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_5k_3_re
Processed	2019-01-23 08:03:17
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)	7.90 cm / 3.11 in
Area Covered	0.538 km^2 / 53.8359 ha / 0.21 sq. mi. / 133.1002 acres
Time for Initial Processing (without report)	08h:02m:19s

Quality Check

Images	median of 30750 keypoints per image	✓
Dataset	10170 out of 10240 images calibrated (99%), 5 images disabled	✓
Camera Optimization	1.29% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 3764.87 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

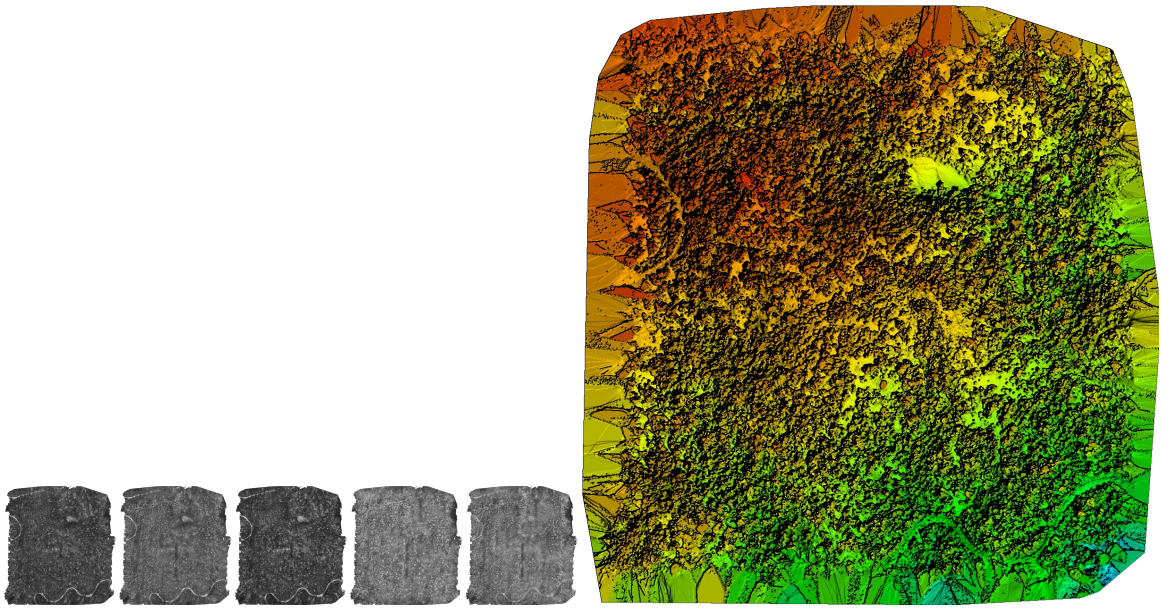


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10170 out of 10245
Number of Geolocated Images	10240 out of 10245

