OpenTopography

Metadata Report

Project Name: High-Resolution SfM Topography of Stromboli volcano (Italy), 15 December 2022.

Summary: Structure-from-Motion digital surface model (DSM) of Stromboli Volcano (Italy) produced by photogrammetry from UAS survey. Coverage includes the central portion of the Sciara del Fuoco.

Personnel

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

Dates of Collection: December 15, 2022

Site Information

- Site description: Stromboli volcano, Aeolian Islands, Italy
- Site objective: The objective was to document at high resolution the morphological changes 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. Cloudy to partly 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 3.5 cm.

Products

- Date of dataset collection: December 15, 2022.
- 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.

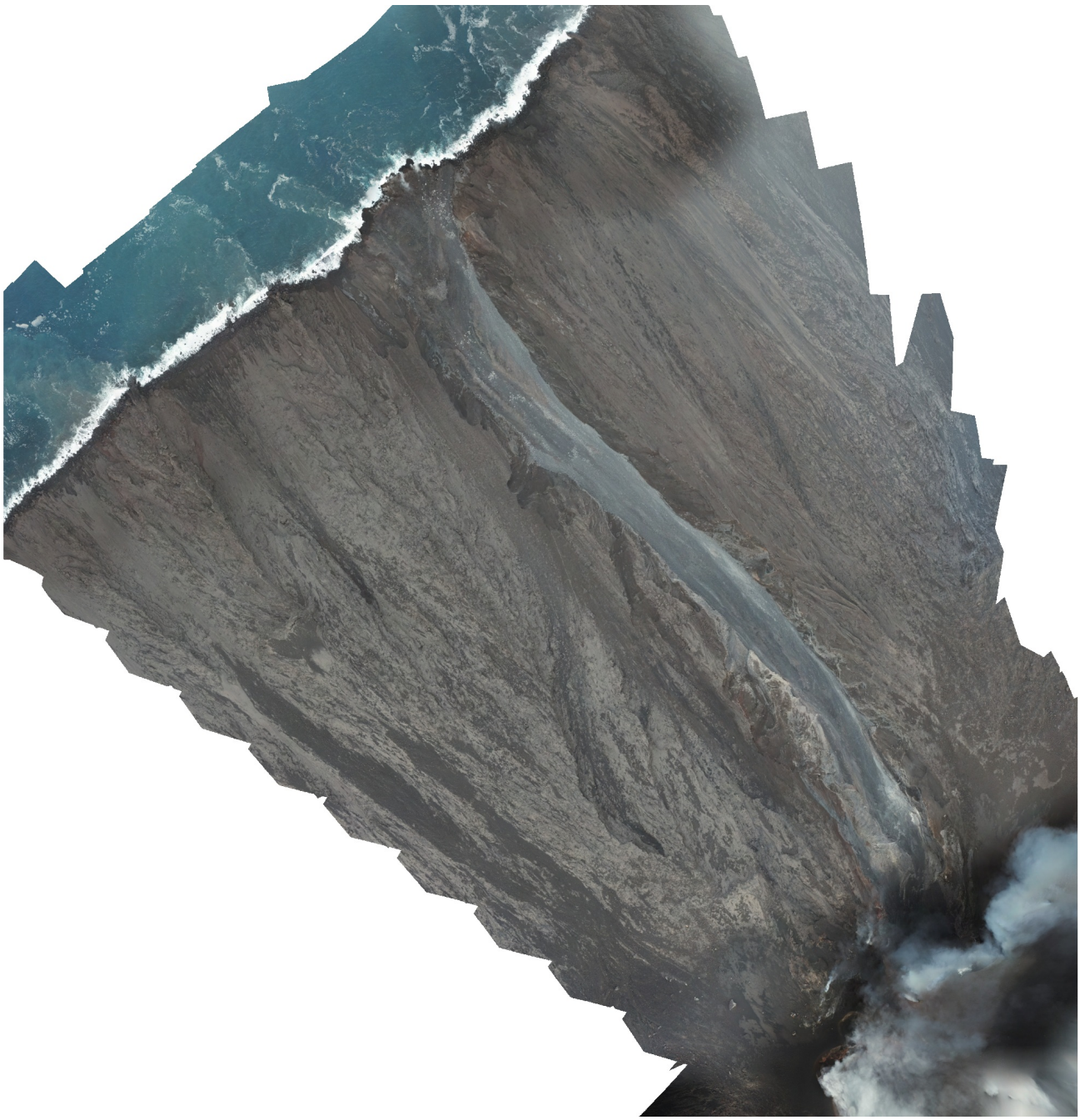
Misc Notes

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

Stromboli Sciara 20221215 P1

Processing Report

17 September 2024



Survey Data

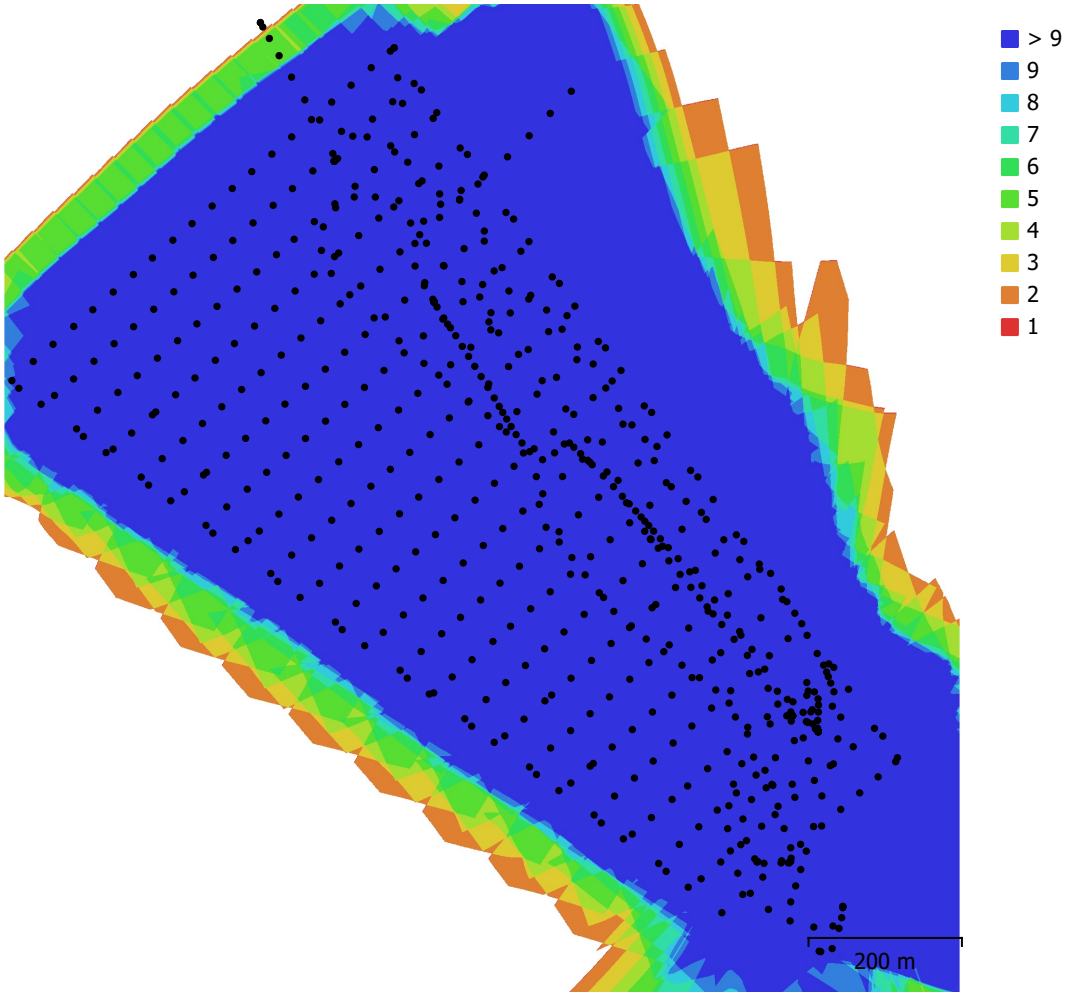


Fig. 1. Camera locations and image overlap.

Number of images:	655	Camera stations:	654
Flying altitude:	233 m	Tie points:	854,508
Ground resolution:	10 cm/pix	Projections:	4,387,491
Coverage area:	1.12 km²	Reprojection error:	0.61 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
ZenmuseP1 (35mm)	8192 x 5460	35 mm	4.39 x 4.39 µm	No

Table 1. Cameras.

