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_3_re
Processed	2019-01-24 04:07:52
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)	8.81 cm / 3.47 in
Area Covered	0.540 km^2 / 54.0002 ha / 0.21 sq. mi. / 133.5064 acres
Time for Initial Processing (without report)	08h:15m:46s

Quality Check

Images	median of 34918 keypoints per image	✓
Dataset	9295 out of 9465 images calibrated (98%), 5 images disabled	✓
Camera Optimization	1.33% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 6427.75 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

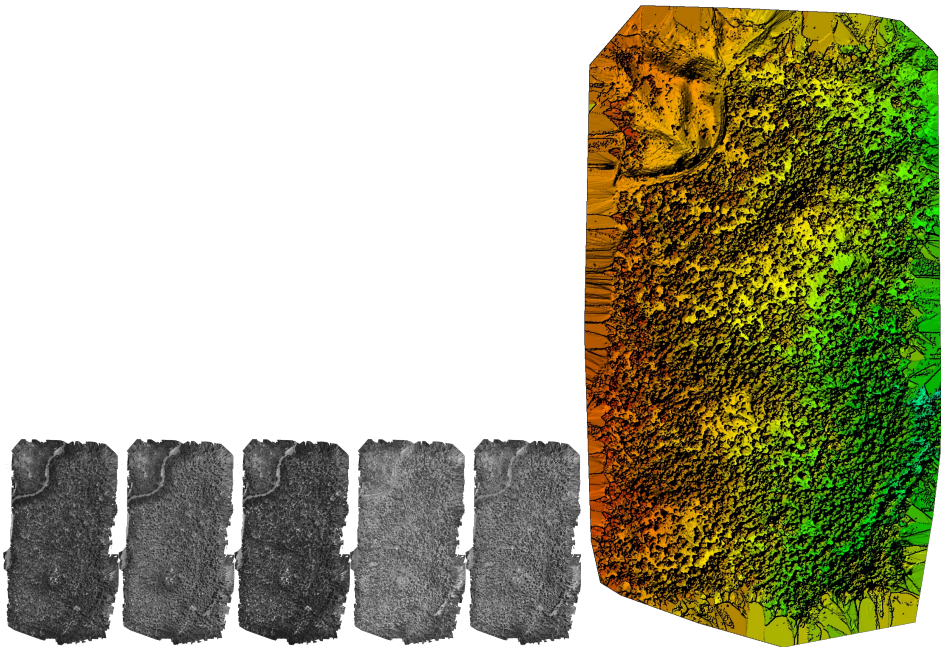


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	9295 out of 9470
Number of Geolocated Images	9470 out of 9470

