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	stan_5k_3_re
Processed	2019-01-23 09:10:58
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)	7.91 cm / 3.11 in
Area Covered	0.587 km^2 / 58.6645 ha / 0.23 sq. mi. / 145.0382 acres
Time for Initial Processing (without report)	10h:13m:29s

Quality Check

Images	median of 25523 keypoints per image	✓
Dataset	11215 out of 11585 images calibrated (96%), 5 images disabled, 3 blocks	⚠
Camera Optimization	1.32% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 4566.42 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

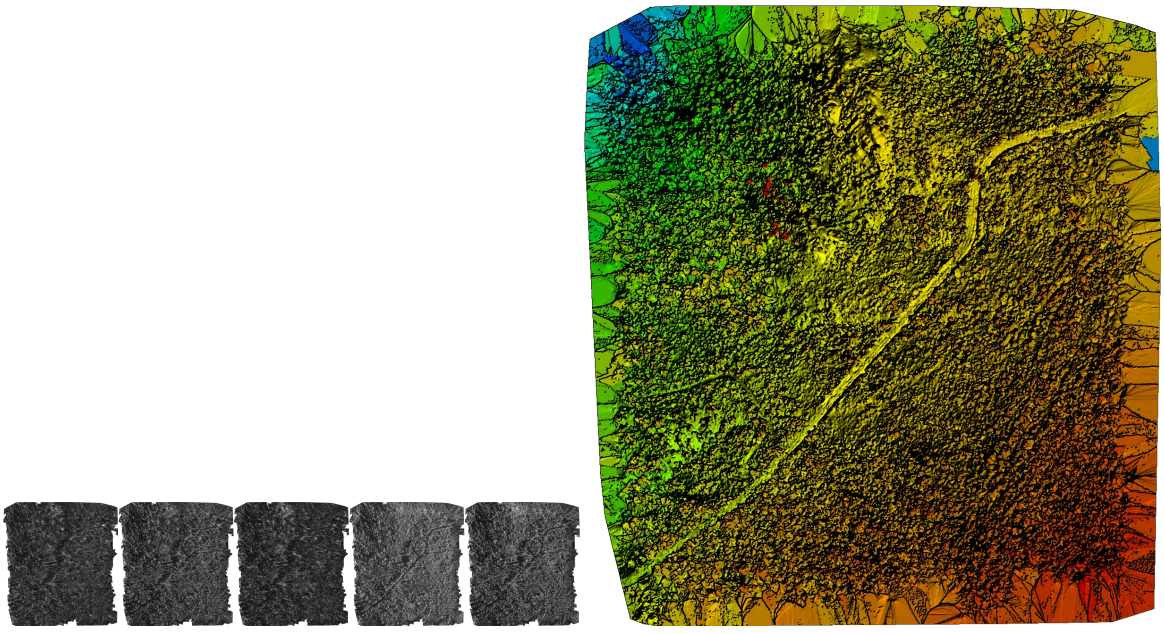


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11215 out of 11590
Number of Geolocated Images	11590 out of 11590