Camera Calibration

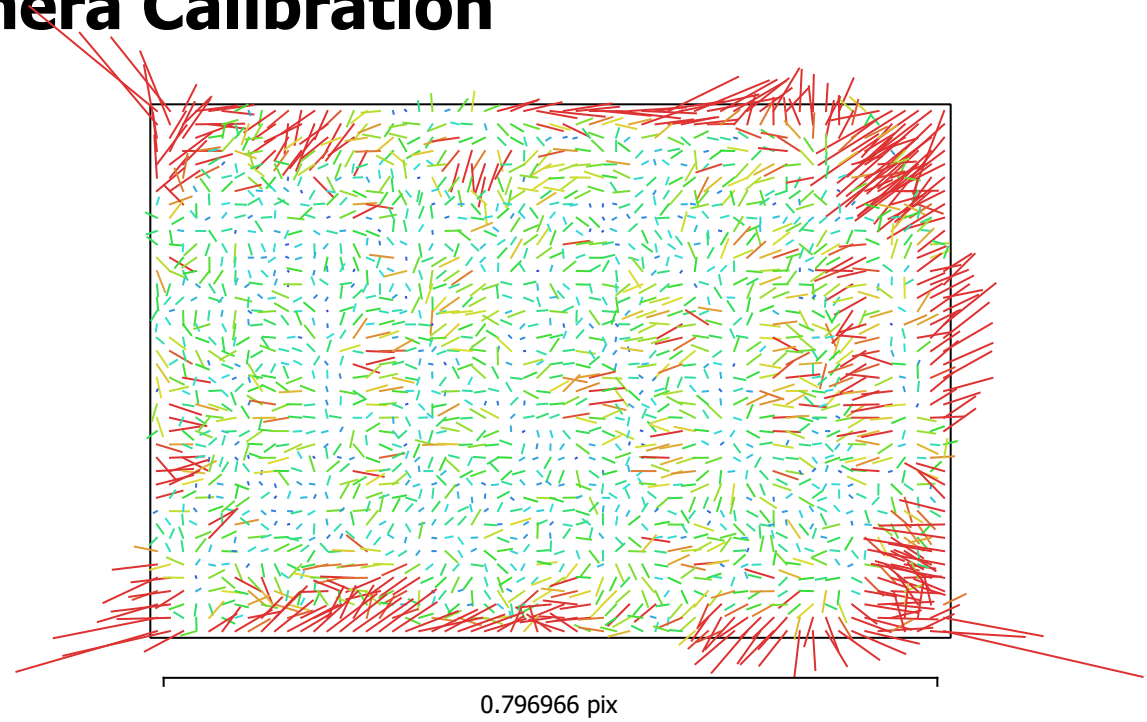


Fig. 2. Image residuals for ZenmuseP1 (35mm).

ZenmuseP1 (35mm)

655 images, additional corrections

Type	Resolution	Focal Length	Pixel Size
Frame	**8192 x 5460**	**35 mm**	**4.39 x 4.39 µm**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2
F	**8192.49**	0.13	1.00	0.03	0.03	-0.31	-0.00	-0.99	0.98	-0.95	0.92	0.03	0.02
Cx	**-22.9034**	0.059		1.00	-0.01	-0.12	0.21	-0.03	0.03	-0.03	0.02	0.98	-0.01
Cy	**39.2846**	0.064			1.00	-0.13	-0.17	-0.02	0.02	-0.03	0.03	-0.01	0.99
B1	**0.497835**	0.0064				1.00	0.00	0.33	-0.34	0.32	-0.30	-0.11	-0.13
B2	**-0.514197**	0.004					1.00	0.00	-0.00	0.00	-0.00	0.20	-0.17
K1	**-0.0415657**	0.00028						1.00	-0.99	0.98	-0.95	-0.03	-0.02
K2	**-0.00500146**	0.0018							1.00	-0.99	0.98	0.03	0.02
K3	**-0.0475946**	0.0051								1.00	-0.99	-0.03	-0.02
K4	**-0.0199838**	0.0053									1.00	0.02	0.03
P1	**-0.000937363**	3.1e-06										1.00	-0.02
P2	**0.00158143**	3.4e-06											1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

