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_4k_3_re
Processed	2019-01-23 10:11:28
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)	8.75 cm / 3.45 in
Area Covered	0.541 km^2 / 54.0799 ha / 0.21 sq. mi. / 133.7034 acres
Time for Initial Processing (without report)	08h:59m:47s

Quality Check

Images	median of 34160 keypoints per image	✓
Dataset	9420 out of 9420 images calibrated (100%), 5 images disabled	✓
Camera Optimization	1.39% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 7212.56 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

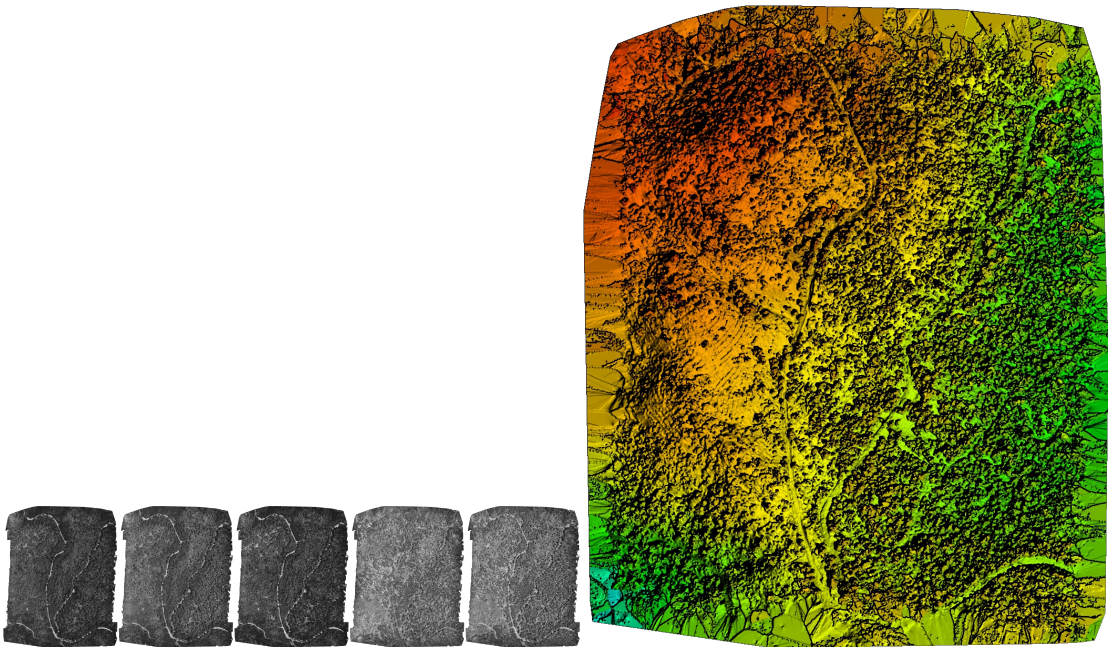


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	9420 out of 9425
Number of Geolocated Images	9425 out of 9425

