

Quality Report



Generated with Pix4Ddiscovery version 4.5.2 Preview



Important: Click on the different icons for:



Help to analyze the results in the Quality Report



Additional information about the sections



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Summary



Project	RGB zenmuse 4s
Processed	2019-10-29 17:05:41
Camera Model Name(s)	FC6510_8.8_5472x3648 (RGB)(1), FC6510_8.8_5472x3648 (RGB)(2), XT2_13.0_640x512 (Grayscale)
Average Ground Sampling Distance (GSD)	3.22 cm / 1.27 in
Area Covered	0.000 km ² / 0.0000 ha / 0.00 sq. mi. / 0.0001 acres

Quality Check



Images	median of 63443 keypoints per image	
Dataset	331 out of 331 images calibrated (100%), all images enabled	
Camera Optimization	150.76% relative difference between initial and optimized internal camera parameters	
Matching	median of 19879.5 matches per calibrated image	
Georeferencing	yes, 12 GCPs (12 3D), mean RMS error = 0.031 m	

Preview

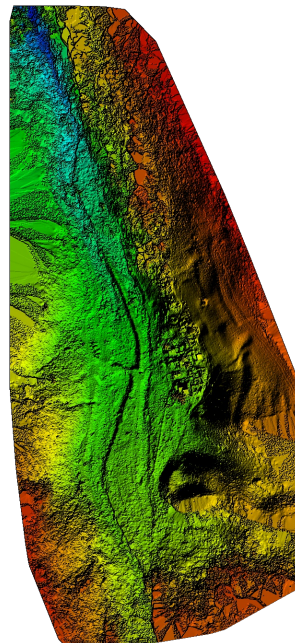


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details



Number of Calibrated Images	331 out of 331
Number of Geolocated Images	331 out of 331

Initial Image Positions

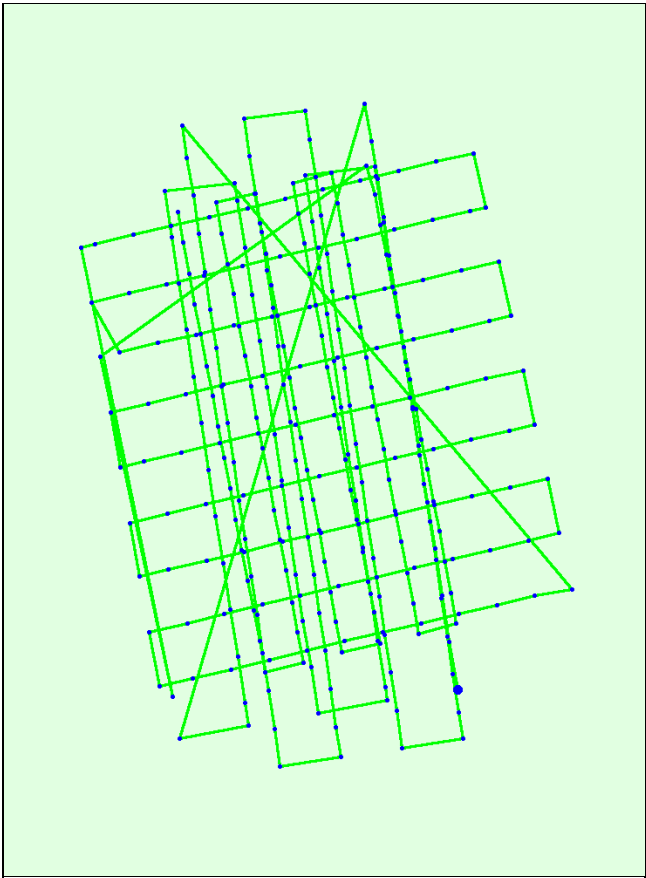
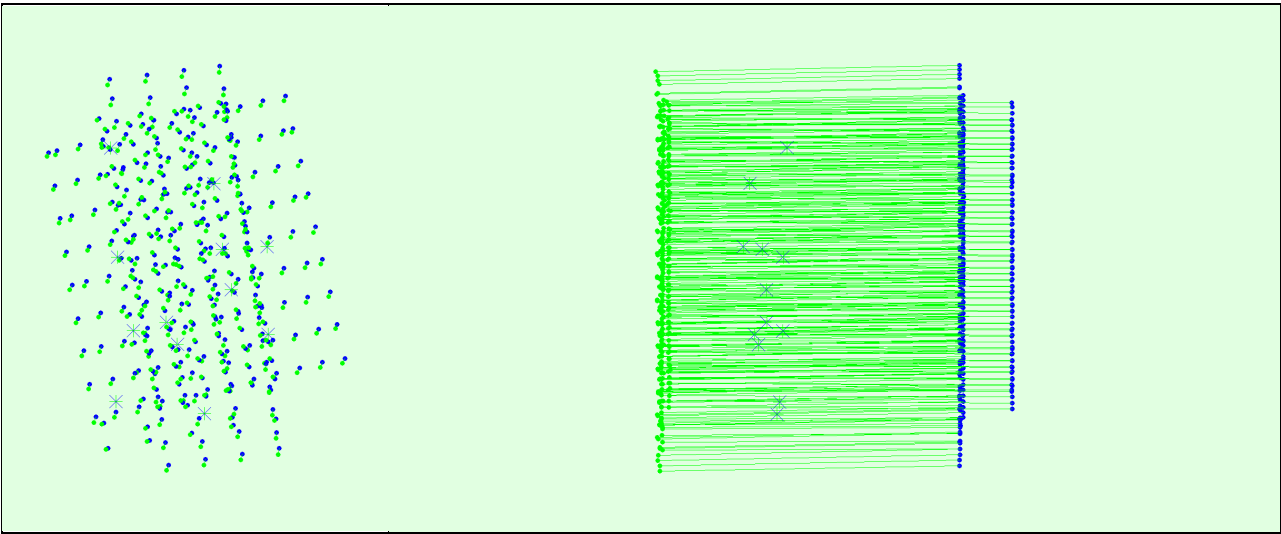


