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	sier_4k_1_re
Processed	2019-01-23 19:52:56
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)	8.44 cm / 3.32 in
Area Covered	0.633 km^2 / 63.3315 ha / 0.24 sq. mi. / 156.5765 acres
Time for Initial Processing (without report)	18h:25m:42s

Quality Check

Images	median of 33565 keypoints per image	✓
Dataset	11760 out of 11760 images calibrated (100%), 5 images disabled	✓
Camera Optimization	1.31% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 6628.64 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

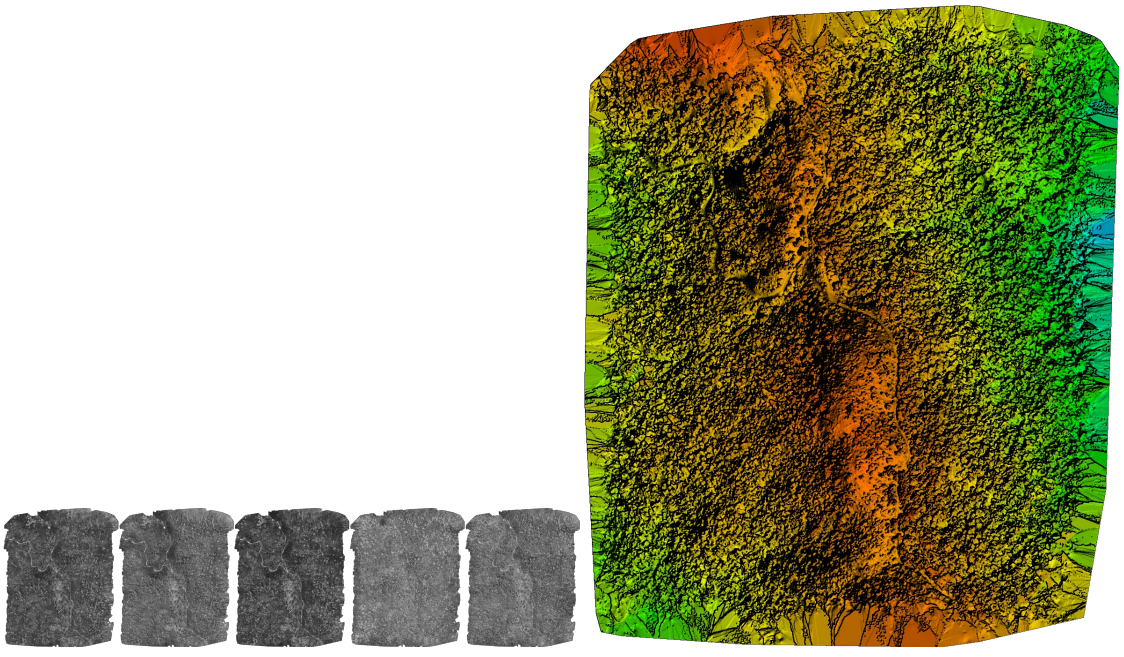


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11760 out of 11765
Number of Geolocated Images	11765 out of 11765

