Quality Report

Generated with Pix4Dmapper version 4.6.4

Important: Click on the different icons for:

Help to analyze the results in the Quality Report

Additional information about the sections

Click here for additional tips to analyze the Quality Report

Summary

Project	20220322_Line9_r1
Processed	2022-05-17 17:05:48
Camera Model Name(s)	_0.0_4096x3000 (RGB)(1), _0.0_4096x3000 (RGB)(2), _0.0_4096x3000 (RGB)(3), _0.0_4096x3000 (RGB)(4), _0.0_4096x3000 (RGB)(5), _0.0_4096x3000 (RGB)(6), _0.0_4096x3000 (RGB)(7), _0.0_4096x3000 (RGB)(8), _0.0_4096x3000 (RGB)(9), _0.0_4096x3000 (RGB)(10)
Average Ground Sampling Distance (GSD)	4.49 cm / 1.77 in

Quality Check

Images	median of 3626 keypoints per image	✓
Dataset	19991 out of 20000 images calibrated (99%), all images enabled, 2 blocks	⚠
Camera Optimization	0.79% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 1514.93 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Calibration Details

Number of Calibrated Images	19991 out of 20000
Number of Geolocated Images	19994 out of 20000

Initial Image Positions

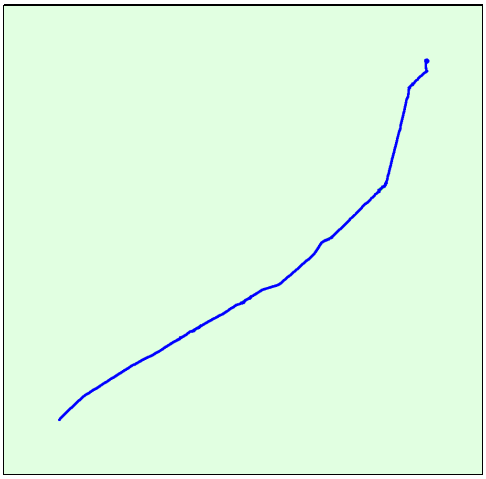


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled or uncalibrated images.

Bundle Block Adjustment Details

Number of 2D Keypoint Observations for Bundle Block Adjustment	30712084
Number of 3D Points for Bundle Block Adjustment	7158048
Mean Reprojection Error [pixels]	0.089

Internal Camera Parameters

_0.0_4096x3000 (RGB)(1). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4654.214 [pixel] 16.020 [mm]	2066.885 [pixel] 7.114 [mm]	1506.707 [pixel] 5.186 [mm]	-0.059	0.162	0.121	-0.000	-0.000

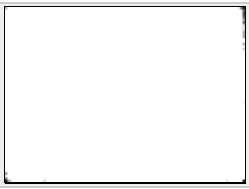
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(2). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4660.307 [pixel] 16.041 [mm]	2069.134 [pixel] 7.122 [mm]	1509.170 [pixel] 5.195 [mm]	-0.058	0.162	0.119	-0.000	-0.000



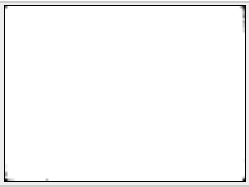
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(3). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4658.181 [pixel] 16.033 [mm]	2062.302 [pixel] 7.098 [mm]	1506.225 [pixel] 5.184 [mm]	-0.059	0.163	0.117	-0.000	-0.000



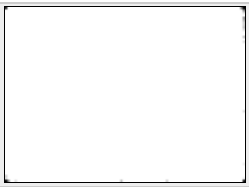
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(4). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4658.763 [pixel] 16.035 [mm]	2067.988 [pixel] 7.118 [mm]	1507.776 [pixel] 5.190 [mm]	-0.058	0.164	0.114	0.000	-0.000



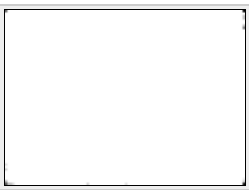
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(5). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4659.650 [pixel] 16.039 [mm]	2069.346 [pixel] 7.123 [mm]	1509.565 [pixel] 5.196 [mm]	-0.059	0.166	0.110	0.000	-0.000



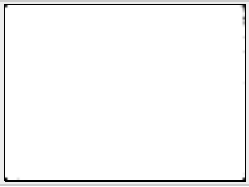
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(6). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4661.924 [pixel] 16.046 [mm]	2066.960 [pixel] 7.114 [mm]	1508.171 [pixel] 5.191 [mm]	-0.059	0.170	0.109	0.000	-0.000



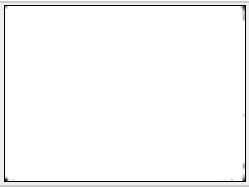
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(7). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4666.953 [pixel] 16.064 [mm]	2064.250 [pixel] 7.105 [mm]	1511.431 [pixel] 5.202 [mm]	-0.060	0.170	0.103	-0.000	-0.000