Initial Image Positions

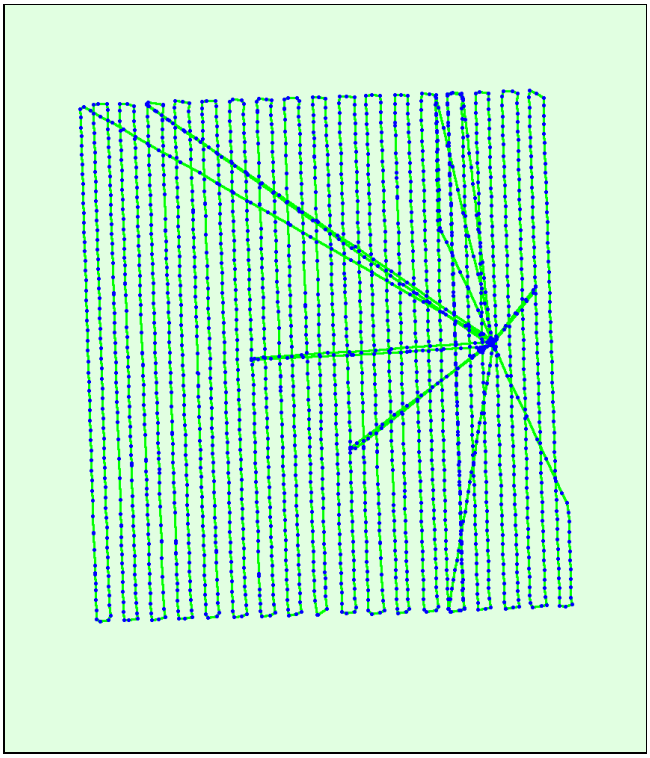
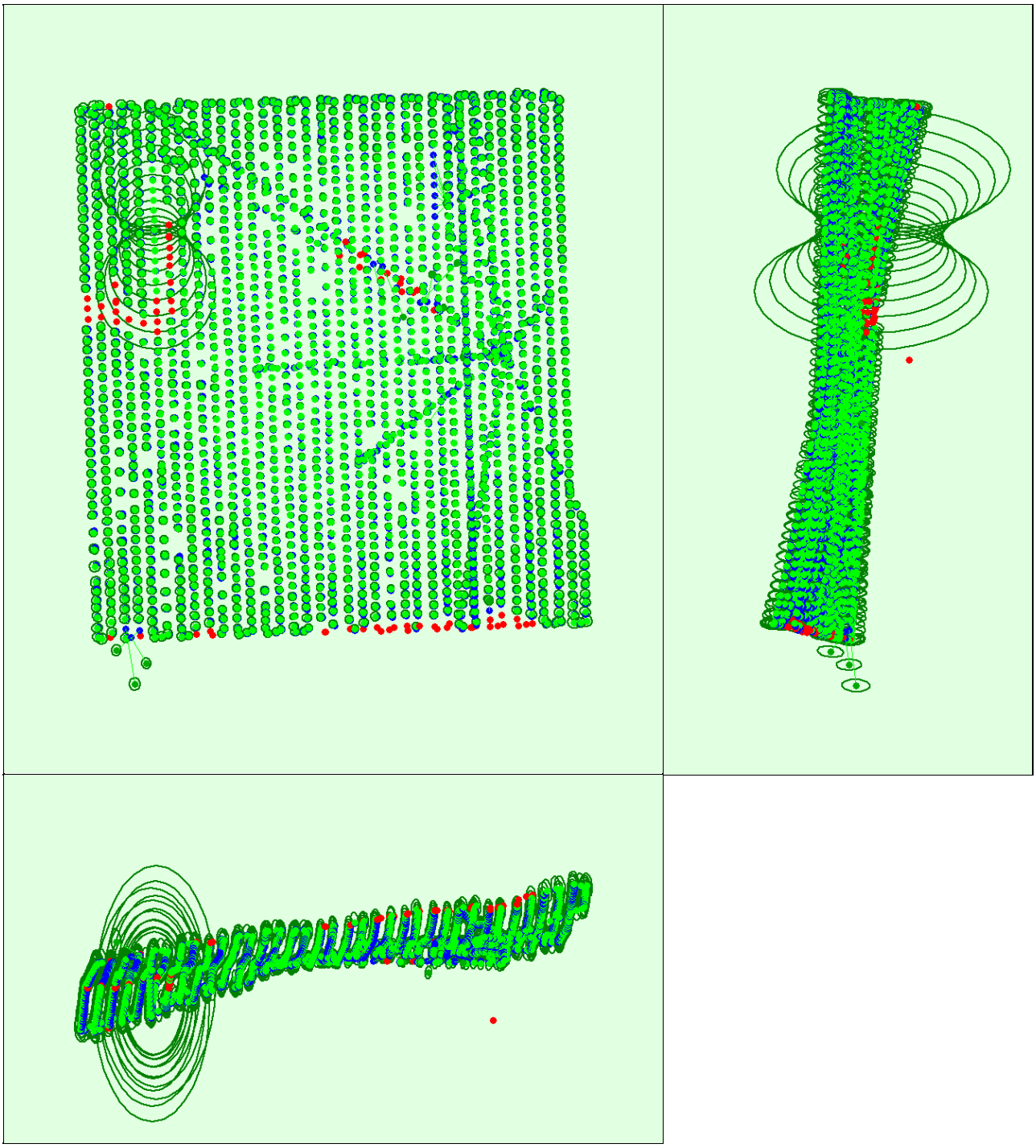