Initial Image Positions

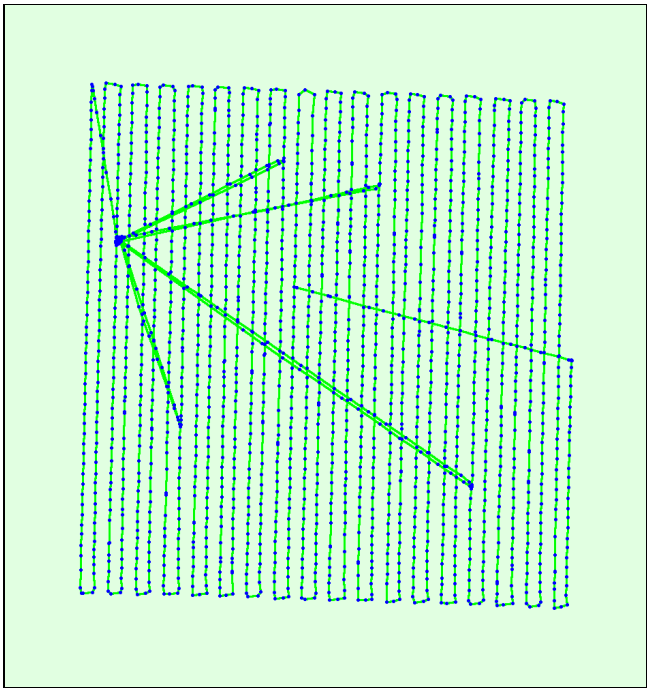
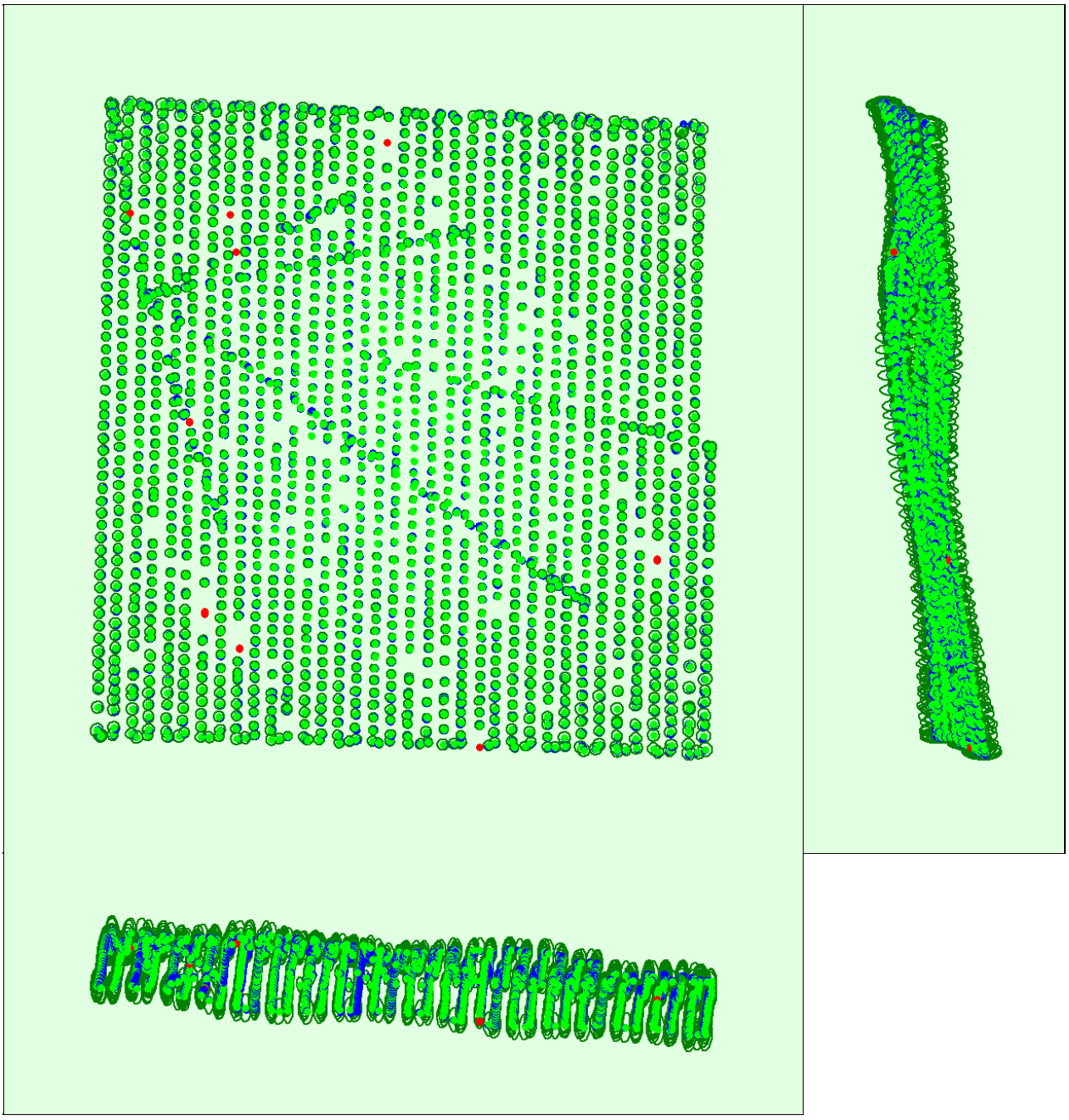


