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_6k_1_re
Processed	2019-01-24 10:31:56
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)	8.72 cm / 3.43 in
Area Covered	0.581 km^2 / 58.0518 ha / 0.22 sq. mi. / 143.5233 acres
Time for Initial Processing (without report)	12h:58m:14s

Quality Check

Images	median of 30726 keypoints per image	✓
Dataset	9655 out of 9670 images calibrated (99%), 5 images disabled	✓
Camera Optimization	1.44% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 7058.51 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

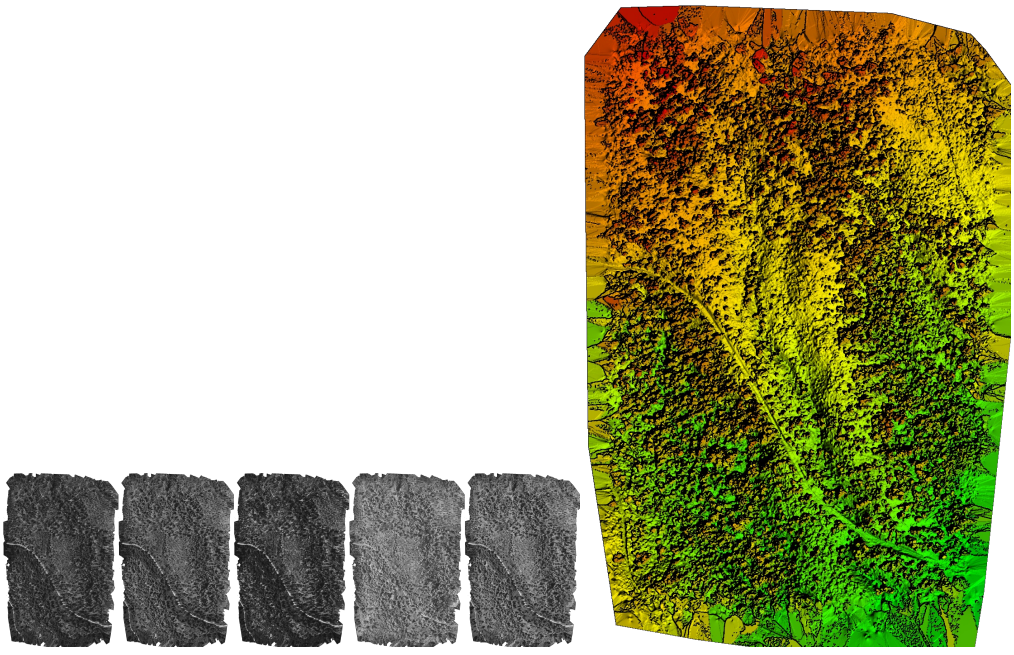


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	9655 out of 9675
Number of Geolocated Images	9675 out of 9675

