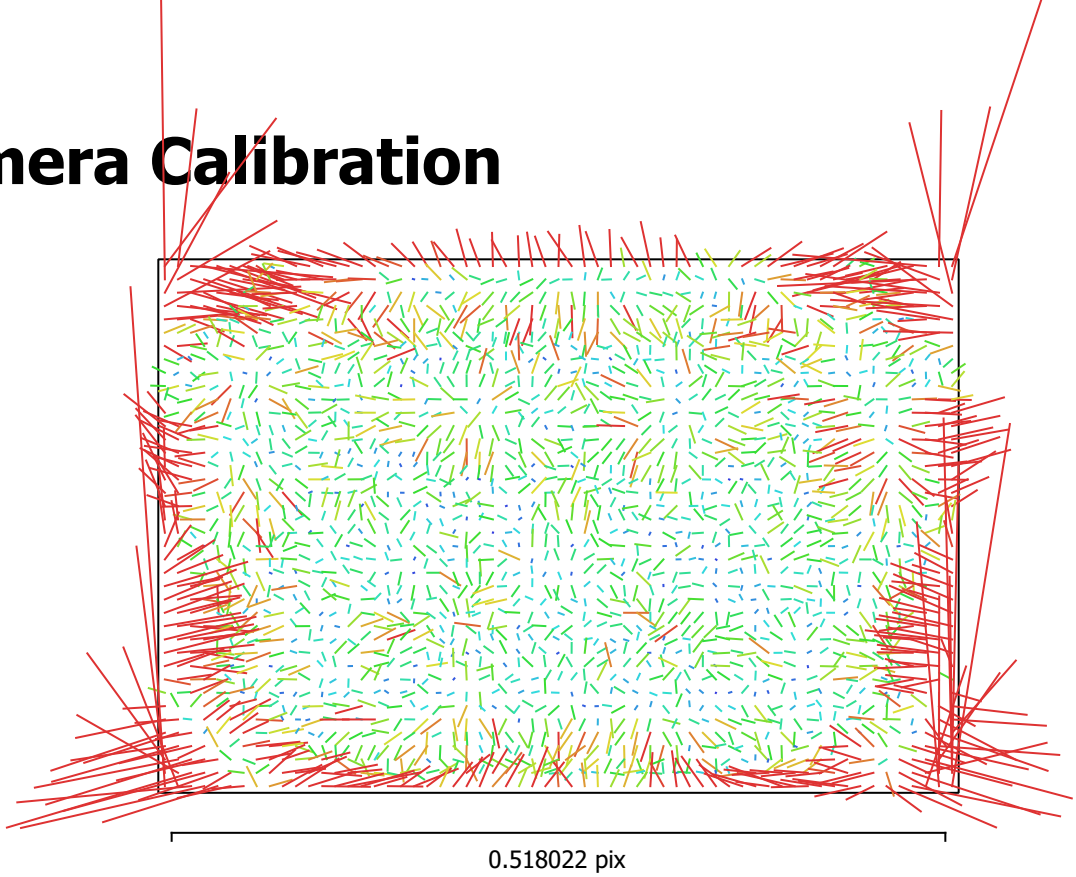


Fig. 2. Image residuals for ZenmuseP1 (24mm).

ZenmuseP1 (24mm)

992 images, additional corrections

Type	Resolution	Focal Length	Pixel Size
Frame	**8192 x 5460**	**24 mm**	**4.39 x 4.39 µm**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2
F	**5613.78**	0.054	1.00	0.02	-0.00	-0.26	0.00	-0.99	0.97	-0.95	0.92	0.02	-0.01
Cx	**0.156186**	0.018		1.00	0.01	-0.05	0.10	-0.02	0.02	-0.02	0.02	0.93	0.01
Cy	**22.0429**	0.02			1.00	-0.06	-0.03	0.01	-0.01	0.01	-0.02	0.00	0.97
B1	**0.585716**	0.004				1.00	-0.01	0.30	-0.32	0.31	-0.30	-0.04	-0.08
B2	**-0.20797**	0.0024					1.00	-0.00	0.00	-0.00	0.00	0.09	-0.04
K1	**-0.162233**	7.2e-05						1.00	-0.99	0.98	-0.96	-0.03	0.02
K2	**0.063473**	0.0002							1.00	-0.99	0.98	0.03	-0.02
K3	**-0.0494785**	0.00023								1.00	-1.00	-0.03	0.02
K4	**0.016827**	0.0001									1.00	0.03	-0.03
P1	**-0.000239278**	8.2e-07										1.00	0.00
P2	**0.00126855**	9.9e-07											1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