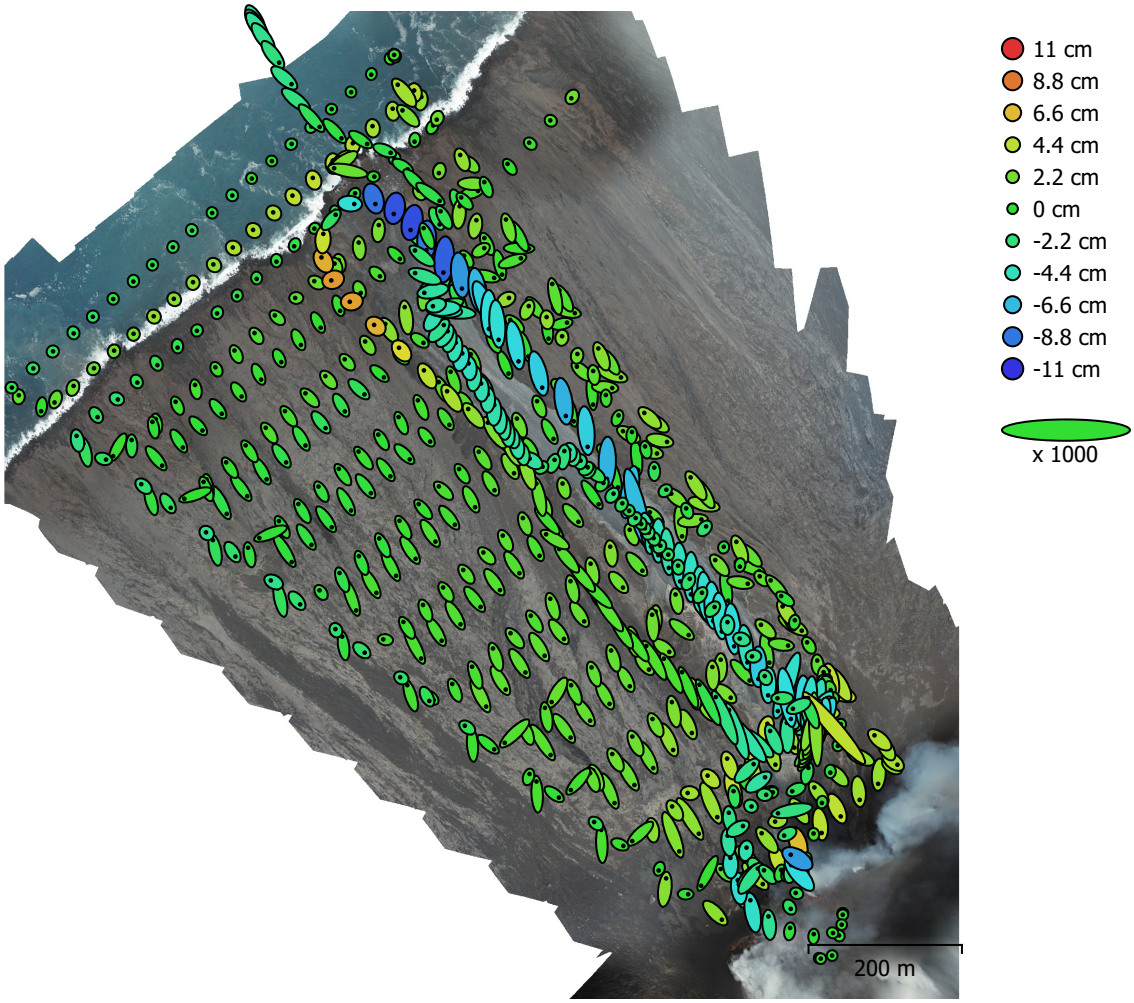


Fig. 3. Camera locations and error estimates.
Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated camera locations are marked with a black dot.

X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total error (cm)
1.1446	1.98657	2.59347	2.29272	3.46159

