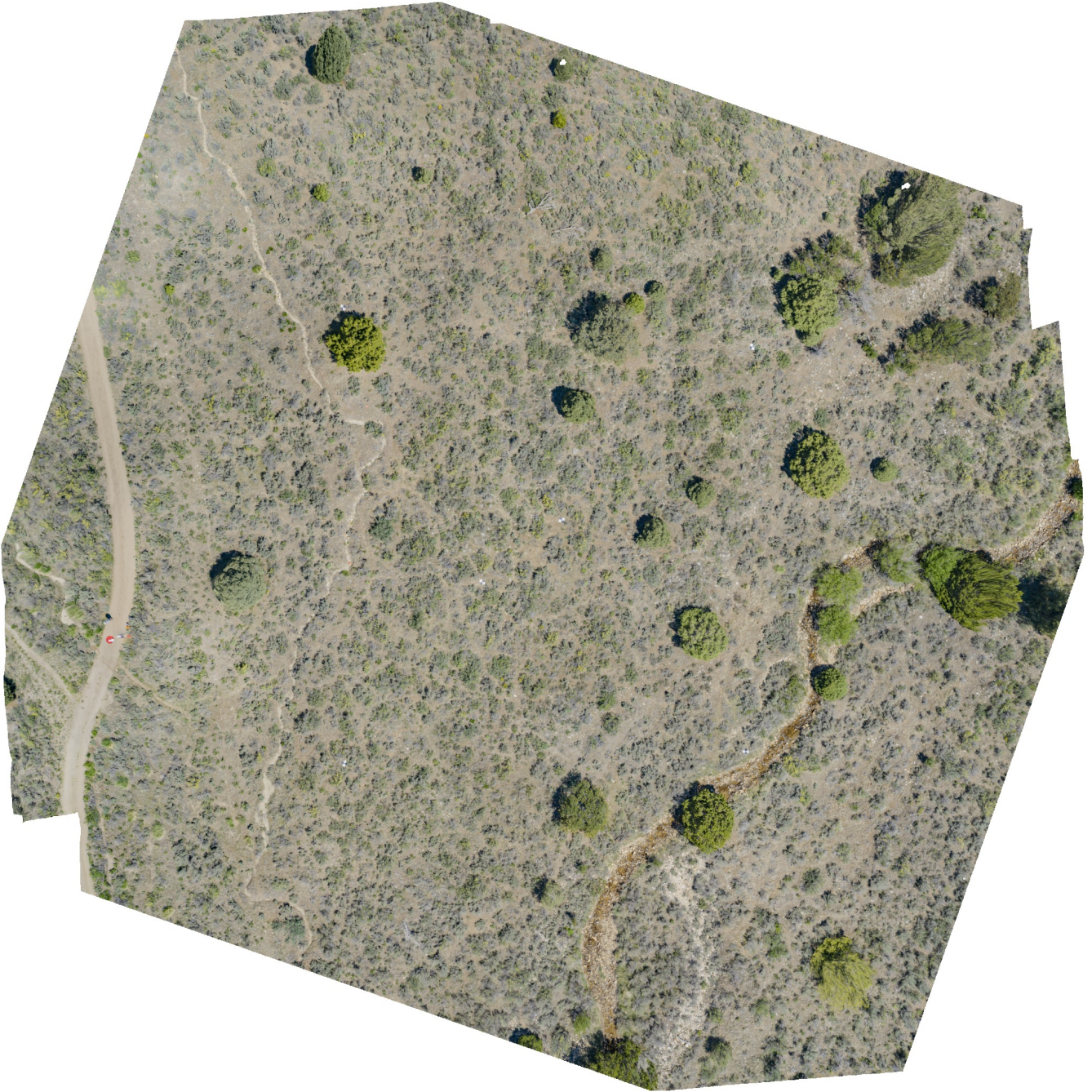


Castle Rocks_Site 2

Processing Report
22 September 2021



Survey Data

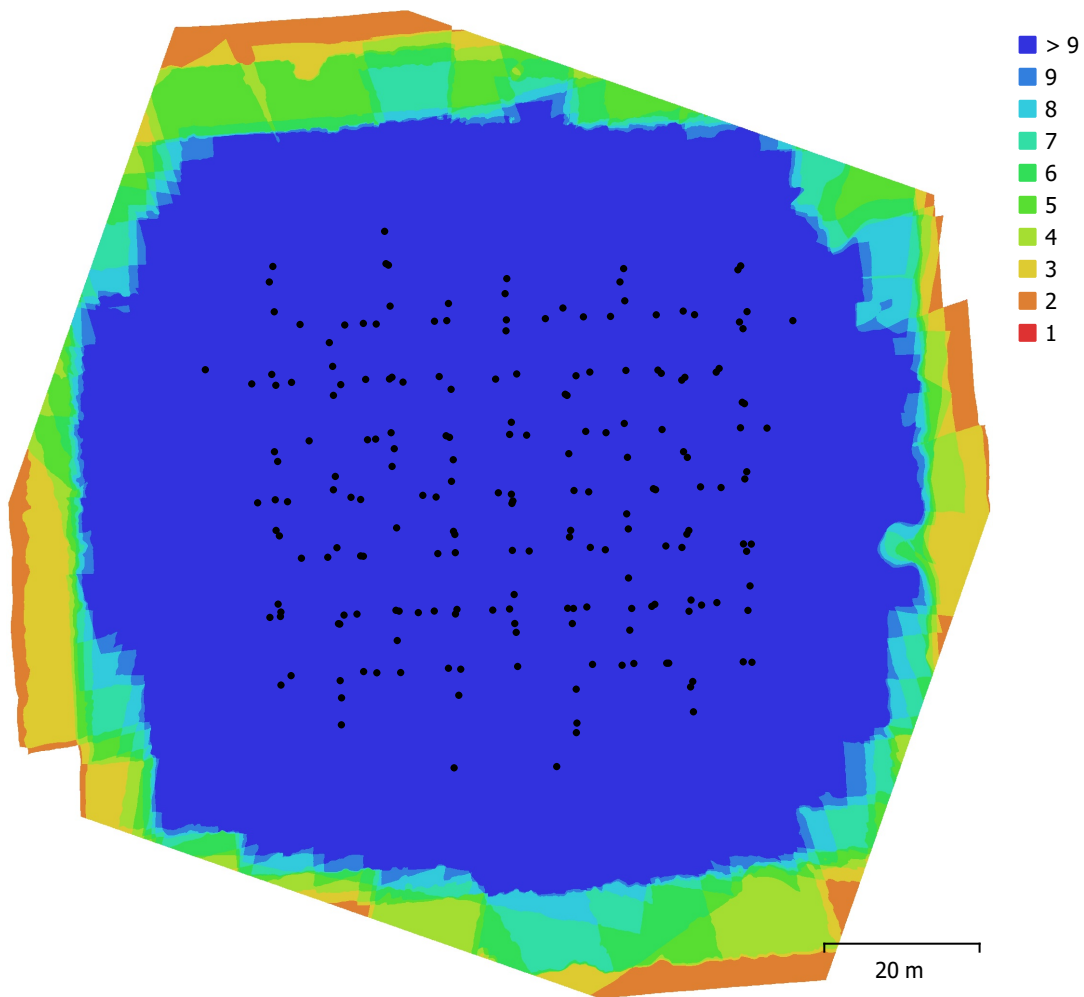


Fig. 1. Camera locations and image overlap.

Number of images:	199	Camera stations:	199
Flying altitude:	42.3 m	Tie points:	575,177
Ground resolution:	9.16 mm/pix	Projections:	1,740,761
Coverage area:	0.0124 km ²	Reprojection error:	0.902 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
L1D-20c, 28.0 mm f/2.8 (10.26mm)	5464 x 3640	10.26 mm	2.41 x 2.41 μ m	No

Table 1. Cameras.