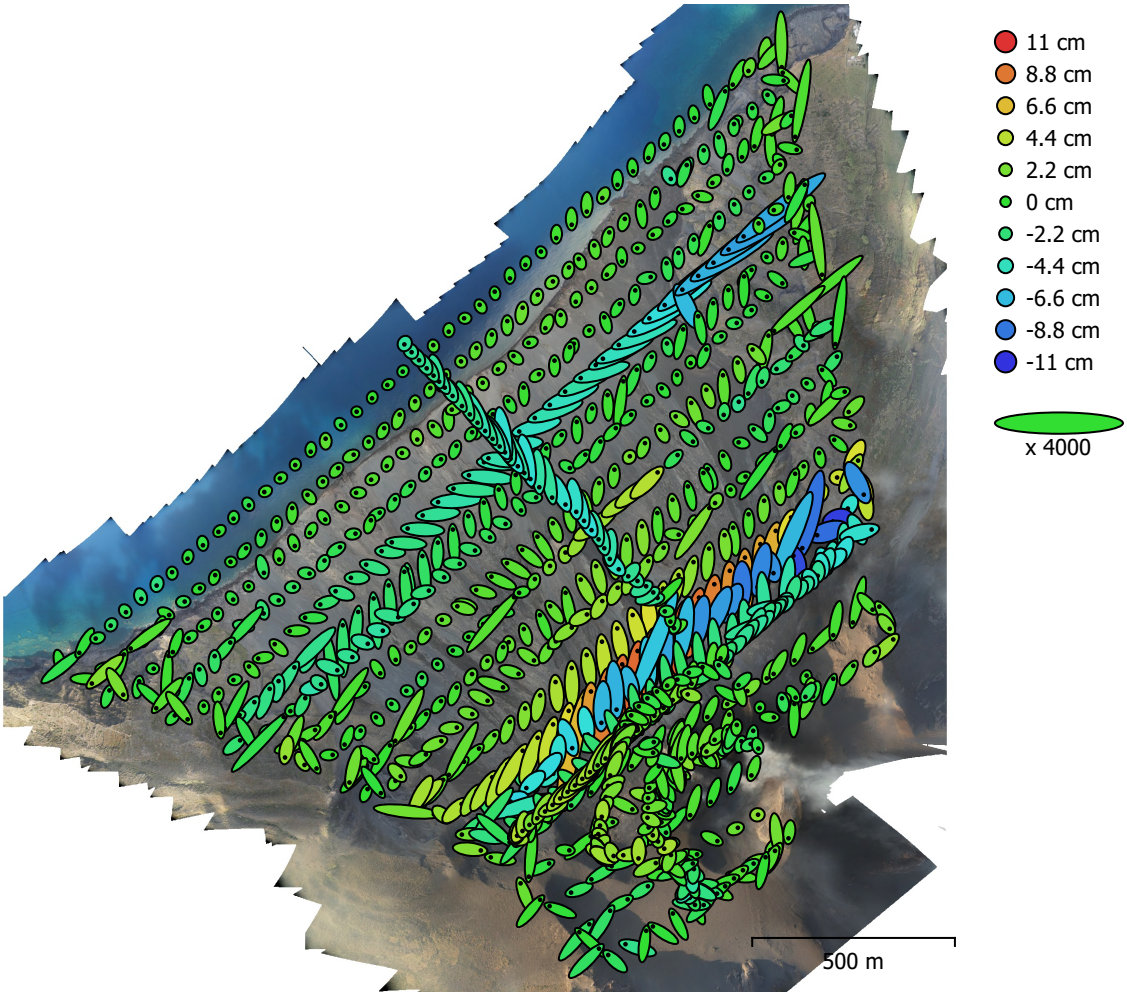


Fig. 3. Camera locations and error estimates.
Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated camera locations are marked with a black dot.

X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total error (cm)
0.811693	1.15846	2.56588	1.41452	2.92995

Table 3. Average camera location error.
X - Easting, Y - Northing, Z - Altitude.