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.087	0.087	0.202	0.041	0.041	0.017
Sigma	0.014	0.014	0.043	0.002	0.002	0.003

Overlap

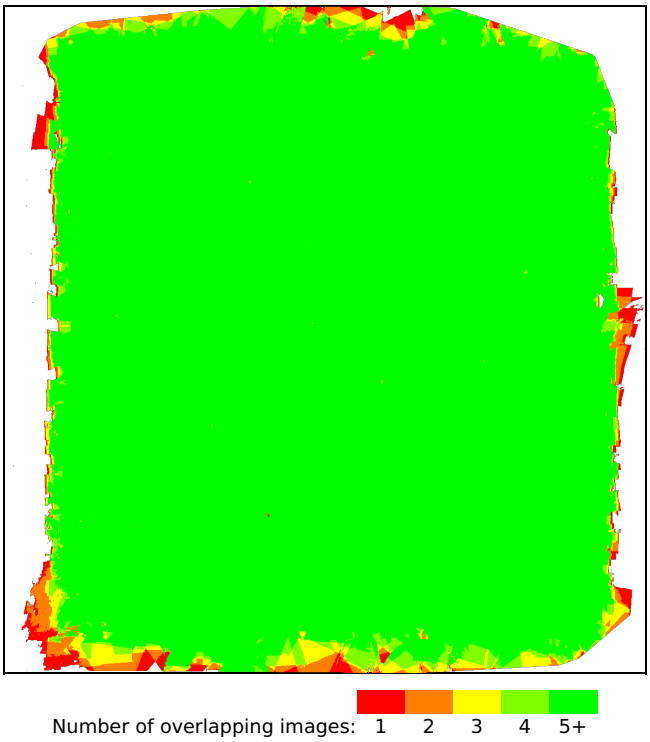


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

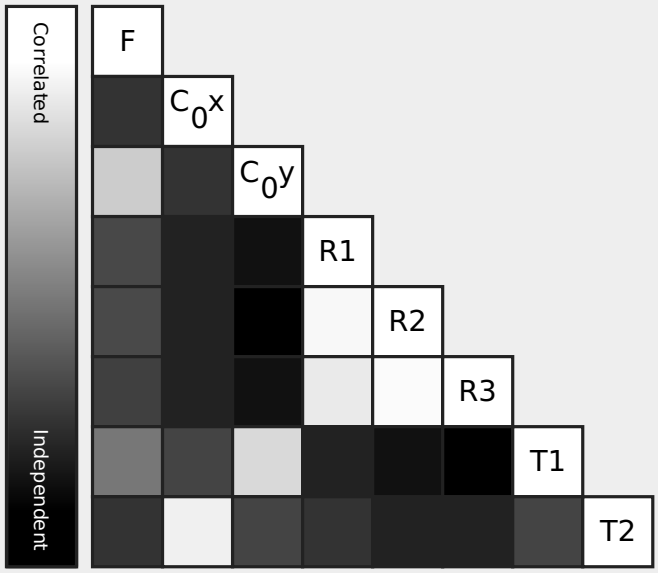
Number of 2D Keypoint Observations for Bundle Block Adjustment	13276051
Number of 3D Points for Bundle Block Adjustment	5183218
Mean Reprojection Error [pixels]	0.199

Internal Camera Parameters

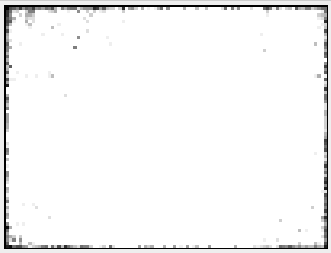
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1447.336 [pixel] 5.428 [mm]	654.581 [pixel] 2.455 [mm]	495.046 [pixel] 1.856 [mm]	-0.097	0.159	-0.048	0.000	-0.000
Uncertainties (Sigma)	0.143 [pixel] 0.001 [mm]	0.133 [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.