Initial Image Positions

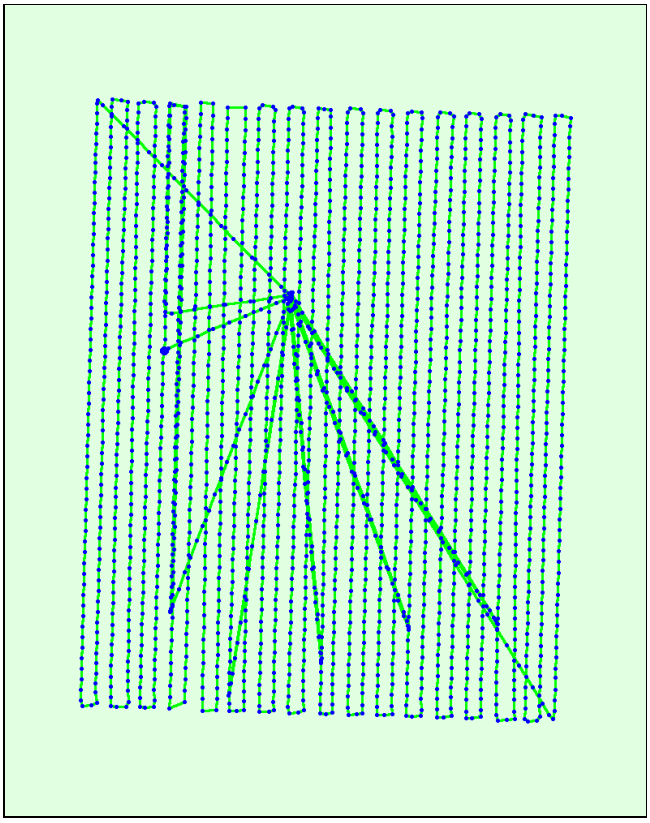
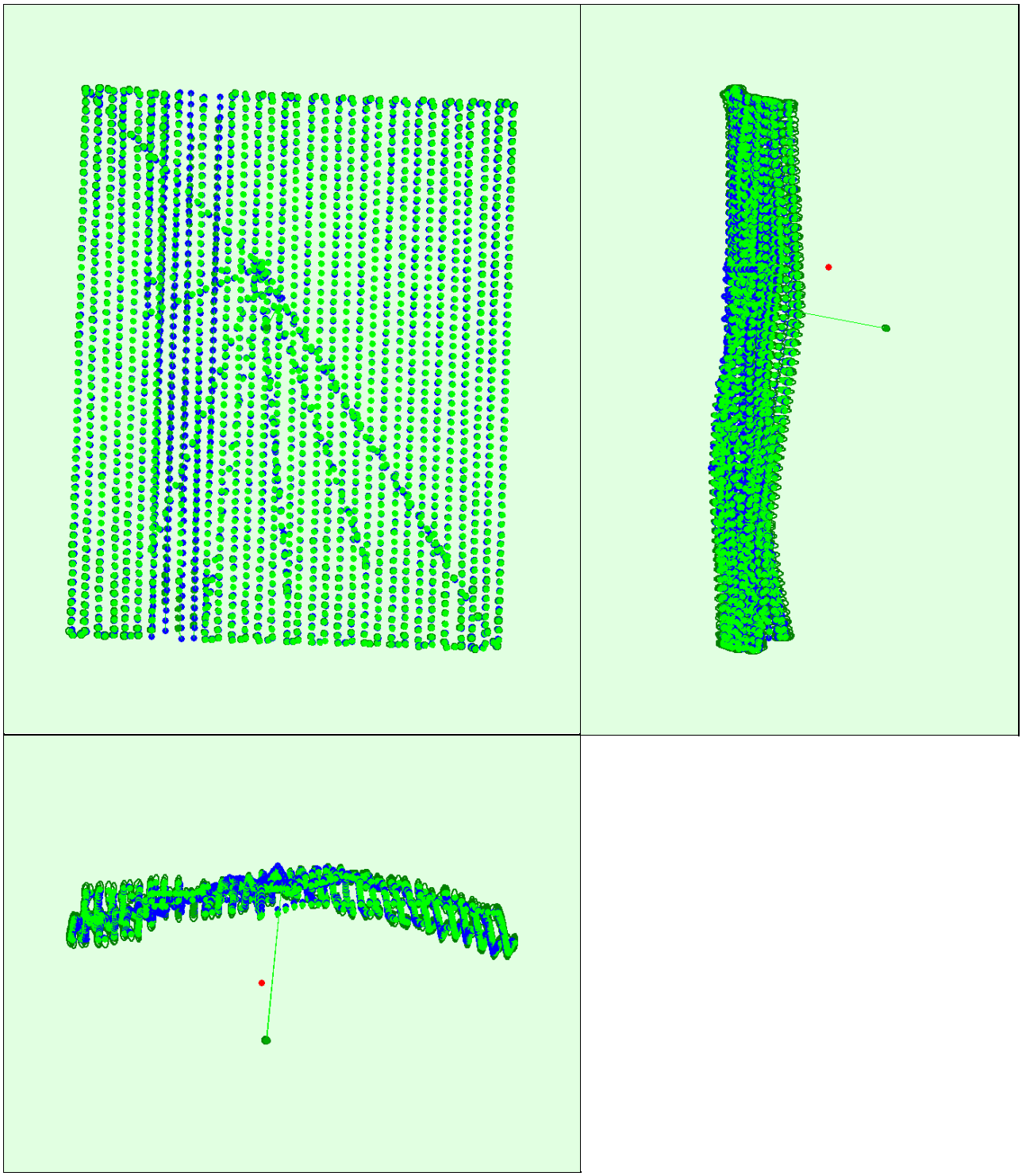


