Quality Report

Generated with Pix4Dmapper version 4.3.31

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	eldo_3k_3_re
Processed	2018-12-28 17:27:07
Camera Model Name(s)	RedEdge_5.5_1280x960 (Blue), RedEdge_5.5_1280x960 (Green), RedEdge_5.5_1280x960 (Red), RedEdge_5.5_1280x960 (NIR), RedEdge_5.5_1280x960 (Red edge)
Rig name(s)	«MicaSense 5 band_merge_eldo_3k_1_re_merge_eldo_3k_1_re_merge_eldo_3k_2_re»
Average Ground Sampling Distance (GSD)	8.81 cm / 3.47 in
Area Covered	0.583 km^2 / 58.3070 ha / 0.23 sq. mi. / 144.1544 acres
Time for Initial Processing (without report)	07h:04m:21s

Quality Check

Images	median of 7259 keypoints per image	⚠
Dataset	11270 out of 11315 images calibrated (99%), all images enabled	✓
Camera Optimization	1.38% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 1333.49 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

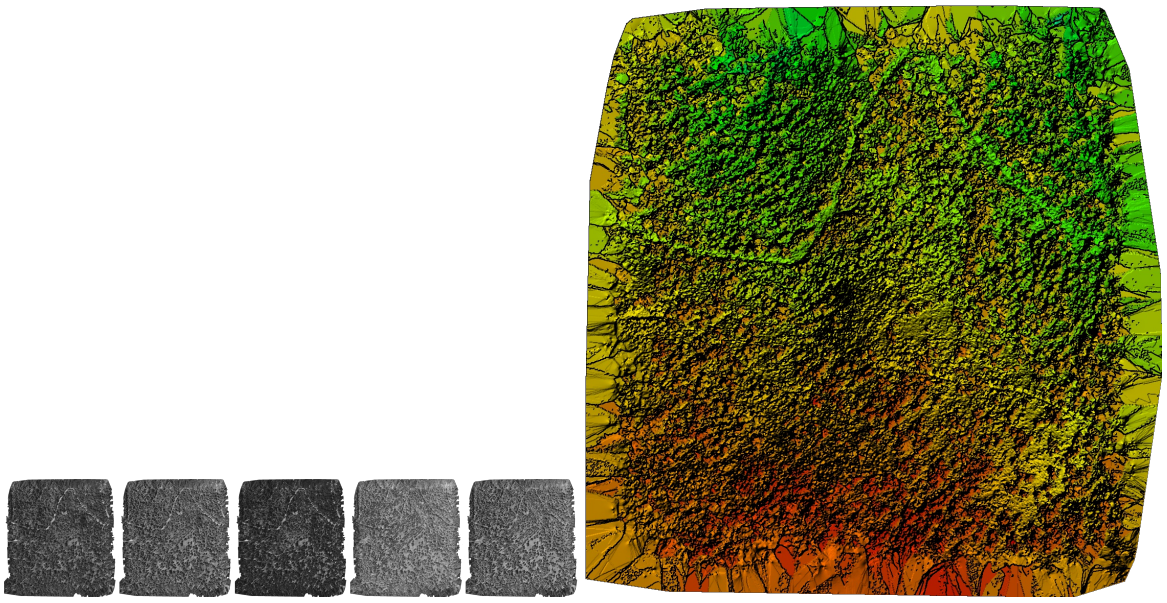


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11270 out of 11315
Number of Geolocated Images	11315 out of 11315