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

Digital Elevation Model

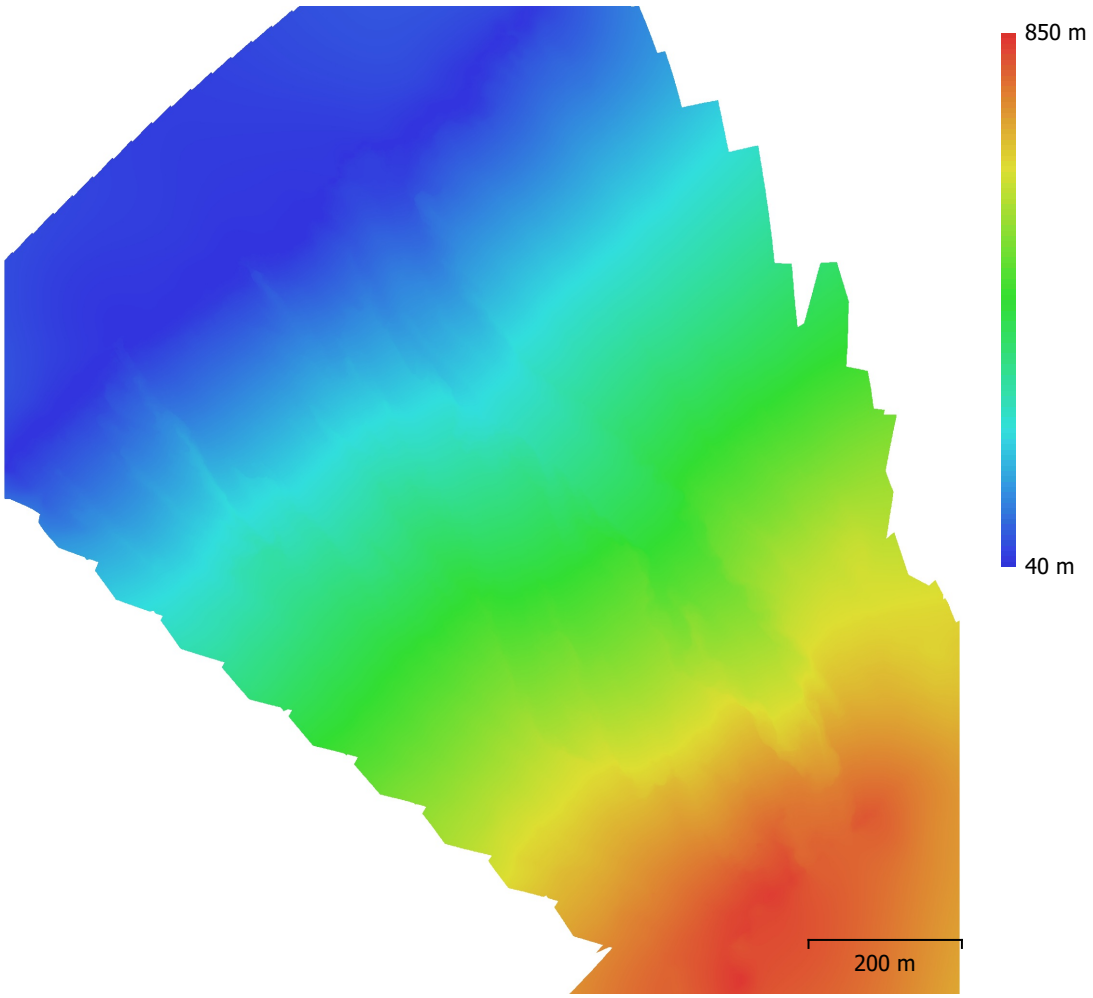


Fig. 4. Reconstructed digital elevation model.

Resolution:	10 cm/pix
Point density:	100 points/m²

Processing Parameters

General	
Images	655
Aligned images	654
Coordinate system	WGS 84 / UTM zone 33N (EPSG::32633)
Camera coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll
Tie Points	
Points	854,508 of 1,099,484
RMS reprojection error	0.146299 (0.609905 pix)
Max reprojection error	0.569042 (48.8814 pix)
Mean key point size	3.06287 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	5.66854
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	3 minutes 0 seconds
Matching memory usage	744.22 MB
Alignment time	4 minutes 6 seconds
Alignment memory usage	2.52 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	47 seconds
Date created	2024:07:31 09:58:52
Software version	2.1.2.18358
File size	117.89 MB
Depth Maps	
Count	653
Depth maps generation parameters	
Quality	High
Filtering mode	Aggressive
Max neighbors	16
Processing time	41 minutes 24 seconds
Memory usage	11.57 GB
Date created	2024:07:31 11:14:01
Software version	2.1.2.18358
File size	8.90 GB

Point Cloud	
Points	135,018,363
Coordinate precision	1.7 cm
Point attributes	
Color	3 bands, uint8
Normal	
Confidence	4 - 119
Point classes	
Created (never classified)	135,018,363
Point cloud generation parameters	
Processing time	2 hours 41 minutes
Memory usage	27.91 GB
Date created	2024:07:31 13:55:46
Software version	2.1.2.18358
File size	1.77 GB
DEM	
Size	12,441 x 12,868
Resolution	10 cm/pix
Coordinate system	WGS 84 / UTM zone 33N (EPSG::32633)
Reconstruction parameters	
Source data	Point cloud
Interpolation	Enabled
Processing time	3 minutes 15 seconds
Memory usage	307.77 MB
Date created	2024:07:31 14:28:58
Software version	2.1.2.18358
File size	505.55 MB
Orthomosaic	
Size	24,872 x 25,725
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	No
Processing time	7 minutes 20 seconds
Memory usage	4.68 GB
Date created	2024:07:31 14:40:18
Software version	2.1.2.18358
File size	6.81 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