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.059	0.063	0.140	0.027	0.031	0.011
Sigma	0.013	0.011	0.033	0.002	0.002	0.003

Overlap

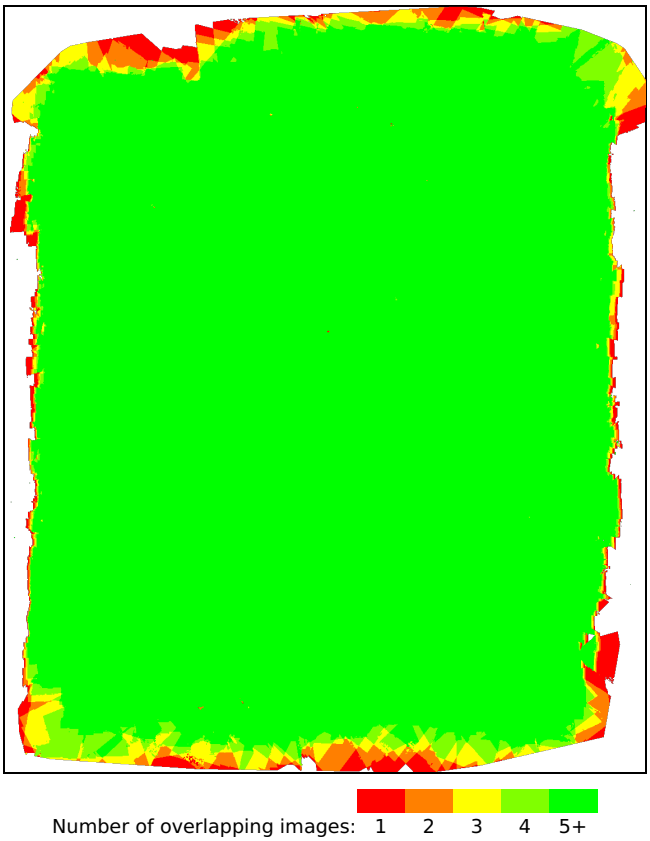


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

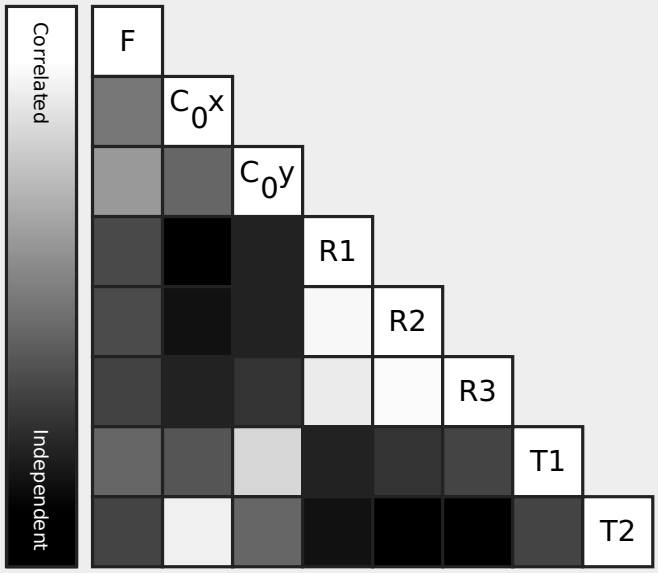
Number of 2D Keypoint Observations for Bundle Block Adjustment	23364960
Number of 3D Points for Bundle Block Adjustment	8379216
Mean Reprojection Error [pixels]	0.195