Initial Image Positions

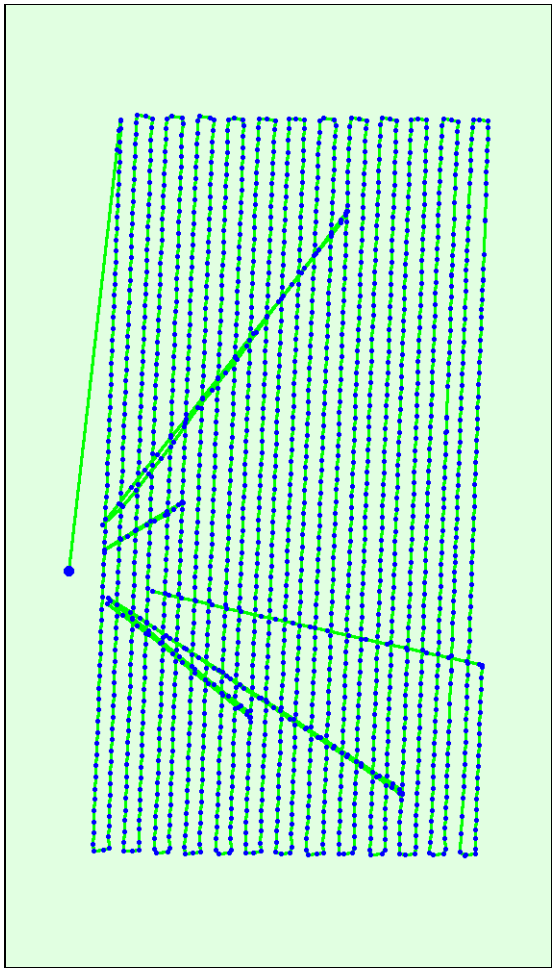
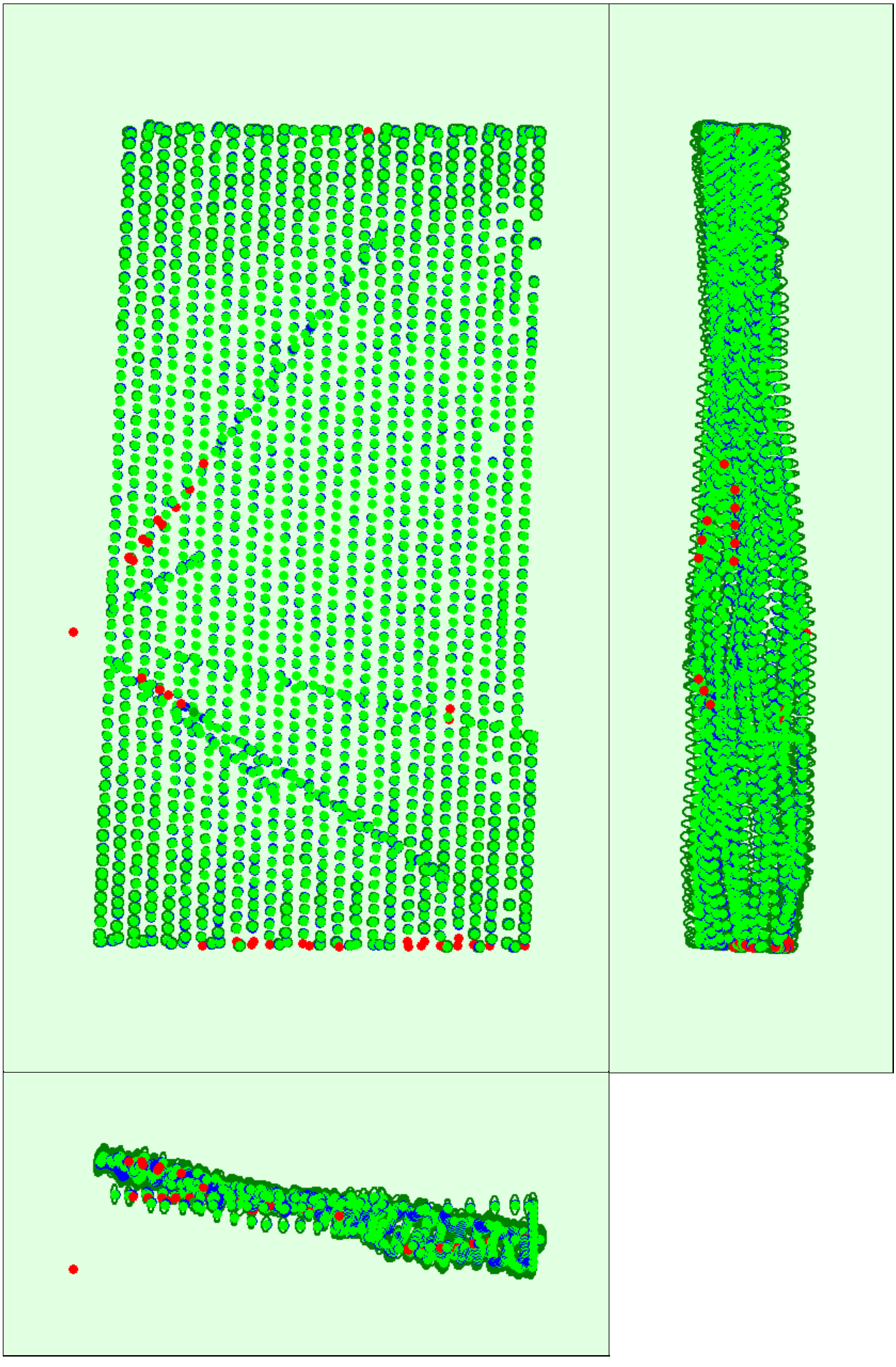


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.081	0.080	0.181	0.031	0.046	0.014
Sigma	0.014	0.014	0.037	0.005	0.004	0.003

