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_2_re
Processed	2018-12-26 17:07:29
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»
Average Ground Sampling Distance (GSD)	8.47 cm / 3.34 in
Area Covered	0.596 km^2 / 59.6225 ha / 0.23 sq. mi. / 147.4066 acres
Time for Initial Processing (without report)	07h:15m:10s

Quality Check

Images	median of 6890 keypoints per image	⚠
Dataset	10615 out of 10650 images calibrated (99%), all images enabled	✓
Camera Optimization	1.37% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 1599.88 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

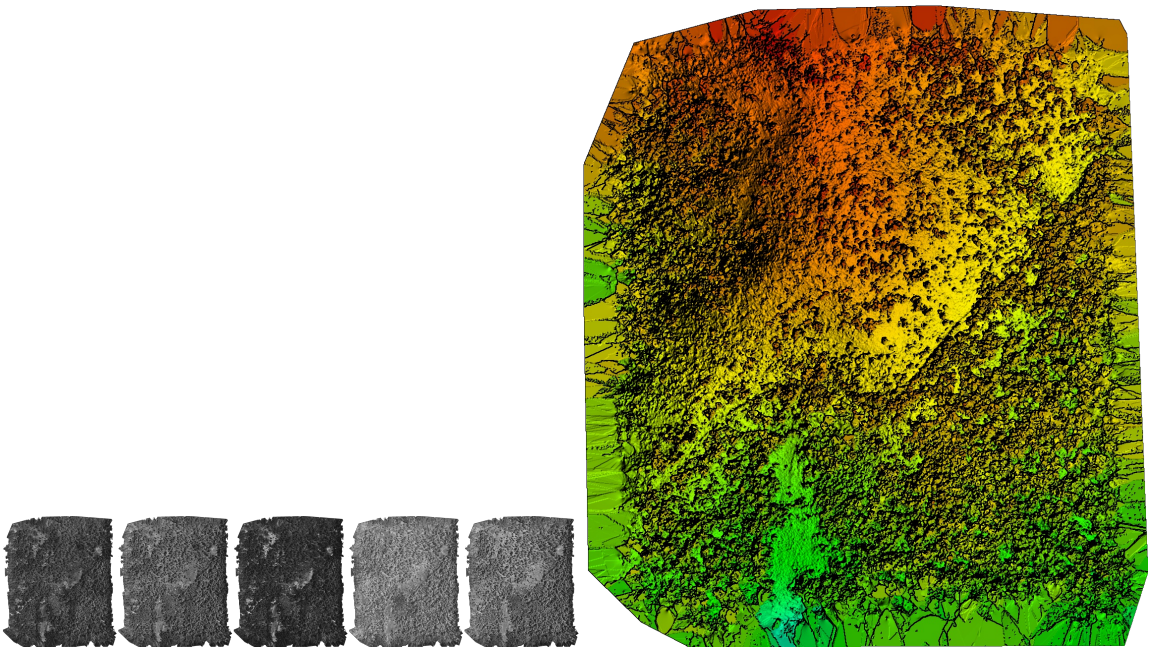


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10615 out of 10650
Number of Geolocated Images	10650 out of 10650