Internal Camera Parameters

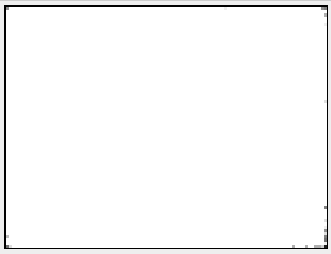
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.906 [pixel] 5.426 [mm]	654.373 [pixel] 2.454 [mm]	494.941 [pixel] 1.856 [mm]	-0.097	0.153	-0.034	0.000	-0.000
Uncertainties (Sigma)	0.090 [pixel] 0.000 [mm]	0.082 [pixel] 0.000 [mm]	0.062 [pixel] 0.000 [mm]	0.001	0.004	0.009	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.



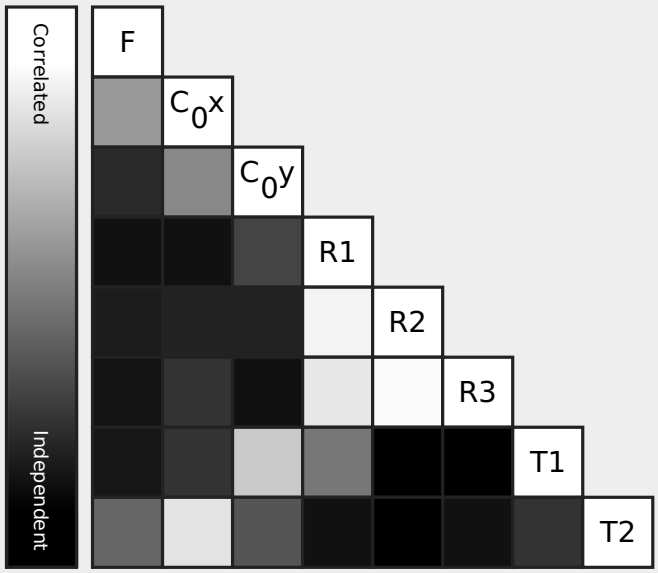
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1443.878 [pixel] 5.415 [mm]	655.500 [pixel] 2.458 [mm]	481.509 [pixel] 1.806 [mm]	-0.099	0.145	-0.021	0.000	0.000
Uncertainties (Sigma)	0.085 [pixel] 0.000 [mm]	0.025 [pixel] 0.000 [mm]	0.020 [pixel] 0.000 [mm]	0.000	0.001	0.003	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.

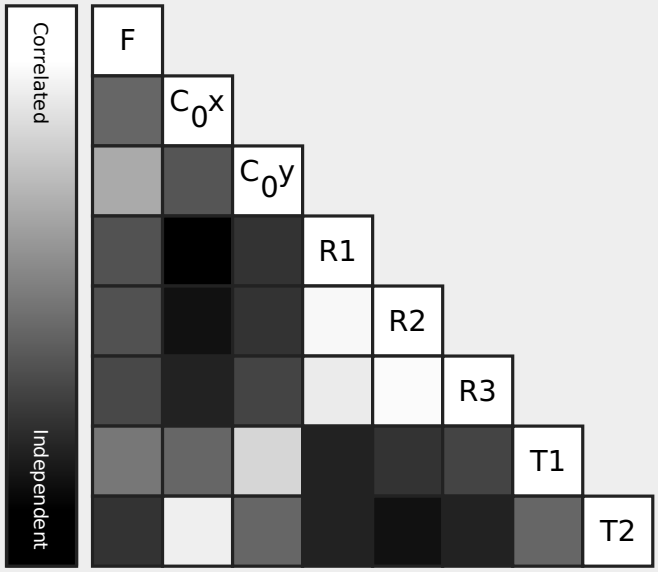
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1448.953 [pixel] 5.434 [mm]	653.551 [pixel] 2.451 [mm]	493.519 [pixel] 1.851 [mm]	-0.097	0.115	0.032	-0.000	-0.000
Uncertainties (Sigma)	0.091 [pixel] 0.000 [mm]	0.093 [pixel] 0.000 [mm]	0.070 [pixel] 0.000 [mm]	0.001	0.004	0.010	0.000	0.000