Camera Calibration

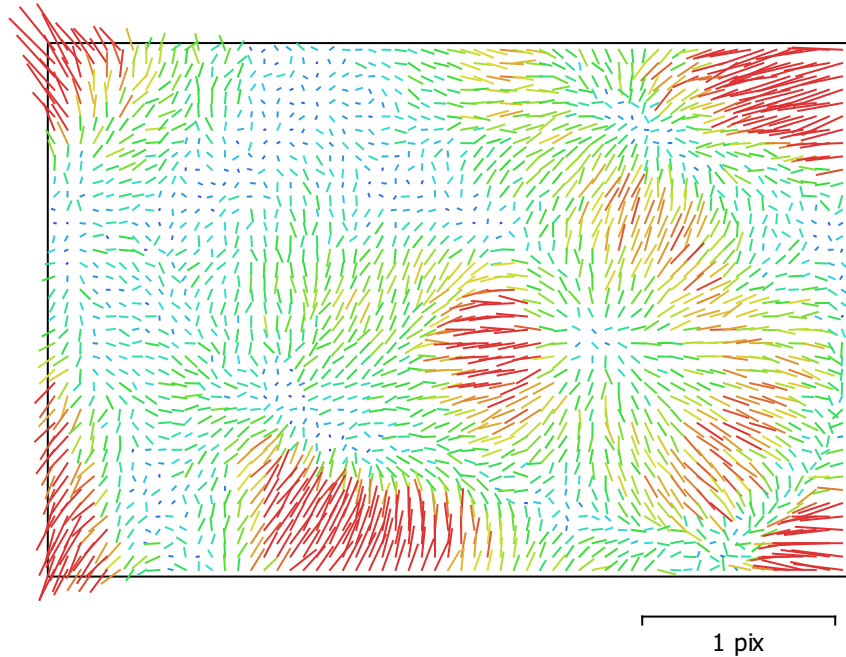


Fig. 2. Image residuals for L1D-20c, 28.0 mm f/2.8 (10.26mm).

L1D-20c, 28.0 mm f/2.8 (10.26mm)

199 images

Type
Frame

Resolution
5464 x 3640

Focal Length
10.26 mm

Pixel Size
2.41 x 2.41 μm

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2
F	4313.89	0.12	1.00	-0.15	-0.83	-0.38	-0.18	-0.10	0.10	-0.10	0.09	-0.00	-0.06
Cx	-8.15379	0.027		1.00	0.12	0.14	0.34	0.00	-0.01	0.01	-0.01	0.74	-0.00
Cy	-13.7644	0.041			1.00	0.11	0.21	-0.01	-0.01	0.01	-0.01	0.00	0.34
B1	-13.7848	0.004				1.00	0.06	0.05	-0.06	0.06	-0.05	0.03	0.03
B2	0.511437	0.0038					1.00	0.00	-0.01	0.01	-0.01	-0.01	0.03
K1	-0.0289886	5.7e-05						1.00	-0.97	0.92	-0.87	0.01	-0.06
K2	0.0720455	0.00038							1.00	-0.99	0.96	-0.01	-0.00
K3	-0.119441	0.001								1.00	-0.99	0.01	0.00
K4	0.0548722	0.00091									1.00	-0.01	-0.01
P1	0.00131987	1.6e-06										1.00	0.01
P2	0.00020397	1.3e-06											1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