Overlap

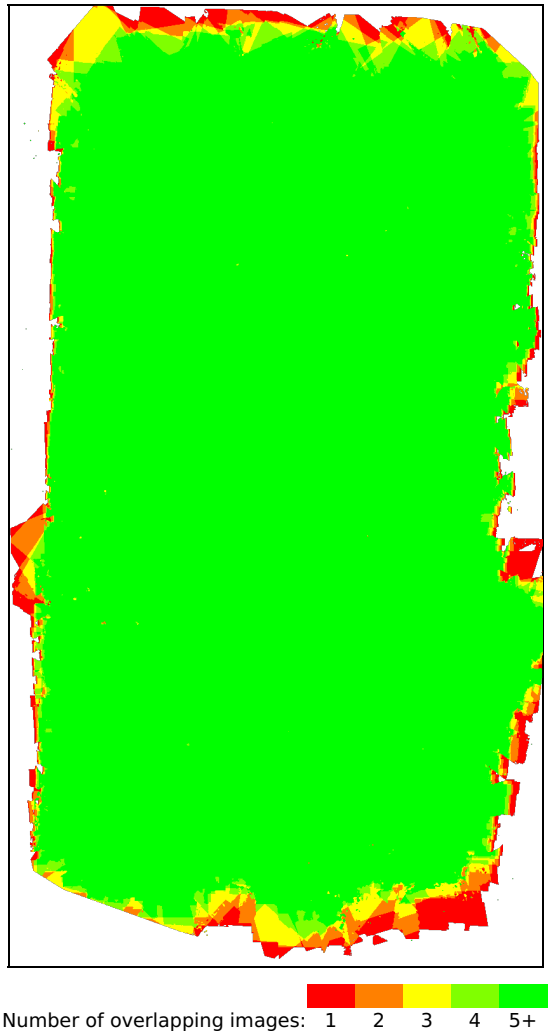


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

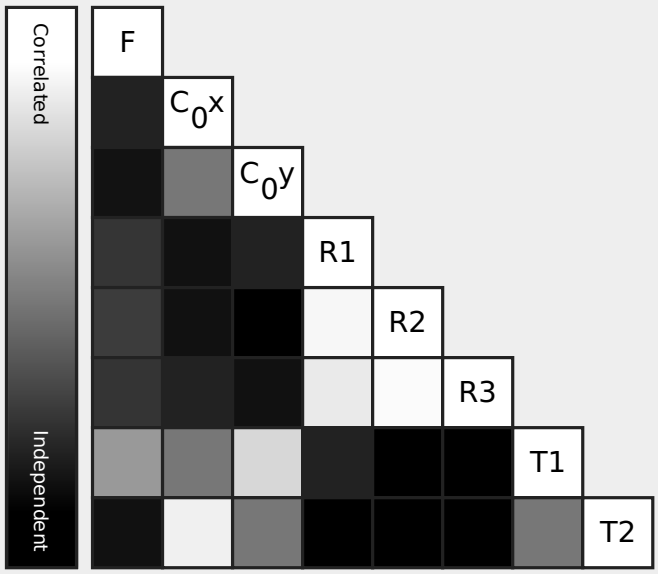
Number of 2D Keypoint Observations for Bundle Block Adjustment	17545294
Number of 3D Points for Bundle Block Adjustment	6177807
Mean Reprojection Error [pixels]	0.197

Internal Camera Parameters

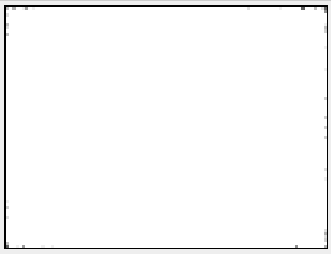
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.657 [pixel] 5.425 [mm]	654.687 [pixel] 2.455 [mm]	495.651 [pixel] 1.859 [mm]	-0.101	0.182	-0.092	0.000	-0.000
Uncertainties (Sigma)	0.140 [pixel] 0.001 [mm]	0.100 [pixel] 0.000 [mm]	0.077 [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.