Initial Image Positions

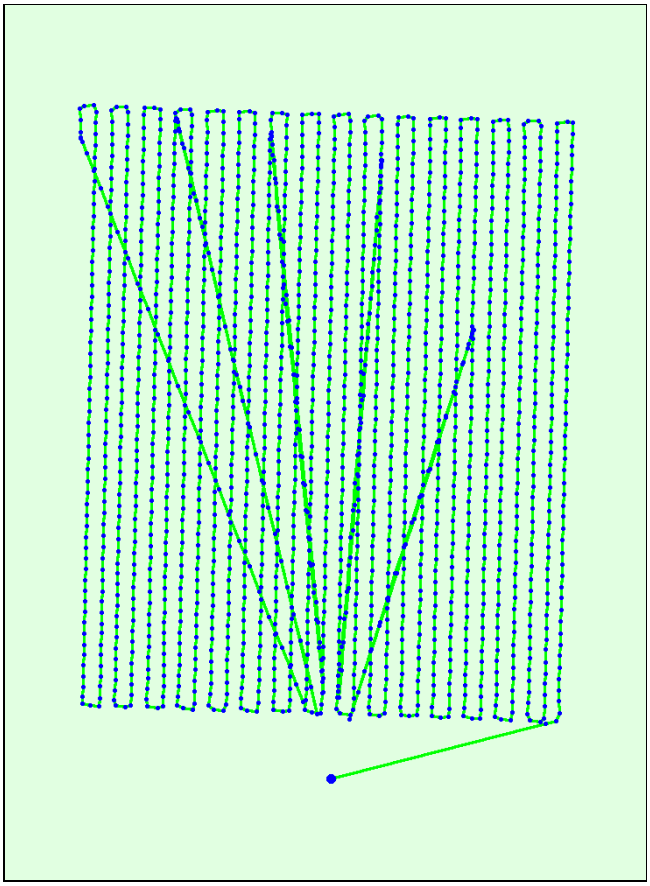
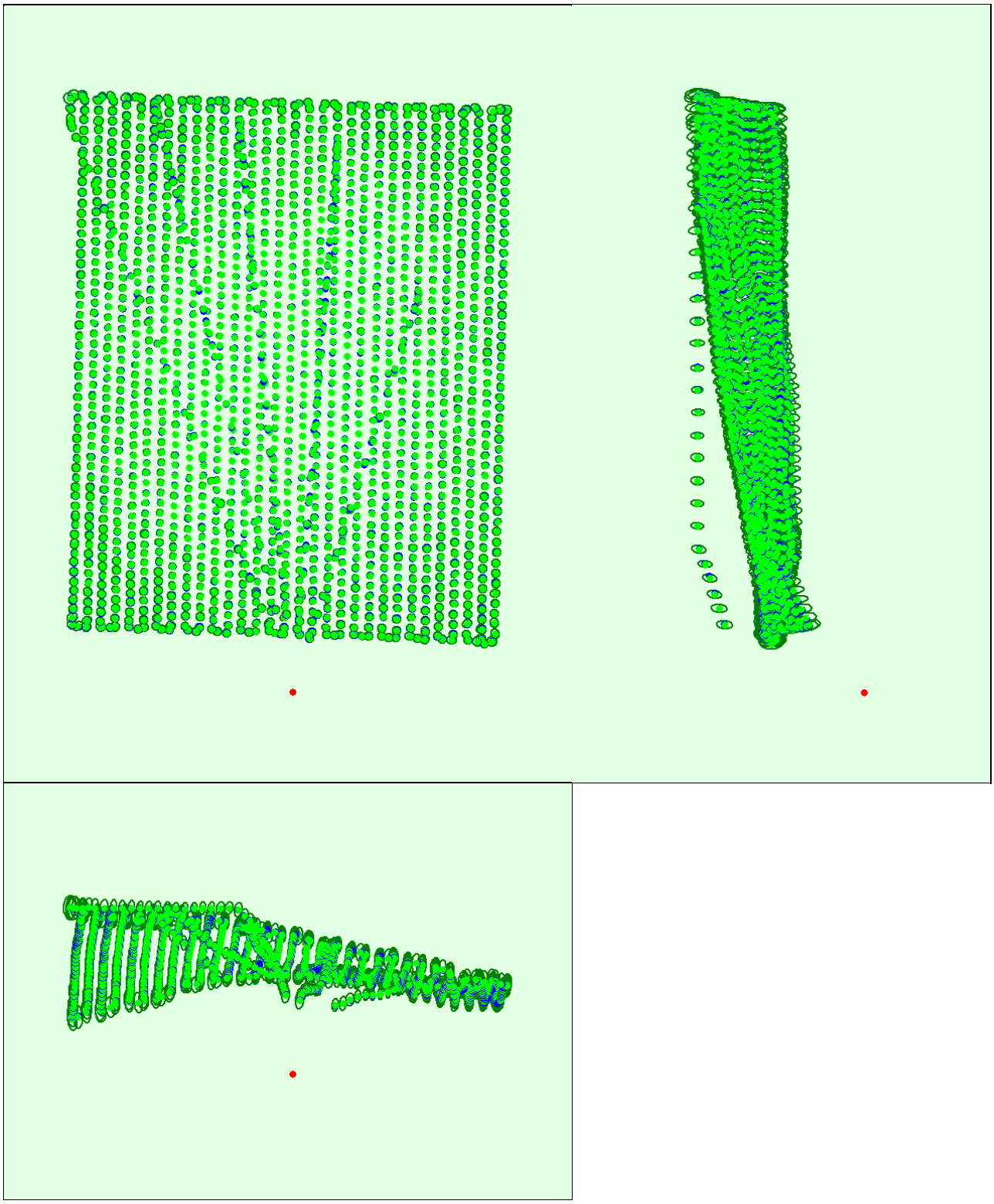


