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	sequ_4k_3_re
Processed	2019-01-24 11:54:33
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)	7.98 cm / 3.14 in
Area Covered	0.586 km^2 / 58.6284 ha / 0.23 sq. mi. / 144.9490 acres
Time for Initial Processing (without report)	12h:39m:24s

Quality Check

Images	median of 31636 keypoints per image	✓
Dataset	10780 out of 10780 images calibrated (100%), 5 images disabled	✓
Camera Optimization	1.4% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 10061.5 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

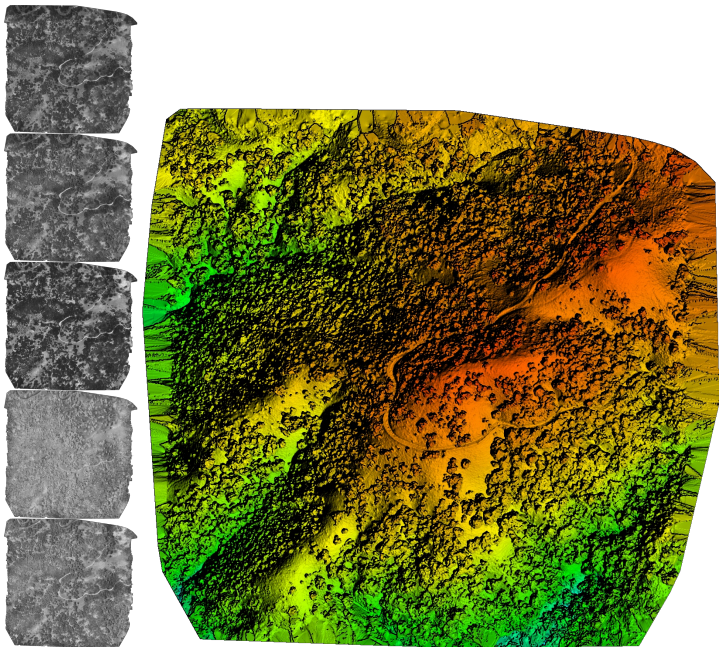


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10780 out of 10785
Number of Geolocated Images	10785 out of 10785

