Quality Report

Generated with Pix4Denterprise 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_4k_1_re
Processed	2019-01-24 11:15:31
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»
Average Ground Sampling Distance (GSD)	8.72 cm / 3.43 in
Area Covered	0.582 km^2 / 58.2272 ha / 0.22 sq. mi. / 143.9571 acres
Time for Initial Processing (without report)	10h:56m:17s

Quality Check

Images	median of 31868 keypoints per image	✓
Dataset	10430 out of 10490 images calibrated (99%), 5 images disabled	✓
Camera Optimization	1.32% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 5528.41 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

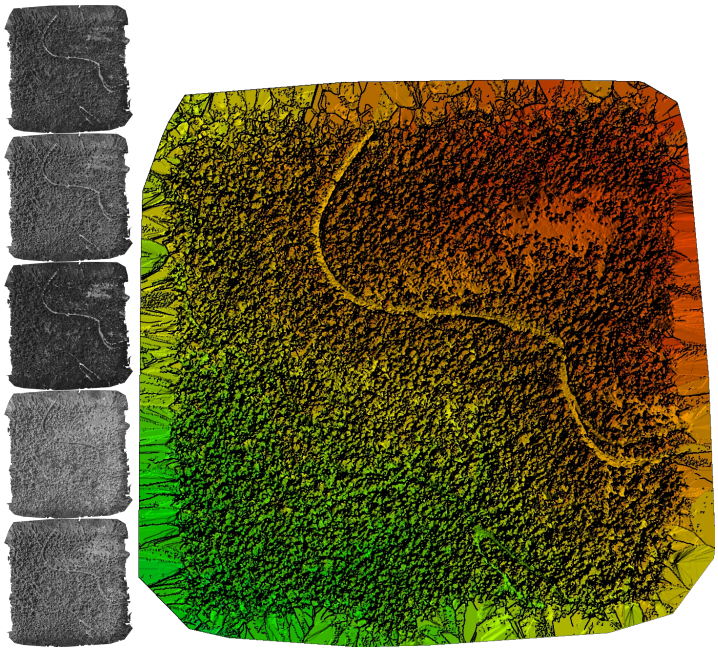


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10430 out of 10495
Number of Geolocated Images	10495 out of 10495