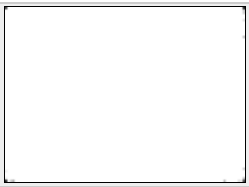
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(8). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4676.563 [pixel] 16.097 [mm]	2058.125 [pixel] 7.084 [mm]	1520.402 [pixel] 5.233 [mm]	-0.060	0.170	0.108	-0.000	-0.000



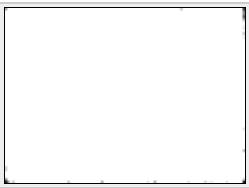
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(9). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4673.820 [pixel] 16.087 [mm]	2056.553 [pixel] 7.079 [mm]	1519.845 [pixel] 5.231 [mm]	-0.060	0.168	0.115	-0.000	-0.000



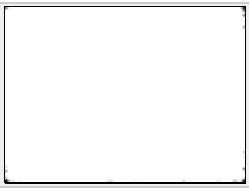
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

_0.0_4096x3000 (RGB)(10). Sensor Dimensions: 14.098 [mm] x 10.326 [mm]

EXIF ID: _0.0_4096x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	4628.120 [pixel] 15.930 [mm]	2030.120 [pixel] 6.988 [mm]	1503.230 [pixel] 5.174 [mm]	-0.063	0.208	-0.023	-0.000	-0.000
Optimized Values	4676.473 [pixel] 16.096 [mm]	2056.223 [pixel] 7.078 [mm]	1520.590 [pixel] 5.234 [mm]	-0.060	0.169	0.115	-0.000	-0.000



The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3626	1515
Min	552	27
Max	5865	4102
Mean	3528	1536

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(1)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3715	2014
Min	552	27
Max	5371	4102
Mean	3643	1988

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(2)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3366	1468
Min	1489	373
Max	5107	2946
Mean	3395	1499

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(3)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3347	1484
Min	1453	260
Max	5140	3521
Mean	3380	1506

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(4)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3581	1569
Min	1557	421
Max	5865	3176
Mean	3555	1582

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(5)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3527	1515
Min	1396	353
Max	5604	3907
Mean	3433	1543

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(6)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3558	1687
Min	1343	310
Max	5487	3736
Mean	3523	1667

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(7)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3935	1637
Min	2686	311
Max	5104	2968
Mean	3900	1649

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(8)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3634	1427
Min	1305	157

Max	4924	2786
Mean	3419	1404

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(9)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3792	1191
Min	1314	151
Max	5260	2902
Mean	3562	1241

2D Keypoints Table for Camera _0.0_4096x3000 (RGB)(10)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	3500	1236
Min	1275	115
Max	4846	2836
Mean	3467	1285

Median / 75% / Maximal Number of Matches Between Camera Models

	_0.0_4096x3000 (RGB)(1)	_0.0_4096x3000 (RGB)(2)	_0.0_4096x3000 (RGB)(3)	_0.0_4096x3000 (RGB)(4)	_0.0_4096x3000 (RGB)(5)	_0.0_4096x3000 (RGB)(6)	_0.0_4096x3000 (RGB)(7)	_0.0_4096x3000 (RGB)(8)	_0.0_40 (RGB)(9
_0.0_4096x3000 (RGB)(1)	202 / 501 / 2990								
_0.0_4096x3000 (RGB)(2)		169 / 370 / 1933							
_0.0_4096x3000 (RGB)(3)			132 / 319 / 2354						
_0.0_4096x3000 (RGB)(4)				135 / 332 / 2148					
_0.0_4096x3000 (RGB)(5)					143 / 335 / 2644				
_0.0_4096x3000 (RGB)(6)						135 / 337 / 2266			
_0.0_4096x3000 (RGB)(7)							90 / 252 / 2156		
_0.0_4096x3000 (RGB)(8)								103 / 293 / 1773	
_0.0_4096x3000 (RGB)(9)									88 / 243
_0.0_4096x3000 (RGB)(10)									

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	3011395
In 3 Images	1261683
In 4 Images	753826
In 5 Images	464693
In 6 Images	362242
In 7 Images	293599
In 8 Images	252378
In 9 Images	173684
In 10 Images	122379
In 11 Images	86859
In 12 Images	72813
In 13 Images	62254
In 14 Images	66146
In 15 Images	49827
In 16 Images	52566
In 17 Images	24340
In 18 Images	20863
In 19 Images	7339
In 20 Images	5130
In 21 Images	3087
In 22 Images	2330
In 23 Images	1780
In 24 Images	1406
In 25 Images	1015
In 26 Images	868
In 27 Images	575
In 28 Images	544
In 29 Images	474
In 30 Images	457
In 31 Images	366
In 32 Images	361
In 33 Images	266
In 34 Images	220
In 35 Images	105
In 36 Images	59
In 37 Images	43

In 38 Images	24
In 39 Images	19
In 40 Images	11
In 41 Images	10
In 42 Images	4
In 43 Images	3
In 44 Images	4
In 45 Images	1