Initial Image Positions

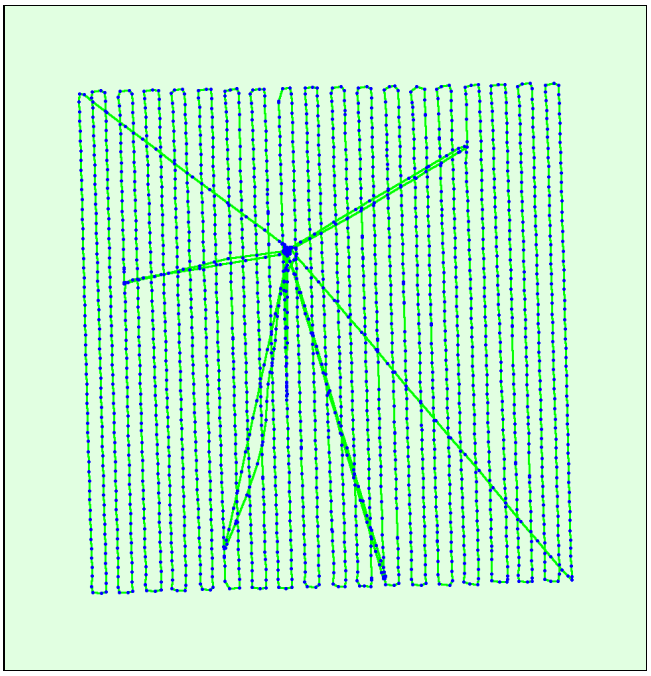
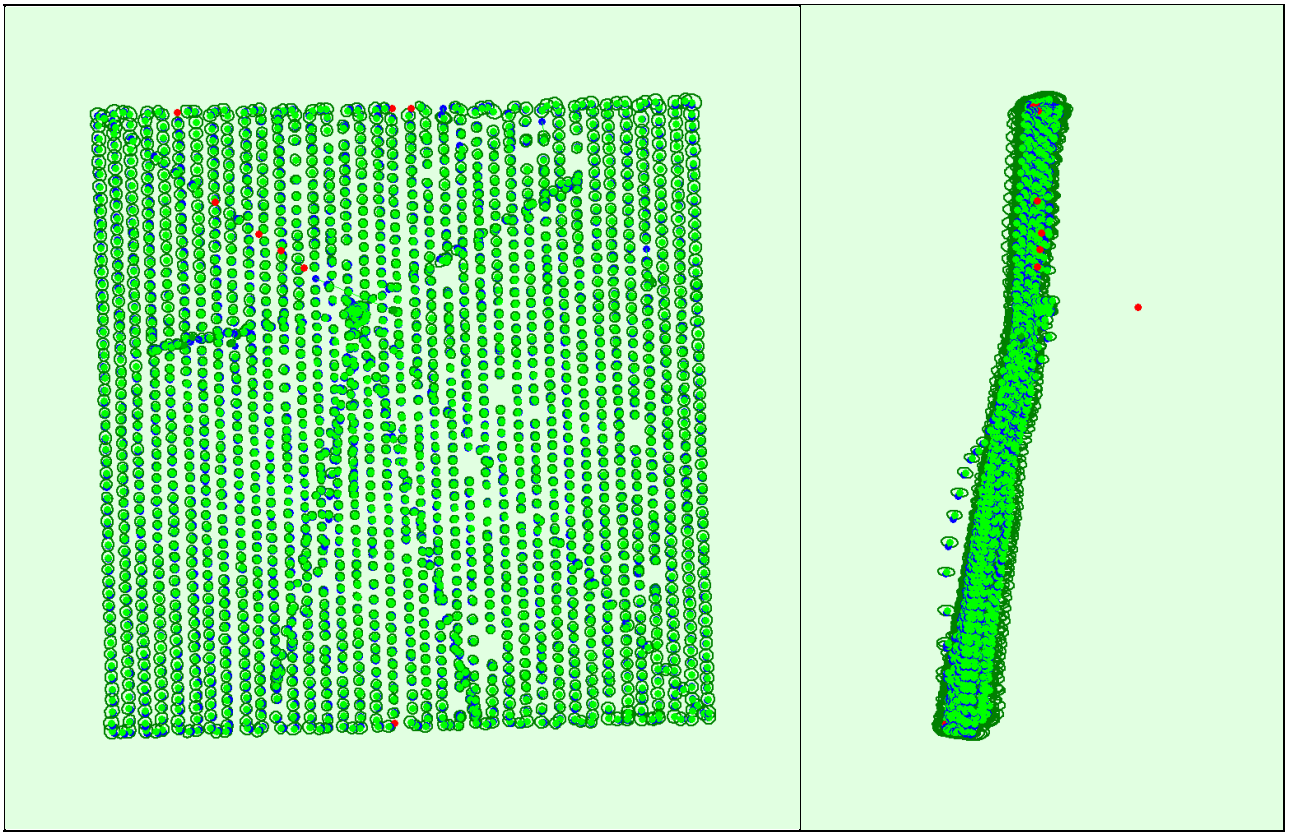
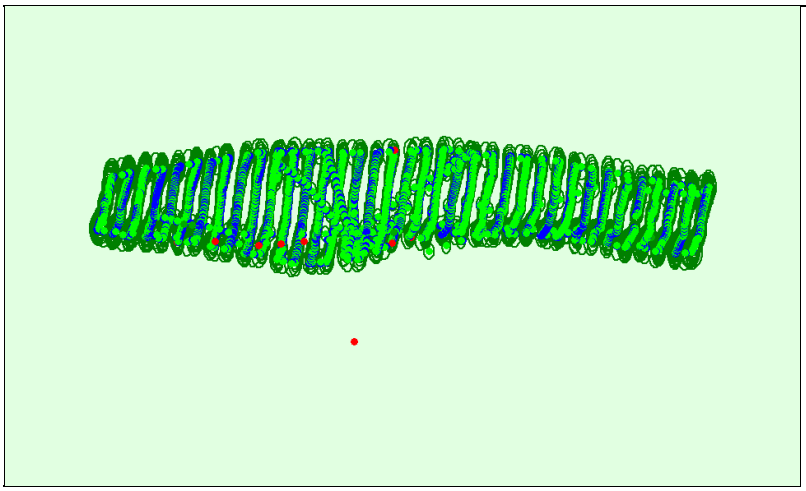