Initial Image Positions

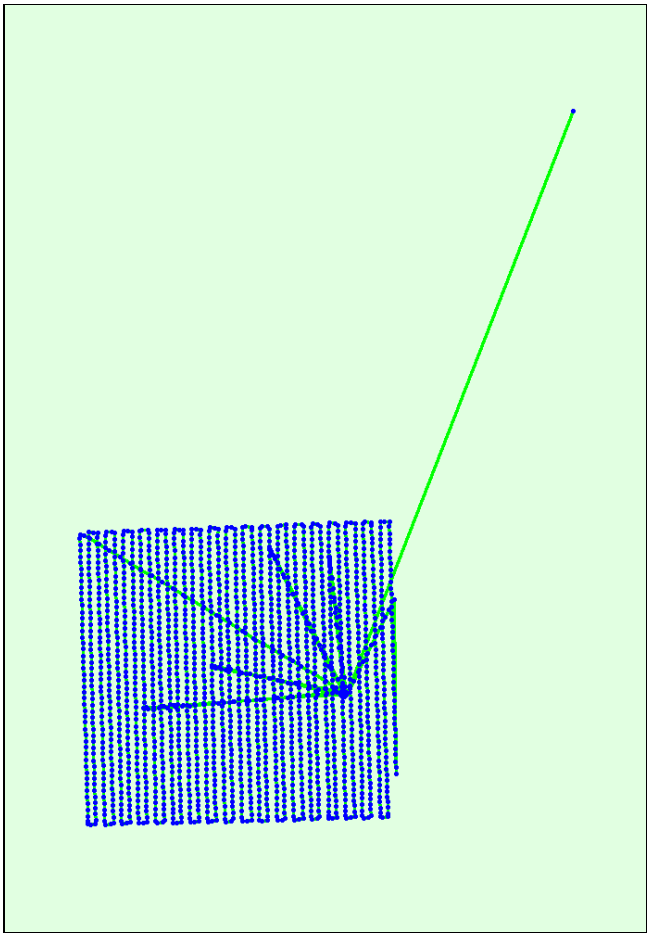
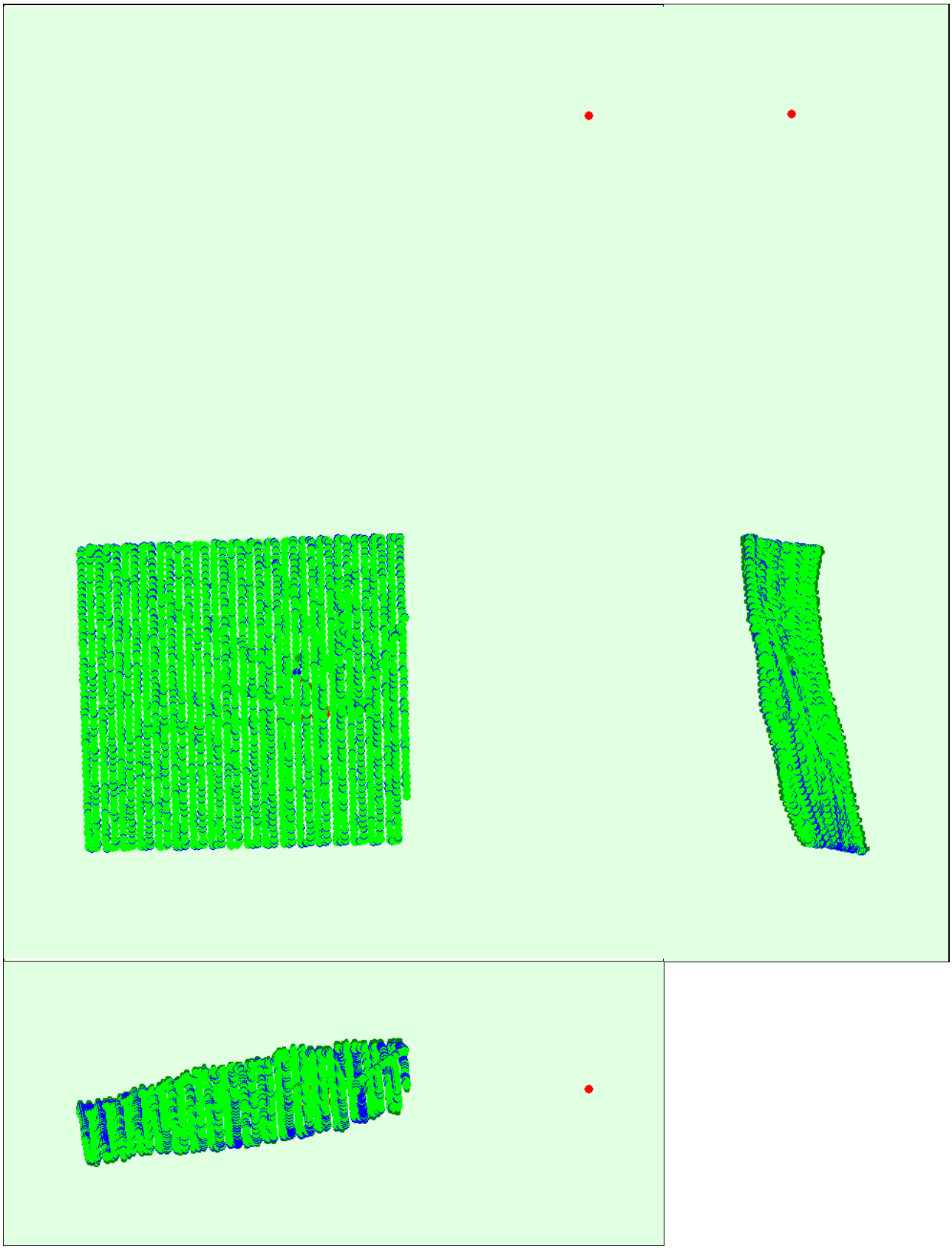


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.083	0.083	0.179	0.036	0.034	0.015

