

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_1_re
Processed	2019-01-23 04:59:45
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)	7.84 cm / 3.09 in
Area Covered	0.348 km ² / 34.7792 ha / 0.13 sq. mi. / 85.9859 acres
Time for Initial Processing (without report)	04h:42m:03s

Quality Check



Images	median of 31679 keypoints per image	
Dataset	6735 out of 6760 images calibrated (99%), 5 images disabled	
Camera Optimization	1.33% relative difference between initial and optimized internal camera parameters	
Matching	median of 4703.79 matches per calibrated image	
Georeferencing	yes, no 3D GCP	

Preview

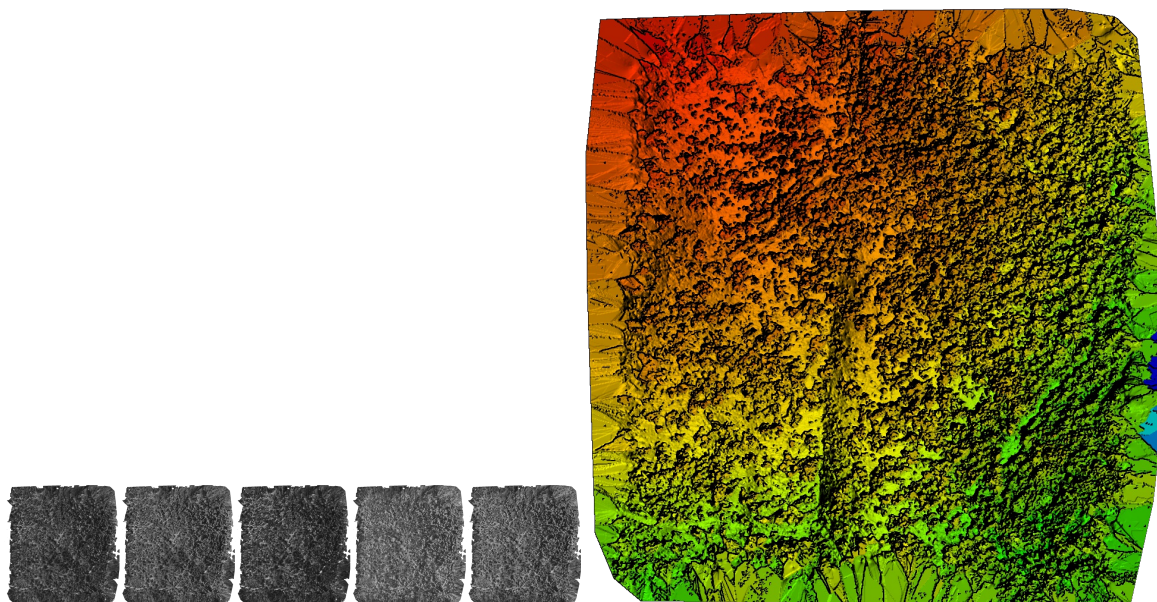


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details



Number of Calibrated Images	6735 out of 6765
Number of Geolocated Images	6765 out of 6765