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions





Uncertainty ellipses 50x magnified

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. Dark green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.

Absolute camera position and orientation uncertainties

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.099	0.101	0.211	0.048	0.048	0.019
Sigma	0.018	0.017	0.047	0.006	0.005	0.005

Overlap

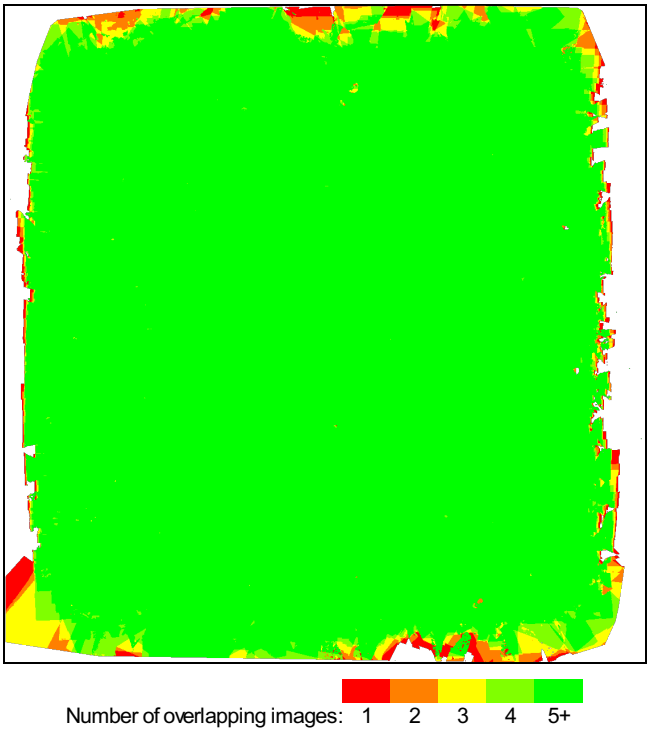


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	4751181

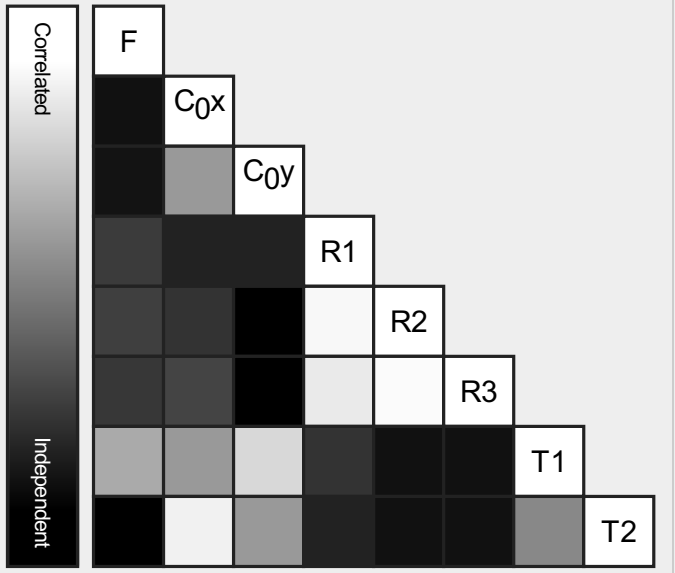
Number of 3D Points for Bundle Block Adjustment	1566407
Mean Reprojection Error [pixels]	0.200