Digital Elevation Model

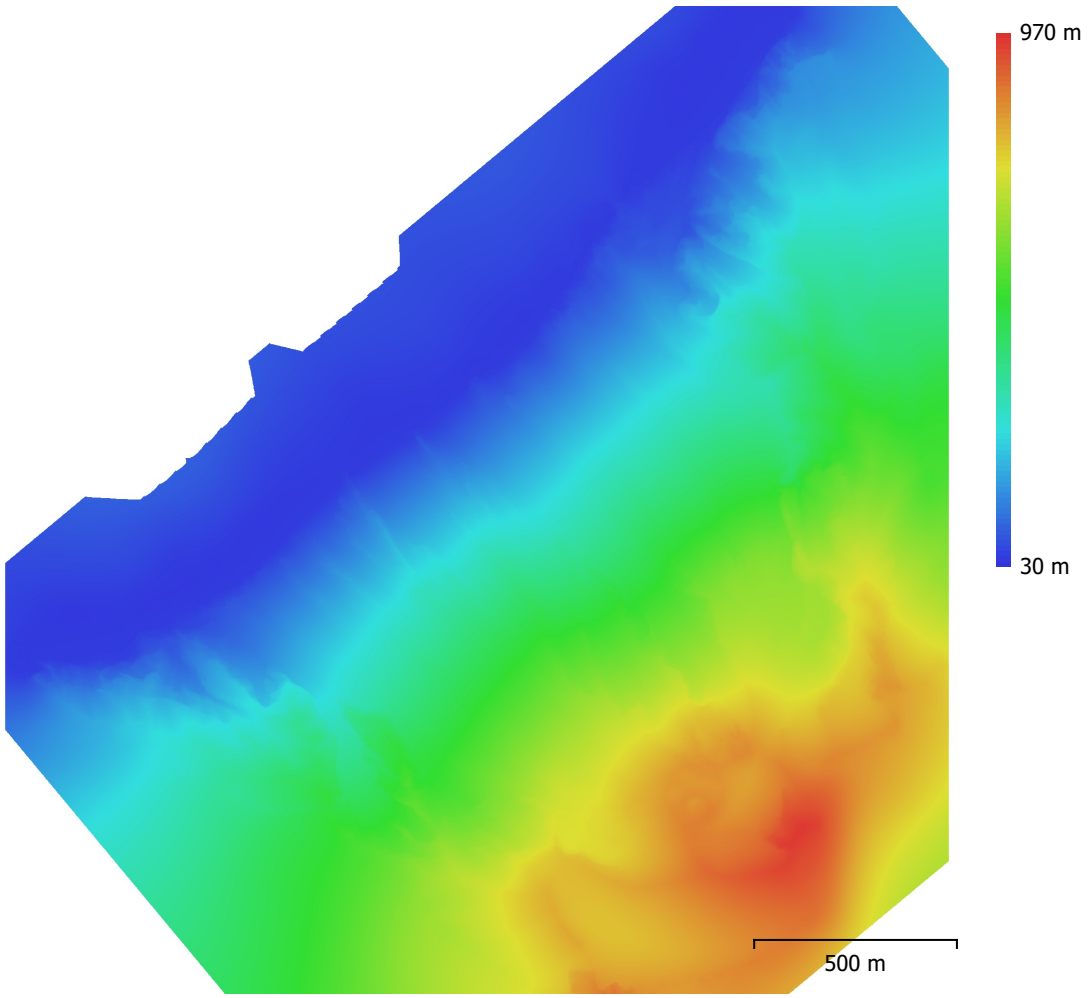


Fig. 4. Reconstructed digital elevation model.

Resolution:	9.2 cm/pix
Point density:	118 points/m²

Processing Parameters

General	
Images	992
Aligned images	974
Coordinate system	WGS 84 / UTM zone 33N (EPSG::32633)
Camera coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll
Tie Points	
Points	2,071,046 of 2,472,748
RMS reprojection error	0.12492 (0.524852 pix)
Max reprojection error	0.500261 (45.0989 pix)
Mean key point size	3.05377 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	3.80946
Alignment parameters	
Accuracy	High
Generic preselection	Yes
Reference preselection	Source
Key point limit	40,000
Key point limit per Mpx	1,000
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	4 minutes 36 seconds
Matching memory usage	1.07 GB
Alignment time	5 minutes 38 seconds
Alignment memory usage	2.83 GB
Optimization parameters	
Parameters	f, b1, b2, cx, cy, k1-k4, p1, p2
Fit additional corrections	Yes
Adaptive camera model fitting	No
Exclude corners	No
Optimization time	38 seconds
Date created	2024:08:16 10:21:13
Software version	2.1.2.18358
File size	198.34 MB
Depth Maps	
Count	974
Depth maps generation parameters	
Quality	High
Filtering mode	Aggressive
Max neighbors	16
Processing time	1 hours 3 minutes
Memory usage	10.50 GB
Date created	2024:08:16 12:18:04
Software version	2.1.2.18358
File size	13.72 GB

Point Cloud	
Points	494,594,530
Point attributes	
Color	3 bands, uint8
Normal	
Confidence	4 - 100
Point classes	
Created (never classified)	494,594,530
Depth maps generation parameters	
Quality	High
Filtering mode	Aggressive
Max neighbors	16
Processing time	1 hours 3 minutes
Memory usage	10.50 GB
Point cloud generation parameters	
Processing time	3 hours 31 minutes
Memory usage	33.49 GB
Date created	2024:08:16 15:49:38
Software version	2.1.2.18358
File size	8.68 GB
DEM	
Size	25,260 x 26,445
Resolution	9.2 cm/pix
Coordinate system	WGS 84 / UTM zone 33N (EPSG::32633)
Reconstruction parameters	
Source data	Point cloud
Interpolation	Enabled
Processing time	6 minutes 47 seconds
Memory usage	309.98 MB
Date created	2024:08:16 16:07:41
Software version	2.1.2.18358
File size	2.13 GB
Orthomosaic	
Size	46,484 x 48,665
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 14 minutes
Memory usage	53.93 GB
Date created	2024:08:16 16:38:14
Software version	2.1.2.18358
File size	20.22 GB
System	
Software name	Agisoft Metashape Professional
Software version	2.1.2 build 18358
OS	Windows 64 bit
RAM	63.72 GB
CPU	Intel(R) Core(TM) i9-14900KF
GPU(s)	NVIDIA GeForce RTX 4090