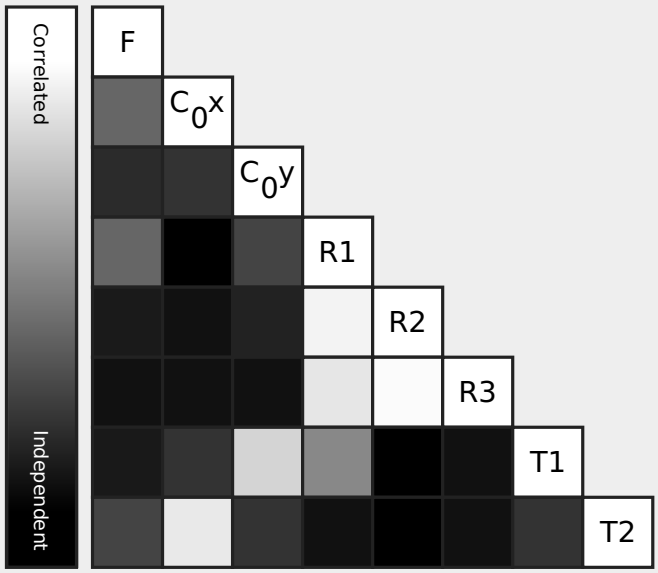
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1444.178 [pixel] 5.416 [mm]	656.102 [pixel] 2.460 [mm]	481.141 [pixel] 1.804 [mm]	-0.098	0.142	-0.017	0.000	0.000
Uncertainties (Sigma)	0.135 [pixel] 0.001 [mm]	0.038 [pixel] 0.000 [mm]	0.031 [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.

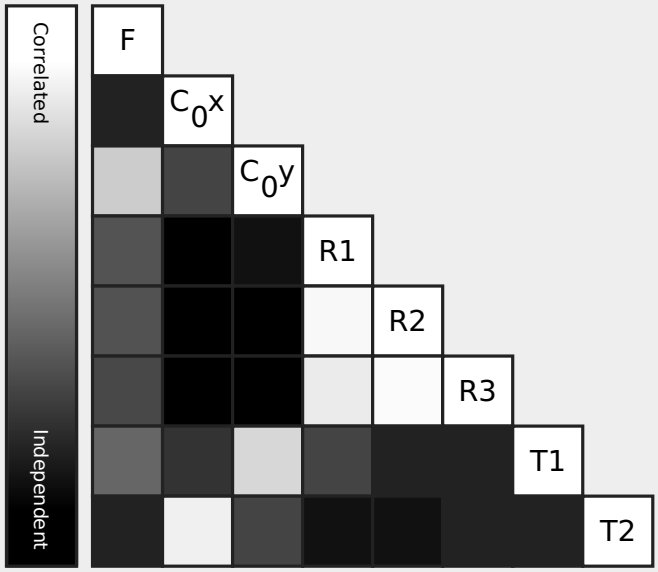
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

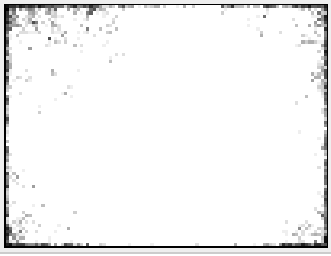
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1449.431 [pixel] 5.435 [mm]	653.534 [pixel] 2.451 [mm]	494.373 [pixel] 1.854 [mm]	-0.099	0.128	0.008	-0.000	-0.000
Uncertainties (Sigma)	0.146 [pixel] 0.001 [mm]	0.154 [pixel] 0.001 [mm]	0.117 [pixel] 0.000 [mm]	0.001	0.007	0.017	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.