Internal Camera Parameters

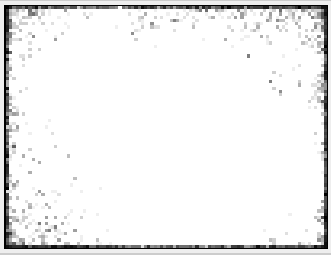
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.605 [pixel] 2.466 [mm]	495.123 [pixel] 1.857 [mm]	-0.097	0.149	-0.017	0.000	0.000
Optimized Values	1446.104 [pixel] 5.423 [mm]	653.522 [pixel] 2.451 [mm]	494.936 [pixel] 1.856 [mm]	-0.098	0.156	-0.041	0.000	-0.000
Uncertainties (Sigma)	0.286 [pixel] 0.001 [mm]	0.231 [pixel] 0.001 [mm]	0.174 [pixel] 0.001 [mm]	0.001	0.011	0.026	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



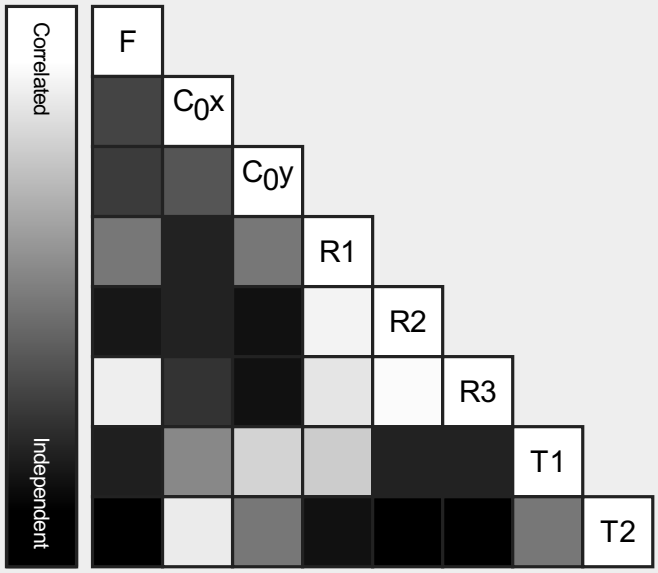
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

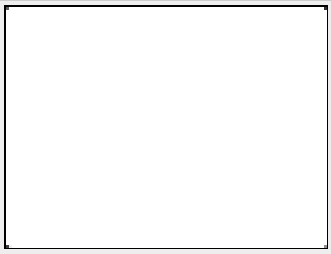
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.835 [pixel] 2.467 [mm]	481.299 [pixel] 1.805 [mm]	-0.099	0.143	-0.021	0.000	0.001
Optimized Values	1442.774 [pixel] 5.410 [mm]	655.839 [pixel] 2.459 [mm]	481.418 [pixel] 1.805 [mm]	-0.097	0.128	0.011	0.000	0.000
Uncertainties (Sigma)	0.274 [pixel] 0.001 [mm]	0.077 [pixel] 0.000 [mm]	0.062 [pixel] 0.000 [mm]	0.000	0.004	0.008	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



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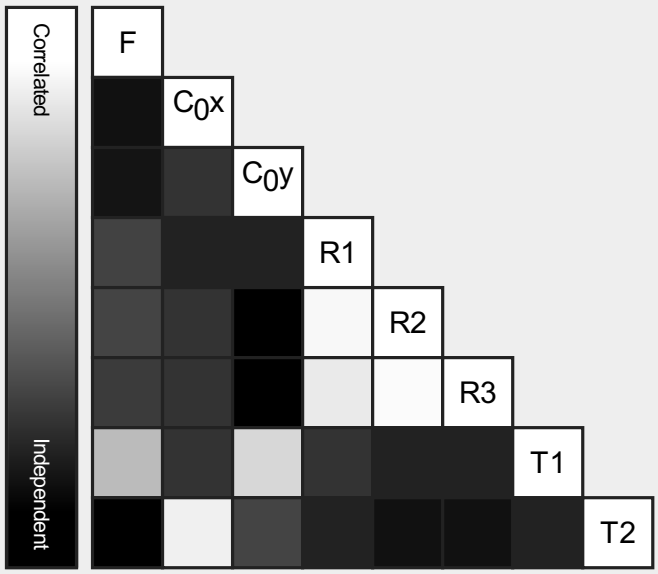
Internal Camera Parameters