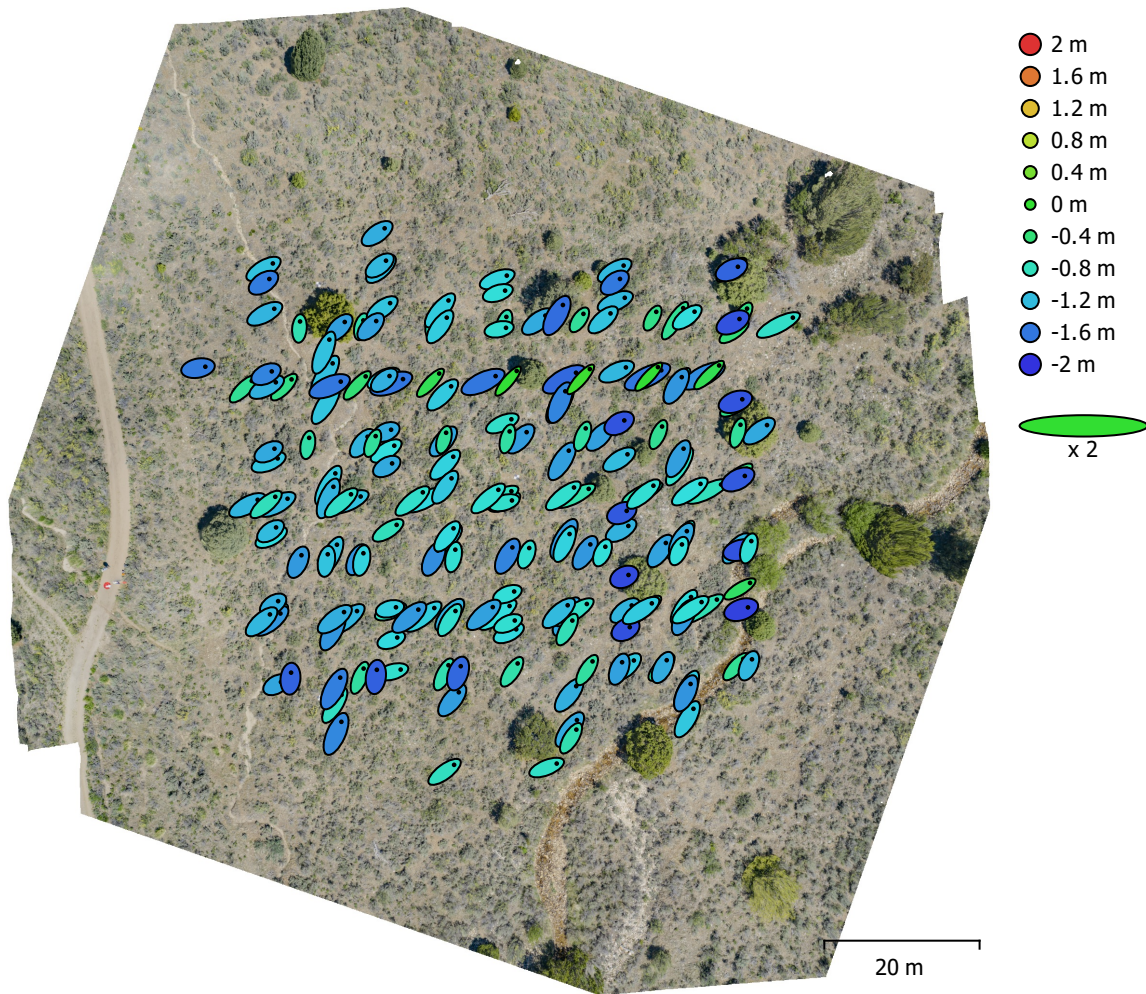


Fig. 3. Camera locations and error estimates.

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 (m)	Y error (m)	Z error (m)	XY error (m)	Total error (m)
0.981631	0.956433	1.15505	1.37053	1.79235

Table 3. Average camera location error.
X - Longitude, Y - Latitude, Z - Altitude.