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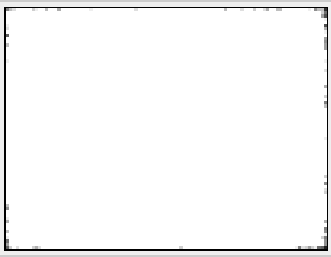

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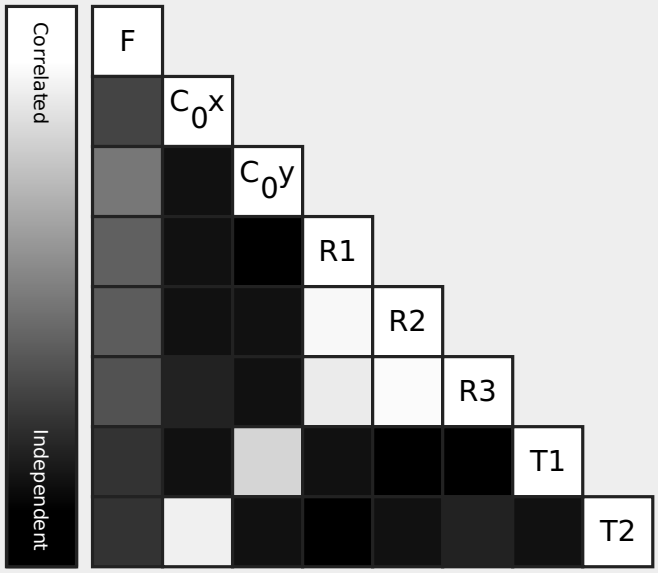
Internal Camera Parameters

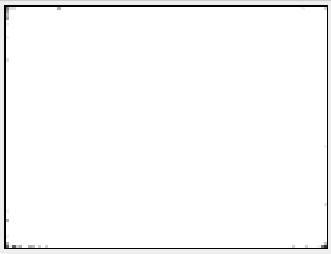
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1449.776 [pixel] 5.437 [mm]	662.400 [pixel] 2.484 [mm]	482.663 [pixel] 1.810 [mm]	-0.104	0.153	-0.046	0.000	-0.000
Uncertainties (Sigma)	0.093 [pixel] 0.000 [mm]	0.106 [pixel] 0.000 [mm]	0.079 [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.



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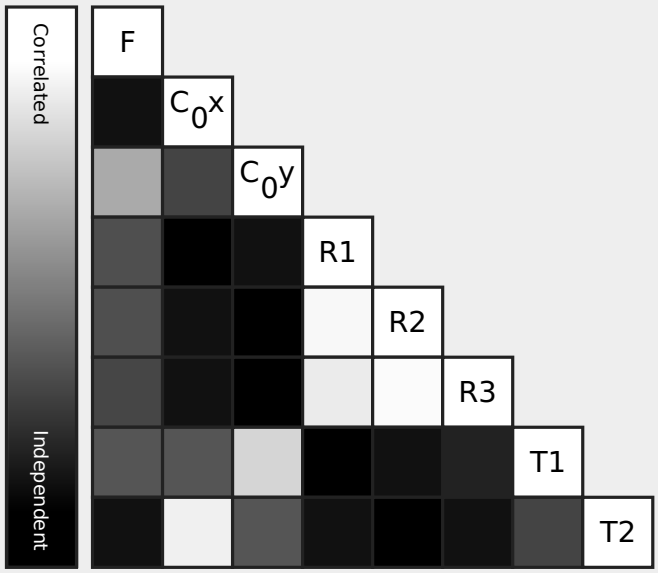
Internal Camera Parameters