Initial Image Positions

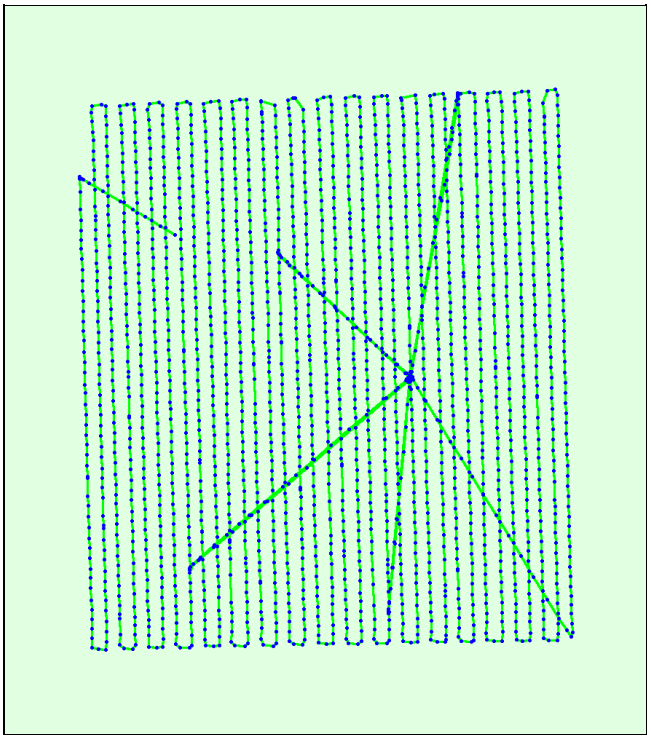


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

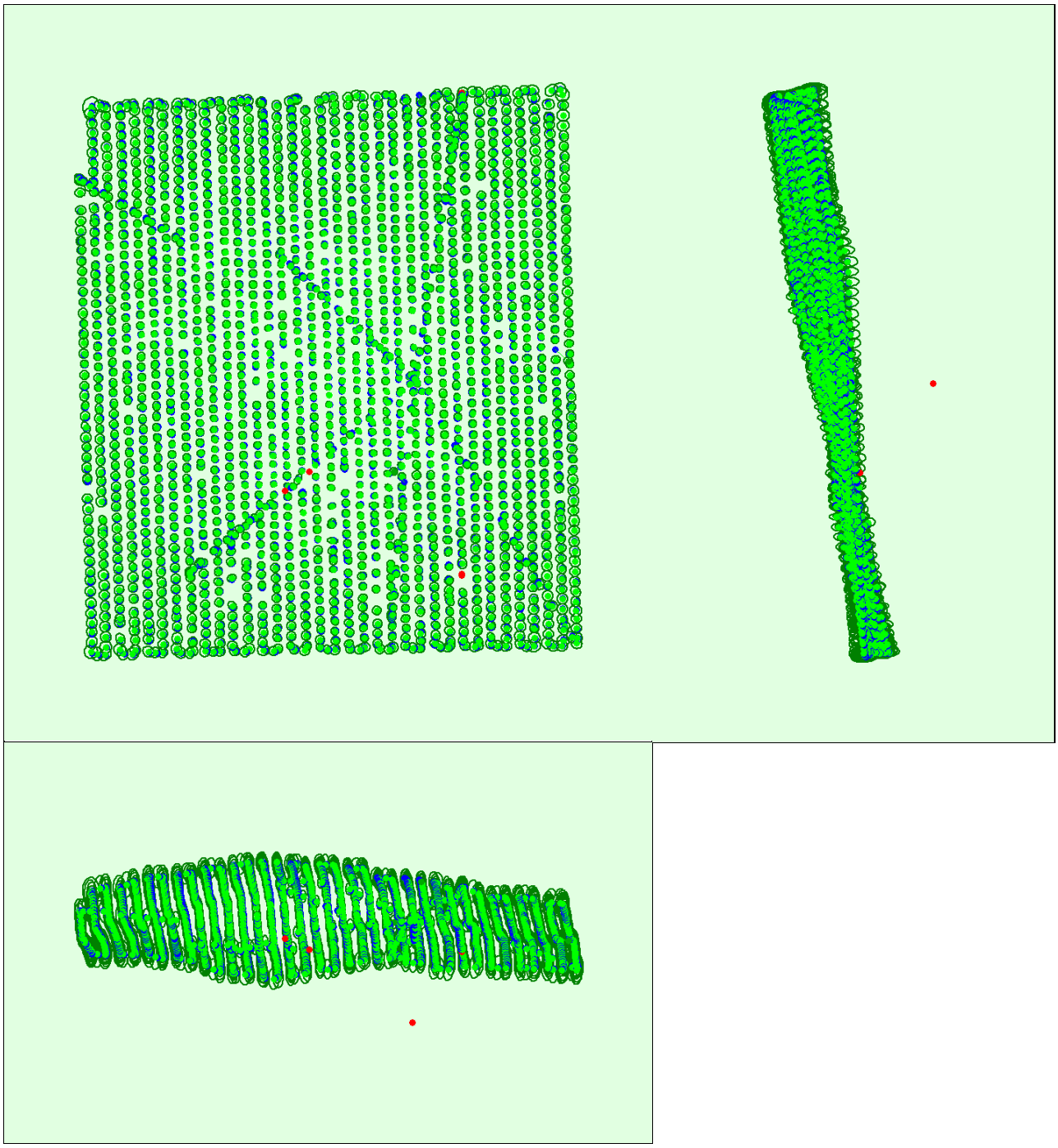


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled or uncalibrated images. 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	0.096	0.099	0.200	0.048	0.048	0.018
Sigma	0.016	0.016	0.042	0.007	0.006	0.005