Initial Image Positions

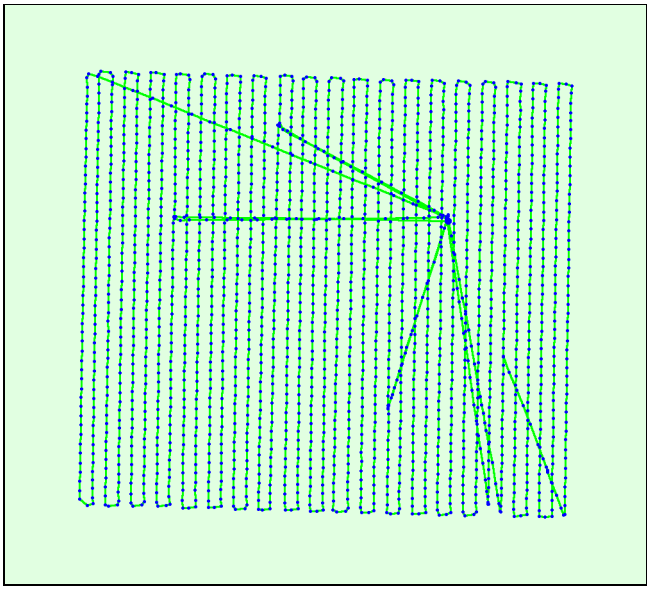
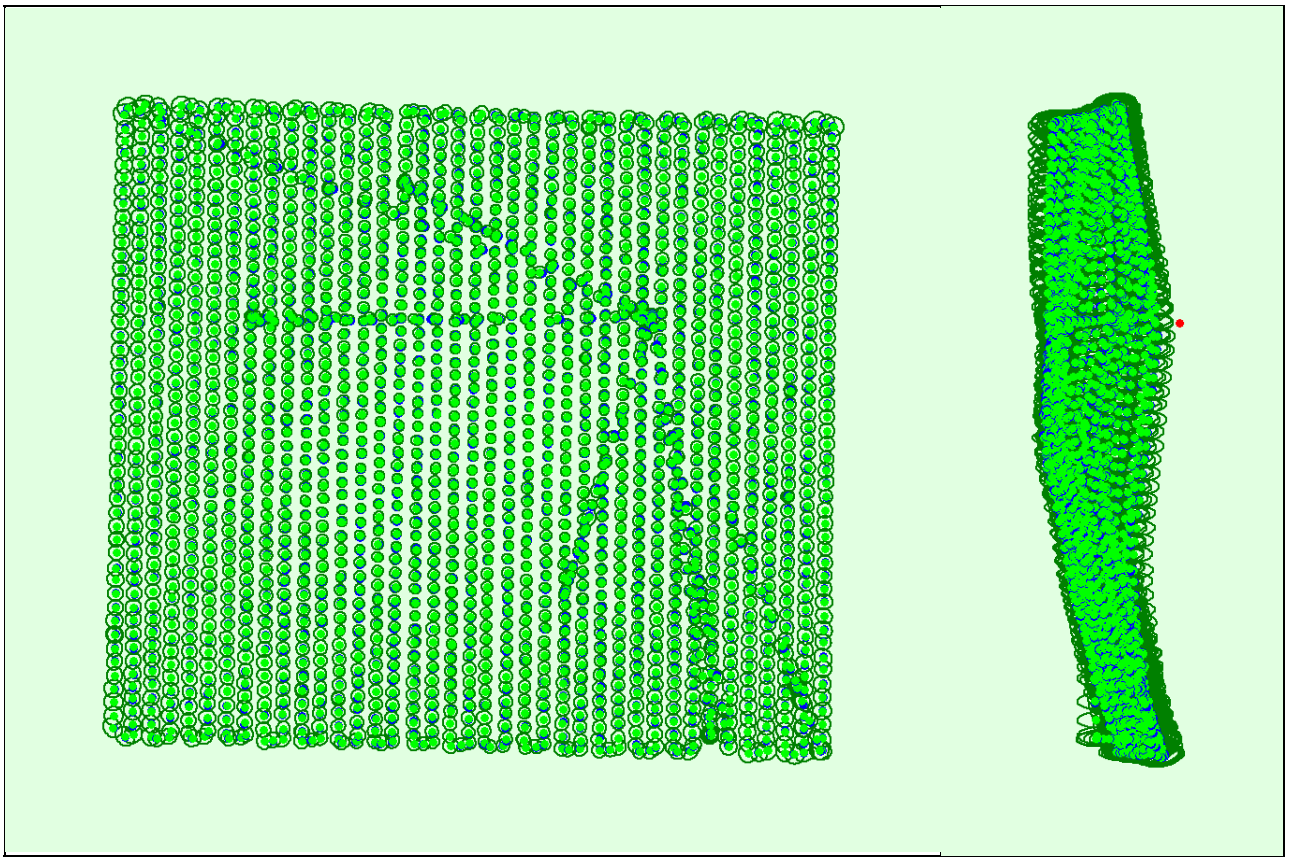
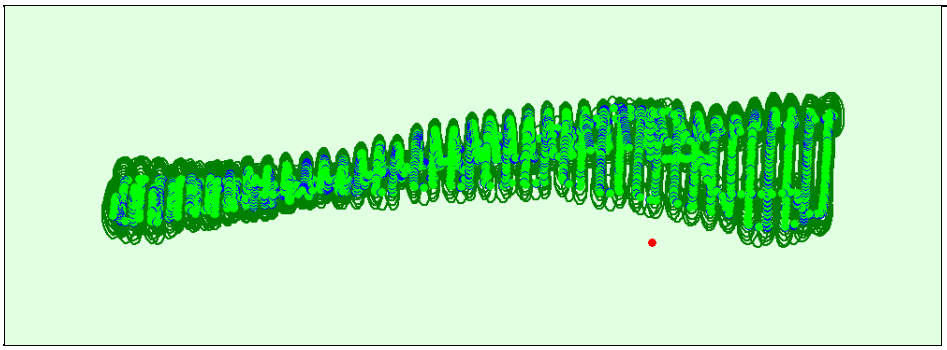


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions





Uncertainty ellipses 100x 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	0.060	0.061	0.134	0.029	0.027	0.011
Sigma	0.010	0.009	0.028	0.002	0.002	0.002