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	1447.517 [pixel] 5.428 [mm]	657.497 [pixel] 2.466 [mm]	494.274 [pixel] 1.854 [mm]	-0.103	0.158	-0.061	0.000	-0.000
Uncertainties (Sigma)	0.090 [pixel] 0.000 [mm]	0.087 [pixel] 0.000 [mm]	0.066 [pixel] 0.000 [mm]	0.001	0.004	0.010	0.000	0.000



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Camera Rig «MicaSense 5 band» Relatives. Images: 11760

	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	-0.086	0.106	-0.374
Uncertainties (sigma)				0.003	0.003	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	0.079	0.072	-0.063
Uncertainties (sigma)				0.003	0.004	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	-0.130	-0.158	0.118
Uncertainties (sigma)				0.003	0.004	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	-0.054	-0.589	-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	33565	6629
Min	18798	25
Max	44025	27718
Mean	32584	7089

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	29617	4251
Min	19911	25
Max	34706	15155
Mean	28801	4823

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34586	7237
Min	18798	47
Max	44025	27718
Mean	33576	7725

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	27141	3540

Min	19671	27
Max	33871	13441
Mean	26778	4041

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31079	5930
Min	19749	55
Max	41124	18197
Mean	31286	6761

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	33391	5692
Min	21707	32
Max	42032	15606
Mean	33591	6389

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)	41 / 347 / 9575	28 / 135 / 4275	42 / 326 / 3979	13 / 68 / 868	20 / 129 / 1290
RedEdge_5.5_1280x960 (Green)		37 / 187 / 17474	24 / 106 / 3282	12 / 59 / 2075	20 / 102 / 4577
RedEdge_5.5_1280x960 (Red)			48 / 392 / 8343	14 / 65 / 588	22 / 125 / 1539
RedEdge_5.5_1280x960 (NIR)				48 / 739 / 12183	31 / 411 / 4819
RedEdge_5.5_1280x960 (Red edge)					30 / 366 / 9024

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	5811181
In 3 Images	1377664
In 4 Images	527362
In 5 Images	240722
In 6 Images	130298
In 7 Images	77466
In 8 Images	50271
In 9 Images	34530
In 10 Images	24324
In 11 Images	18437
In 12 Images	14347
In 13 Images	11060
In 14 Images	8613
In 15 Images	6927
In 16 Images	5805
In 17 Images	4806
In 18 Images	4019
In 19 Images	3404
In 20 Images	2879
In 21 Images	2474
In 22 Images	2235
In 23 Images	1937
In 24 Images	1666

In 25 Images	1450
In 26 Images	1302
In 27 Images	1073
In 28 Images	1019
In 29 Images	862
In 30 Images	808
In 31 Images	721
In 32 Images	638
In 33 Images	531
In 34 Images	526
In 35 Images	516
In 36 Images	413
In 37 Images	419
In 38 Images	370
In 39 Images	328
In 40 Images	327
In 41 Images	307
In 42 Images	238
In 43 Images	228
In 44 Images	241
In 45 Images	219
In 46 Images	184
In 47 Images	172
In 48 Images	144
In 49 Images	164
In 50 Images	156
In 51 Images	141
In 52 Images	141
In 53 Images	120
In 54 Images	107
In 55 Images	102
In 56 Images	104
In 57 Images	114
In 58 Images	98
In 59 Images	69
In 60 Images	96
In 61 Images	82
In 62 Images	80
In 63 Images	72
In 64 Images	69
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In 66 Images	56
In 67 Images	65
In 68 Images	46
In 69 Images	60
In 70 Images	47
In 71 Images	47
In 72 Images	41
In 73 Images	39
In 74 Images	40
In 75 Images	36
In 76 Images	36
In 77 Images	43
In 78 Images	55
In 79 Images	38
In 80 Images	42
In 81 Images	24
In 82 Images	27
In 83 Images	23