Initial Image Positions

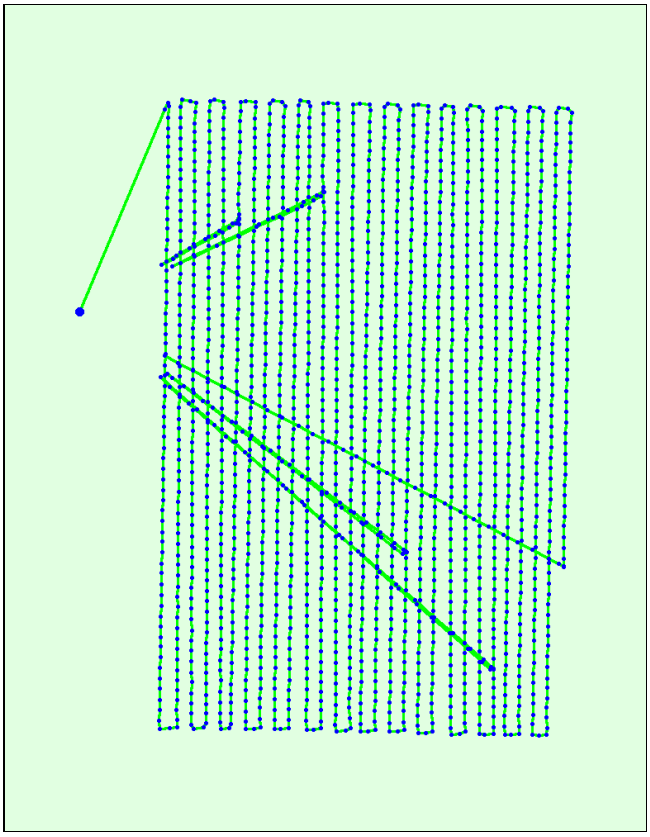
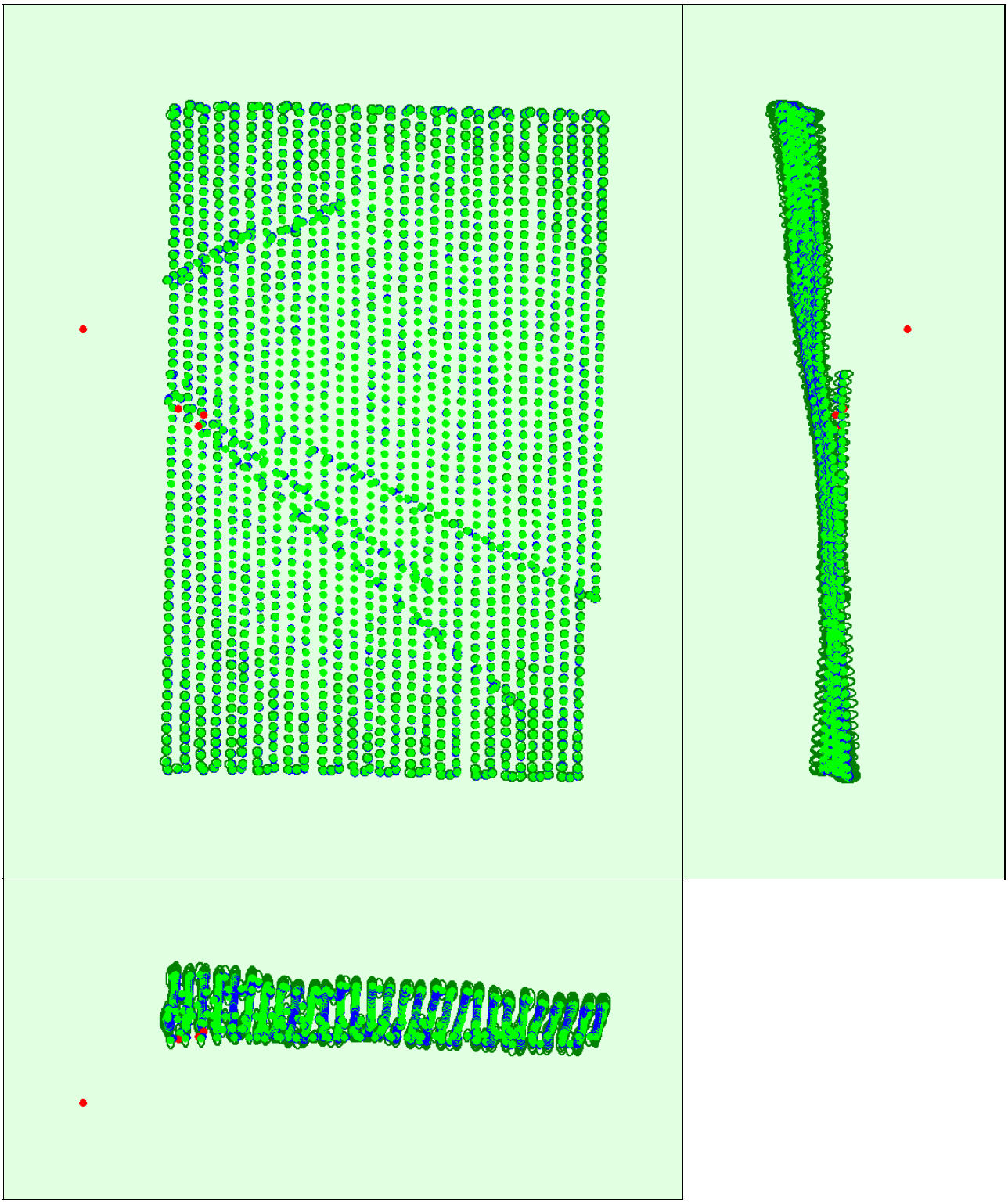