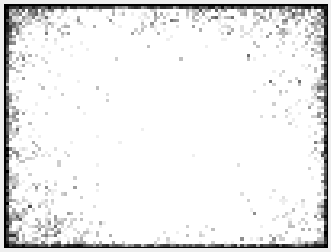
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	657.200 [pixel] 2.465 [mm]	493.864 [pixel] 1.852 [mm]	-0.100	0.131	-0.003	-0.000	0.000
Optimized Values	1448.037 [pixel] 5.430 [mm]	652.955 [pixel] 2.449 [mm]	493.466 [pixel] 1.850 [mm]	-0.098	0.127	-0.006	-0.000	-0.000
Uncertainties (Sigma)	0.288 [pixel] 0.001 [mm]	0.251 [pixel] 0.001 [mm]	0.190 [pixel] 0.001 [mm]	0.002	0.012	0.028	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



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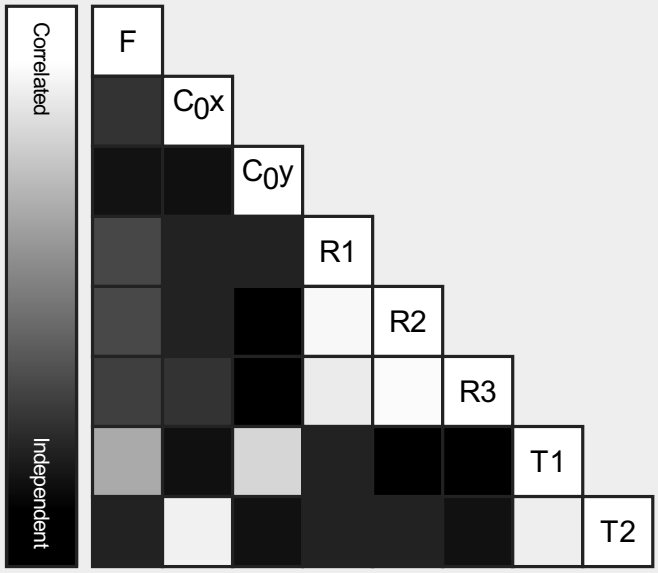
Internal Camera Parameters

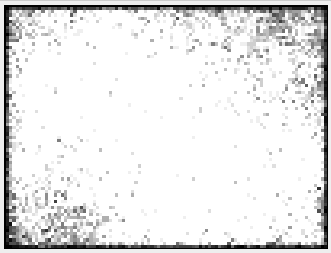
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	666.605 [pixel] 2.500 [mm]	482.221 [pixel] 1.808 [mm]	-0.105	0.153	-0.045	0.000	0.000
Optimized Values	1448.586 [pixel] 5.432 [mm]	661.327 [pixel] 2.480 [mm]	481.859 [pixel] 1.807 [mm]	-0.103	0.147	-0.036	0.000	-0.000
Uncertainties (Sigma)	0.290 [pixel] 0.001 [mm]	0.260 [pixel] 0.001 [mm]	0.195 [pixel] 0.001 [mm]	0.002	0.013	0.028	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