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



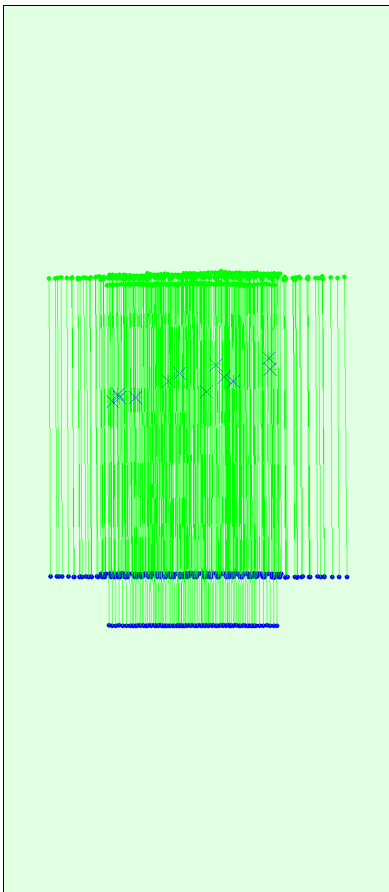


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane).

Overlap

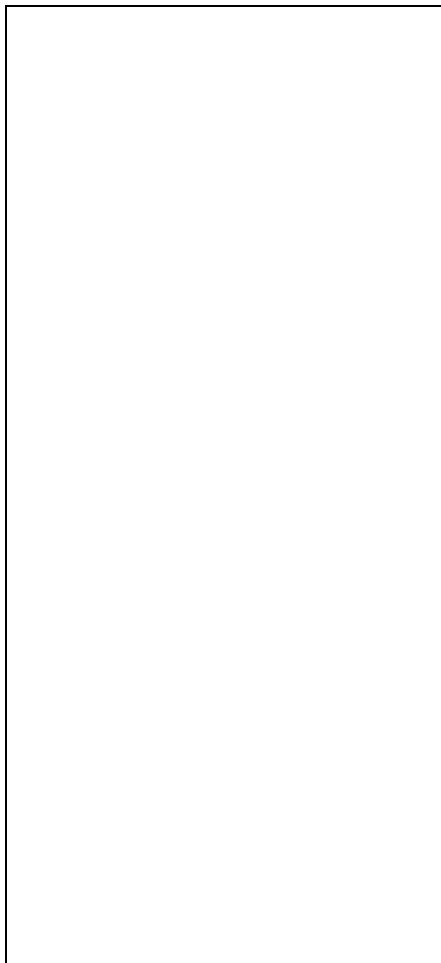




Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint matches is also sufficient for these areas (see Figure 5 for keypoint matches).