? Initial Image Positions

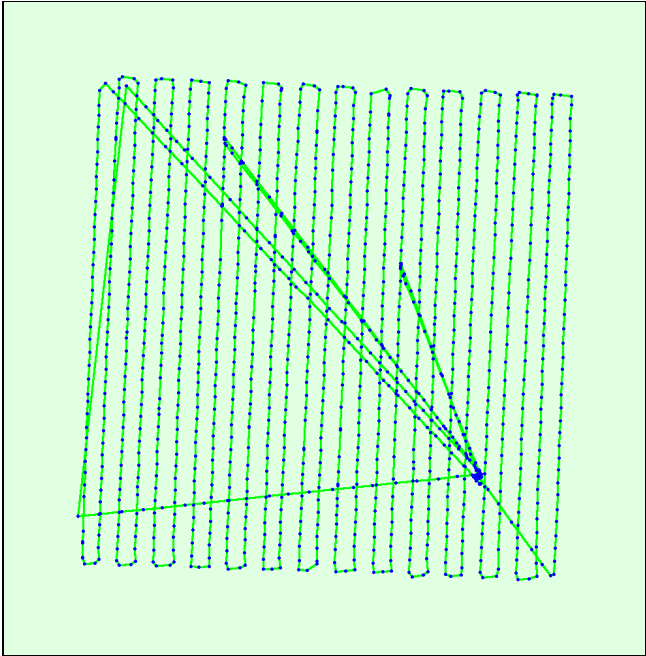
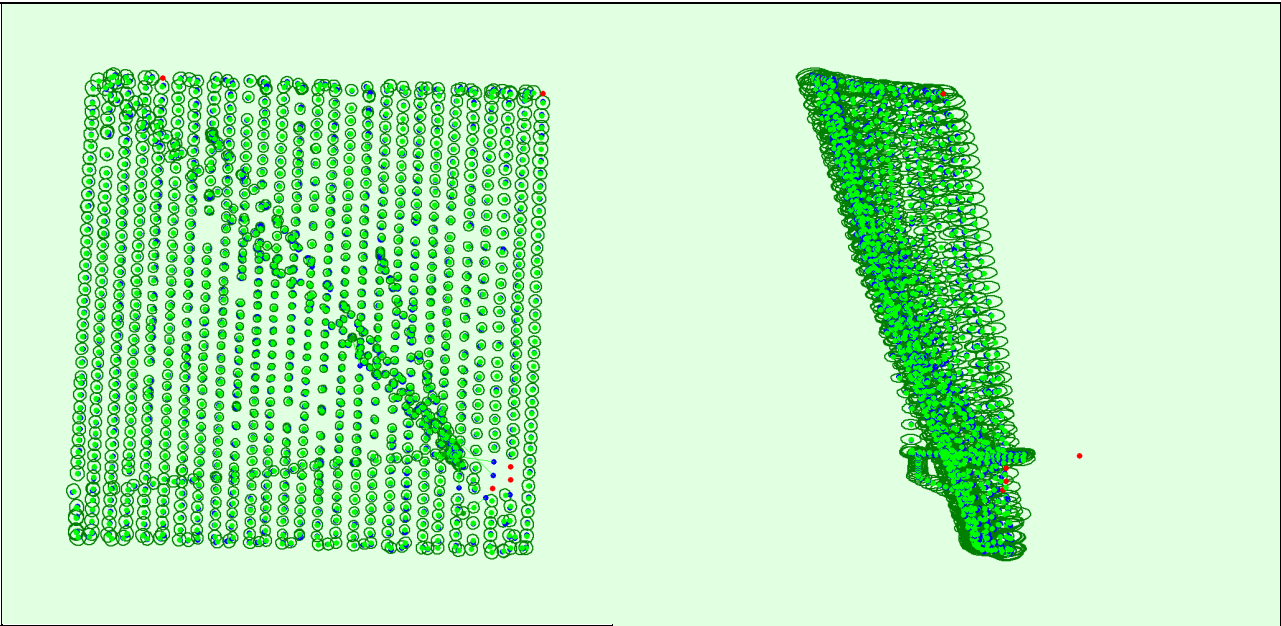
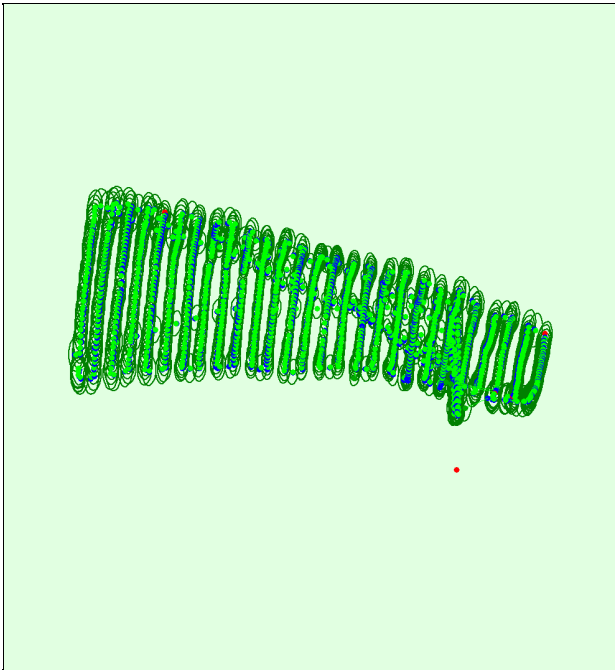


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

? 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	0.106	0.107	0.224	0.054	0.055	0.026
Sigma	0.018	0.019	0.046	0.002	0.002	0.004

? Overlap



Number of overlapping images: 1 2 3 4 5+

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	10722669
Number of 3D Points for Bundle Block Adjustment	3672824
Mean Reprojection Error [pixels]	0.201