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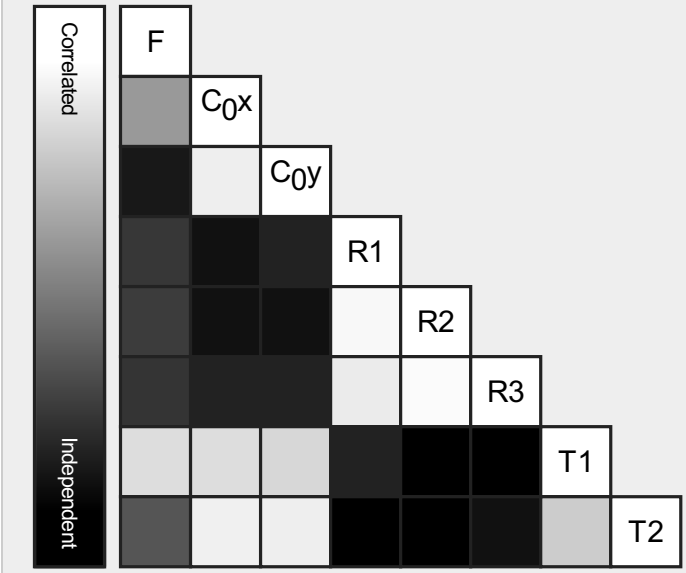
Internal Camera Parameters

RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: RedEdge_5.5_1280x960

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	1466.667 [pixel] 5.500 [mm]	661.440 [pixel] 2.480 [mm]	495.379 [pixel] 1.858 [mm]	-0.103	0.155	-0.049	0.000	0.001
Optimized Values	1446.197 [pixel] 5.423 [mm]	656.851 [pixel] 2.463 [mm]	493.962 [pixel] 1.852 [mm]	-0.100	0.138	-0.018	0.000	-0.000
Uncertainties (Sigma)	0.285 [pixel] 0.001 [mm]	0.211 [pixel] 0.001 [mm]	0.160 [pixel] 0.001 [mm]	0.001	0.011	0.024	0.000	0.000



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Camera Rig «MicaSense 5 band_merge_eldo_3k_1_re_merge_eldo_3k_1_re_merge_eldo_3k_2_re» Relatives. Images: 11315

	Transl X [m]	Transl Y [m]	Transl Z [m]	Rot X [degree]	Rot Y [degree]	Rot Z [degree]
RedEdge_5.5_1280x960 (Green)	Reference Camera					
RedEdge_5.5_1280x960 (Blue)						
Initial Values	0.030	0.000	0.000	0.000	0.000	0.000
Optimized values	0.030	0.000	0.000	-0.103	0.095	-0.374
Uncertainties (sigma)				0.007	0.010	0.001
RedEdge_5.5_1280x960 (Red)						
Initial Values	0.000	0.022	0.000	0.000	0.000	0.000
Optimized values	0.000	0.022	0.000	0.054	0.053	-0.062
Uncertainties (sigma)				0.008	0.010	0.001
RedEdge_5.5_1280x960 (NIR)						
Initial Values	0.030	0.022	0.000	0.000	0.000	0.000
Optimized values	0.030	0.022	0.000	-0.132	-0.167	0.118
Uncertainties (sigma)				0.008	0.011	0.001
RedEdge_5.5_1280x960 (Red edge)						
Initial Values	0.015	0.011	0.000	0.000	0.000	0.000
Optimized values	0.015	0.011	0.000	-0.061	-0.596	-0.321
Uncertainties (sigma)				0.007	0.009	0.001

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7259	1333
Min	5601	21
Max	9448	6076
Mean	7222	1501

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Blue)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image

Median	6531	1086
Min	5601	21
Max	7938	4426
Mean	6544	1233

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Green)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7307	1388
Min	5805	185
Max	9448	6076
Mean	7233	1568

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Red)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6711	1057
Min	5626	24
Max	8142	4278
Mean	6665	1199

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (NIR)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7919	1150
Min	6622	46
Max	9398	5413
Mean	7888	1388

2D Keypoints Table for Camera RedEdge_5.5_1280x960 (Red edge)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7718	1267
Min	6450	45
Max	9269	5540
Mean	7676	1516

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

	RedEdge_5.5_12... (Blue)	RedEdge_5.5_1... (Green)	RedEdge_5.5_128... (Red)	RedEdge_5.5_128... (NIR)	RedEdge_5....(Red edge)
RedEdge_5.5_1280x960 (Blue)	28 / 92 / 3413	12 / 43 / 1981	22 / 91 / 2134	8 / 38 / 935	10 / 44 / 1538
RedEdge_5.5_1280x960 (Green)		14 / 54 / 4698	10 / 31 / 1331	6 / 21 / 1923	10 / 32 / 3667
RedEdge_5.5_1280x960 (Red)			30 / 99 / 3453	12 / 36 / 660	14 / 43 / 1062
RedEdge_5.5_1280x960 (NIR)				31 / 111 / 4511	18 / 83 / 2212
RedEdge_5.5_1280x960 (Red edge)					17 / 62 / 3813