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.089	0.090	0.201	0.072	0.105	0.041
Sigma	0.065	0.065	0.132	0.524	1.014	0.397

Overlap

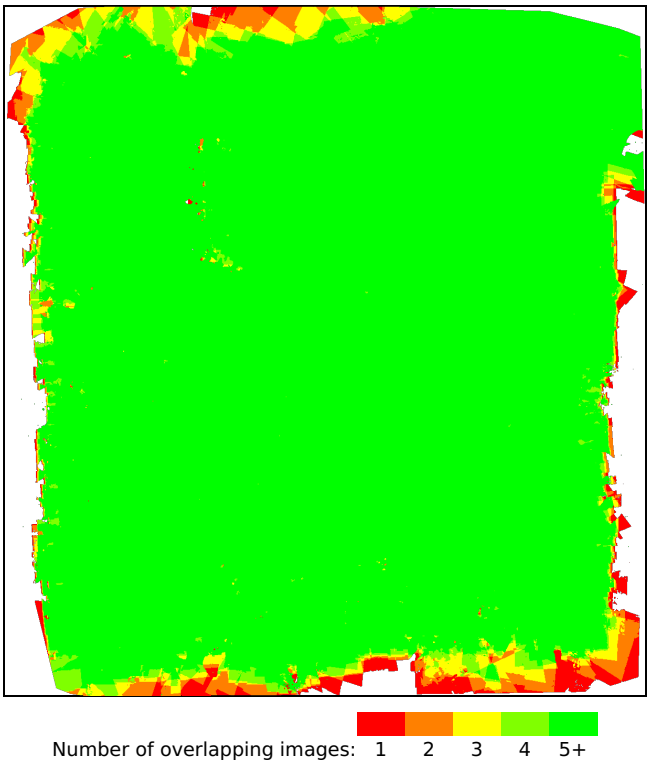


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

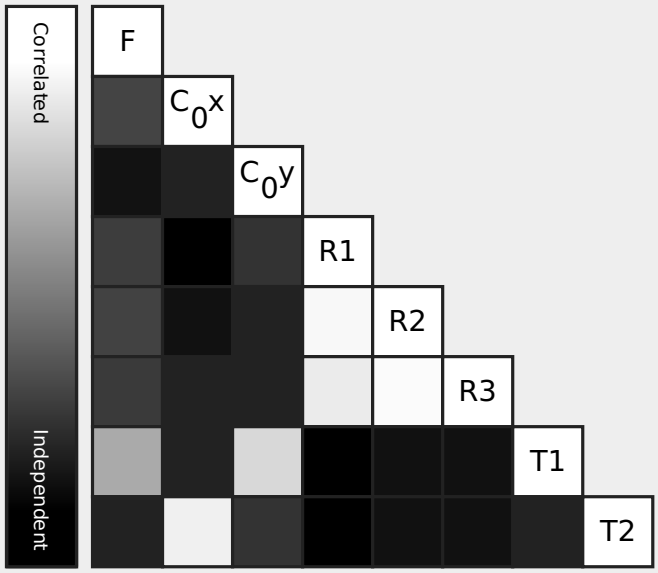
Number of 2D Keypoint Observations for Bundle Block Adjustment	16971514
Number of 3D Points for Bundle Block Adjustment	5472794
Mean Reprojection Error [pixels]	0.212

Internal Camera Parameters

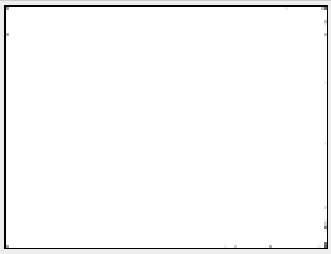
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.837 [pixel] 5.426 [mm]	654.421 [pixel] 2.454 [mm]	494.534 [pixel] 1.855 [mm]	-0.101	0.177	-0.087	0.000	-0.000
Uncertainties (Sigma)	0.138 [pixel] 0.001 [mm]	0.111 [pixel] 0.000 [mm]	0.085 [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.



