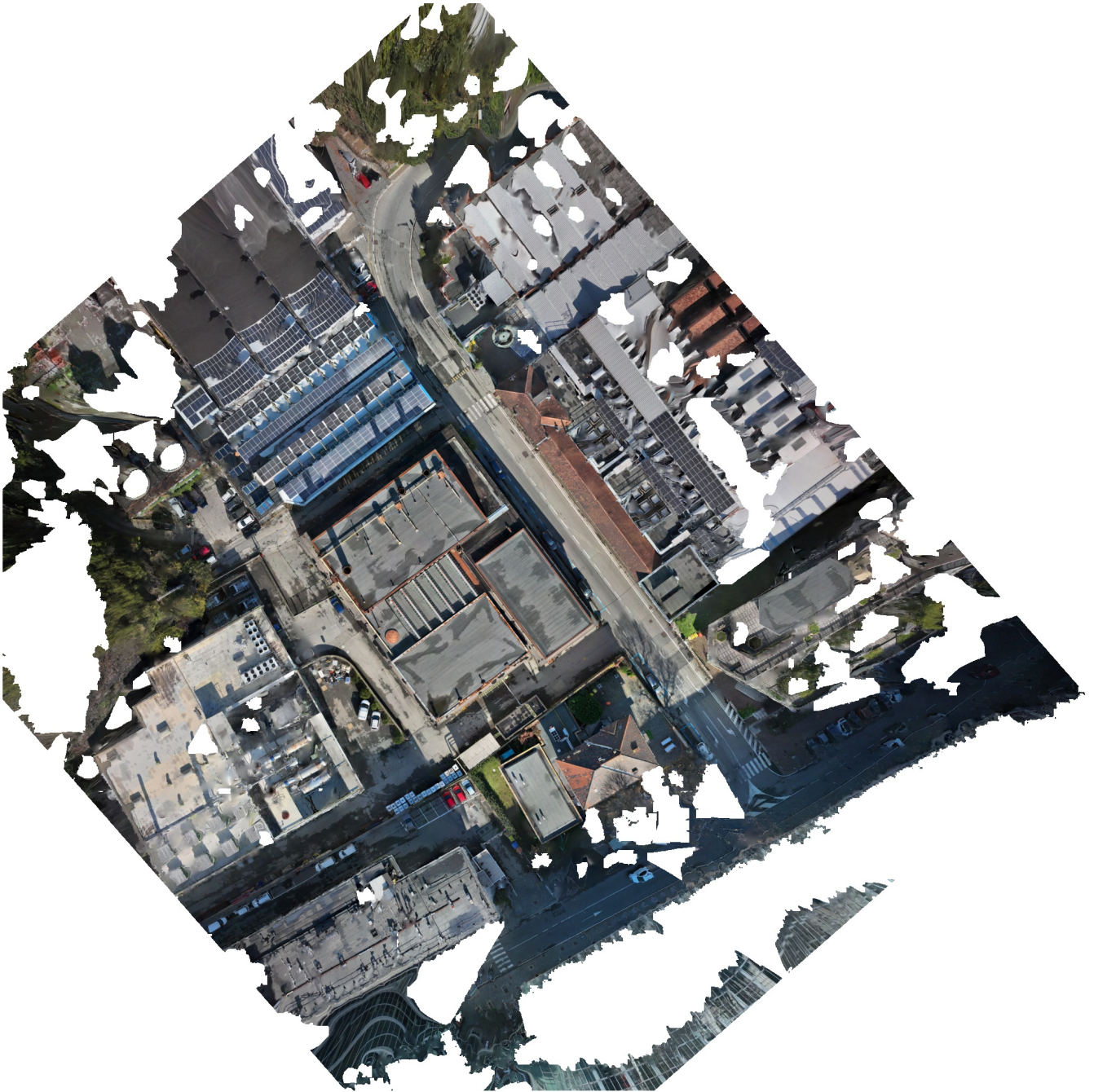


REPORT_UAV_RGB

report drone rgb
14 March 2024



Survey Data

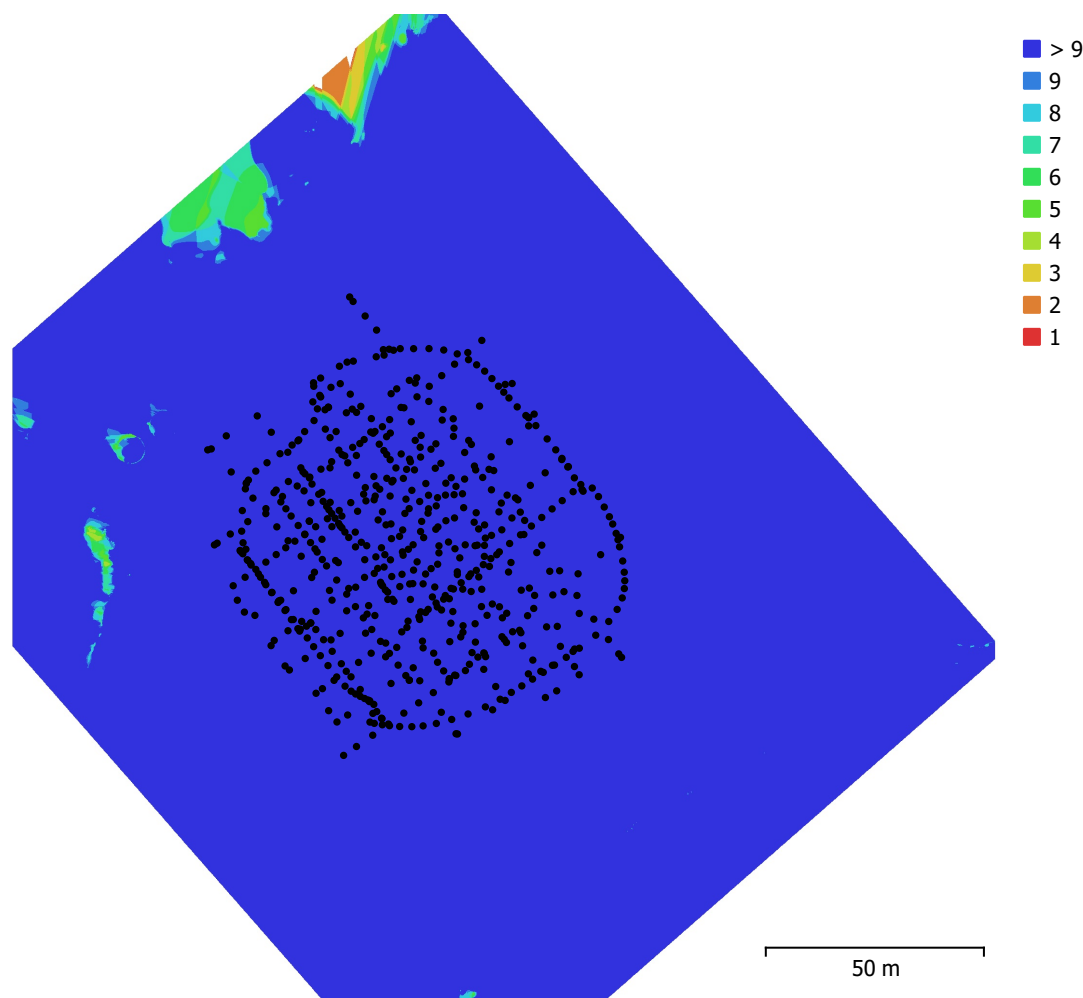


Fig. 1. Camera locations and image overlap.

Number of images:	598	Camera stations:	598
Flying altitude:	24.9 m	Tie points:	146,635
Ground resolution:	6.65 mm/pix	Projections:	1,089,970
Coverage area:	0.0321 km ²	Reprojection error:	8.14 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
M3M (12.29mm)	5280 x 3956	12.29 mm	3.36 x 3.36 μm	Yes

Table 1. Cameras.