Overlap

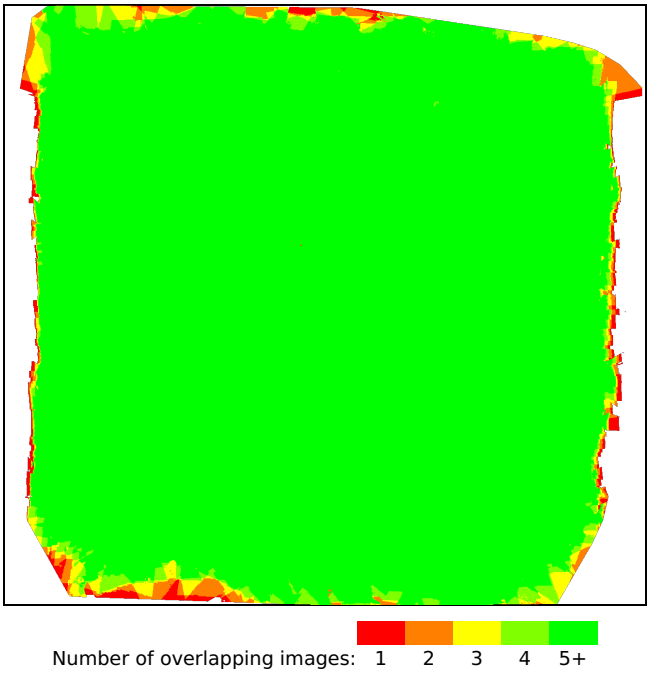


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

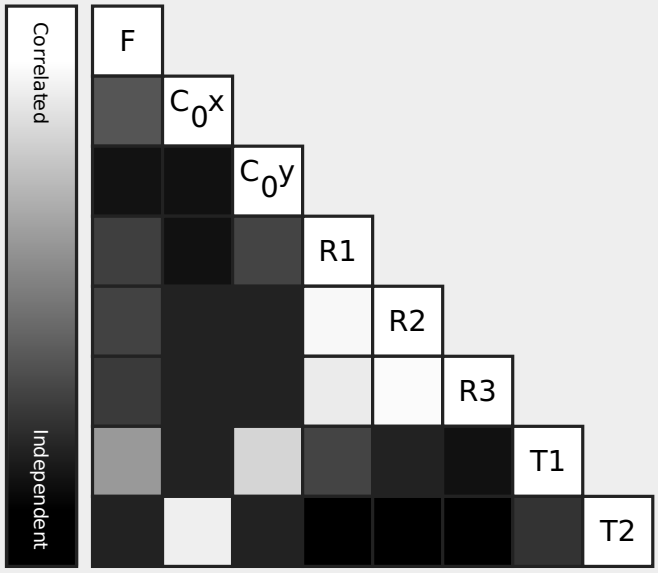
Number of 2D Keypoint Observations for Bundle Block Adjustment	30390799
Number of 3D Points for Bundle Block Adjustment	10182233
Mean Reprojection Error [pixels]	0.197

Internal Camera Parameters

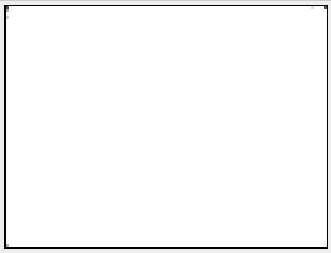
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1445.653 [pixel] 5.421 [mm]	654.580 [pixel] 2.455 [mm]	495.191 [pixel] 1.857 [mm]	-0.097	0.159	-0.050	0.000	-0.000
Uncertainties (Sigma)	0.107 [pixel] 0.000 [mm]	0.085 [pixel] 0.000 [mm]	0.064 [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.



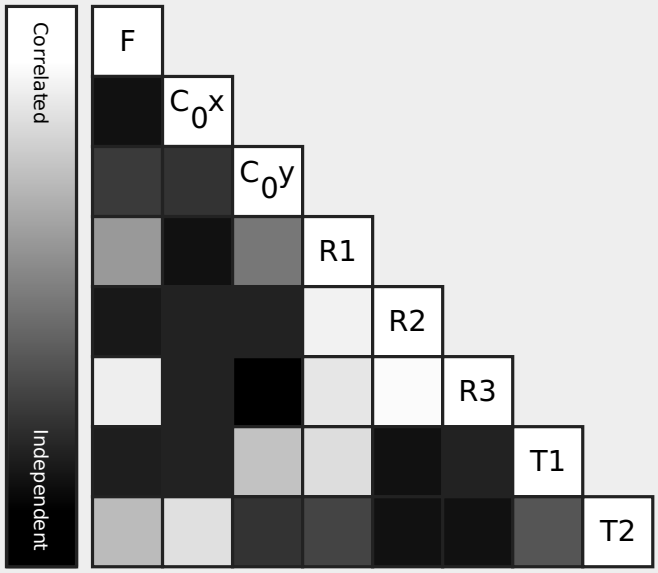
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