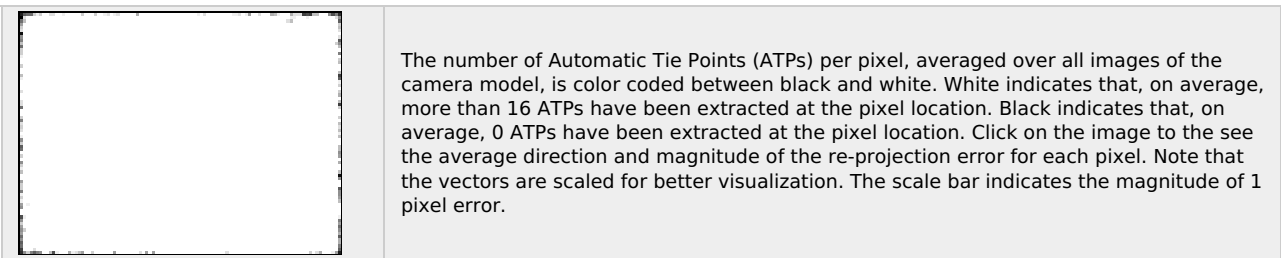
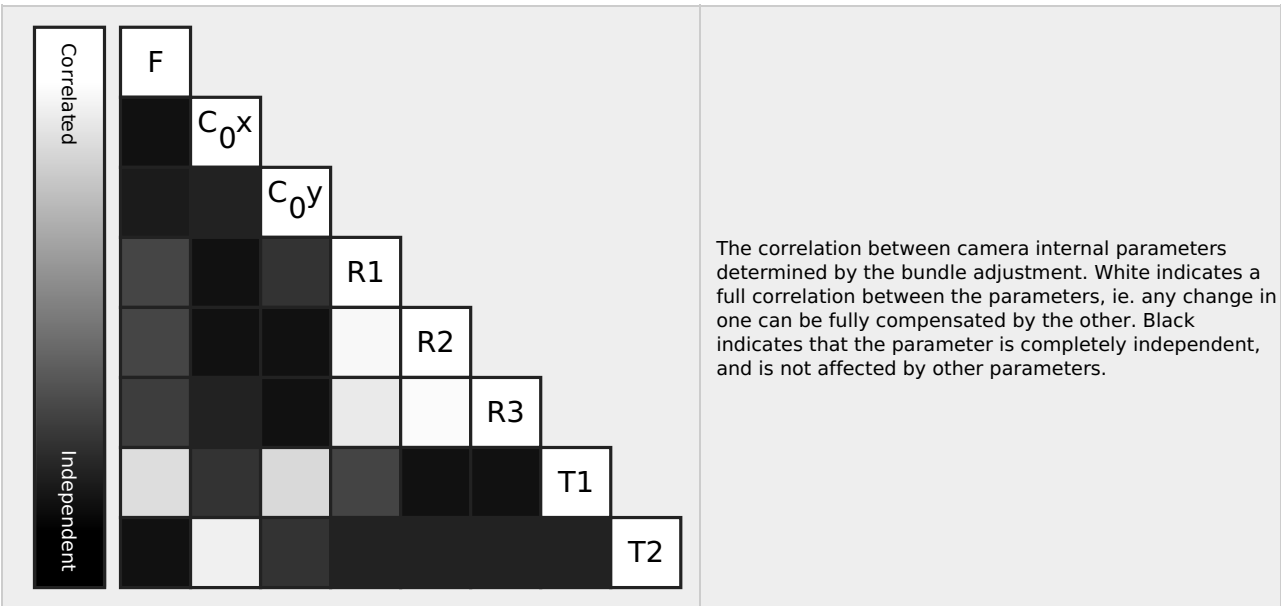
? Internal Camera Parameters

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	1446.595 [pixel] 5.425 [mm]	654.520 [pixel] 2.454 [mm]	494.915 [pixel] 1.856 [mm]	-0.099	0.172	-0.073	0.000	-0.000
Uncertainties (Sigma)	0.152 [pixel] 0.001 [mm]	0.135 [pixel] 0.001 [mm]	0.105 [pixel] 0.000 [mm]	0.001	0.007	0.015	0.000	0.000