Sigma	0.014	0.014	0.036	0.002	0.002	0.003

Overlap

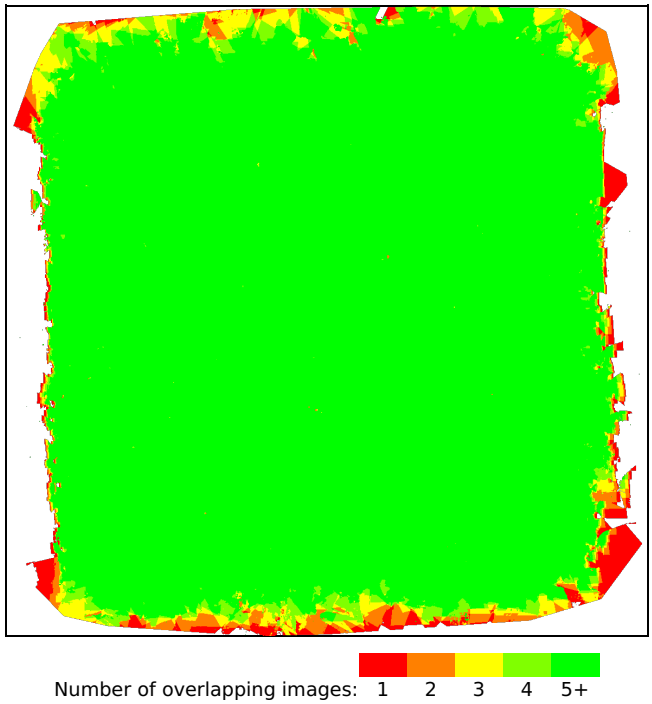


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

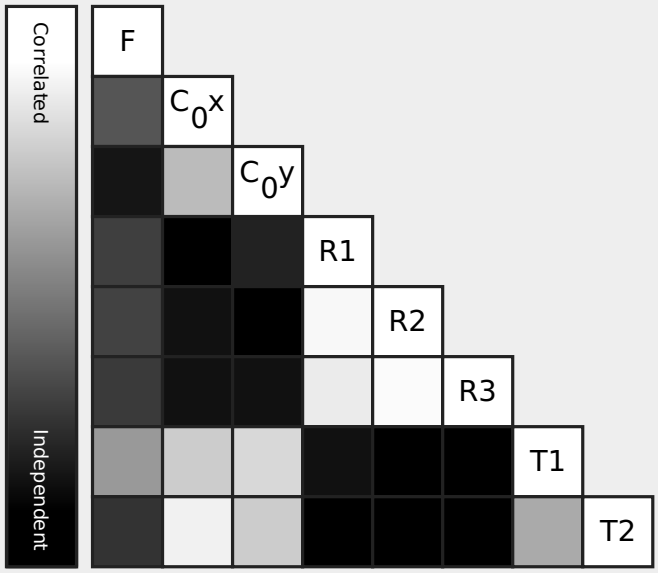
Number of 2D Keypoint Observations for Bundle Block Adjustment	17676066
Number of 3D Points for Bundle Block Adjustment	6342509
Mean Reprojection Error [pixels]	0.205

Internal Camera Parameters

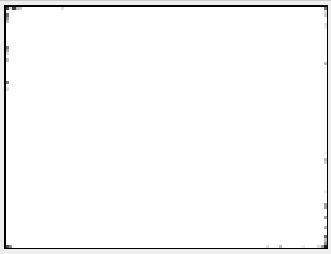
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.763 [pixel] 5.425 [mm]	654.158 [pixel] 2.453 [mm]	495.468 [pixel] 1.858 [mm]	-0.099	0.178	-0.095	0.000	-0.000
Uncertainties (Sigma)	0.129 [pixel] 0.000 [mm]	0.107 [pixel] 0.000 [mm]	0.081 [pixel] 0.000 [mm]	0.001	0.005	0.012	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.