Bundle Block Adjustment Details

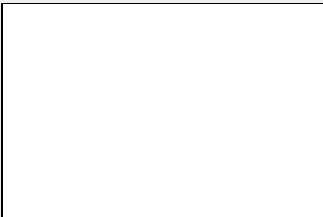
Number of 2D Keypoint Observations for Bundle Block Adjustment	6489350
Number of 3D Points for Bundle Block Adjustment	2419304
Mean Reprojection Error [pixels]	0.157

Internal Camera Parameters

FC6510_8.8_5472x3648 (RGB)(1). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6510_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3689.447 [pixel] 8.653 [mm]	2730.905 [pixel] 6.405 [mm]	1829.687 [pixel] 4.291 [mm]	0.003	-0.011	0.011	0.001	0.001
Optimized Values	3683.037 [pixel] 8.638 [mm]	2727.989 [pixel] 6.398 [mm]	1860.335 [pixel] 4.363 [mm]	0.008	-0.012	0.011	0.001	0.001



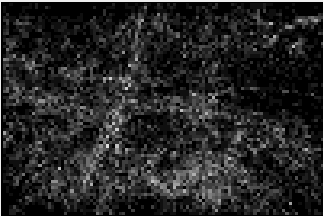
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to 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

FC6510_8.8_5472x3648 (RGB)(2). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6510_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3689.447 [pixel] 8.653 [mm]	2730.905 [pixel] 6.405 [mm]	1829.687 [pixel] 4.291 [mm]	0.003	-0.011	0.011	0.001	0.001
Optimized Values	3688.051 [pixel] 8.649 [mm]	2724.688 [pixel] 6.390 [mm]	1859.032 [pixel] 4.360 [mm]	0.008	-0.013	0.013	0.001	0.001



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 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.

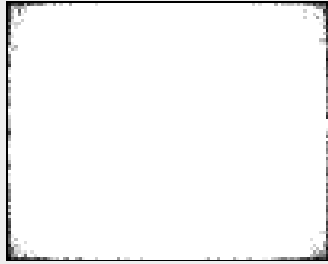
Internal Camera Parameters

XT2_13.0_640x512 (Grayscale). Sensor Dimensions: 58.824 [mm] x 47.059 [mm]

EXIF ID: XT2_13.0_640x512

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
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Initial Values	141.440 [pixel] 13.000 [mm]	320.000 [pixel] 29.412 [mm]	256.000 [pixel] 23.529 [mm]	0.000	0.000	0.000	0.000	0.000
Optimized Values	780.879 [pixel] 71.772 [mm]	317.085 [pixel] 29.144 [mm]	257.942 [pixel] 23.708 [mm]	-0.048	0.465	-0.058	-0.001	-0.001



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 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	63443	19880
Mn	8185	3324
Max	79981	39004
Mean	51250	19605

2D Keypoints Table for Camera FC6510_8.8_5472x3648 (RGB)(1)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	68809	25218
Mn	53304	8554
Max	79981	39004
Mean	68306	25360

2D Keypoints Table for Camera FC6510_8.8_5472x3648 (RGB)(2)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	59162	0
Mn	55240	16213
Max	59162	24483
Mean	57201	20348

2D Keypoints Table for Camera XT2_13.0_640x512 (Grayscale)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	9749	5785
Mn	8185	3324
Max	12252	8302
Mean	9728	5622

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

	FC6510_8.8_5...(RGB)(1)	FC6510_8.8_5...(RGB)(2)	XT2_13.0_...(Grayscale)
FC6510_8.8_5472x3648 (RGB)(1)	61 / 341 / 32981	56 / 193 / 20579	
FC6510_8.8_5472x3648 (RGB)(2)			
XT2_13.0_640x512 (Grayscale)			350 / 972 / 4041

? 3D Points from 2D Keypoint Matches



	Number of 3D Points Observed
In 2 Images	1685047
In 3 Images	389861
In 4 Images	151853
In 5 Images	73524