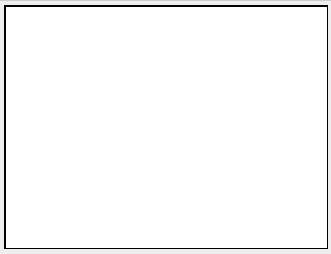
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1442.621 [pixel] 5.410 [mm]	655.886 [pixel] 2.460 [mm]	481.434 [pixel] 1.805 [mm]	-0.099	0.146	-0.027	0.000	0.000
Uncertainties (Sigma)	0.102 [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.



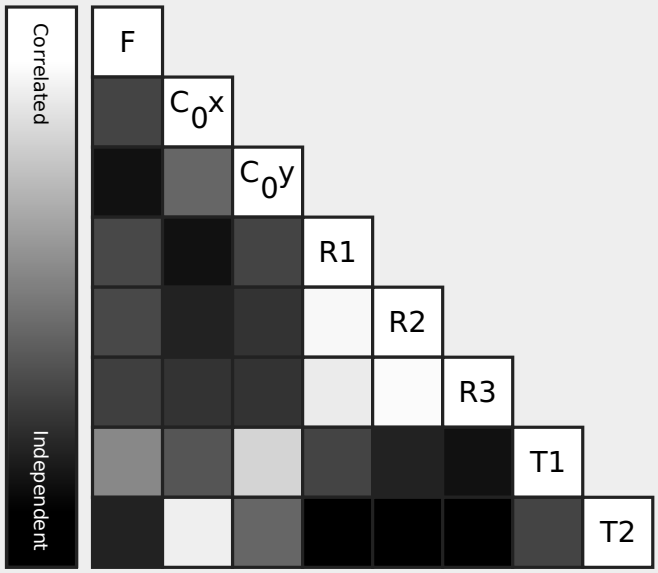
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1447.574 [pixel] 5.428 [mm]	653.875 [pixel] 2.452 [mm]	493.766 [pixel] 1.852 [mm]	-0.097	0.110	0.044	-0.000	-0.000
Uncertainties (Sigma)	0.109 [pixel] 0.000 [mm]	0.095 [pixel] 0.000 [mm]	0.072 [pixel] 0.000 [mm]	0.001	0.005	0.010	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.

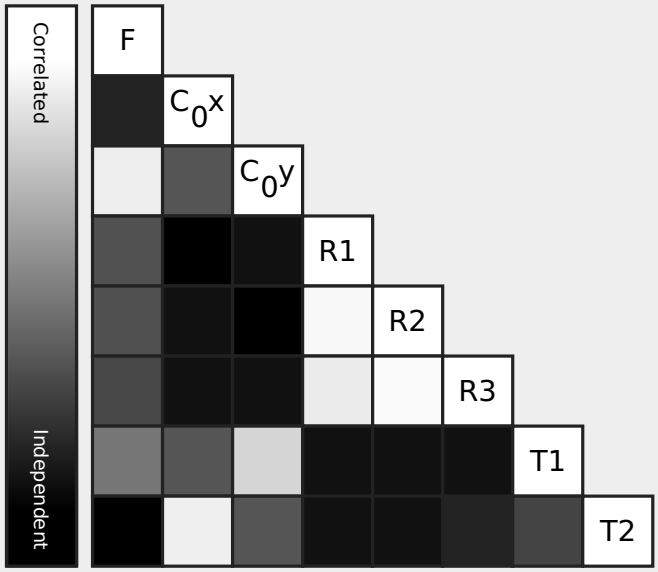
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1448.397 [pixel] 5.431 [mm]	662.668 [pixel] 2.485 [mm]	482.238 [pixel] 1.808 [mm]	-0.105	0.160	-0.061	0.000	-0.000
Uncertainties (Sigma)	0.110 [pixel] 0.000 [mm]	0.108 [pixel] 0.000 [mm]	0.082 [pixel] 0.000 [mm]	0.001	0.005	0.012	0.000	0.000