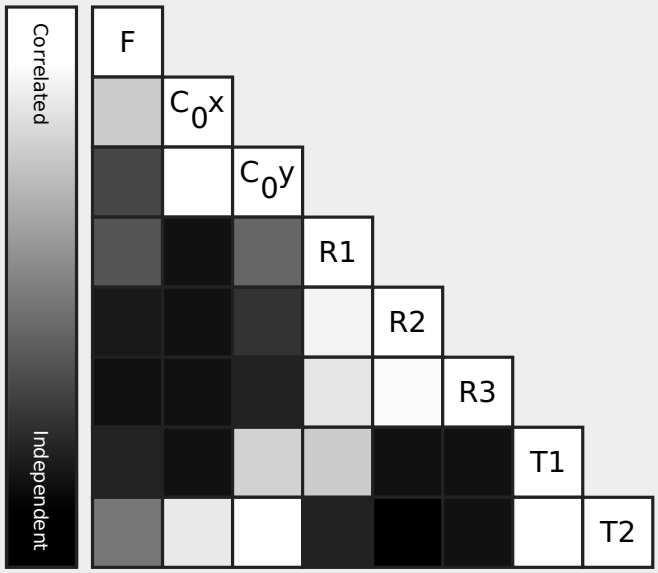
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1443.678 [pixel] 5.414 [mm]	655.803 [pixel] 2.459 [mm]	481.314 [pixel] 1.805 [mm]	-0.100	0.156	-0.046	0.000	0.000
Uncertainties (Sigma)	0.124 [pixel] 0.000 [mm]	0.036 [pixel] 0.000 [mm]	0.029 [pixel] 0.000 [mm]	0.000	0.002	0.004	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.

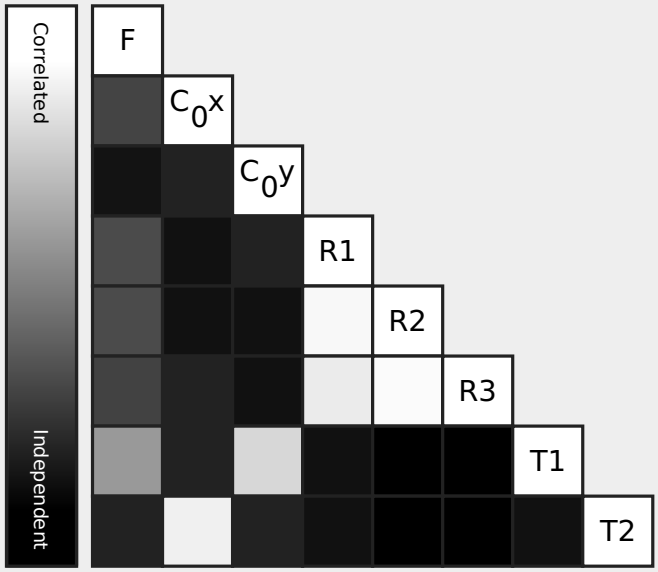
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1448.947 [pixel] 5.434 [mm]	653.437 [pixel] 2.450 [mm]	493.727 [pixel] 1.851 [mm]	-0.101	0.145	-0.033	-0.000	-0.000
Uncertainties (Sigma)	0.132 [pixel] 0.000 [mm]	0.126 [pixel] 0.000 [mm]	0.095 [pixel] 0.000 [mm]	0.001	0.006	0.014	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.

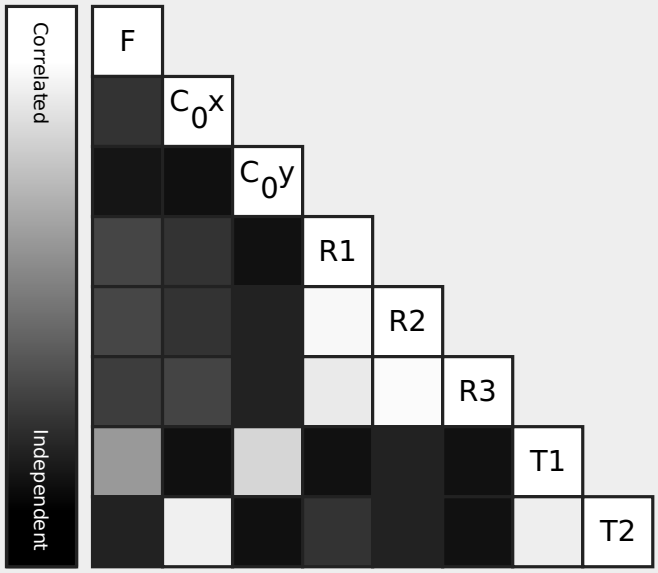
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