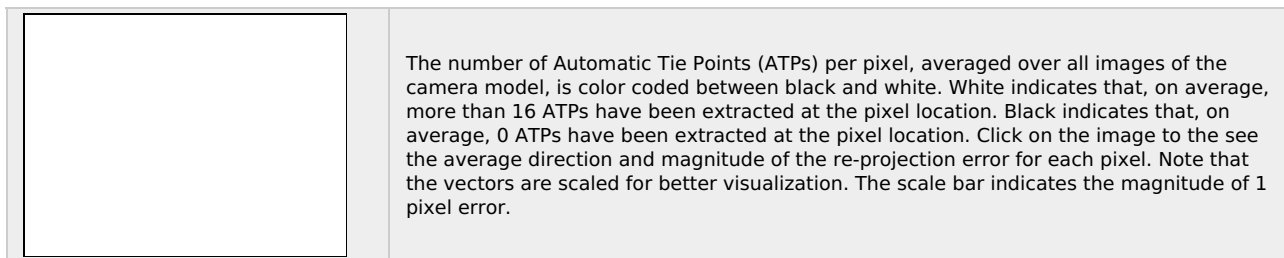
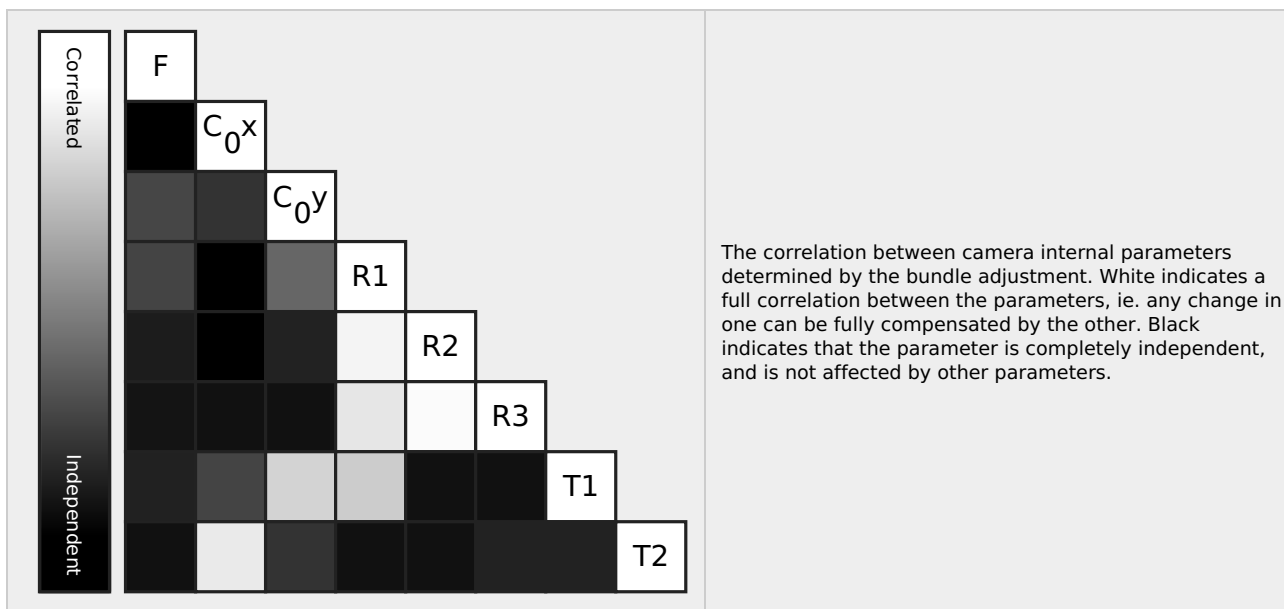
? Internal Camera Parameters

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	1443.500 [pixel] 5.413 [mm]	655.524 [pixel] 2.458 [mm]	481.261 [pixel] 1.805 [mm]	-0.100	0.157	-0.049	0.000	0.000
Uncertainties (Sigma)	0.145 [pixel] 0.001 [mm]	0.047 [pixel] 0.000 [mm]	0.040 [pixel] 0.000 [mm]	0.000	0.002	0.005	0.000	0.000