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.080	0.080	0.178	0.034	0.040	0.015
Sigma	0.014	0.013	0.039	0.003	0.002	0.003

Overlap

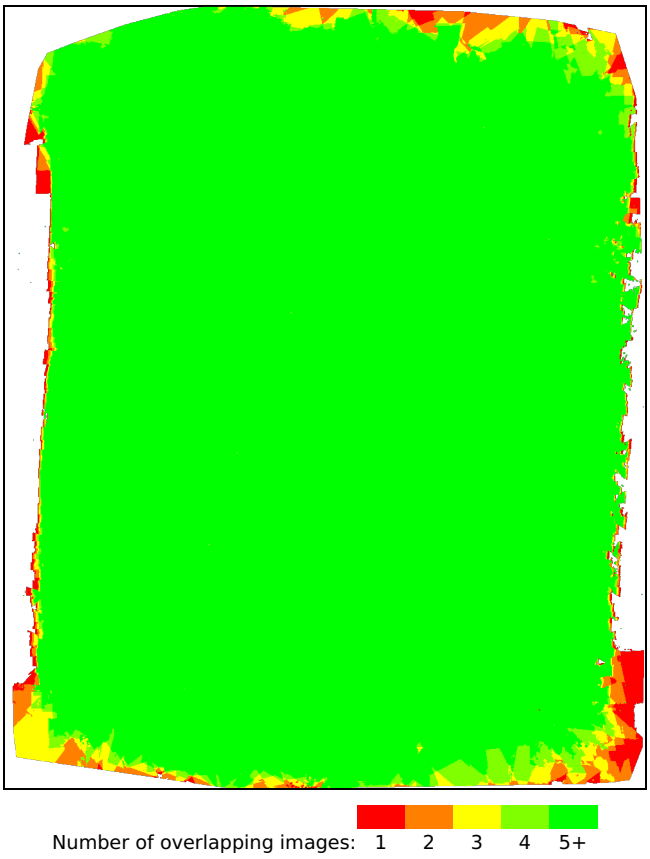


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

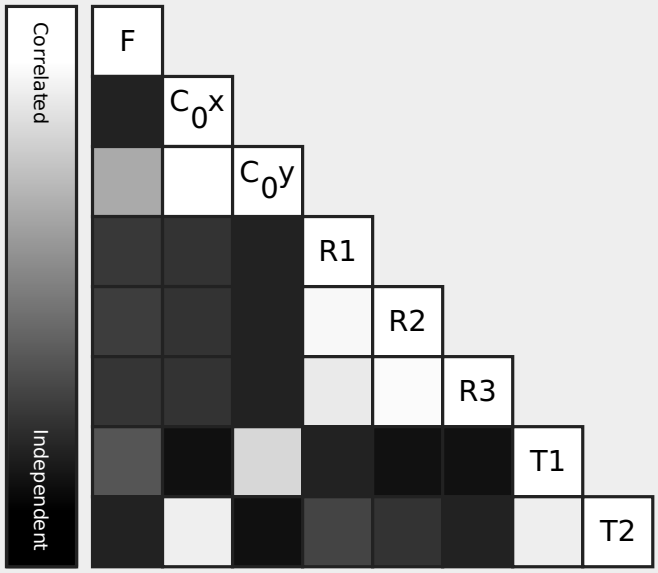
Number of 2D Keypoint Observations for Bundle Block Adjustment	19175467
Number of 3D Points for Bundle Block Adjustment	6697904
Mean Reprojection Error [pixels]	0.202

Internal Camera Parameters

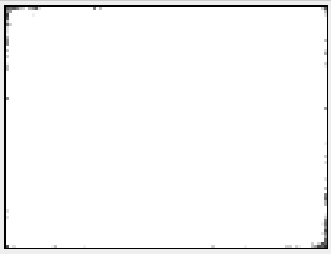
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1445.713 [pixel] 5.421 [mm]	654.790 [pixel] 2.455 [mm]	495.392 [pixel] 1.858 [mm]	-0.099	0.168	-0.074	0.000	-0.000
Uncertainties (Sigma)	0.141 [pixel] 0.001 [mm]	0.107 [pixel] 0.000 [mm]	0.081 [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.