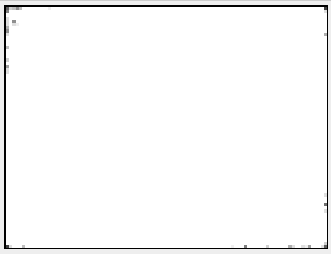
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1449.546 [pixel] 5.436 [mm]	662.232 [pixel] 2.483 [mm]	482.674 [pixel] 1.810 [mm]	-0.104	0.149	-0.033	0.000	-0.000
Uncertainties (Sigma)	0.130 [pixel] 0.000 [mm]	0.117 [pixel] 0.000 [mm]	0.088 [pixel] 0.000 [mm]	0.001	0.006	0.012	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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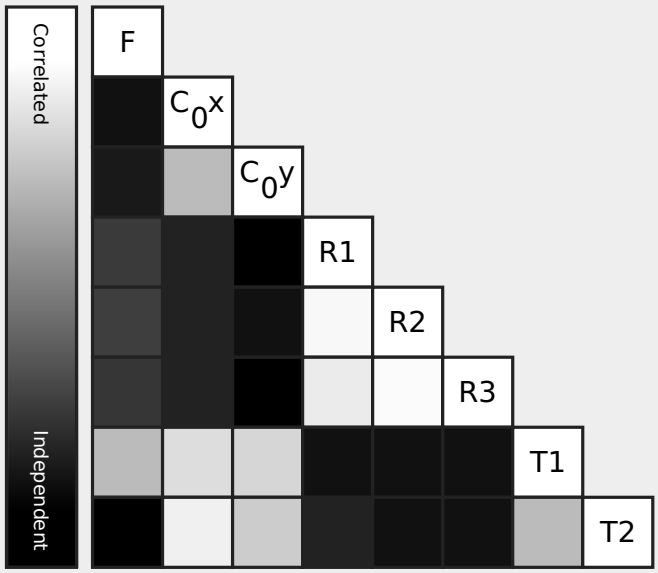
Internal Camera Parameters

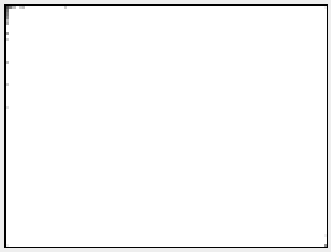
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1447.254 [pixel] 5.427 [mm]	657.229 [pixel] 2.465 [mm]	494.403 [pixel] 1.854 [mm]	-0.103	0.157	-0.056	0.000	-0.000
Uncertainties (Sigma)	0.129 [pixel] 0.000 [mm]	0.101 [pixel] 0.000 [mm]	0.076 [pixel] 0.000 [mm]	0.001	0.005	0.011	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» Relatives. Images: 10490

	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	-0.126	0.117	-0.372
Uncertainties (sigma)				0.003	0.004	0.000
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	0.041	0.076	-0.061
Uncertainties (sigma)				0.004	0.005	0.000
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	-0.166	-0.132	0.119
Uncertainties (sigma)				0.004	0.005	0.000
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	-0.082	-0.577	-0.322
Uncertainties (sigma)				0.003	0.004	0.000

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31868	5528
Min	16642	315
Max	42606	26815
Mean	30984	6049

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	27112	3832
Min	19046	1005
Max	37121	19595
Mean	27047	4620

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	33136	5926
Min	16642	315
Max	42606	26815
Mean	32439	6470

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21421	2731

Min	17394	740
Max	34224	18788
Mean	22029	3460

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	29164	4614
Min	18836	1011
Max	39512	24323
Mean	29116	5599

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	31722	5466
Min	18199	1402
Max	40791	21551
Mean	31216	6324

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)	34 / 201 / 13179	19 / 94 / 5694	36 / 325 / 6712	18 / 200 / 3074	24 / 253 / 4587
RedEdge_5.5_1280x960 (Green)		23 / 134 / 19212	14 / 62 / 3439	9 / 39 / 6246	14 / 59 / 10490
RedEdge_5.5_1280x960 (Red)			24 / 162 / 12791	18 / 140 / 2022	23 / 191 / 2909
RedEdge_5.5_1280x960 (NIR)				24 / 249 / 18261	28 / 454 / 7796
RedEdge_5.5_1280x960 (Red edge)					22 / 185 / 13426