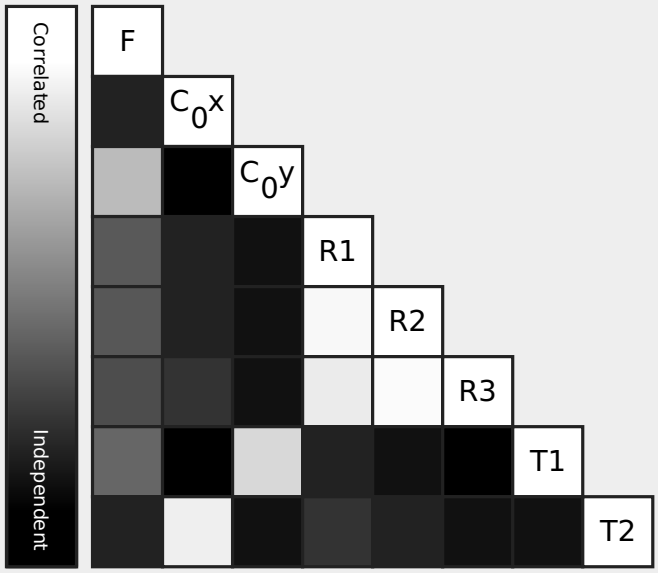
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1449.970 [pixel] 5.437 [mm]	662.959 [pixel] 2.486 [mm]	483.074 [pixel] 1.812 [mm]	-0.104	0.152	-0.043	0.000	-0.000
Uncertainties (Sigma)	0.147 [pixel] 0.001 [mm]	0.158 [pixel] 0.001 [mm]	0.121 [pixel] 0.000 [mm]	0.001	0.008	0.017	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.

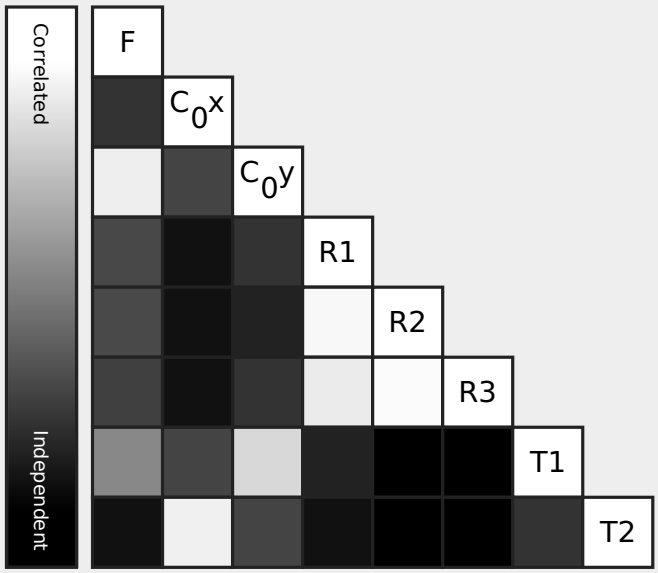
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1447.784 [pixel] 5.429 [mm]	657.907 [pixel] 2.467 [mm]	494.892 [pixel] 1.856 [mm]	-0.102	0.155	-0.056	0.000	0.000
Uncertainties (Sigma)	0.143 [pixel] 0.001 [mm]	0.129 [pixel] 0.000 [mm]	0.098 [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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Camera Rig «MicaSense 5 band» Relatives. Images: 10240

	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	-0.105	0.101	-0.372
Uncertainties (sigma)				0.004	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	0.048	0.067	-0.061
Uncertainties (sigma)				0.005	0.006	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	-0.152	-0.144	0.118
Uncertainties (sigma)				0.005	0.006	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	-0.086	-0.582	-0.321
Uncertainties (sigma)				0.004	0.005	0.000

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	30750	3765
Min	17442	25
Max	40638	21904
Mean	29688	4652

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21221	1940
Min	17982	25
Max	34790	12830
Mean	22553	2745

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31382	3987
Min	18500	205
Max	39829	21904
Mean	30954	5022

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21739	2087

Min	17442	35
Max	34044	14272
Mean	22638	2789

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	30279	4040
Min	17895	63
Max	37699	19875
Mean	29444	4967

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	32169	3171
Min	18099	131
Max	40638	19115
Mean	31550	4427

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)	24 / 213 / 10220	12 / 56 / 3660	37 / 205 / 3534	7 / 25 / 607	10 / 58 / 1552
RedEdge_5.5_1280x960 (Green)		18 / 96 / 19808	10 / 39 / 3724	6 / 28 / 2373	10 / 51 / 7992
RedEdge_5.5_1280x960 (Red)			29 / 324 / 8792	6 / 20 / 615	12 / 51 / 2774
RedEdge_5.5_1280x960 (NIR)				39 / 491 / 15228	41 / 307 / 3928
RedEdge_5.5_1280x960 (Red edge)					15 / 231 / 14039