Overlap

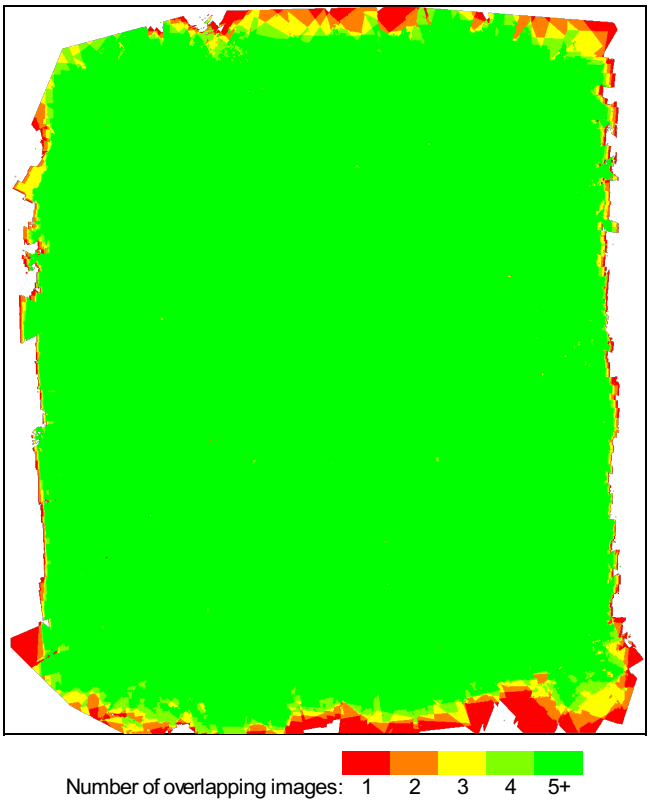


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

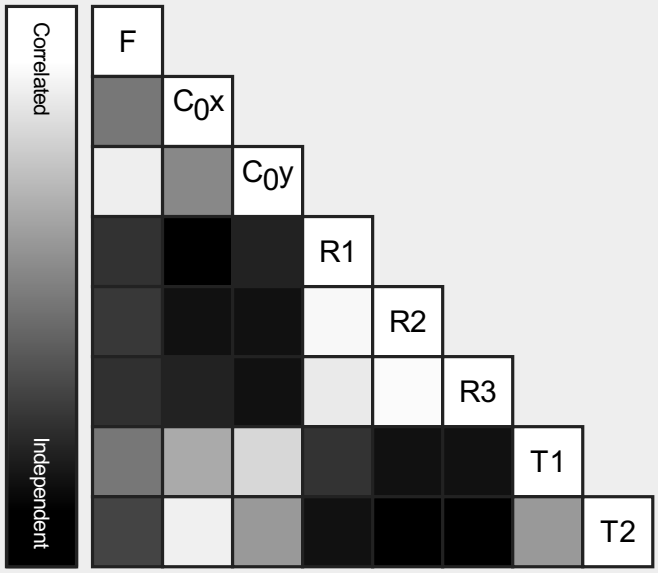
Number of 2D Keypoint Observations for Bundle Block Adjustment	5117939
Number of 3D Points for Bundle Block Adjustment	1571109
Mean Reprojection Error [pixels]	0.199

Internal Camera Parameters

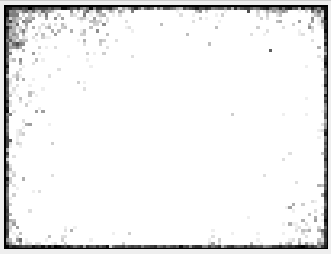
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.108 [pixel] 5.423 [mm]	655.047 [pixel] 2.456 [mm]	495.181 [pixel] 1.857 [mm]	-0.093	0.122	0.038	0.000	-0.000
Uncertainties (Sigma)	0.314 [pixel] 0.001 [mm]	0.220 [pixel] 0.001 [mm]	0.166 [pixel] 0.001 [mm]	0.001	0.011	0.024	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.