In 6 Images	42490
In 7 Images	24511
In 8 Images	16502
In 9 Images	11031
In 10 Images	7066
In 11 Images	4849
In 12 Images	3604
In 13 Images	2186
In 14 Images	1536
In 15 Images	1191
In 16 Images	859
In 17 Images	580
In 18 Images	509
In 19 Images	391
In 20 Images	317
In 21 Images	228
In 22 Images	224
In 23 Images	181
In 24 Images	134
In 25 Images	110
In 26 Images	110
In 27 Images	92
In 28 Images	83
In 29 Images	42
In 30 Images	39
In 31 Images	26
In 32 Images	42
In 33 Images	16
In 34 Images	14
In 35 Images	11
In 36 Images	8
In 37 Images	9
In 38 Images	5
In 39 Images	3
In 40 Images	3
In 41 Images	2
In 42 Images	1
In 43 Images	1
In 44 Images	2
In 45 Images	2
In 46 Images	3
In 47 Images	2
In 48 Images	3
In 51 Images	1

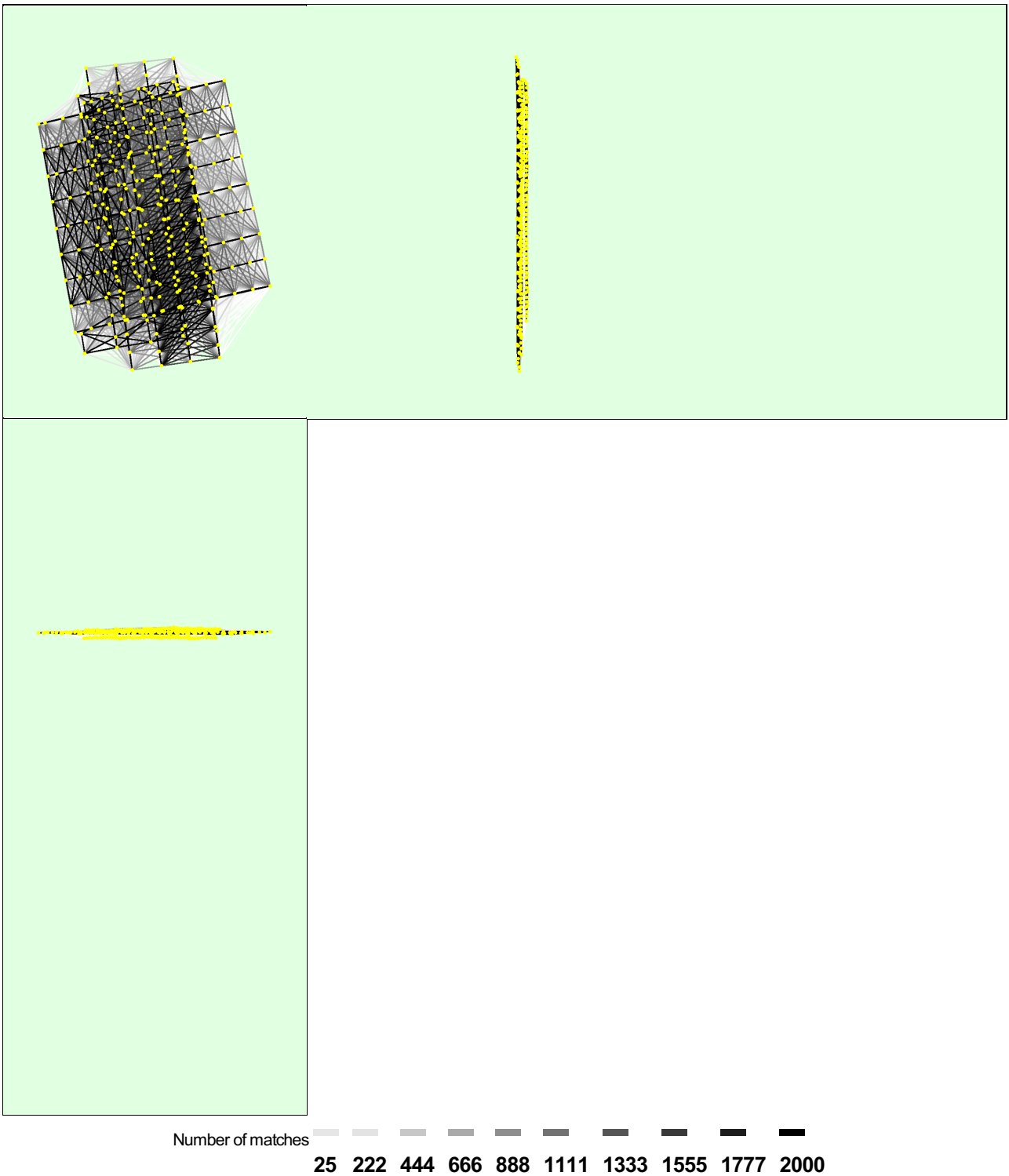


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Ground Control Points

GCP Name	Accuracy XY/Z [m]	Error X [m]	Error Y [m]	Error Z [m]	Projection Error [pixel]	Verified/Marked
ft348 (3D)	0.020/ 0.020	0.072	-0.022	0.041	0.171	2 / 2
ft349 (3D)	0.020/ 0.020	0.158	0.080	0.043	0.860	3 / 3
MA202 (3D)	0.020/ 0.020	0.034	0.003	0.035	0.599	14 / 14
MA204 (3D)	0.020/ 0.020	0.017	0.013	0.031	0.428	9 / 9

MA205 (3D)	0.020/ 0.020	0.024	0.004	0.046	0.490	10 / 10
MA206 (3D)	0.020/ 0.020	0.011	-0.002	0.018	0.602	11 / 11
MA210 (3D)	0.020/ 0.020	0.016	0.006	0.011	0.580	15 / 15
MB207 (3D)	0.020/ 0.020	0.020	0.006	-0.029	0.087	3 / 3
MG201 (3D)	0.020/ 0.020	0.003	-0.006	0.032	0.363	10 / 10
MG203 (3D)	0.020/ 0.020	-0.006	0.014	0.003	0.260	8 / 8
MG208 (3D)	0.020/ 0.020	-0.006	-0.014	-0.036	0.306	7 / 7
MG209 (3D)	0.020/ 0.020	0.026	0.013	0.007	0.674	6 / 6
Mean [m]		0.030767	0.007936	0.016692		
Sigma [m]		0.043130	0.024062	0.025969		
RMS Error [m]		0.052979	0.025337	0.030871		

Localisation accuracy per GCP and mean errors in the three coordinate directions. The last column counts the number of calibrated images where the GCP has been automatically verified v.s. manually marked.

? Absolute Geolocation Variance



Mn Error [m]	Max Error [m]	Geolocation Error X[%]	Geolocation Error Y[%]	Geolocation Error Z[%]
-	-15.00	0.00	0.00	100.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	0.00	0.00	0.00