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4373407
In 3 Images	1024546
In 4 Images	411808
In 5 Images	193634
In 6 Images	107928
In 7 Images	62256
In 8 Images	40937
In 9 Images	28264
In 10 Images	20741
In 11 Images	15004
In 12 Images	11623
In 13 Images	8412
In 14 Images	6463
In 15 Images	5203
In 16 Images	4359
In 17 Images	3534
In 18 Images	3065
In 19 Images	2544
In 20 Images	2110
In 21 Images	1898
In 22 Images	1602
In 23 Images	1385
In 24 Images	1251

In 25 Images	1071
In 26 Images	934
In 27 Images	847
In 28 Images	731
In 29 Images	636
In 30 Images	619
In 31 Images	569
In 32 Images	484
In 33 Images	453
In 34 Images	420
In 35 Images	330
In 36 Images	307
In 37 Images	250
In 38 Images	225
In 39 Images	237
In 40 Images	194
In 41 Images	180
In 42 Images	162
In 43 Images	170
In 44 Images	170
In 45 Images	129
In 46 Images	117
In 47 Images	112
In 48 Images	94
In 49 Images	101
In 50 Images	85
In 51 Images	78
In 52 Images	57
In 53 Images	57
In 54 Images	53
In 55 Images	47
In 56 Images	38
In 57 Images	32
In 58 Images	24
In 59 Images	17
In 60 Images	19
In 61 Images	23
In 62 Images	26
In 63 Images	12
In 64 Images	16
In 65 Images	24
In 66 Images	19
In 67 Images	9
In 68 Images	14
In 69 Images	13
In 70 Images	9
In 71 Images	11
In 72 Images	13
In 73 Images	16
In 74 Images	5
In 75 Images	11
In 76 Images	10
In 77 Images	13
In 78 Images	7
In 79 Images	12
In 80 Images	5
In 81 Images	9
In 82 Images	3
In 83 Images	9

In 84 Images	6
In 85 Images	13
In 86 Images	11
In 87 Images	7
In 88 Images	10
In 89 Images	6
In 90 Images	5
In 91 Images	10
In 92 Images	13
In 93 Images	7
In 94 Images	9
In 95 Images	5
In 96 Images	6
In 97 Images	6
In 98 Images	8
In 99 Images	7
In 100 Images	4
In 101 Images	3
In 102 Images	3
In 103 Images	4
In 104 Images	6
In 105 Images	6
In 106 Images	3
In 107 Images	2
In 108 Images	3
In 109 Images	3
In 110 Images	2
In 111 Images	2
In 112 Images	1
In 113 Images	3
In 114 Images	3
In 115 Images	2
In 117 Images	2
In 118 Images	2
In 119 Images	1
In 120 Images	2
In 121 Images	1
In 122 Images	2
In 123 Images	1
In 126 Images	1
In 129 Images	1
In 130 Images	2
In 132 Images	1
In 135 Images	1
In 143 Images	1