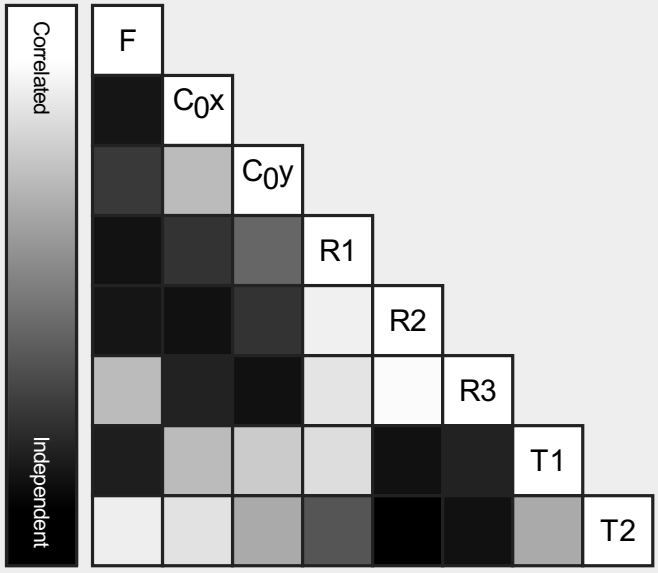
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1443.079 [pixel] 5.412 [mm]	655.807 [pixel] 2.459 [mm]	481.428 [pixel] 1.805 [mm]	-0.096	0.124	0.021	0.000	0.000
Uncertainties (Sigma)	0.304 [pixel] 0.001 [mm]	0.067 [pixel] 0.000 [mm]	0.055 [pixel] 0.000 [mm]	0.000	0.003	0.007	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.

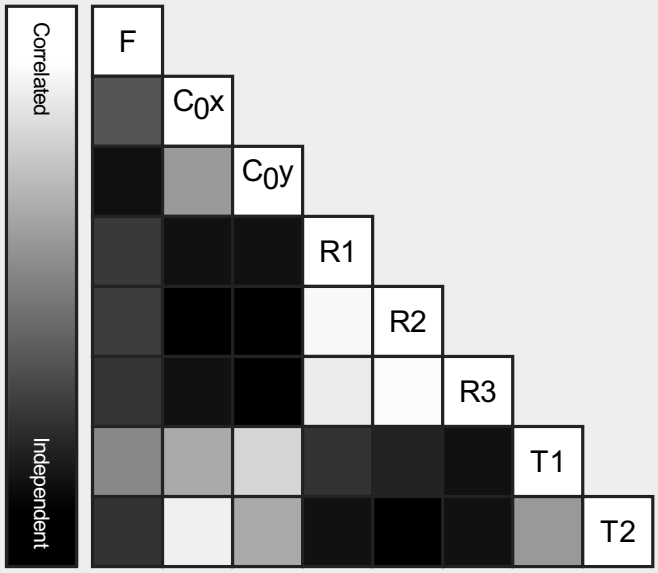
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

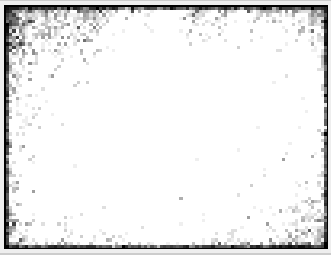
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.224 [pixel] 5.431 [mm]	654.550 [pixel] 2.455 [mm]	493.830 [pixel] 1.852 [mm]	-0.098	0.124	0.017	-0.000	-0.000
Uncertainties (Sigma)	0.316 [pixel] 0.001 [mm]	0.240 [pixel] 0.001 [mm]	0.180 [pixel] 0.001 [mm]	0.002	0.012	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.