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	1036335
In 3 Images	241088
In 4 Images	107832
In 5 Images	56149

In 6 Images	34179
In 7 Images	21724
In 8 Images	15301
In 9 Images	11010
In 10 Images	8270
In 11 Images	6419
In 12 Images	4836
In 13 Images	3716
In 14 Images	3165
In 15 Images	2446
In 16 Images	2088
In 17 Images	1696
In 18 Images	1446
In 19 Images	1149
In 20 Images	1003
In 21 Images	837
In 22 Images	752
In 23 Images	655
In 24 Images	524
In 25 Images	441
In 26 Images	396
In 27 Images	352
In 28 Images	297
In 29 Images	252
In 30 Images	238
In 31 Images	192
In 32 Images	179
In 33 Images	152
In 34 Images	155
In 35 Images	107
In 36 Images	94
In 37 Images	102
In 38 Images	81
In 39 Images	69
In 40 Images	49
In 41 Images	54
In 42 Images	55
In 43 Images	40
In 44 Images	37
In 45 Images	32
In 46 Images	28
In 47 Images	23
In 48 Images	25
In 49 Images	25
In 50 Images	24
In 51 Images	18
In 52 Images	16
In 53 Images	13
In 54 Images	14
In 55 Images	16
In 56 Images	8
In 57 Images	15
In 58 Images	6
In 59 Images	4
In 60 Images	5
In 61 Images	8
In 62 Images	6
In 63 Images	8
In 64 Images	4

In 65 Images	3
In 66 Images	4
In 67 Images	7
In 68 Images	6
In 70 Images	3
In 71 Images	3
In 72 Images	2
In 73 Images	1
In 74 Images	5
In 75 Images	2
In 76 Images	2
In 77 Images	3
In 78 Images	1
In 79 Images	2
In 80 Images	3
In 81 Images	2
In 82 Images	5
In 83 Images	2
In 84 Images	2
In 85 Images	2
In 86 Images	2
In 87 Images	5
In 88 Images	2
In 89 Images	2
In 90 Images	2
In 91 Images	1
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In 93 Images	4
In 95 Images	2
In 96 Images	1
In 97 Images	1
In 98 Images	3
In 100 Images	2
In 101 Images	2
In 103 Images	1
In 104 Images	3
In 105 Images	3
In 106 Images	1
In 108 Images	4
In 110 Images	1
In 111 Images	1
In 113 Images	1
In 114 Images	3
In 115 Images	2
In 116 Images	2
In 122 Images	1
In 123 Images	1
In 124 Images	1
In 126 Images	1
In 127 Images	1
In 128 Images	3
In 129 Images	1
In 130 Images	1
In 131 Images	1
In 132 Images	1
In 133 Images	1
In 135 Images	1
In 136 Images	2
In 137 Images	1

In 142 Images	2
In 143 Images	1
In 145 Images	1
In 146 Images	2
In 147 Images	1
In 150 Images	1
In 154 Images	1
In 178 Images	1
In 190 Images	1
In 194 Images	1
In 195 Images	1
In 204 Images	1
In 220 Images	1