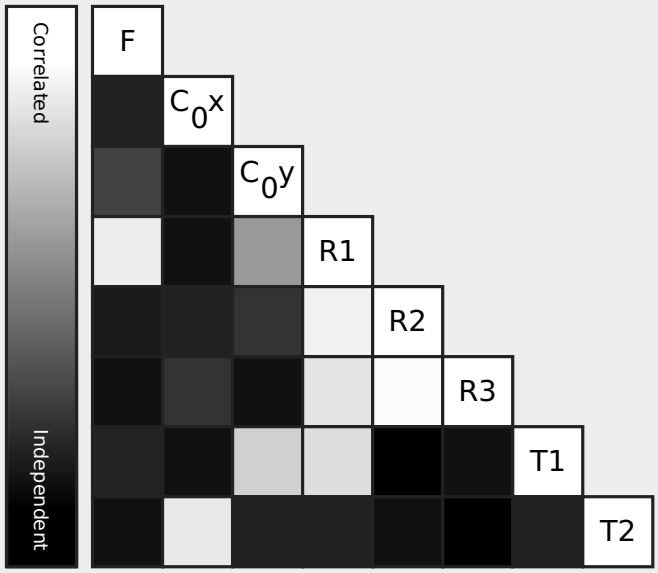
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

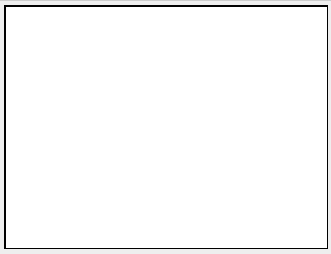
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1443.330 [pixel] 5.412 [mm]	655.730 [pixel] 2.459 [mm]	481.579 [pixel] 1.806 [mm]	-0.100	0.154	-0.040	0.000	0.000
Uncertainties (Sigma)	0.135 [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.



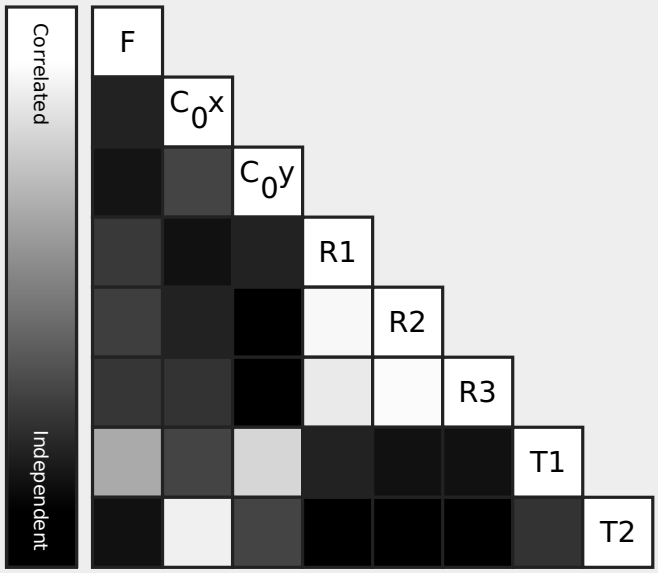
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

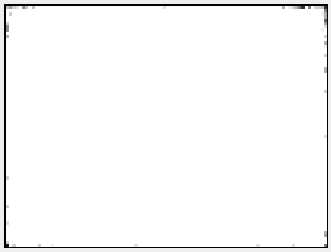
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.664 [pixel] 5.432 [mm]	653.942 [pixel] 2.452 [mm]	494.230 [pixel] 1.853 [mm]	-0.100	0.137	-0.011	-0.000	-0.000
Uncertainties (Sigma)	0.140 [pixel] 0.001 [mm]	0.108 [pixel] 0.000 [mm]	0.082 [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.



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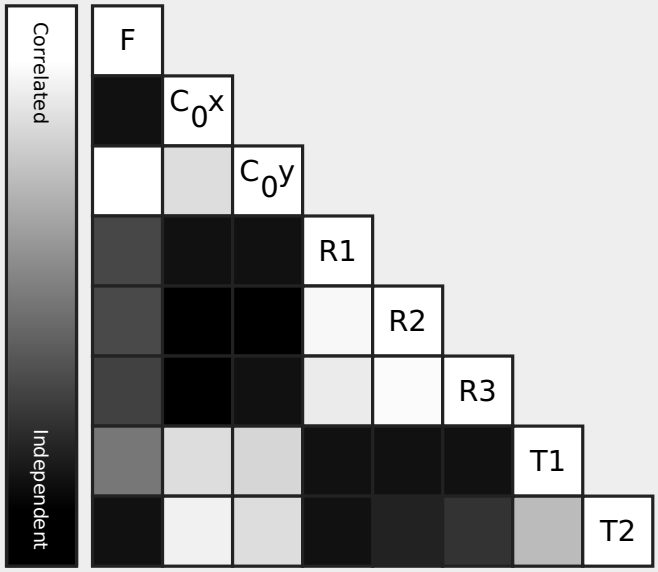
Internal Camera Parameters