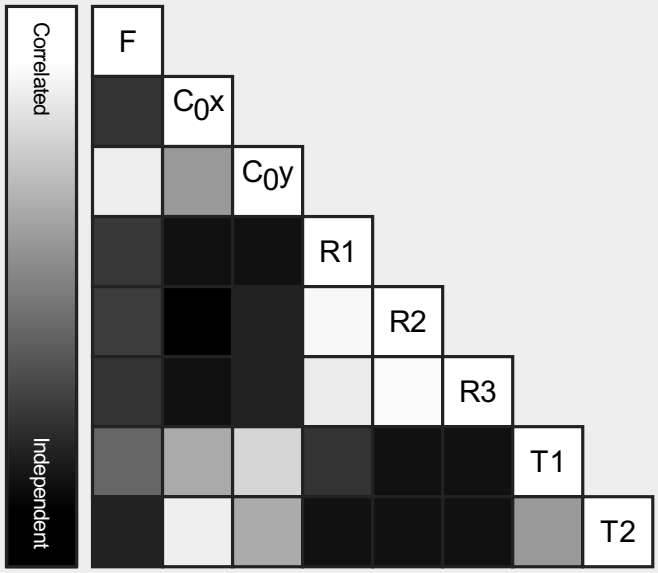
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

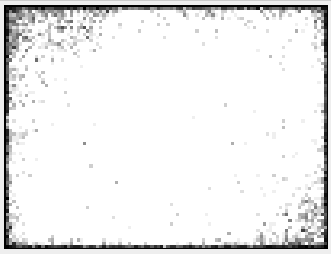
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.513 [pixel] 5.432 [mm]	662.717 [pixel] 2.485 [mm]	482.180 [pixel] 1.808 [mm]	-0.098	0.115	0.025	0.000	-0.000
Uncertainties (Sigma)	0.316 [pixel] 0.001 [mm]	0.236 [pixel] 0.001 [mm]	0.179 [pixel] 0.001 [mm]	0.002	0.011	0.025	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.



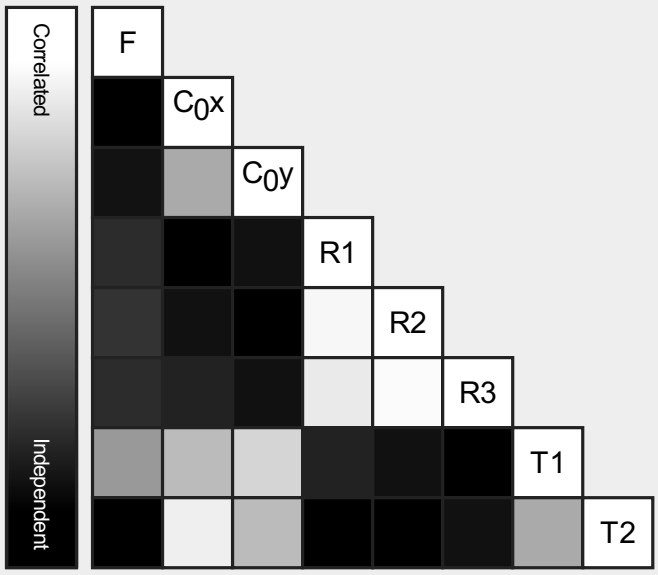
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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 (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	1446.301 [pixel] 5.424 [mm]	658.214 [pixel] 2.468 [mm]	494.285 [pixel] 1.854 [mm]	-0.096	0.111	0.039	0.000	0.000
Uncertainties (Sigma)	0.312 [pixel] 0.001 [mm]	0.198 [pixel] 0.001 [mm]	0.151 [pixel] 0.001 [mm]	0.001	0.010	0.022	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.