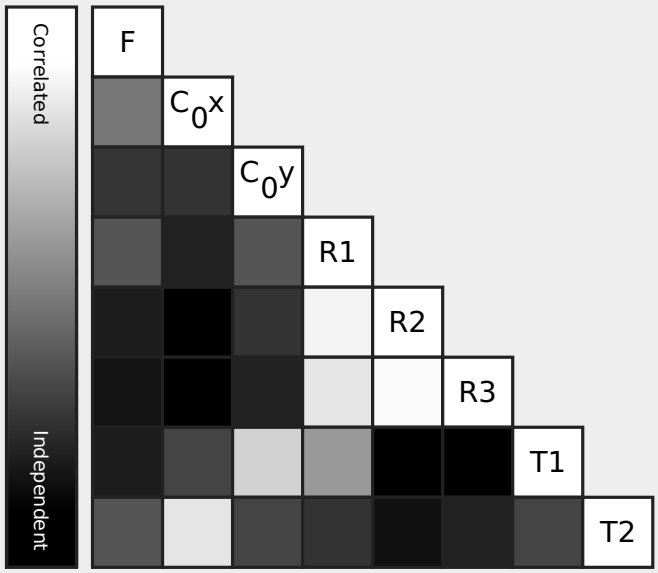
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1443.631 [pixel] 5.414 [mm]	655.780 [pixel] 2.459 [mm]	481.340 [pixel] 1.805 [mm]	-0.100	0.152	-0.038	0.000	0.000
Uncertainties (Sigma)	0.133 [pixel] 0.000 [mm]	0.038 [pixel] 0.000 [mm]	0.032 [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.

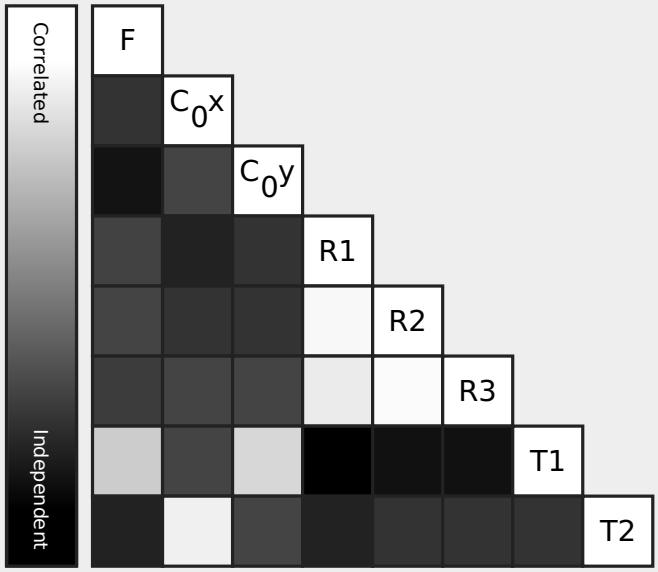
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

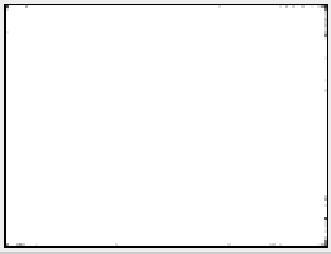
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.629 [pixel] 5.432 [mm]	653.879 [pixel] 2.452 [mm]	493.690 [pixel] 1.851 [mm]	-0.098	0.120	0.024	-0.000	-0.000
Uncertainties (Sigma)	0.139 [pixel] 0.001 [mm]	0.121 [pixel] 0.000 [mm]	0.092 [pixel] 0.000 [mm]	0.001	0.006	0.013	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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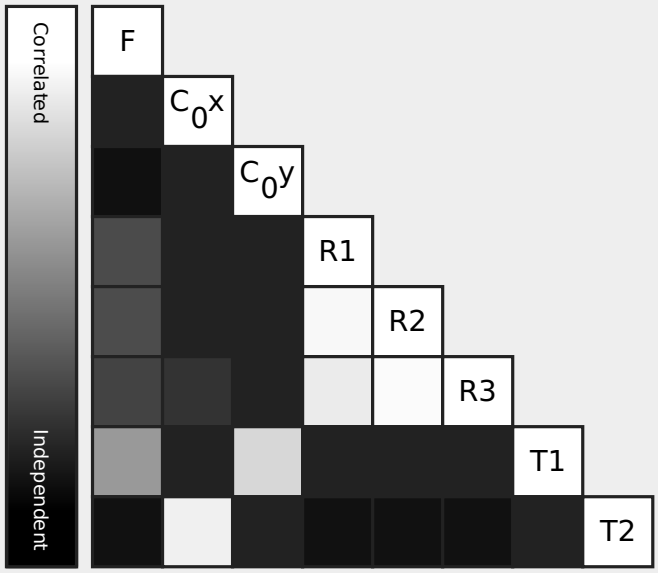
Internal Camera Parameters