2D Keypoint Matches

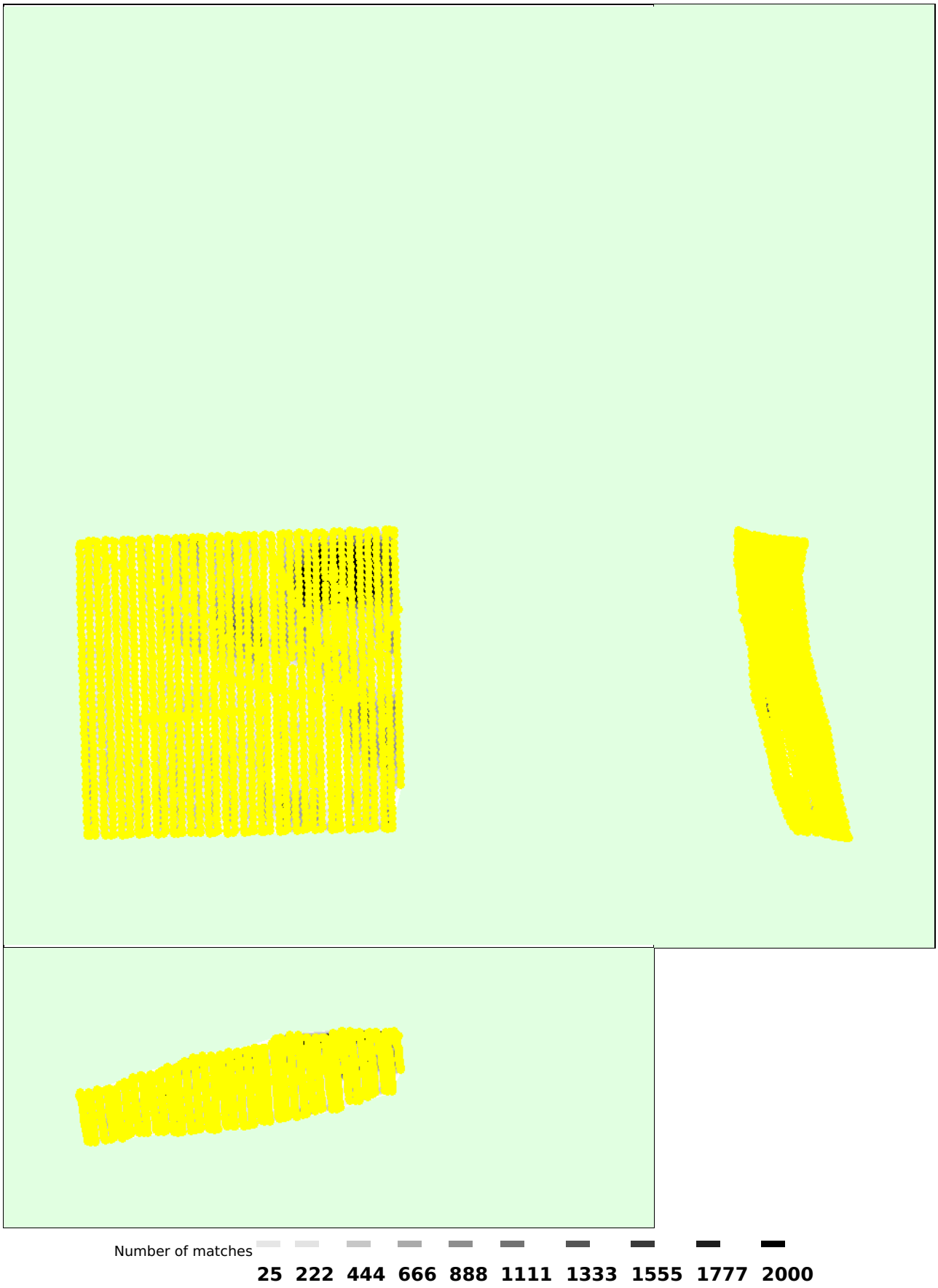


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.01	0.00
-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	0.01	0.05	1.35
-3.00	0.00	47.95	50.29	44.72
0.00	3.00	52.04	49.41	53.93
3.00	6.00	0.00	0.24	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]		0.001931	0.011466	0.002023
Sigma [m]		0.718353	1.008304	1.212974
RMS Error [m]		0.718355	1.008369	1.212976

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	99.99	100.00
[-2.00, 2.00]	100.00	99.99	100.00
[-3.00, 3.00]	100.00	99.99	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) Xeon(R) Platinum 8124M CPU @ 3.00GHz RAM: 69GB GPU: no info (Driver: unknown)
Operating System	Linux 4.15.0-1031-aws x86_64

Coordinate Systems

Image Coordinate System	WGS 84 (EGM 96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 10N (EGM 96 Geoid)

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Custom, Image Scale: 2
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» processing	optimize relative rotation using a subset of secondary cameras

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: Medium Resolution (default) Color Balancing: no
LOD	Generated: no
Advanced: 3D Textured Mesh Settings	Sample Density Divider: 1
Advanced: Image Groups	Blue, Green, Red, NIR, Red edge
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	09m:59s
Time for Point Cloud Classification	43s
Time for 3D Textured Mesh Generation	11m:06s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11448509
Average Density (per m^3)	3.81

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.72 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Triangulation Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Radiometric calibration with reflectance target	yes
Index Calculator: Reflectance Map	Generated: yes Resolution: 1 x GSD (8.72 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	54s
Time for Orthomosaic Generation	01h:23m:02s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:37m:56s
Time for Index Map Generation	32s

Camera Radiometric Correction

Camera Name	Band	Radiometric Correction Type	Reflectance target
RedEdge_5.5_1280x960	Blue	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	Green	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	Red	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	NIR	Camera and Sun Irradiance	✓
RedEdge_5.5_1280x960	Red edge	Camera and Sun Irradiance	✓