Camera Calibration

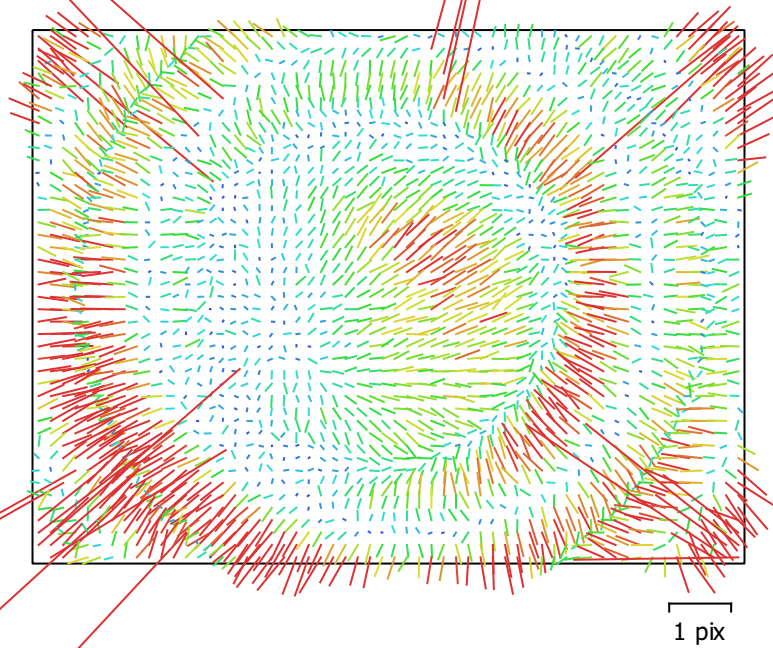


Fig. 2. Image residuals for M3M (12.29mm).

M3M (12.29mm)

598 images, precalibrated

Type	Resolution	Focal Length	Pixel Size
Frame	5280 x 3956	12.29 mm	3.36 x 3.36 μm

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2
F	3704.81	0.18	1.00	-0.05	-0.43	-0.28	-0.02	-0.57	0.51	-0.46	0.41	0.02	-0.12
Cx	12.0515	0.17		1.00	0.05	-0.01	0.08	-0.02	0.03	-0.03	0.04	0.61	-0.01
Cy	-32.8365	0.21			1.00	-0.18	0.08	-0.01	0.01	-0.01	0.02	-0.02	0.18
B1	0.111185	0.072				1.00	-0.05	0.03	-0.04	0.04	-0.04	0.00	0.43
B2	0.098025	0.058					1.00	0.01	-0.01	0.01	-0.00	-0.31	-0.08
K1	-0.0874328	0.00038						1.00	-0.97	0.93	-0.88	-0.02	-0.05
K2	-0.0811946	0.0016							1.00	-0.99	0.96	0.03	0.03
K3	0.121414	0.0025								1.00	-0.99	-0.03	-0.02
K4	-0.0802081	0.0014									1.00	0.04	0.02
P1	-9.25687e-05	7.9e-06										1.00	0.03
P2	-0.000252014	9.3e-06											1.00

Table 2. Calibration coefficients and correlation matrix.

Ground Control Points



Fig. 3. 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)
27	0.321935	0.322966	0.262992	0.456014	0.526416

Table 3. Control points RMSE.

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

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
6	0.651747	0.562501	0.633697	0.860919	1.069

Table 4. Check points RMSE.

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

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
1000					
3000					
2000					
M2001					
M2002					
M2003	0.385269	0.719413	0.0685316	0.818953	0.214 (10)
V2005					
V2006	-0.118793	-0.142597	0.854577	0.874499	1.004 (19)
F2007					
F2008					
F2015					
F2016					
F2017	0.108976	-0.308498	-0.350073	0.479164	0.141 (10)
F2018					
F2019	0.237935	0.247319	-0.326219	0.473496	0.558 (12)
F2020					
F2021					
F2022					
F2023					
F2024					
F2025	-0.188664	-0.485425	0.117879	0.533973	0.480 (10)
F2026					
F2027					
F2028					
M2029					
M2030	0.272164	0.0598436	-0.0198832	0.279374	0.250 (11)
M2031					
M2032					
M2033					
C2034					
C2035					

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
F2035					
F2036					
F2037					
M2038					
F2039	-0.102125	0.14728	-0.259017	0.314978	0.259 (10)
F2040					
F2041					
F2042					
F2043					
F2044	-0.441942	0.410438	0.202482	0.636216	0.511 (8)
F2045					
F2046					
F2048					
F2049					
F2050					
F2051					
F2052					
F2054					
F2055					
F2056					
F2057					
F2058					
M3050					
M3051	-0.806595	0.0659762	0.157772	0.824524	0.314 (7)
M3052	-0.341048	0.0545167	-0.165908	0.383159	0.293 (10)
F3054	0.315401	0.154033	0.00764252	0.351087	0.768 (10)
F3055	0.140284	-0.208381	-0.0532586	0.256785	0.147 (10)
V3056					
V3057	0.347811	0.11336	0.486895	0.609007	0.401 (10)
V3058	-0.0909654	-0.457716	0.280408	0.544433	0.508 (10)
V3059	0.110336	-0.145971	0.00983563	0.183244	0.390 (10)
V3060	0.621725	-0.0918175	0.116192	0.639119	0.617 (10)