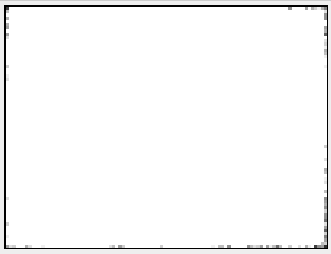
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1449.737 [pixel] 5.437 [mm]	662.619 [pixel] 2.485 [mm]	482.469 [pixel] 1.809 [mm]	-0.108	0.177	-0.094	0.000	-0.000
Uncertainties (Sigma)	0.141 [pixel] 0.001 [mm]	0.135 [pixel] 0.001 [mm]	0.102 [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.



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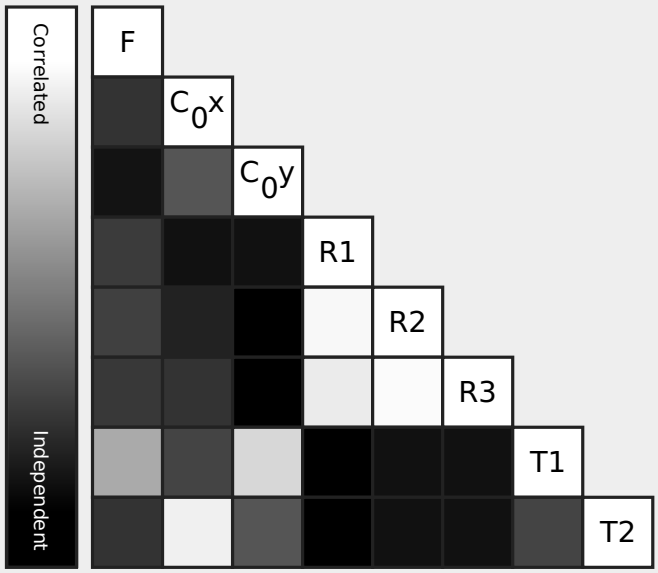
Internal Camera Parameters

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	1447.345 [pixel] 5.428 [mm]	658.097 [pixel] 2.468 [mm]	494.279 [pixel] 1.854 [mm]	-0.105	0.170	-0.082	0.000	-0.000
Uncertainties (Sigma)	0.138 [pixel] 0.001 [mm]	0.110 [pixel] 0.000 [mm]	0.084 [pixel] 0.000 [mm]	0.001	0.005	0.011	0.000	0.000



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Camera Rig «MicaSense 5 band» Relatives. Images: 11585

	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	-0.090	0.104	-0.374
Uncertainties (sigma)				0.003	0.005	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	0.059	0.086	-0.063
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	-0.144	-0.144	0.117
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	-0.067	-0.569	-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	25523	4566
Min	13967	78
Max	39015	22769
Mean	25253	5420

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	22825	3391
Min	16067	100
Max	30232	14316
Mean	22743	4178

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	26604	4876
Min	17055	169
Max	39015	22769
Mean	26158	5820

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21747	3336

Min	13967	78
Max	27868	14707
Mean	21533	4085

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	22208	3262
Min	17762	114
Max	34477	16845
Mean	22580	4210

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	25033	4071
Min	15509	92
Max	35865	17256
Mean	25006	5177

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 / 245 / 9474	23 / 110 / 5662	38 / 388 / 5357	17 / 133 / 2011	22 / 221 / 3647
RedEdge_5.5_1280x960 (Green)		30 / 161 / 19144	20 / 95 / 4929	14 / 67 / 4198	22 / 110 / 8587
RedEdge_5.5_1280x960 (Red)			42 / 340 / 11215	16 / 116 / 1560	20 / 201 / 3080
RedEdge_5.5_1280x960 (NIR)				51 / 411 / 12605	37 / 384 / 5662
RedEdge_5.5_1280x960 (Red edge)					37 / 319 / 10334