2D Keypoint Matches

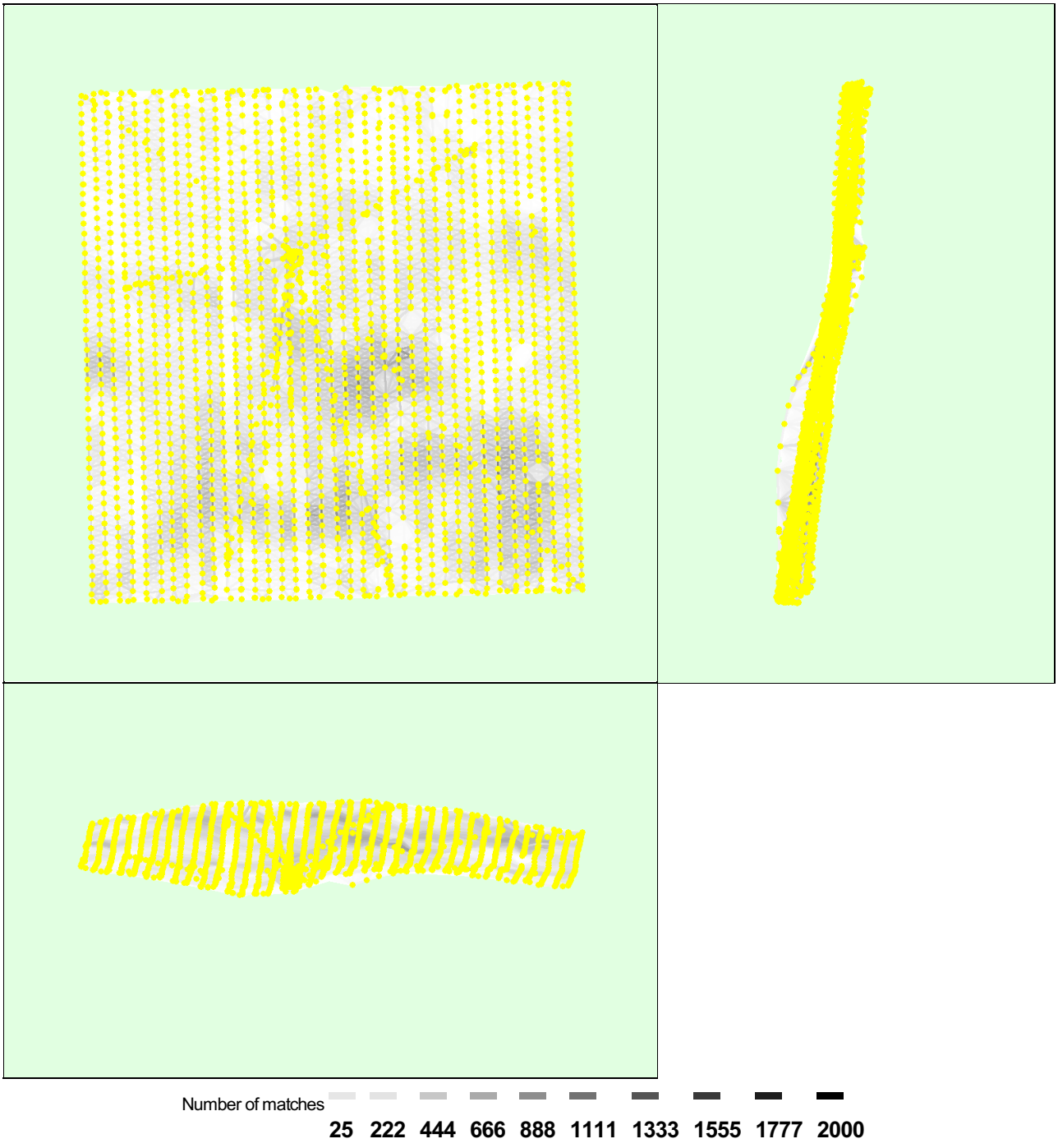

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.01	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	0.05	0.13	0.00
-3.00	0.00	52.29	50.08	50.09
0.00	3.00	47.64	49.59	49.90
3.00	6.00	0.00	0.15	0.01
6.00	9.00	0.02	0.00	0.00
9.00	12.00	0.00	0.02	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.02	0.00
Mean [m]		-0.002428	-0.020897	-0.000208
Sigma [m]		0.772733	1.129794	0.823122
RMS Error [m]		0.772737	1.129987	0.823122

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]	99.98	99.96	100.00
[-2.00, 2.00]	100.00	99.96	100.00
[-3.00, 3.00]	100.00	99.98	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: Intel(R) Core(TM) i7-8700K CPU @ 3.70GHz RAM: 64GB GPU: NVIDIA GeForce GTX 1080 Ti (Driver: 24.21.13.9882), Intel(R) UHD Graphics 630 (Driver: 22.20.16.4758)
Operating System	Windows 10 Education, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 10N (EGM96 Geoid)

Processing Options

Detected Template	Multispec local structure bark beetle severity*
Keypoints Image Scale	Custom, 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: Custom, yes
Rig «MicaSense 5 band_merge_eldo_3k_1_re_merge_eldo_3k_1_re_merge_eldo_3k_2_re» processing	optimize relative rotation using a subset of secondary cameras