Camera Rig «MicaSense 5 band_merge_eldo_3k_1_re_merge_eldo_3k_1_re» Relatives. Images: 10650

	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	-0.111	0.154	-0.372
Uncertainties (sigma)				0.007	0.009	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	0.040	0.117	-0.062
Uncertainties (sigma)				0.007	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	-0.143	-0.112	0.119
Uncertainties (sigma)				0.007	0.010	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	-0.072	-0.542	-0.320
Uncertainties (sigma)				0.006	0.008	0.001

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6890	1600
Min	5348	80
Max	9292	6091
Mean	6907	1718

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6210	1149
Min	5532	80
Max	7993	4101
Mean	6278	1307

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6881	1691
Min	5348	163
Max	9147	6091
Mean	6880	1818

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6360	1079

Min	5631	83
Max	8380	4245
Mean	6441	1293

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7624	1430
Min	6723	151
Max	9292	5231
Mean	7671	1595

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	7475	1539
Min	6303	140
Max	8950	4883
Mean	7495	1684

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)	25 / 132 / 2918	14 / 54 / 1107	32 / 176 / 1990	13 / 57 / 482	17 / 83 / 714
RedEdge_5.5_1280x960 (Green)		22 / 94 / 5406	13 / 46 / 816	10 / 35 / 1127	14 / 55 / 2209
RedEdge_5.5_1280x960 (Red)			30 / 166 / 3167	13 / 55 / 415	16 / 81 / 626
RedEdge_5.5_1280x960 (NIR)				31 / 169 / 4226	26 / 149 / 1813
RedEdge_5.5_1280x960 (Red edge)					21 / 114 / 3425

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	1001500
In 3 Images	246588
In 4 Images	113619
In 5 Images	58702
In 6 Images	37094
In 7 Images	24314
In 8 Images	17225
In 9 Images	12676
In 10 Images	10155
In 11 Images	7955
In 12 Images	6259
In 13 Images	5076
In 14 Images	4210
In 15 Images	3350
In 16 Images	2934
In 17 Images	2401
In 18 Images	2019
In 19 Images	1805
In 20 Images	1532
In 21 Images	1310
In 22 Images	1172
In 23 Images	1042
In 24 Images	881

In 25 Images	781
In 26 Images	664
In 27 Images	576
In 28 Images	498
In 29 Images	468
In 30 Images	414
In 31 Images	366
In 32 Images	366
In 33 Images	316
In 34 Images	275
In 35 Images	227
In 36 Images	197
In 37 Images	225
In 38 Images	170
In 39 Images	134
In 40 Images	129
In 41 Images	142
In 42 Images	115
In 43 Images	106
In 44 Images	84
In 45 Images	88
In 46 Images	74
In 47 Images	68
In 48 Images	53
In 49 Images	41
In 50 Images	52
In 51 Images	42
In 52 Images	45
In 53 Images	31
In 54 Images	31
In 55 Images	33
In 56 Images	31
In 57 Images	22
In 58 Images	22
In 59 Images	19
In 60 Images	40
In 61 Images	13
In 62 Images	26
In 63 Images	19
In 64 Images	12
In 65 Images	12
In 66 Images	17
In 67 Images	14
In 68 Images	20
In 69 Images	12
In 70 Images	10
In 71 Images	9
In 72 Images	8
In 73 Images	7
In 74 Images	8
In 75 Images	6
In 76 Images	8
In 77 Images	9
In 78 Images	8
In 79 Images	7
In 80 Images	12
In 81 Images	6
In 82 Images	6
In 83 Images	10

In 84 Images	5
In 85 Images	4
In 86 Images	6
In 87 Images	7
In 88 Images	6
In 89 Images	1
In 90 Images	5
In 91 Images	4
In 92 Images	1
In 94 Images	4
In 95 Images	3
In 96 Images	2
In 97 Images	5
In 98 Images	2
In 99 Images	1
In 100 Images	2
In 102 Images	2
In 103 Images	1
In 104 Images	5
In 105 Images	3
In 106 Images	1
In 107 Images	4
In 108 Images	2
In 109 Images	1
In 110 Images	1
In 115 Images	1
In 118 Images	2
In 119 Images	2
In 121 Images	1
In 122 Images	1
In 123 Images	1