2D Keypoint Matches

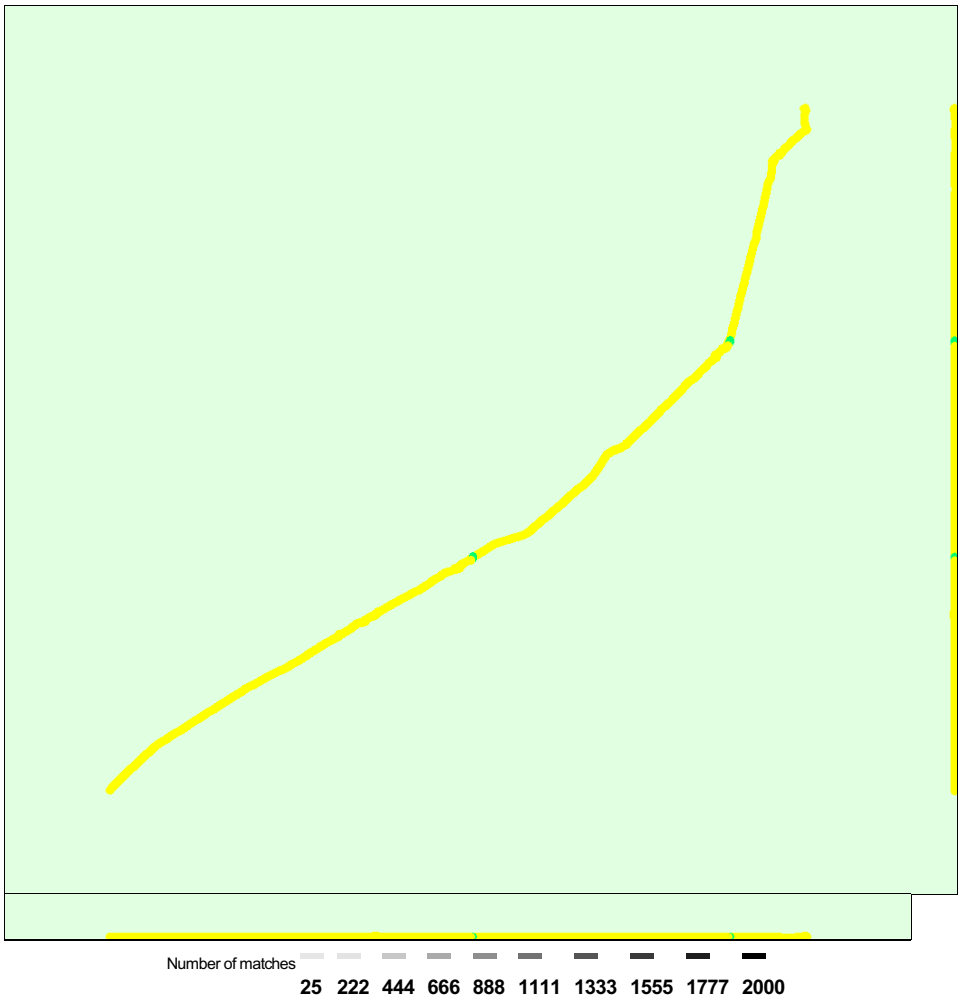


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.00	0.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	0.00	0.00	0.04
-9.00	-6.00	0.00	0.00	0.16
-6.00	-3.00	0.00	0.00	0.39
-3.00	0.00	53.19	44.98	47.40
0.00	3.00	46.81	55.02	51.66
3.00	6.00	0.00	0.00	0.27
6.00	9.00	0.00	0.00	0.07
9.00	12.00	0.00	0.00	0.04
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		-0.011362	0.011667	0.012800
Sigma [m]		0.383742	0.556792	0.853548
RMS Error [m]		0.383910	0.556914	0.853644

Min Error and Max Error represent geolocation error intervals between -1.5 and 1.5 times the maximum accuracy of all the images. Columns X, Y, Z show the percentage of images with geolocation errors within the predefined error intervals. The geolocation error is the difference between the initial and computed image positions. Note that the image geolocation errors do not correspond to the accuracy of the observed 3D points.

Relative Geolocation Variance

Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	100.00	100.00	99.97
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
Mean of Geolocation Accuracy [m]	5.000000	5.000000	10.000000
Sigma of Geolocation Accuracy [m]	0.000000	0.000000	0.000000

Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

Initial Processing Details

System Information

Hardware	CPU: AMD Ryzen 9 5950X 16-Core Processor RAM: 64GB GPU: NVIDIA GeForce RTX 2080 Ti (Driver: 30.0.14.7212)
Operating System	Windows 10 Home, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 18N (EGM96 Geoid)

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Rapid, Image Scale: 0.25
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Standard Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, no

Point Cloud Densification details

Processing Options

Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Low (Fast)
Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: no
LOD	Generated: no
Advanced: 3D Textured Mesh Settings	Sample Density Divider: 1
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes

Results

Number of Generated Tiles	7
Number of 3D Densified Points	372681247
Average Density (per m^3)	7.9

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (4.49 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: no