-9.00	-6.00	0.00	0.00	0.00
-6.00	-3.00	0.00	0.00	0.00
-3.00	0.00	0.00	29.00	0.00
0.00	3.00	100.00	71.00	0.00
3.00	6.00	0.00	0.00	0.00
6.00	9.00	0.00	0.00	0.00
9.00	12.00	0.00	0.00	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		0.815317	1.129564	-138.657900
Sigma [m]		0.163228	1.386991	8.648448
RMS Error [m]		0.831495	1.788759	138.927351

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	0.00
[-2.00, 2.00]	100.00	100.00	0.00
[-3.00, 3.00]	100.00	100.00	0.00
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.

Geolocation Orientational Variance	RMS [degree]
Omega	8.855
Phi	3.023
Kappa	4.048

Geolocation RMS error of the orientation angles given by the difference between the initial and computed image orientation angles.

Initial Processing Details



System Information



Hardware	CPU: Intel(R) Core(TM) i7-4700HQ CPU @ 2.40GHz RAM: 16GB GPU: Intel(R) HD Graphics 4600 (Driver: 20.19.15.4549)
Operating System	Windows 10 Home, 64-bit

Coordinate Systems



Image Coordinate System	WGS 84 (EGM96 Geoid)
Ground Control Point (GCP) Coordinate System	WGS 84 / UTM zone 32N (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 32N (EGM96 Geoid)

Processing Options



Detected Template	3D Maps
Keypoints Image Scale	Full, Image Scale: 1
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, yes

Point Cloud Densification details



Processing Options



Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Optimal
Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: High Resolution 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
Time for Point Cloud Densification	01h:42m:25s
Time for Point Cloud Classification	NA
Time for 3D Textured Mesh Generation	36m:20s

Results



Number of Generated Tiles	1
Number of 3D Densified Points	28621592
Average Density (per m ³)	238.9

DSM, Orthomosaic and Index Details



Processing Options



DSM and Orthomosaic Resolution	1 x GSD (3.22 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: no
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Grid DSM	Generated: yes, Spacing [cm]: 100
Time for DSM Generation	39m:59s
Time for Orthomosaic Generation	34m:03s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s