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.078	0.079	0.181	0.033	0.043	0.014
Sigma	0.013	0.013	0.039	0.004	0.003	0.003

Overlap

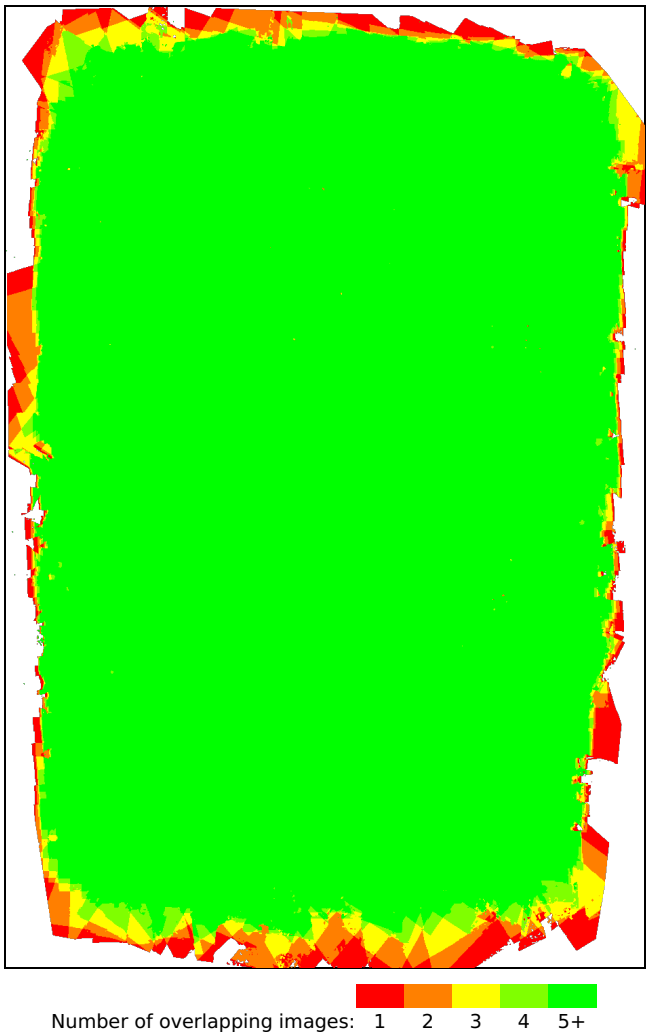


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

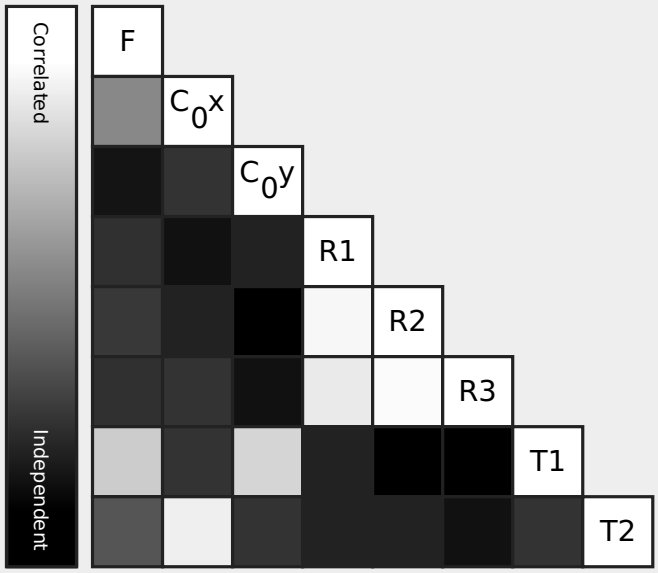
Number of 2D Keypoint Observations for Bundle Block Adjustment	19727710
Number of 3D Points for Bundle Block Adjustment	6391606
Mean Reprojection Error [pixels]	0.203