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	3527988
In 3 Images	881872
In 4 Images	396842
In 5 Images	207314
In 6 Images	127220
In 7 Images	77157
In 8 Images	53242
In 9 Images	39017
In 10 Images	30402
In 11 Images	23602
In 12 Images	18306
In 13 Images	14217
In 14 Images	11478
In 15 Images	9120
In 16 Images	7429
In 17 Images	6350
In 18 Images	5292
In 19 Images	4495
In 20 Images	3984
In 21 Images	3517
In 22 Images	2988
In 23 Images	2541
In 24 Images	2248

In 25 Images	1997
In 26 Images	1740
In 27 Images	1614
In 28 Images	1312
In 29 Images	1115
In 30 Images	978
In 31 Images	841
In 32 Images	723
In 33 Images	582
In 34 Images	527
In 35 Images	464
In 36 Images	422
In 37 Images	355
In 38 Images	260
In 39 Images	259
In 40 Images	229
In 41 Images	201
In 42 Images	185
In 43 Images	159
In 44 Images	146
In 45 Images	119
In 46 Images	132
In 47 Images	102
In 48 Images	88
In 49 Images	100
In 50 Images	80
In 51 Images	66
In 52 Images	75
In 53 Images	55
In 54 Images	74
In 55 Images	54
In 56 Images	51
In 57 Images	50
In 58 Images	36
In 59 Images	40
In 60 Images	42
In 61 Images	38
In 62 Images	45
In 63 Images	36
In 64 Images	37
In 65 Images	32
In 66 Images	23
In 67 Images	34
In 68 Images	27
In 69 Images	29
In 70 Images	16
In 71 Images	20
In 72 Images	29
In 73 Images	25
In 74 Images	18
In 75 Images	28
In 76 Images	23
In 77 Images	19
In 78 Images	15
In 79 Images	12
In 80 Images	12
In 81 Images	10
In 82 Images	20
In 83 Images	16

In 84 Images	15
In 85 Images	10
In 86 Images	12
In 87 Images	13
In 88 Images	14
In 89 Images	4
In 90 Images	13
In 91 Images	13
In 92 Images	7
In 93 Images	10
In 94 Images	6
In 95 Images	11
In 96 Images	8
In 97 Images	6
In 98 Images	9
In 99 Images	6
In 100 Images	7
In 101 Images	5
In 102 Images	10
In 103 Images	6
In 104 Images	10
In 105 Images	7
In 106 Images	8
In 107 Images	5
In 108 Images	6
In 109 Images	3
In 110 Images	4
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In 112 Images	1
In 113 Images	2
In 114 Images	3
In 115 Images	2
In 116 Images	3
In 117 Images	2
In 118 Images	4
In 120 Images	5
In 121 Images	4
In 122 Images	6
In 123 Images	1
In 124 Images	6
In 125 Images	3
In 126 Images	4
In 127 Images	4
In 128 Images	2
In 129 Images	2
In 130 Images	1
In 131 Images	4
In 132 Images	1
In 133 Images	4
In 134 Images	2
In 135 Images	2
In 136 Images	1
In 137 Images	3
In 138 Images	2
In 139 Images	1
In 140 Images	1
In 141 Images	1
In 143 Images	4
In 145 Images	3

In 147 Images	1
In 148 Images	1
In 151 Images	1
In 154 Images	2
In 155 Images	1
In 156 Images	1
In 160 Images	1
In 166 Images	1
In 172 Images	1
In 175 Images	1
In 182 Images	1
In 232 Images	1