Ground Control Points

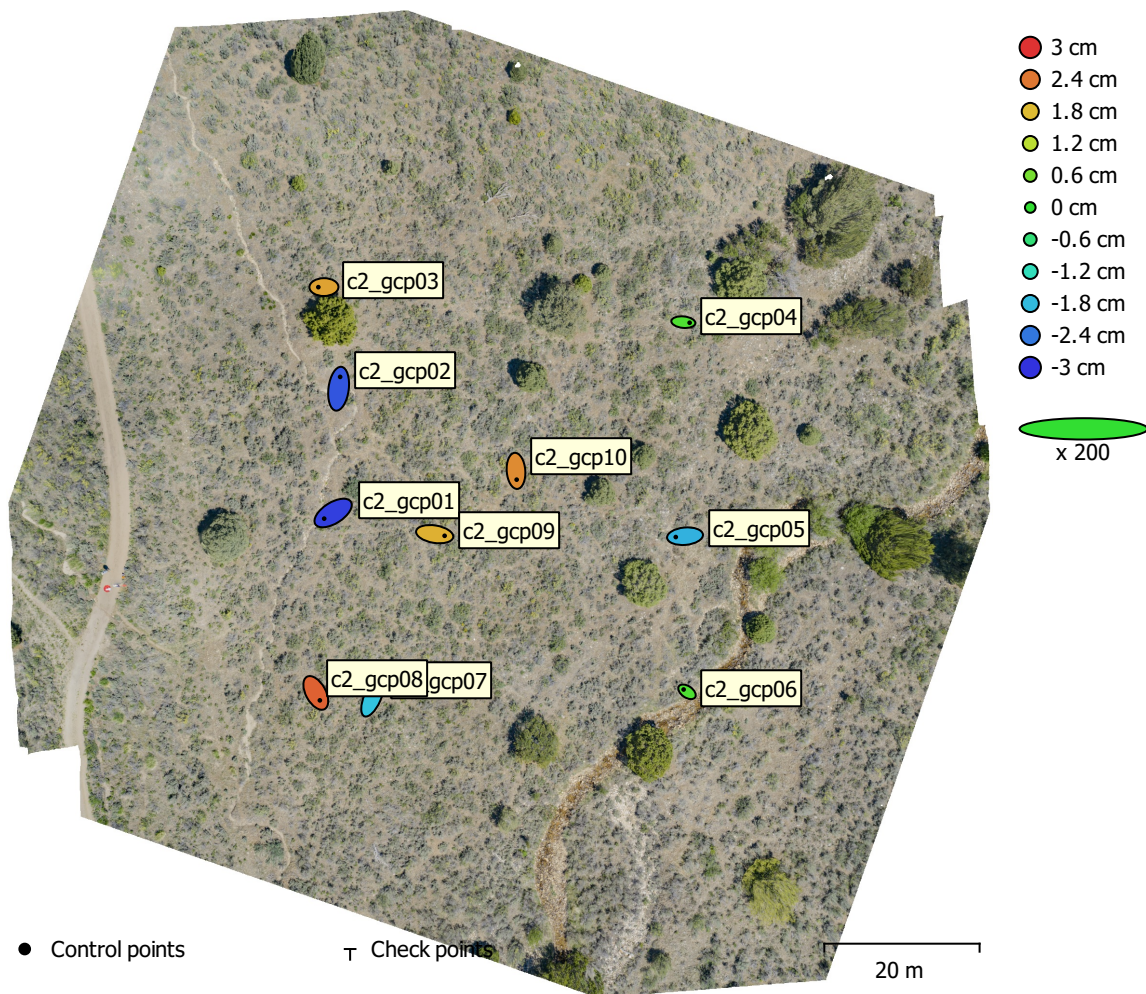


Fig. 4. GCP locations and error estimates.

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

Estimated GCP locations are marked with a dot or crossing.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
10	0.802154	0.844243	2.04153	1.16456	2.35033

Table 4. Control points RMSE.

X - Longitude, Y - Latitude, Z - Altitude.