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	1449.420 [pixel] 5.435 [mm]	662.843 [pixel] 2.486 [mm]	483.046 [pixel] 1.811 [mm]	-0.107	0.171	-0.078	0.000	-0.000
Uncertainties (Sigma)	0.143 [pixel] 0.001 [mm]	0.123 [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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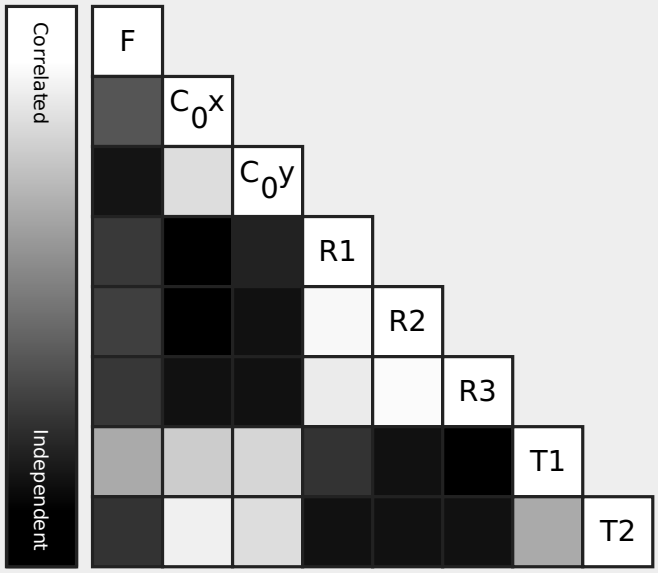
Internal Camera Parameters

RedEdge_5.5_1280x960 (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	1447.009 [pixel] 5.426 [mm]	657.737 [pixel] 2.467 [mm]	494.658 [pixel] 1.855 [mm]	-0.104	0.163	-0.067	0.000	0.000
Uncertainties (Sigma)	0.140 [pixel] 0.001 [mm]	0.102 [pixel] 0.000 [mm]	0.076 [pixel] 0.000 [mm]	0.001	0.005	0.011	0.000	0.000



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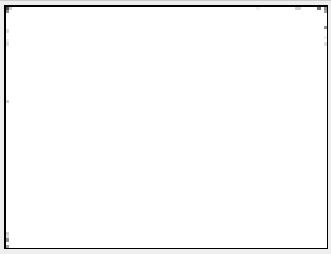

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Camera Rig «MicaSense 5 band» Relatives. Images: 9465

	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	-0.122	0.135	-0.374
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	0.038	0.098	-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	-0.169	-0.110	0.119
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	-0.081	-0.559	-0.321
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	34918	6428
Min	20002	200
Max	44637	29321
Mean	33844	6730

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

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

Median	30580	4622
Min	20561	251
Max	37634	16034
Mean	29908	4858

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	35695	6808
Min	20002	413
Max	44637	29321
Mean	34793	7259

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	28917	4530
Min	20018	231
Max	39638	16846
Mean	28295	4840

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	32859	5466
Min	22360	200
Max	39303	19106
Mean	32175	5751

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	35929	5733
Min	27395	221
Max	42847	20465
Mean	35563	6217

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)	36 / 193 / 12646	21 / 94 / 5852	46 / 281 / 6858	12 / 114 / 1861	15 / 118 / 3452
RedEdge_5.5_1280x960 (Green)		30 / 146 / 21161	19 / 83 / 4615	9 / 40 / 5197	14 / 63 / 10727
RedEdge_5.5_1280x960 (Red)			43 / 239 / 13627	13 / 125 / 2031	18 / 149 / 3701
RedEdge_5.5_1280x960 (NIR)				15 / 195 / 16498	19 / 364 / 6427
RedEdge_5.5_1280x960 (Red edge)					18 / 142 / 15455