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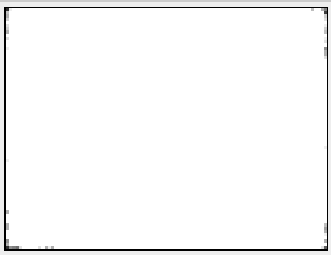

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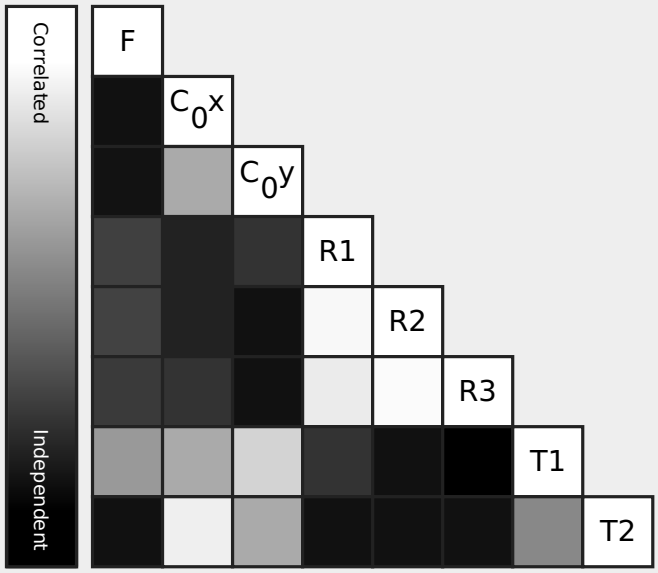
Internal Camera Parameters

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	1446.058 [pixel] 5.423 [mm]	657.540 [pixel] 2.466 [mm]	494.295 [pixel] 1.854 [mm]	-0.101	0.143	-0.023	0.000	-0.000
Uncertainties (Sigma)	0.107 [pixel] 0.000 [mm]	0.087 [pixel] 0.000 [mm]	0.066 [pixel] 0.000 [mm]	0.001	0.004	0.009	0.000	0.000



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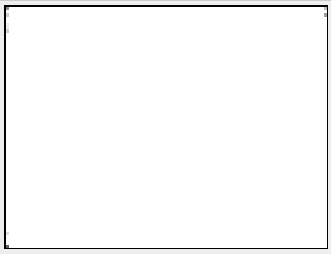

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Camera Rig «MicaSense 5 band» Relatives. Images: 10780

	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	0.132	-0.373
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	0.044	0.091	-0.062
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	-0.147	-0.117	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	-0.074	-0.571	-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	31636	10061
Min	17848	368
Max	44516	27682
Mean	30303	10063

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

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

Median	27183	6075
Min	18913	967
Max	37707	19451
Mean	26633	6501

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	32512	11134
Min	18342	2223
Max	44253	27682
Mean	31260	11146

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21015	4668
Min	18151	537
Max	28880	13412
Mean	21601	5068

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31081	8433
Min	17848	368
Max	43082	26519
Mean	30848	8754

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	33102	8704
Min	18678	502
Max	44516	27216
Mean	32576	9123

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 / 247 / 14417	42 / 177 / 6692	40 / 238 / 5026	19 / 97 / 1455	30 / 177 / 3398
RedEdge_5.5_1280x960 (Green)		61 / 308 / 18885	34 / 135 / 3460	18 / 71 / 4061	32 / 140 / 8335
RedEdge_5.5_1280x960 (Red)			34 / 248 / 10280	21 / 115 / 1782	33 / 215 / 3384
RedEdge_5.5_1280x960 (NIR)				36 / 430 / 23614	41 / 404 / 6256
RedEdge_5.5_1280x960 (Red edge)					33 / 292 / 19079

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	6662708
In 3 Images	1740141
In 4 Images	711982
In 5 Images	349782
In 6 Images	200229