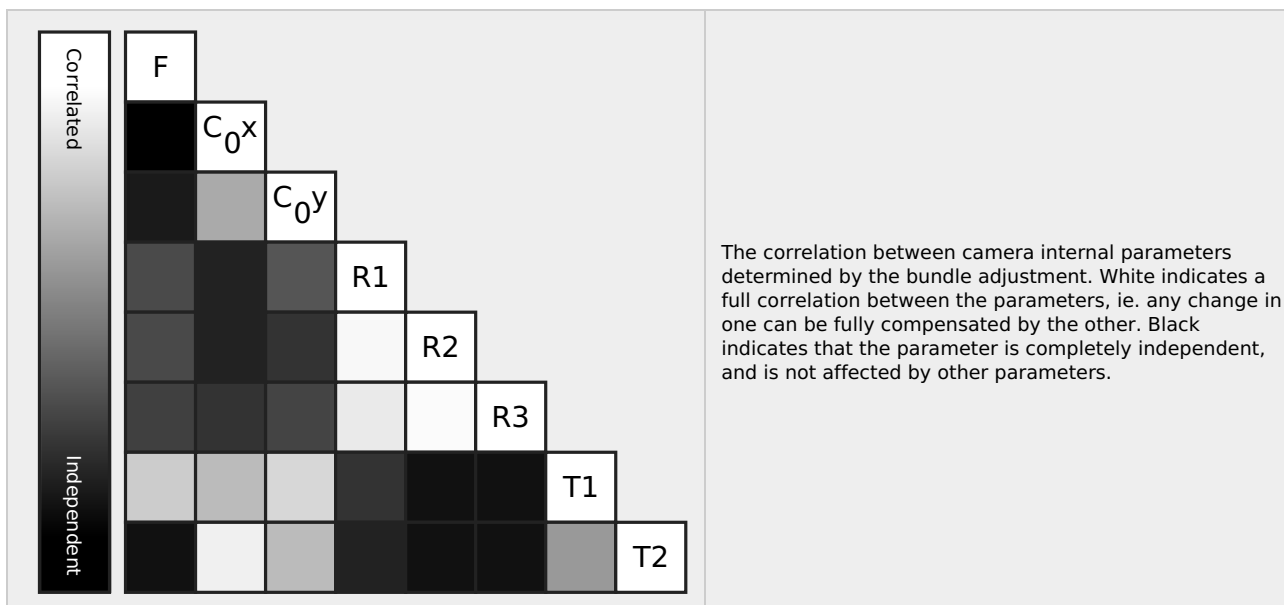
Internal Camera Parameters

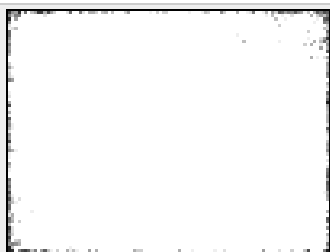
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]



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	1448.677 [pixel] 5.433 [mm]	653.419 [pixel] 2.450 [mm]	493.813 [pixel] 1.852 [mm]	-0.100	0.136	-0.009	-0.000	-0.000
Uncertainties (Sigma)	0.153 [pixel] 0.001 [mm]	0.146 [pixel] 0.001 [mm]	0.112 [pixel] 0.000 [mm]	0.001	0.007	0.016	0.000	0.000





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 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.

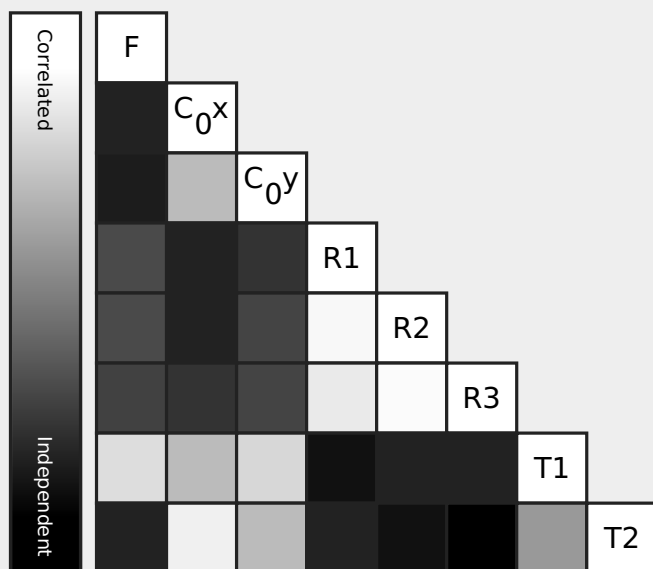
? Internal Camera Parameters

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

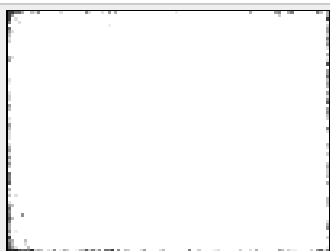


EXIF ID: RedEdge_5.5_1280x960

	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	1449.483 [pixel] 5.436 [mm]	662.494 [pixel] 2.484 [mm]	482.274 [pixel] 1.809 [mm]	-0.106	0.163	-0.058	0.000	-0.000
Uncertainties (Sigma)	0.153 [pixel] 0.001 [mm]	0.146 [pixel] 0.001 [mm]	0.112 [pixel] 0.000 [mm]	0.001	0.007	0.016	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 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.