2D Keypoint Matches

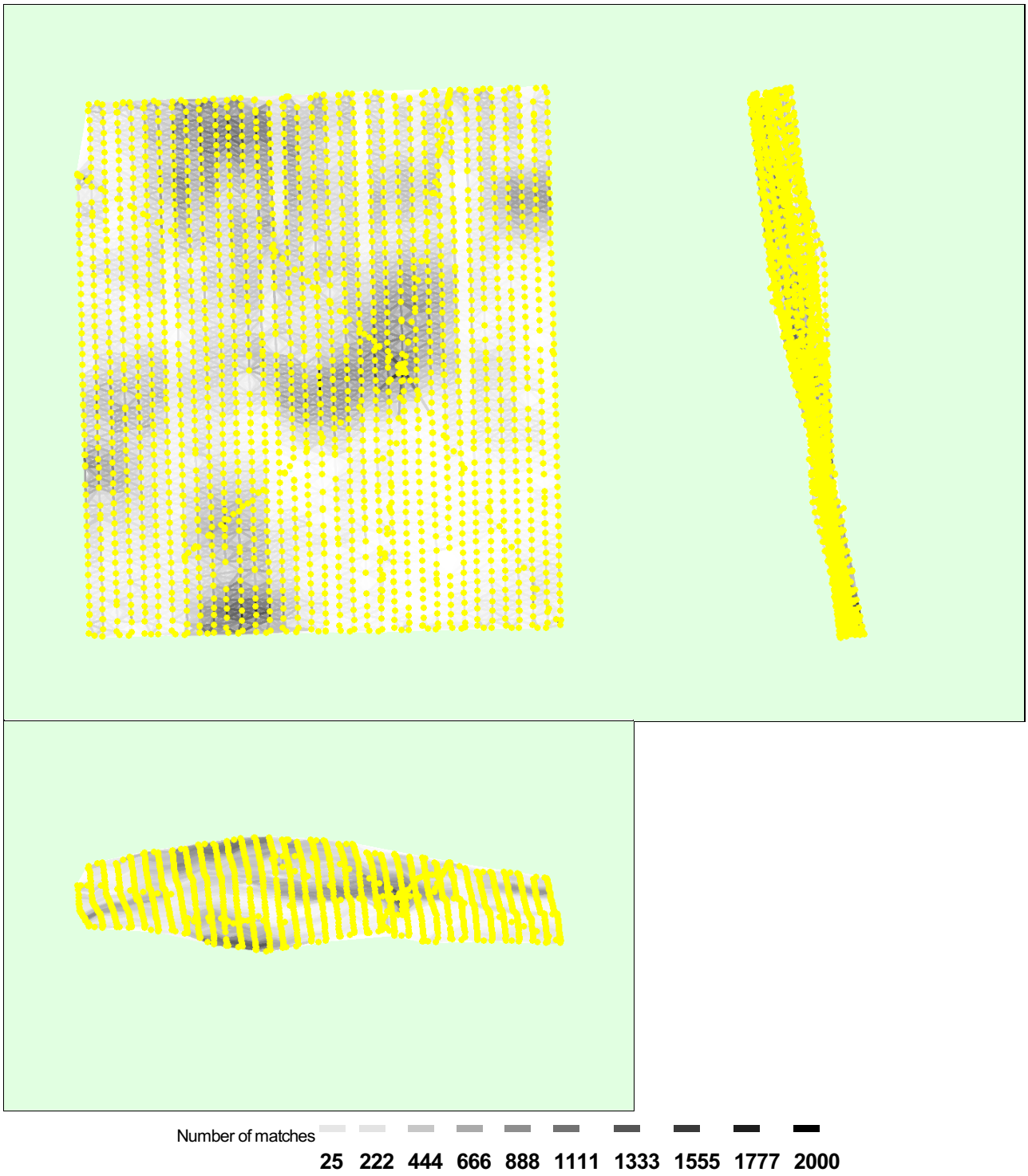


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.01	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	0.24	0.01

-3.00	0.00	49.83	49.28	48.59
0.00	3.00	50.10	50.36	51.39
3.00	6.00	0.00	0.09	0.01
6.00	9.00	0.00	0.01	0.00
9.00	12.00	0.00	0.00	0.00
12.00	15.00	0.01	0.01	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		0.001740	-0.003213	-0.001041
Sigma [m]		0.801705	1.181721	0.575827
RMS Error [m]		0.801707	1.181725	0.575828

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	99.97	100.00
[-2.00, 2.00]	99.98	99.98	100.00
[-3.00, 3.00]	99.99	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: 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» processing	optimize relative rotation using a subset of secondary cameras