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
c2_gcp02	0.196452	1.52442	-2.69992	3.10677	0.554 (54)
c2_gcp03	-0.719086	-0.00724625	2.02102	2.14515	0.909 (32)
c2_gcp04	0.807109	-0.0777637	0.237981	0.845048	0.850 (40)
c2_gcp05	-1.19248	-0.108188	-1.8903	2.23762	0.921 (64)
c2_gcp06	-0.436682	0.298736	0.238402	0.580319	0.987 (40)
c2_gcp07	0.60302	1.38943	-1.73229	2.30109	0.883 (48)
c2_gcp08	0.523905	-0.957409	2.59412	2.81435	0.890 (38)
c2_gcp01	-1.15247	-0.725924	-2.8871	3.19226	0.737 (62)
c2_gcp09	1.28112	-0.209842	1.90312	2.30372	0.851 (79)
c2_gcp10	0.0845926	-1.13066	2.22041	2.49314	0.891 (80)
Total	0.802154	0.844243	2.04153	2.35033	0.849

Table 5. Control points.
X - Longitude, Y - Latitude, Z - Altitude.

Digital Elevation Model

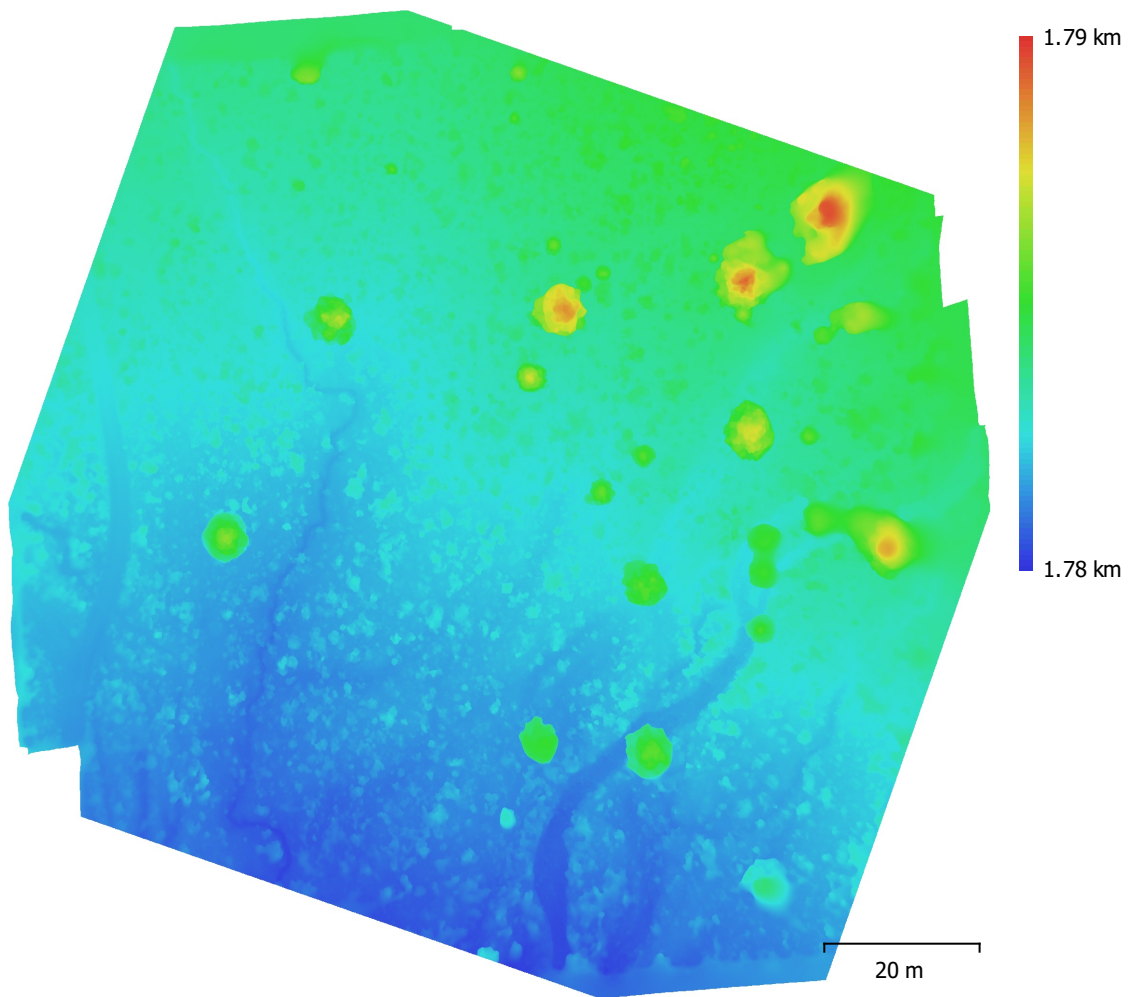


Fig. 5. Reconstructed digital elevation model.