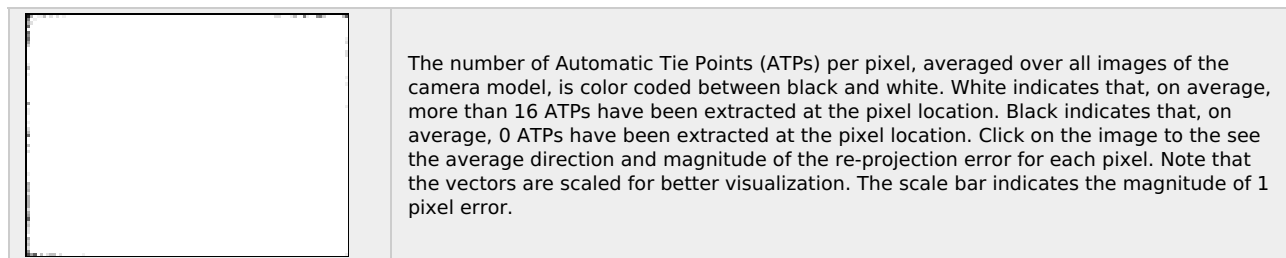
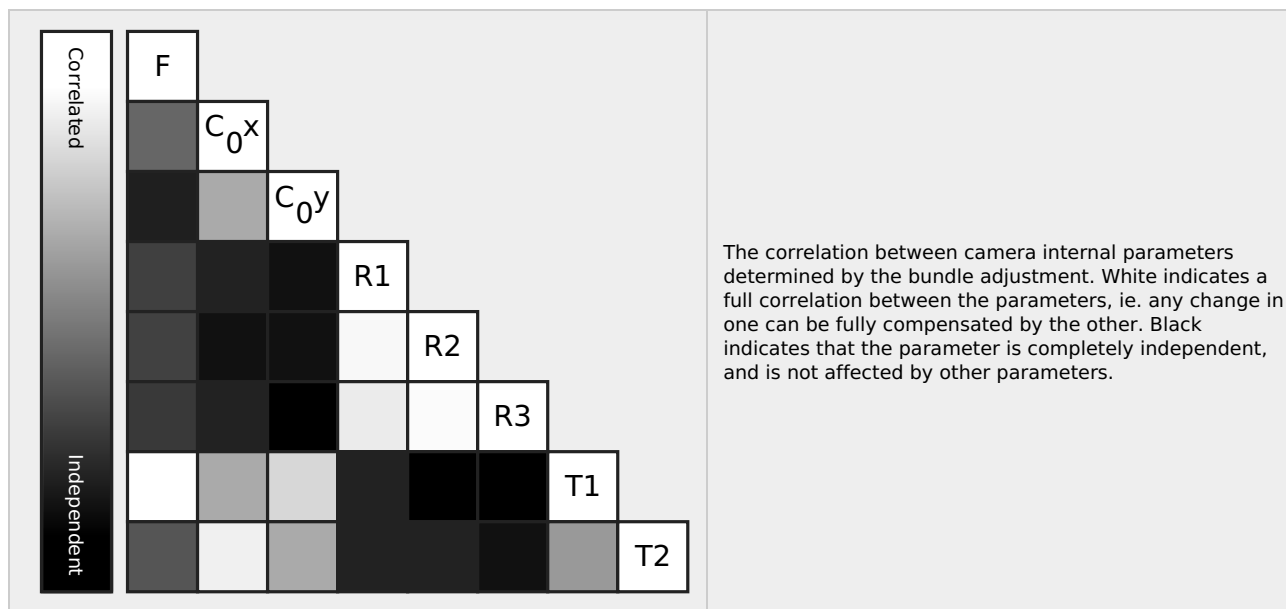
? Internal Camera Parameters

 **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	1447.105 [pixel] 5.427 [mm]	657.301 [pixel] 2.465 [mm]	493.961 [pixel] 1.852 [mm]	-0.102	0.154	-0.043	0.000	-0.000
Uncertainties (Sigma)	0.151 [pixel] 0.001 [mm]	0.126 [pixel] 0.000 [mm]	0.097 [pixel] 0.000 [mm]	0.001	0.006	0.014	0.000	0.000



🔍 Camera Rig «MicaSense 5 band» Relatives. Images: 6760



	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	0.143	-0.372
Uncertainties (sigma)				0.004	0.006	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	0.035	0.082	-0.062
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	-0.155	-0.104	0.119
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	-0.070	-0.567	-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	31679	4704
Min	17887	0
Max	43505	25974
Mean	31751	5670

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

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

Median	29147	3382
Min	18735	0
Max	38506	16327
Mean	28770	4396

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	32815	4973
Min	17887	220
Max	43505	25974
Mean	32685	6051

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	28080	3259
Min	18147	0
Max	36455	12225
Mean	27298	3730

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	28794	3632
Min	19348	0
Max	39974	22480
Mean	28637	4920