In 7 Images	124902
In 8 Images	85222
In 9 Images	60821
In 10 Images	45496
In 11 Images	35106
In 12 Images	27282
In 13 Images	21746
In 14 Images	17674
In 15 Images	14192
In 16 Images	11713
In 17 Images	9890
In 18 Images	8338
In 19 Images	6884
In 20 Images	5915
In 21 Images	5031
In 22 Images	4422
In 23 Images	3786
In 24 Images	3299
In 25 Images	2805
In 26 Images	2490
In 27 Images	2210
In 28 Images	1991
In 29 Images	1746
In 30 Images	1531
In 31 Images	1318
In 32 Images	1168
In 33 Images	1051
In 34 Images	839
In 35 Images	799
In 36 Images	736
In 37 Images	609
In 38 Images	576
In 39 Images	452
In 40 Images	421
In 41 Images	388
In 42 Images	374
In 43 Images	285
In 44 Images	315
In 45 Images	228
In 46 Images	237
In 47 Images	205
In 48 Images	178
In 49 Images	164
In 50 Images	148
In 51 Images	147
In 52 Images	138
In 53 Images	106
In 54 Images	105
In 55 Images	95
In 56 Images	88
In 57 Images	99
In 58 Images	77
In 59 Images	60
In 60 Images	79
In 61 Images	52
In 62 Images	73
In 63 Images	51
In 64 Images	49
In 65 Images	33

In 66 Images	33
In 67 Images	38
In 68 Images	40
In 69 Images	41
In 70 Images	37
In 71 Images	40
In 72 Images	31
In 73 Images	33
In 74 Images	31
In 75 Images	31
In 76 Images	17
In 77 Images	29
In 78 Images	30
In 79 Images	20
In 80 Images	26
In 81 Images	21
In 82 Images	24
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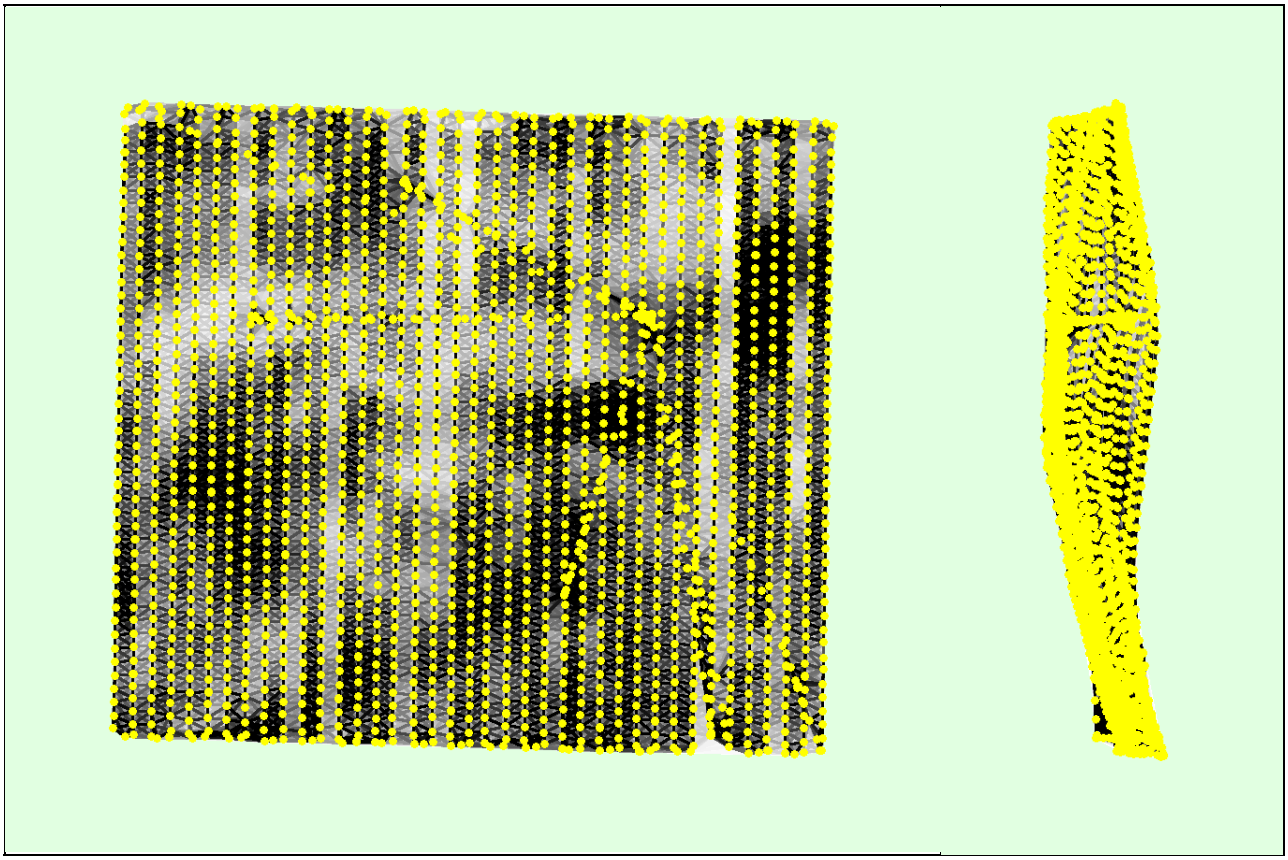
In 109 Images	15
In 110 Images	9
In 111 Images	9
In 112 Images	16
In 113 Images	8
In 114 Images	10
In 115 Images	17
In 116 Images	8
In 117 Images	9
In 118 Images	2
In 119 Images	8
In 120 Images	7
In 121 Images	4
In 122 Images	4
In 123 Images	4
In 124 Images	1