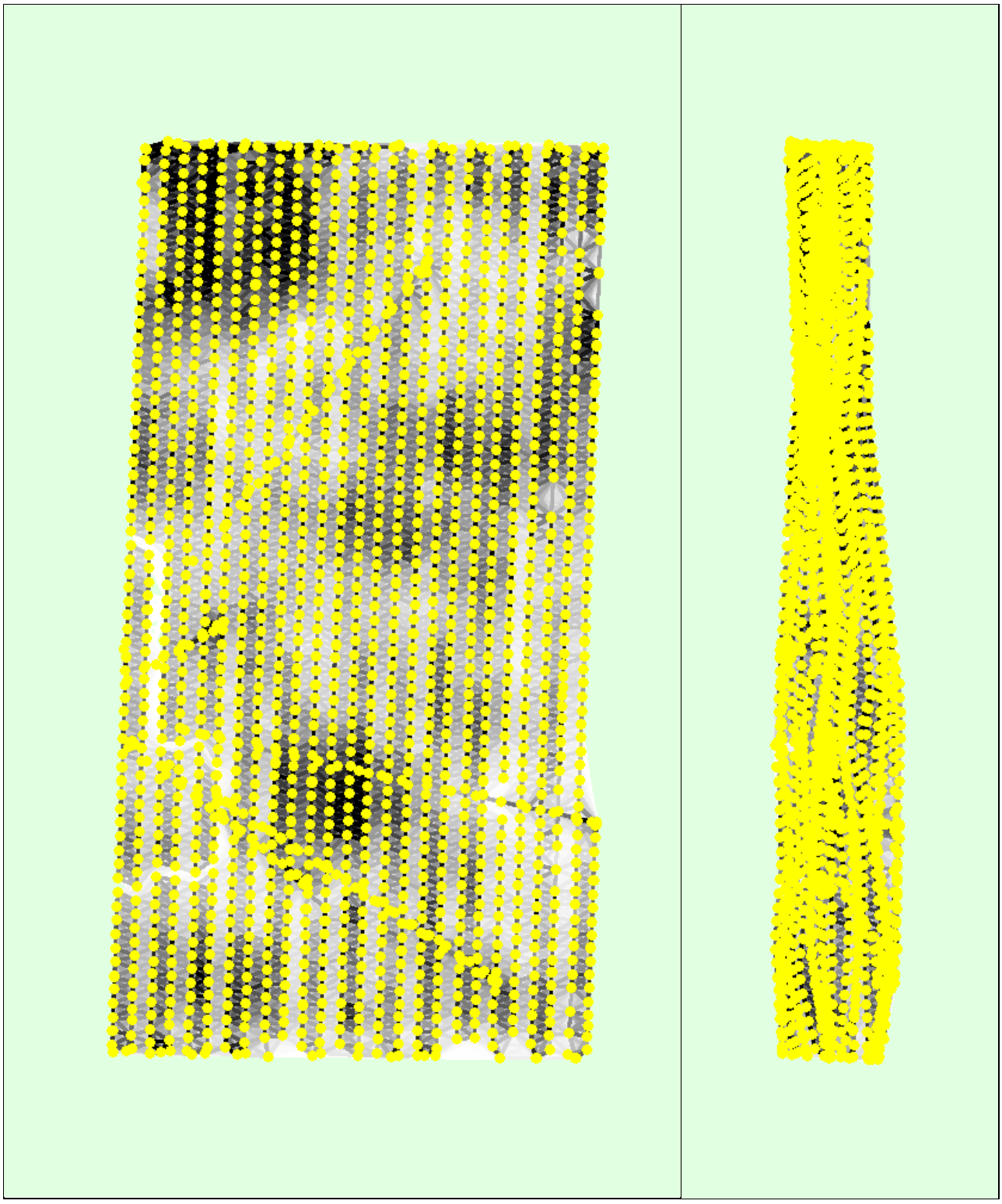
3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4192218
In 3 Images	993516
In 4 Images	420256
In 5 Images	199507
In 6 Images	115230