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	33461	4705
Min	22908	0
Max	43195	23653
Mean	33055	5870

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 / 200 / 13348	26 / 101 / 5447	35 / 234 / 5140	19 / 127 / 2380	27 / 182 / 3804
RedEdge_5.5_1280x960 (Green)		25 / 113 / 25258	20 / 74 / 4067	15 / 83 / 6470	20 / 112 / 11503
RedEdge_5.5_1280x960 (Red)			27 / 151 / 7661	18 / 113 / 1860	24 / 153 / 3271
RedEdge_5.5_1280x960 (NIR)				24 / 239 / 19007	32 / 335 / 9502
RedEdge_5.5_1280x960 (Red edge)					26 / 182 / 16474

3D Points from 2D Keypoint Matches



	Number of 3D Points Observed
In 2 Images	2449936
In 3 Images	588631
In 4 Images	258322
In 5 Images	125774
In 6 Images	72508

In 7 Images	44296
In 8 Images	30223
In 9 Images	21717
In 10 Images	16420
In 11 Images	12477
In 12 Images	9920
In 13 Images	7607
In 14 Images	6223
In 15 Images	4928
In 16 Images	4058
In 17 Images	3217
In 18 Images	2586
In 19 Images	2087
In 20 Images	1882
In 21 Images	1549
In 22 Images	1339
In 23 Images	1018
In 24 Images	888
In 25 Images	708
In 26 Images	534
In 27 Images	486
In 28 Images	424
In 29 Images	333
In 30 Images	330
In 31 Images	278
In 32 Images	219
In 33 Images	192
In 34 Images	155
In 35 Images	140
In 36 Images	123
In 37 Images	91
In 38 Images	107
In 39 Images	66
In 40 Images	72
In 41 Images	78
In 42 Images	73
In 43 Images	60
In 44 Images	54
In 45 Images	47
In 46 Images	48
In 47 Images	38
In 48 Images	33
In 49 Images	31
In 50 Images	30
In 51 Images	28
In 52 Images	21
In 53 Images	23
In 54 Images	24
In 55 Images	20
In 56 Images	27
In 57 Images	10
In 58 Images	9
In 59 Images	14
In 60 Images	16
In 61 Images	18
In 62 Images	12
In 63 Images	11
In 64 Images	11
In 65 Images	13

In 66 Images	4
In 67 Images	7
In 68 Images	8
In 69 Images	8
In 70 Images	12
In 71 Images	10
In 72 Images	4
In 73 Images	9
In 74 Images	4
In 75 Images	11
In 76 Images	4
In 77 Images	6
In 78 Images	4
In 79 Images	3
In 80 Images	8
In 81 Images	4
In 82 Images	3
In 83 Images	4
In 84 Images	2
In 85 Images	3
In 86 Images	6
In 87 Images	4
In 88 Images	3
In 89 Images	2
In 90 Images	2
In 91 Images	3
In 92 Images	1
In 93 Images	1
In 94 Images	2
In 95 Images	3
In 96 Images	1
In 97 Images	1
In 98 Images	3
In 99 Images	2
In 100 Images	2
In 101 Images	1
In 102 Images	1
In 103 Images	1
In 104 Images	1
In 108 Images	3
In 109 Images	4
In 110 Images	1
In 112 Images	1
In 113 Images	1
In 115 Images	2
In 117 Images	3
In 119 Images	5
In 120 Images	1
In 123 Images	1
In 125 Images	1
In 126 Images	1
In 127 Images	2
In 129 Images	2
In 133 Images	1
In 134 Images	1
In 139 Images	1
In 140 Images	1
In 144 Images	1
In 146 Images	1

In 148 Images	1
In 149 Images	1
In 150 Images	1
In 153 Images	3
In 158 Images	2
In 160 Images	1
In 161 Images	1
In 162 Images	1
In 164 Images	1
In 167 Images	1
In 168 Images	1
In 180 Images	2
In 183 Images	1
In 188 Images	1
In 190 Images	1