In 125 Images	6
In 126 Images	3
In 127 Images	2
In 128 Images	3
In 129 Images	8
In 130 Images	6
In 131 Images	1
In 132 Images	4
In 133 Images	3
In 134 Images	4
In 135 Images	3
In 136 Images	5
In 137 Images	4
In 138 Images	1
In 139 Images	5
In 140 Images	1
In 141 Images	1
In 142 Images	1
In 143 Images	1
In 144 Images	1
In 145 Images	3
In 146 Images	1
In 147 Images	1

2D Keypoint Matches



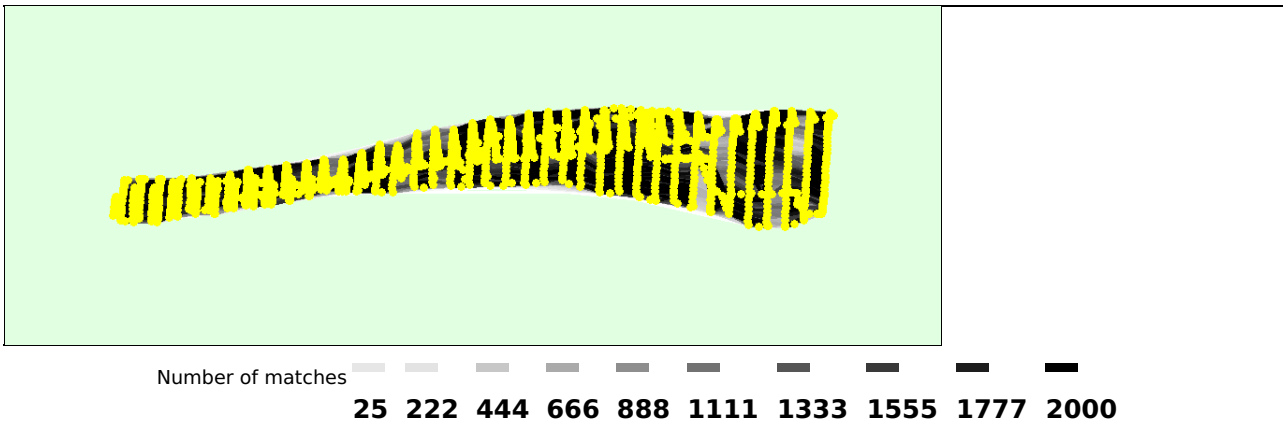


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.00	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	0.03	0.00	0.00
-3.00	0.00	50.27	50.32	50.02
0.00	3.00	49.70	49.63	49.98
3.00	6.00	0.00	0.05	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]		0.000146	0.000261	0.000161
Sigma [m]		0.394724	0.893959	0.512355
RMS Error [m]		0.394724	0.893959	0.512355

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	100.00	100.00
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	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) 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	10m:51s
Time for Point Cloud Classification	01m:08s
Time for 3D Textured Mesh Generation	10m:30s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	12174535
Average Density (per m^3)	8.04

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (7.98 [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 (7.98 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	51s
Time for Orthomosaic Generation	44m:26s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	48m:44s
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	✓