Resolution: 10 mm/pix
Point density: 1 points/cm²

Processing Parameters

General

Cameras	199
Aligned cameras	199
Markers	10
Coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll

Point Cloud

Points	575,177 of 887,580
RMS reprojection error	0.166785 (0.901621 pix)
Max reprojection error	0.555979 (27.0578 pix)
Mean key point size	4.27245 pix
Point colors	3 bands, uint16
Key points	No
Average tie point multiplicity	3.40856

Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Source
Key point limit	60,000
Tie point limit	0
Exclude stationary tie points	No
Guided image matching	No
Adaptive camera model fitting	Yes
Matching time	2 minutes 26 seconds
Matching memory usage	1.06 GB
Alignment time	2 minutes 27 seconds
Alignment memory usage	305.44 MB

Optimization parameters

Parameters	f, b1, b2, cx, cy, k1-k4, p1, p2
Adaptive camera model fitting	No
Optimization time	5 seconds
Software version	1.7.1.11797
File size	64.43 MB

Depth Maps

Count	199
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Depth maps generation parameters

Quality	High
Filtering mode	Aggressive
Processing time	17 minutes 34 seconds
Memory usage	16.30 GB
Software version	1.7.1.11797
File size	1.39 GB

Dense Point Cloud

Points	262,809,601
Point colors	3 bands, uint16

Depth maps generation parameters

Quality	Ultra High
Filtering mode	Disabled
Processing time	50 minutes 15 seconds
Memory usage	17.48 GB

Dense cloud generation parameters	
Processing time	2 hours 21 minutes
Memory usage	39.90 GB
Software version	1.7.1.11797
File size	4.37 GB
Model	
Faces	9,571,026
Vertices	4,788,372
Vertex colors	3 bands, uint8
Texture	4,096 x 4,096, 4 bands, uint16
Depth maps generation parameters	
Quality	High
Filtering mode	Aggressive
Processing time	17 minutes 34 seconds
Memory usage	16.30 GB
Reconstruction parameters	
Surface type	Arbitrary
Source data	Depth maps
Interpolation	Enabled
Strict volumetric masks	No
Processing time	9 minutes 21 seconds
Memory usage	10.91 GB
Texturing parameters	
Mapping mode	Generic
Blending mode	Mosaic
Texture size	4,096
Enable hole filling	Yes
Enable ghosting filter	Yes
UV mapping time	4 minutes 19 seconds
UV mapping memory usage	3.27 GB
Blending time	1 minutes 25 seconds
Blending memory usage	5.09 GB
Software version	1.7.1.11797
File size	503.08 MB
DEM	
Size	15,001 x 14,519
Coordinate system	WGS 84 (EPSG::4326)
Reconstruction parameters	
Source data	Mesh
Interpolation	Enabled
Processing time	55 seconds
Memory usage	461.79 MB
Software version	1.7.1.11797
File size	383.49 MB
Orthomosaic	
Size	25,294 x 25,424
Coordinate system	WGS 84 (EPSG::4326)
Colors	3 bands, uint16
Reconstruction parameters	
Blending mode	Mosaic
Surface	DEM
Enable hole filling	Yes
Enable ghosting filter	No
Processing time	19 minutes 47 seconds
Memory usage	26.04 GB
Software version	1.7.1.11797

File size	133.70 GB
System	
Software name	Agisoft Metashape Professional
Software version	1.7.1 build 11797
OS	Windows 64 bit
RAM	127.70 GB
CPU	Intel(R) Core(TM) i9-9940X CPU @ 3.30GHz
GPU(s)	GeForce RTX 2080