Internal Camera Parameters

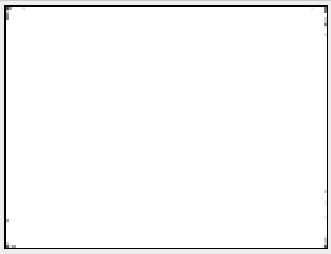
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1444.971 [pixel] 5.419 [mm]	654.581 [pixel] 2.455 [mm]	494.884 [pixel] 1.856 [mm]	-0.101	0.179	-0.091	0.000	-0.000
Uncertainties (Sigma)	0.141 [pixel] 0.001 [mm]	0.097 [pixel] 0.000 [mm]	0.074 [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.



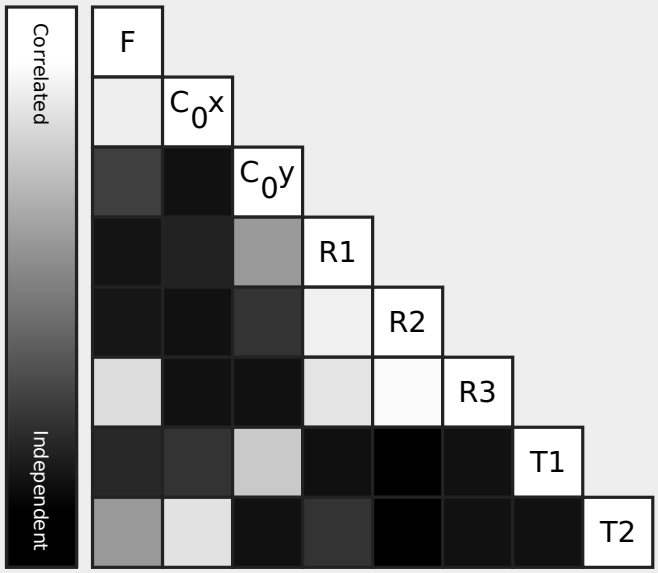
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

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	1441.789 [pixel] 5.407 [mm]	655.898 [pixel] 2.460 [mm]	481.252 [pixel] 1.805 [mm]	-0.101	0.157	-0.046	0.000	0.000
Uncertainties (Sigma)	0.137 [pixel] 0.001 [mm]	0.031 [pixel] 0.000 [mm]	0.025 [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.

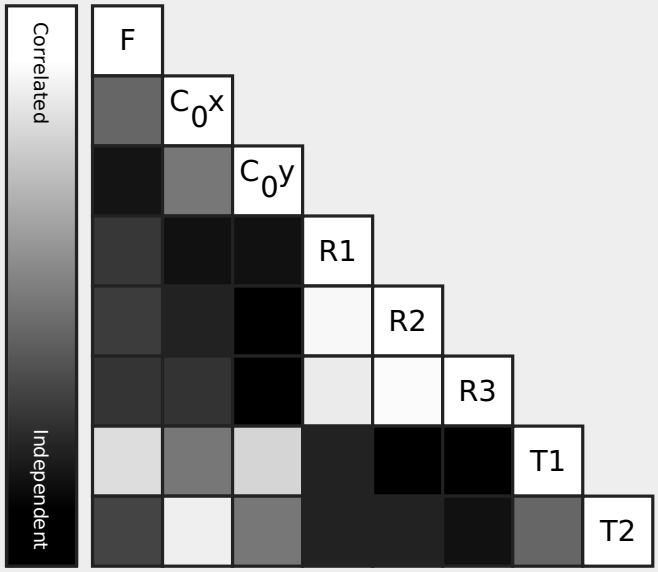
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1447.052 [pixel] 5.426 [mm]	653.819 [pixel] 2.452 [mm]	493.479 [pixel] 1.851 [mm]	-0.102	0.144	-0.028	-0.000	-0.000
Uncertainties (Sigma)	0.142 [pixel] 0.001 [mm]	0.109 [pixel] 0.000 [mm]	0.083 [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.