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
F3061	-0.418324	-0.0585307	0.114764	0.437712	0.830 (10)
F3062	-0.220449	0.175827	-0.19058	0.340344	0.341 (10)
F3063					
F3064	-0.233372	0.514937	-0.0283905	0.566064	1.190 (11)
F3065					
F3066					
F3067					
F3068					
F3069					
M3070	0.140097	0.64049	-0.330433	0.734194	0.195 (10)
M3071					
F3072					
F3073					
F3074					
F3075					
M1100	0.0444145	-0.389605	0.0864177	0.401538	0.378 (8)
M1101	0.0414374	-0.449319	-0.152176	0.476195	0.368 (13)
M1102	0.243872	-0.374471	-0.229395	0.502319	0.491 (14)
M1103					
M1104	-0.152676	-0.0394684	0.0277905	0.160125	0.578 (7)
M1105	-0.149781	0.259308	-0.389293	0.491146	0.189 (6)
M1106					
M1107					
M1108					
F1110					
F1112					
F1113					
F1114					
F1115					
F1116					
F1117					
F1118					

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
F1119					
F1120					
F1121	0.574024	-0.273498	0.00137024	0.635851	0.757 (11)
F1122	-0.319012	-0.137442	-0.0379275	0.349425	0.224 (7)
F1123					
F1124					
F1125					
Total	0.321935	0.322966	0.262992	0.526416	0.560

Table 5. Control points.
X - Easting, Y - Northing, Z - Altitude.

Label	X error (cm)	Y error (cm)	Z error (cm)	Total (cm)	Image (pix)
M2004	0.404193	0.935736	0.703628	1.23857	0.143 (9)
F2047	1.05807	0.176598	-0.364437	1.13292	0.366 (12)
F2053	0.544972	0.0663735	-0.838886	1.00256	0.780 (10)
F3053	-0.641829	0.443418	-0.421832	0.886852	0.503 (7)
V1109	-0.558692	-0.836198	0.319126	1.05509	0.605 (12)
F1111	0.494652	-0.302337	-0.893315	1.06494	0.524 (14)
Total	0.651747	0.562501	0.633697	1.069	0.529

Table 6. Check points.
X - Easting, Y - Northing, Z - Altitude.