In 7 Images	69151
In 8 Images	45925
In 9 Images	31473
In 10 Images	23287
In 11 Images	16810
In 12 Images	12984
In 13 Images	9777
In 14 Images	7680
In 15 Images	6213
In 16 Images	5028
In 17 Images	4155
In 18 Images	3442
In 19 Images	2876
In 20 Images	2389
In 21 Images	1970
In 22 Images	1677
In 23 Images	1466
In 24 Images	1232
In 25 Images	1056
In 26 Images	919
In 27 Images	766
In 28 Images	681
In 29 Images	678
In 30 Images	578
In 31 Images	496
In 32 Images	477
In 33 Images	401
In 34 Images	402
In 35 Images	318
In 36 Images	319
In 37 Images	247
In 38 Images	225
In 39 Images	229
In 40 Images	187
In 41 Images	180
In 42 Images	167
In 43 Images	146
In 44 Images	116
In 45 Images	109
In 46 Images	79
In 47 Images	100
In 48 Images	72
In 49 Images	60
In 50 Images	49
In 51 Images	59
In 52 Images	45
In 53 Images	46
In 54 Images	40
In 55 Images	41
In 56 Images	43
In 57 Images	24
In 58 Images	21
In 59 Images	21
In 60 Images	20
In 61 Images	18
In 62 Images	12
In 63 Images	16
In 64 Images	9
In 65 Images	15

In 66 Images	8
In 67 Images	10
In 68 Images	11
In 69 Images	5
In 70 Images	6
In 71 Images	8
In 72 Images	3
In 75 Images	2
In 78 Images	1
In 79 Images	2
In 80 Images	1
In 81 Images	1

2D Keypoint Matches



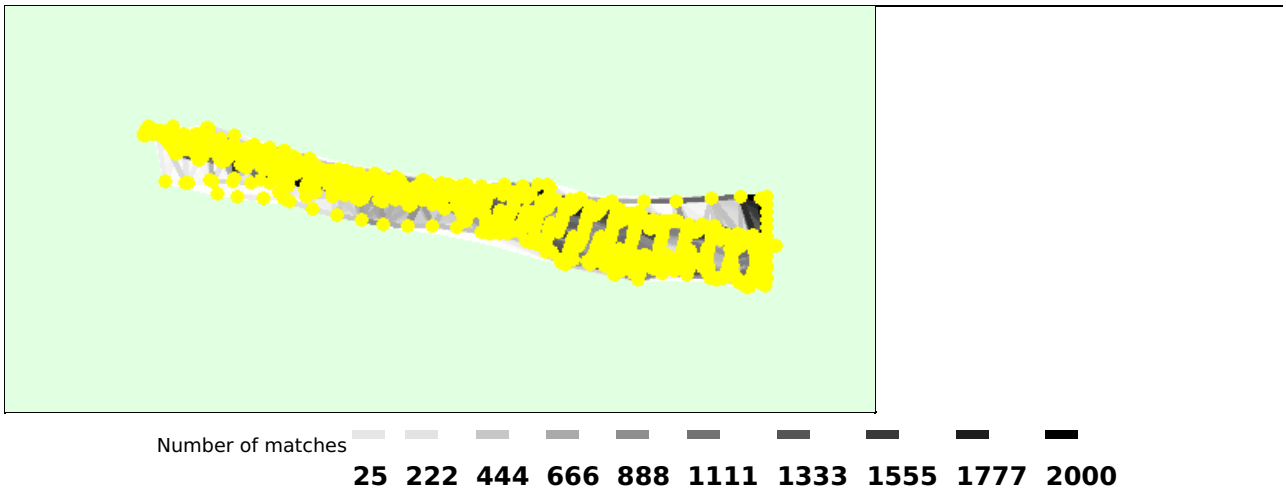


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.01	0.00	0.00
-9.00	-6.00	0.00	0.00	0.00
-6.00	-3.00	0.05	0.00	0.00
-3.00	0.00	51.73	51.12	50.52
0.00	3.00	48.21	48.86	49.37
3.00	6.00	0.00	0.00	0.11
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]		0.005479	-0.004142	0.004291
Sigma [m]		0.517457	0.884319	0.833198
RMS Error [m]		0.517486	0.884329	0.833209

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]	99.99	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:33s
Time for Point Cloud Classification	50s
Time for 3D Textured Mesh Generation	09m:48s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	10152341
Average Density (per m^3)	4.12

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.81 [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 (8.81 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	41s
Time for Orthomosaic Generation	45m:57s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	51m:35s
Time for Index Map Generation	31s

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	✓