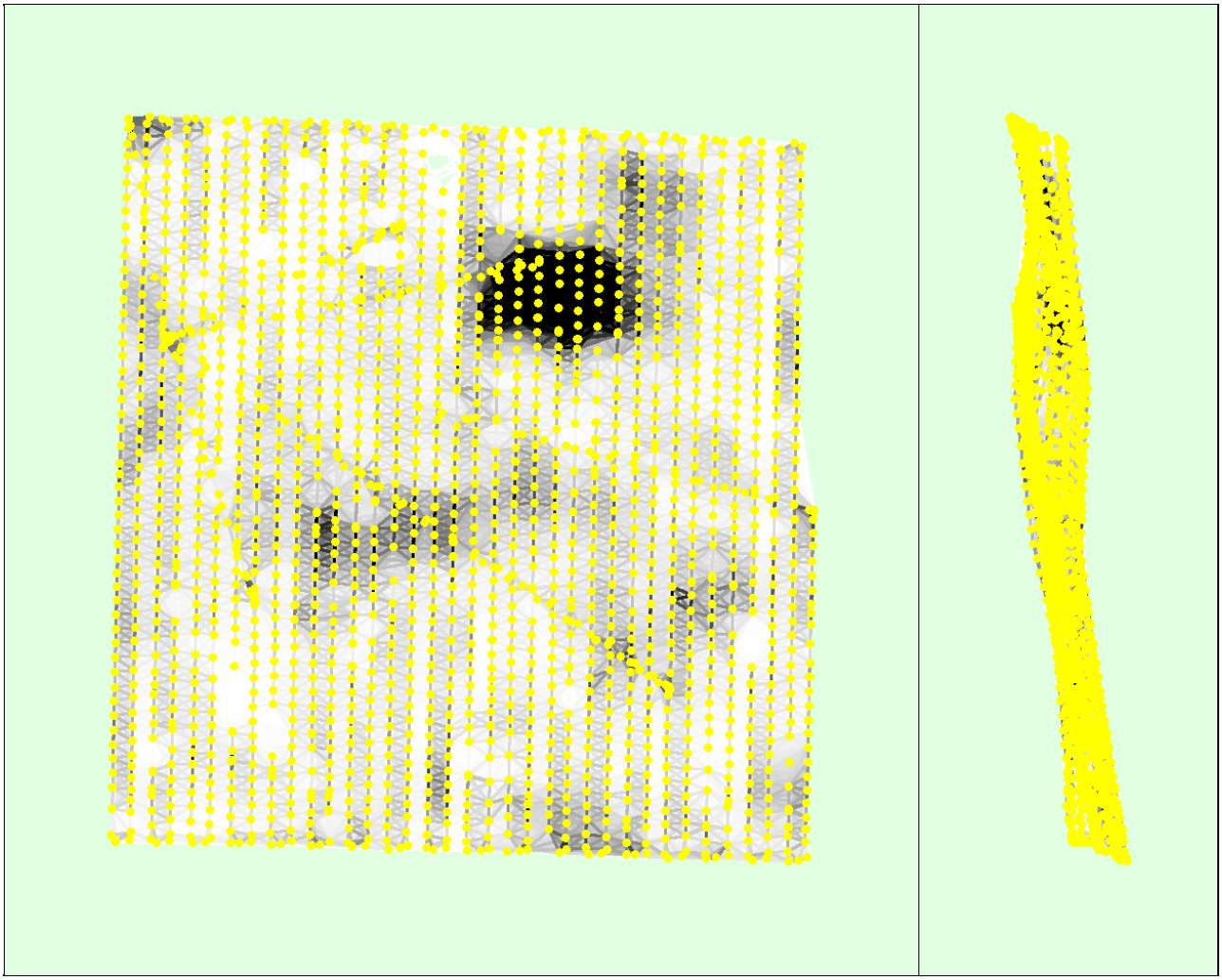
3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	3983088
In 3 Images	698181
In 4 Images	238871
In 5 Images	97846
In 6 Images	51445
In 7 Images	29272
In 8 Images	18576
In 9 Images	12417
In 10 Images	9170
In 11 Images	6799
In 12 Images	5319
In 13 Images	4026
In 14 Images	3273
In 15 Images	2761
In 16 Images	2238
In 17 Images	1886
In 18 Images	1625
In 19 Images	1450
In 20 Images	1186
In 21 Images	1059
In 22 Images	993
In 23 Images	867
In 24 Images	794