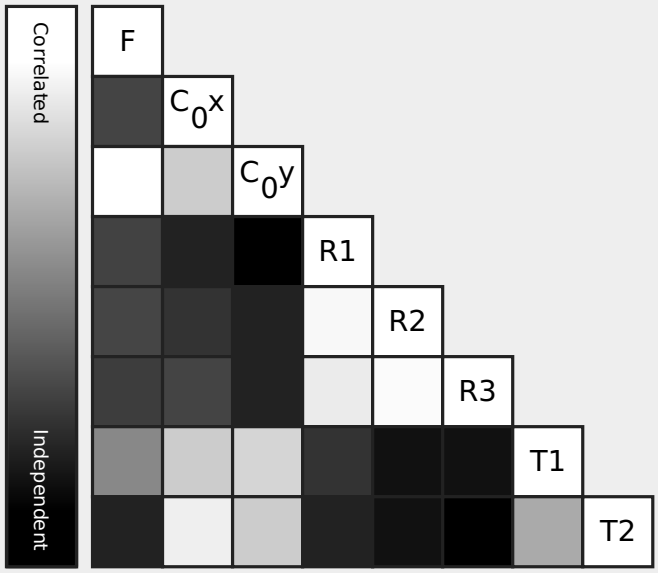
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

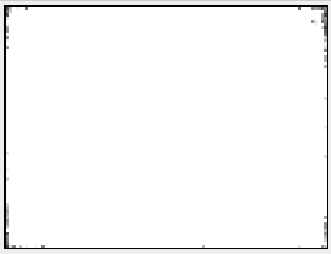
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1447.847 [pixel] 5.429 [mm]	662.641 [pixel] 2.485 [mm]	482.439 [pixel] 1.809 [mm]	-0.107	0.165	-0.066	0.000	-0.000
Uncertainties (Sigma)	0.144 [pixel] 0.001 [mm]	0.124 [pixel] 0.000 [mm]	0.094 [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.



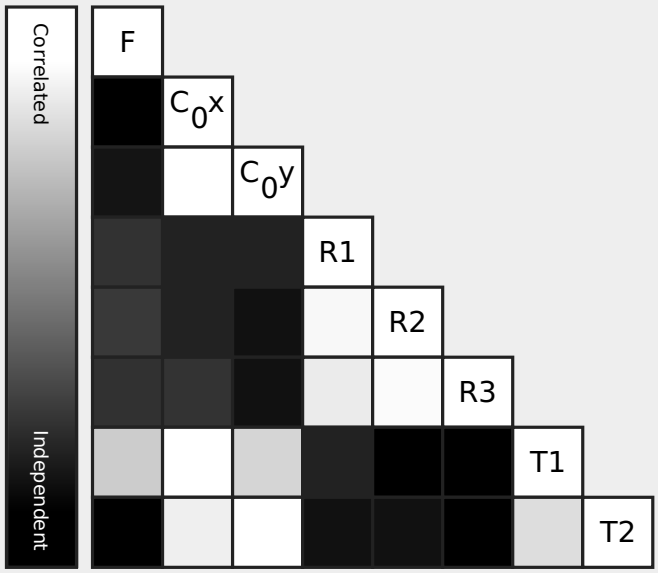
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1445.458 [pixel] 5.420 [mm]	657.755 [pixel] 2.467 [mm]	494.122 [pixel] 1.853 [mm]	-0.104	0.161	-0.056	0.000	-0.000
Uncertainties (Sigma)	0.141 [pixel] 0.001 [mm]	0.100 [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: 9670