2D Keypoint Matches

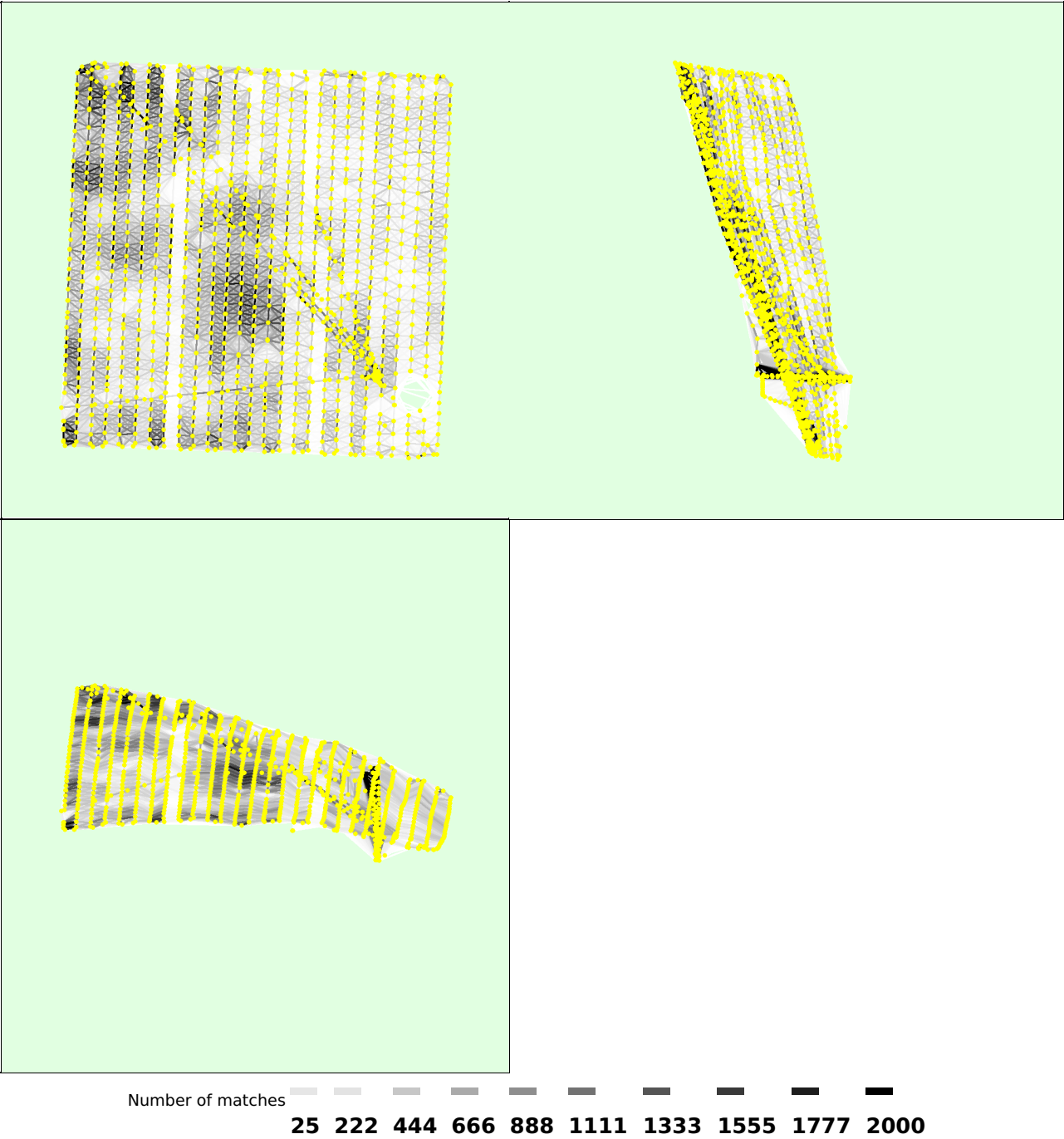


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details



? Absolute Geolocation Variance



Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.01	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	0.07	0.00
-3.00	0.00	45.01	49.17	51.27
0.00	3.00	54.90	50.66	48.72
3.00	6.00	0.07	0.07	0.00
6.00	9.00	0.00	0.00	0.00
9.00	12.00	0.00	0.00	0.01
12.00	15.00	0.00	0.00	0.00
15.00	-	0.01	0.01	0.00
Mean [m]		0.085150	-0.007672	-0.101128
Sigma [m]		0.719667	0.853997	0.978366
RMS Error [m]		0.724687	0.854032	0.983578

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	99.97	100.00
[-2.00, 2.00]	99.99	99.97	100.00
[-3.00, 3.00]	99.99	99.97	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	05m:20s
Time for Point Cloud Classification	29s
Time for 3D Textured Mesh Generation	06m:55s

Results



Number of Generated Tiles	1
Number of 3D Densified Points	6378534
Average Density (per m ³)	5.33

DSM, Orthomosaic and Index Details



Processing Options



DSM and Orthomosaic Resolution	1 x GSD (7.84 [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 (7.84 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	31s
Time for Orthomosaic Generation	58m:22s

Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:13m:14s
Time for Index Map Generation	23s

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	✓