In 84 Images	37
In 85 Images	32
In 86 Images	32
In 87 Images	19
In 88 Images	26
In 89 Images	28
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In 95 Images	22
In 96 Images	24
In 97 Images	32
In 98 Images	30
In 99 Images	16
In 100 Images	24
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In 102 Images	14
In 103 Images	22
In 104 Images	17
In 105 Images	15
In 106 Images	17
In 107 Images	9
In 108 Images	18
In 109 Images	10
In 110 Images	11
In 111 Images	13
In 112 Images	17
In 113 Images	18
In 114 Images	10
In 115 Images	19
In 116 Images	8
In 117 Images	9
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In 119 Images	18
In 120 Images	13
In 121 Images	10
In 122 Images	14
In 123 Images	12
In 124 Images	19
In 125 Images	13
In 126 Images	7
In 127 Images	11
In 128 Images	10
In 129 Images	7
In 130 Images	7
In 131 Images	10
In 132 Images	5
In 133 Images	9
In 134 Images	4
In 135 Images	8
In 136 Images	3
In 137 Images	5
In 138 Images	11
In 139 Images	6
In 140 Images	11
In 141 Images	10
In 142 Images	8

In 143 Images	12
In 144 Images	6
In 145 Images	8
In 146 Images	8
In 147 Images	7
In 148 Images	5
In 149 Images	7
In 150 Images	5
In 151 Images	5
In 152 Images	8
In 153 Images	7
In 154 Images	7
In 155 Images	10
In 156 Images	4
In 157 Images	2
In 158 Images	4
In 159 Images	3
In 160 Images	5
In 161 Images	3
In 162 Images	6
In 163 Images	4
In 164 Images	7
In 165 Images	7
In 166 Images	2
In 167 Images	2
In 168 Images	4
In 169 Images	9
In 170 Images	5
In 171 Images	5
In 172 Images	3
In 173 Images	6
In 174 Images	3
In 175 Images	2
In 176 Images	1
In 177 Images	6
In 178 Images	3
In 179 Images	2
In 180 Images	1
In 181 Images	5
In 182 Images	1
In 183 Images	2
In 184 Images	2
In 185 Images	4
In 188 Images	1
In 189 Images	1
In 190 Images	2
In 191 Images	1
In 192 Images	1
In 194 Images	1
In 195 Images	5
In 196 Images	1
In 197 Images	2
In 198 Images	1
In 199 Images	3
In 200 Images	2
In 201 Images	2
In 202 Images	1
In 204 Images	2
In 205 Images	2

In 206 Images	3
In 210 Images	5
In 212 Images	1
In 214 Images	1
In 215 Images	1
In 221 Images	2
In 224 Images	3
In 225 Images	1
In 235 Images	2