	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	-0.109	0.131	-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	0.049	0.087	-0.062
Uncertainties (sigma)				0.003	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	-0.158	-0.120	0.120
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	-0.073	-0.564	-0.320
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	30726	7059
Min	17550	266
Max	43251	24063
Mean	30512	7288

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	25692	5457
Min	18986	478
Max	37250	13262
Mean	26657	5575

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31210	7515
Min	19271	953
Max	42952	24063
Mean	31174	7769

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	23908	4936

Min	18015	333
Max	36961	12855
Mean	25285	5115

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	30066	6368
Min	17550	266
Max	41663	17741
Mean	31043	6745

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	31597	6755
Min	18097	446
Max	43251	14325
Mean	32479	6922

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)	47 / 269 / 8245	35 / 143 / 3835	43 / 314 / 3703	18 / 149 / 1512	26 / 188 / 2202
RedEdge_5.5_1280x960 (Green)		46 / 207 / 12683	28 / 110 / 3428	14 / 62 / 2086	25 / 115 / 4476
RedEdge_5.5_1280x960 (Red)			45 / 291 / 8392	16 / 130 / 1881	25 / 177 / 2791
RedEdge_5.5_1280x960 (NIR)				33 / 435 / 12591	28 / 339 / 2919
RedEdge_5.5_1280x960 (Red edge)					31 / 308 / 7813

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4112858
In 3 Images	1056717
In 4 Images	458569
In 5 Images	236114
In 6 Images	143091
In 7 Images	90975
In 8 Images	61686
In 9 Images	44842
In 10 Images	34330
In 11 Images	26690
In 12 Images	21256
In 13 Images	16685
In 14 Images	13382
In 15 Images	10651
In 16 Images	8899
In 17 Images	7534
In 18 Images	6196
In 19 Images	5249
In 20 Images	4562
In 21 Images	3954
In 22 Images	3190
In 23 Images	2815
In 24 Images	2483

In 25 Images	2181
In 26 Images	1917
In 27 Images	1642
In 28 Images	1494
In 29 Images	1317
In 30 Images	1167
In 31 Images	1016
In 32 Images	881
In 33 Images	792
In 34 Images	717
In 35 Images	645
In 36 Images	574
In 37 Images	488
In 38 Images	467
In 39 Images	397
In 40 Images	349
In 41 Images	345
In 42 Images	262
In 43 Images	276
In 44 Images	223
In 45 Images	219
In 46 Images	176
In 47 Images	169
In 48 Images	165
In 49 Images	123
In 50 Images	108
In 51 Images	111
In 52 Images	95
In 53 Images	79
In 54 Images	74
In 55 Images	57
In 56 Images	56
In 57 Images	44
In 58 Images	40
In 59 Images	37
In 60 Images	19
In 61 Images	18
In 62 Images	23
In 63 Images	15
In 64 Images	16
In 65 Images	14
In 66 Images	10
In 67 Images	13
In 68 Images	6
In 69 Images	10
In 70 Images	4
In 71 Images	3
In 72 Images	2
In 73 Images	1
In 74 Images	3
In 75 Images	7
In 76 Images	1
In 77 Images	1
In 78 Images	1
In 79 Images	3
In 81 Images	2
In 82 Images	1
In 83 Images	1
In 86 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	0.00	0.00	1.04
-3.00	0.00	54.23	51.29	42.43
0.00	3.00	45.72	48.71	56.53
3.00	6.00	0.05	0.00	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]		-0.006926	0.000316	-0.000912
Sigma [m]		0.689998	0.732059	0.965912
RMS Error [m]		0.690033	0.732059	0.965912

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	09m:17s
Time for Point Cloud Classification	59s
Time for 3D Textured Mesh Generation	10m:03s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	10881677
Average Density (per m^3)	4.49

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	47s
Time for Orthomosaic Generation	01h:01m:23s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:10m:12s
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	✓