2D Keypoint Matches

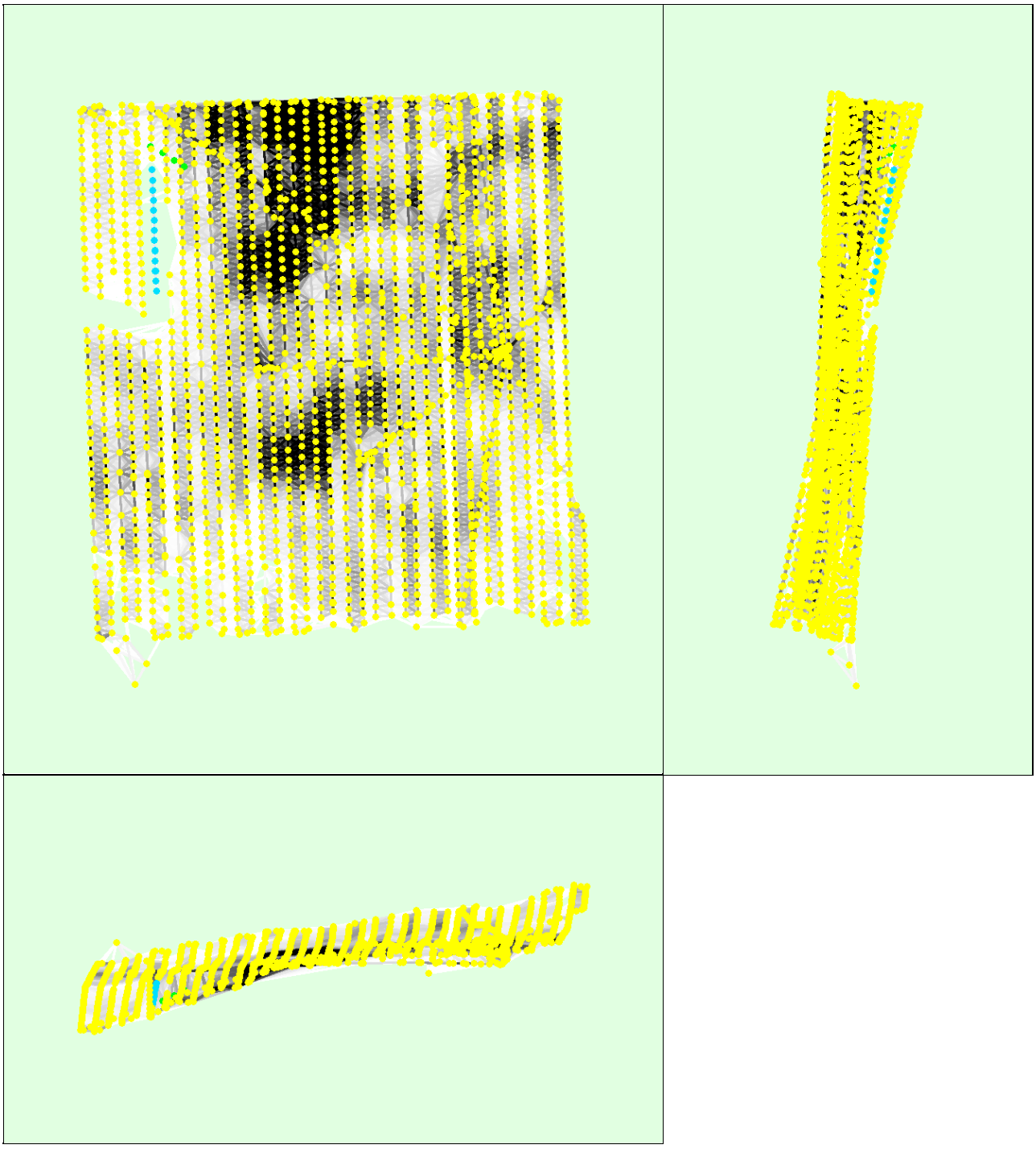

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D

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	0.07	0.02	0.00
-15.00	-12.00	0.00	0.00	0.00
-12.00	-9.00	0.03	0.01	0.00
-9.00	-6.00	0.03	0.00	0.00
-6.00	-3.00	0.13	1.40	0.03
-3.00	0.00	48.57	52.71	49.72
0.00	3.00	51.16	45.46	50.22
3.00	6.00	0.00	0.29	0.03
6.00	9.00	0.00	0.01	0.01
9.00	12.00	0.00	0.02	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.08	0.00
Mean [m]		0.060159	-0.150303	-0.000857
Sigma [m]		0.906072	1.890314	0.965638
RMS Error [m]		0.908067	1.896280	0.965638

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]	99.87	99.87	100.00
[-2.00, 2.00]	99.90	99.87	100.00
[-3.00, 3.00]	99.93	99.90	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:51s
Time for Point Cloud Classification	57s
Time for 3D Textured Mesh Generation	10m:31s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11932812
Average Density (per m^3)	5.61

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (7.91 [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 (7.91 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi

Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	50s
Time for Orthomosaic Generation	01h:08m:35s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:17m:55s
Time for Index Map Generation	41s

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	✓