2D Keypoint Matches

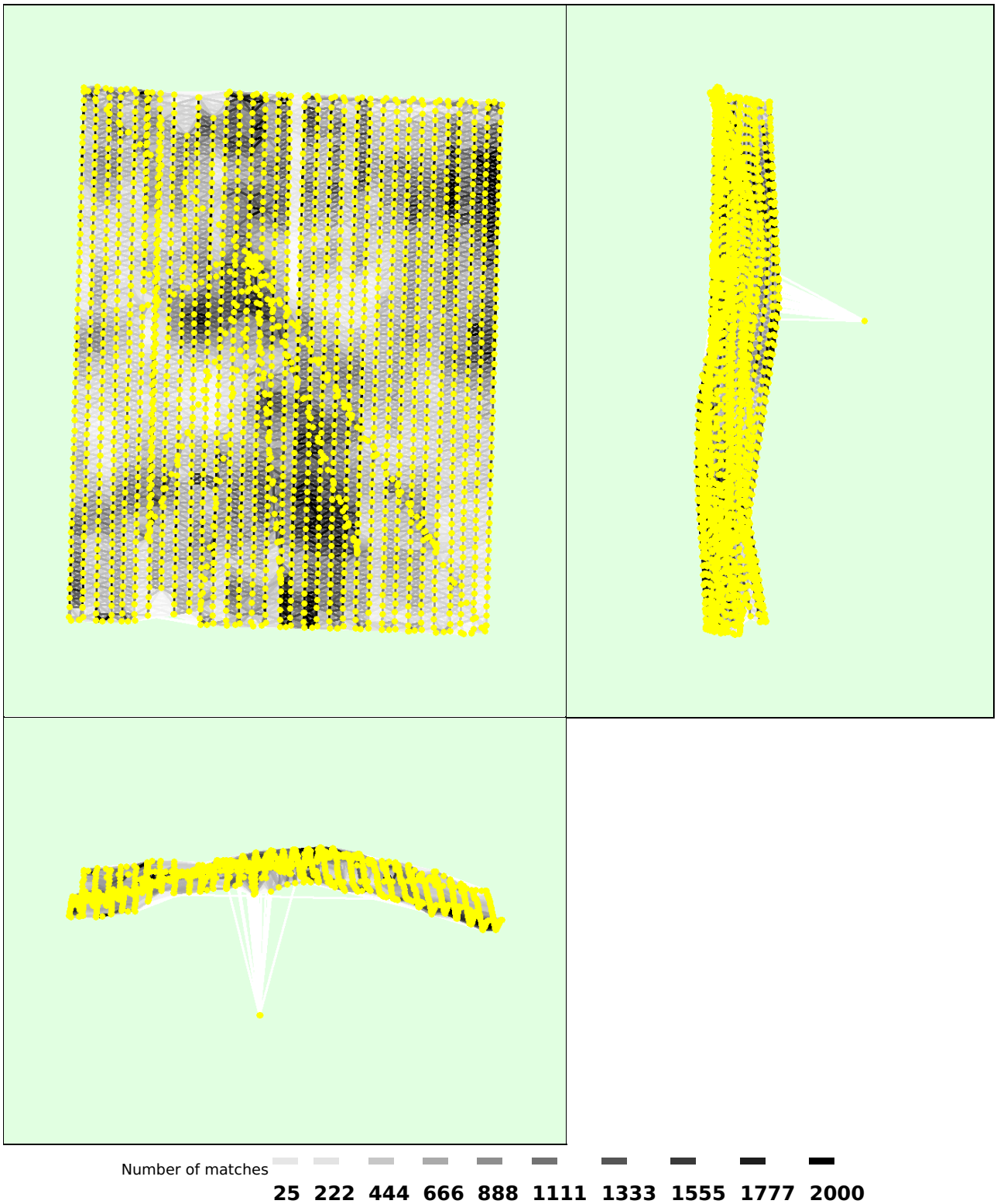

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.31	0.00
-15.00	-12.00	0.00	0.09	0.18
-12.00	-9.00	0.00	0.12	1.22
-9.00	-6.00	0.00	1.18	4.53
-6.00	-3.00	0.04	2.39	1.34
-3.00	0.00	45.87	60.34	36.06
0.00	3.00	53.55	33.19	50.08
3.00	6.00	0.53	0.93	5.79
6.00	9.00	0.00	0.58	0.72
9.00	12.00	0.00	0.10	0.09
12.00	15.00	0.00	0.10	0.00
15.00	-	0.00	0.68	0.00
Mean [m]		-0.063699	-0.482289	-0.064688
Sigma [m]		1.009361	3.419923	2.748545
RMS Error [m]		1.011369	3.453763	2.749306

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	96.22	99.28
[-2.00, 2.00]	100.00	98.65	100.00
[-3.00, 3.00]	100.00	99.01	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 11N (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	12m:19s
Time for Point Cloud Classification	01m:02s
Time for 3D Textured Mesh Generation	11m:45s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	12550008
Average Density (per m^3)	5.63

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.44 [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 (8.44 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	53s
Time for Orthomosaic Generation	57m:07s

Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:07m:58s
Time for Index Map Generation	37s

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	✓