In 25 Images	720
In 26 Images	633
In 27 Images	554
In 28 Images	521
In 29 Images	473
In 30 Images	456
In 31 Images	404
In 32 Images	420
In 33 Images	367
In 34 Images	335
In 35 Images	299
In 36 Images	292
In 37 Images	300
In 38 Images	286
In 39 Images	249
In 40 Images	237
In 41 Images	193
In 42 Images	192
In 43 Images	190
In 44 Images	167
In 45 Images	184
In 46 Images	178
In 47 Images	145
In 48 Images	136
In 49 Images	137
In 50 Images	158
In 51 Images	117
In 52 Images	129
In 53 Images	121
In 54 Images	105
In 55 Images	96
In 56 Images	80
In 57 Images	92
In 58 Images	66
In 59 Images	90
In 60 Images	69
In 61 Images	64
In 62 Images	51
In 63 Images	69
In 64 Images	51
In 65 Images	43
In 66 Images	50
In 67 Images	42
In 68 Images	41
In 69 Images	35
In 70 Images	34
In 71 Images	38
In 72 Images	32
In 73 Images	37
In 74 Images	23
In 75 Images	26
In 76 Images	22
In 77 Images	18
In 78 Images	24
In 79 Images	22
In 80 Images	10
In 81 Images	14
In 82 Images	20
In 83 Images	14

In 84 Images	15
In 85 Images	11
In 86 Images	9
In 87 Images	11
In 88 Images	13
In 89 Images	7
In 90 Images	5
In 91 Images	5
In 92 Images	4
In 93 Images	5
In 94 Images	2
In 95 Images	1
In 96 Images	3
In 97 Images	4
In 99 Images	1
In 101 Images	1
In 102 Images	2
In 103 Images	3
In 105 Images	1
In 109 Images	1
In 113 Images	1

2D Keypoint Matches



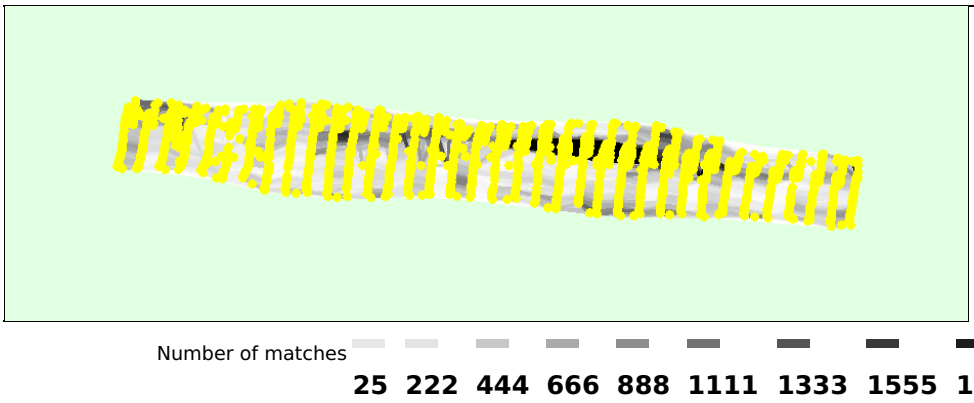


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.10	0.10	0.10
-3.00	0.00	44.83	49.95	37.48
0.00	3.00	55.08	49.84	62.37
3.00	6.00	0.00	0.10	0.05
6.00	9.00	0.00	0.01	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]		-0.000054	-0.002205	-0.000631
Sigma [m]		0.728319	0.790954	0.997939
RMS Error [m]		0.728319	0.790957	0.997939

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	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	08m:12s
Time for Point Cloud Classification	53s
Time for 3D Textured Mesh Generation	10m:20s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11653792
Average Density (per m^3)	5.2

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (7.9 [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 (7.9 [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	56m:50s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:07m:42s
Time for Index Map Generation	40s

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	✓