Digital Elevation Model

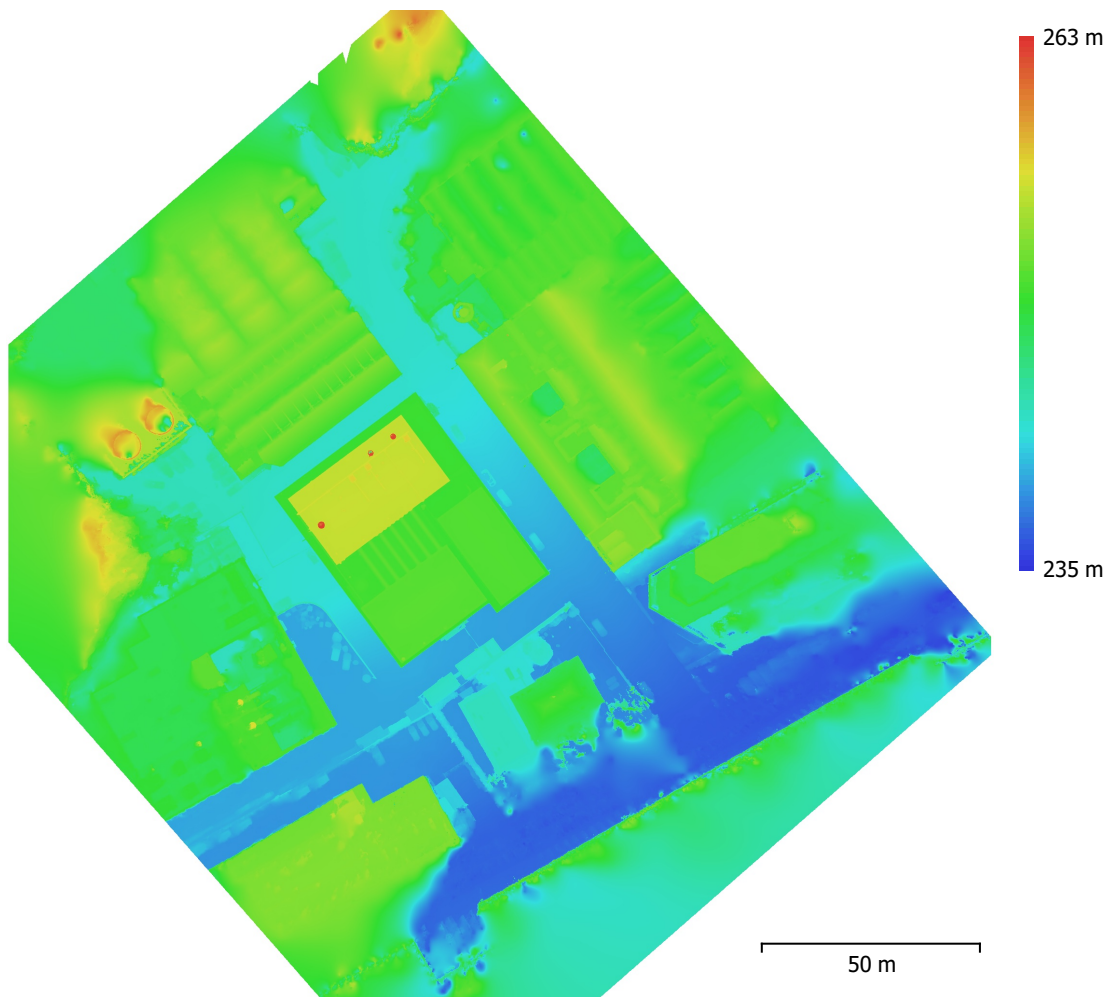


Fig. 4. Reconstructed digital elevation model.

Resolution: 3.28 cm/pix
Point density: 927 points/m²

Processing Parameters

General

Cameras	598
Aligned cameras	598
Markers	108
Coordinate system	WGS 84 / UTM zone 32N (EPSG::32632)
Rotation angles	Omega, Phi, Kappa

Tie Points

Points	146,635 of 255,047
RMS reprojection error	1.68768 (8.13659 pix)
Max reprojection error	703.662 (3165.37 pix)
Mean key point size	6.74383 pix
Point colors	3 bands, uint8
Key points	1.07 GB
Average tie point multiplicity	10.2202

Alignment parameters

Accuracy	Medium
Generic preselection	No
Reference preselection	Source
Key point limit	40,000
Key point limit per Mpx	4,000
Tie point limit	4,000
Exclude stationary tie points	No
Guided image matching	No
Adaptive camera model fitting	No
Matching time	31 minutes 38 seconds
Matching memory usage	485.38 MB
Alignment time	7 minutes 20 seconds
Alignment memory usage	521.86 MB

Optimization parameters

Parameters	f, b1, b2, cx, cy, k1-k4, p1, p2
Adaptive camera model fitting	No
Optimization time	6 seconds
Date created	2023:11:21 16:53:30
Software version	1.8.5.15709
File size	53.89 MB

Point Cloud

Points	36,002,464
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Point attributes

Color	3 bands, uint8
Normal	

Point classes

Created (never classified)	36,002,464
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Depth maps generation parameters

Quality	High
Filtering mode	Mild
Max neighbors	16
Processing time	3 hours 15 minutes
Memory usage	7.75 GB

Point cloud generation parameters

Processing time	3 hours 48 minutes
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Memory usage	35.00 GB
Date created	2024:02:06 22:23:16
Software version	2.0.3.16960
File size	474.89 MB
DEM	
Size	6,850 x 6,889
Coordinate system	WGS 84 / UTM zone 32N (EPSG::32632)
Reconstruction parameters	
Source data	Point cloud
Interpolation	Enabled
Processing time	40 seconds
Memory usage	305.49 MB
Date created	2024:01:08 16:03:23
Software version	2.0.3.16960
File size	115.47 MB
Orthomosaic	
Size	11,244 x 11,308
Coordinate system	WGS 84 / UTM zone 32N (EPSG::32632)
Colors	3 bands, uint8
Reconstruction parameters	
Blending mode	Mosaic
Surface	DEM
Enable hole filling	Yes
Enable ghosting filter	No
Processing time	16 minutes 37 seconds
Memory usage	1.91 GB
Date created	2024:01:08 16:15:16
Software version	2.0.3.16960
File size	4.11 GB
System	
Software name	Agisoft Metashape Professional
Software version	2.0.3 build 16960
OS	Windows 64 bit
RAM	127.91 GB
CPU	Intel(R) Core(TM) i7-6850K CPU @ 3.60GHz
GPU(s)	Quadro M2000