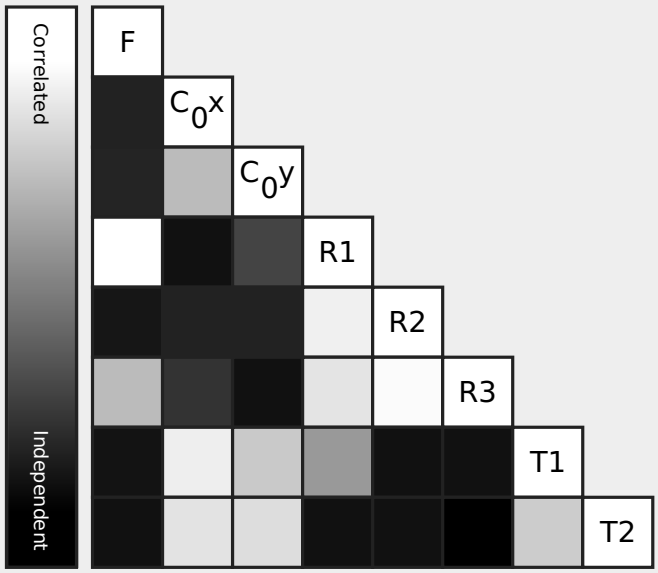
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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 (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	1442.603 [pixel] 5.410 [mm]	655.718 [pixel] 2.459 [mm]	481.546 [pixel] 1.806 [mm]	-0.098	0.136	-0.004	0.000	0.000
Uncertainties (Sigma)	0.136 [pixel] 0.001 [mm]	0.031 [pixel] 0.000 [mm]	0.024 [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.

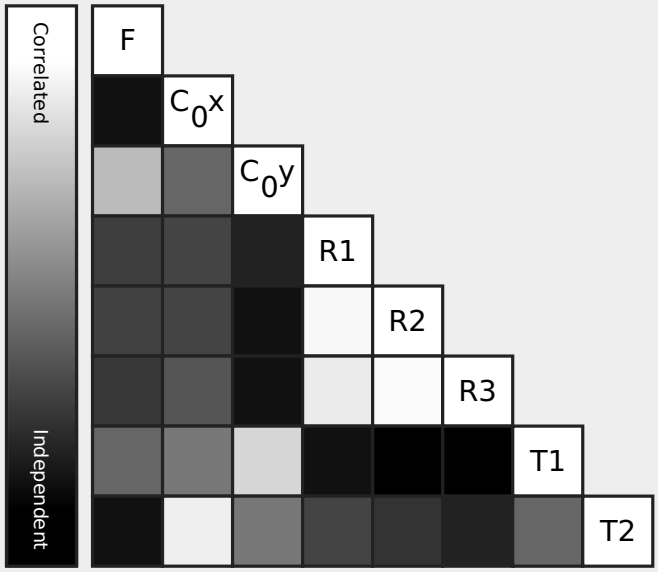
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

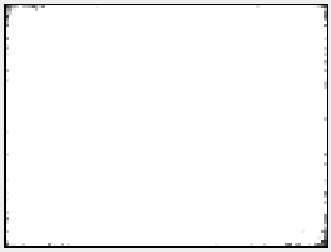
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1447.719 [pixel] 5.429 [mm]	653.758 [pixel] 2.452 [mm]	494.076 [pixel] 1.853 [mm]	-0.098	0.119	0.025	-0.000	-0.000
Uncertainties (Sigma)	0.143 [pixel] 0.001 [mm]	0.116 [pixel] 0.000 [mm]	0.089 [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.



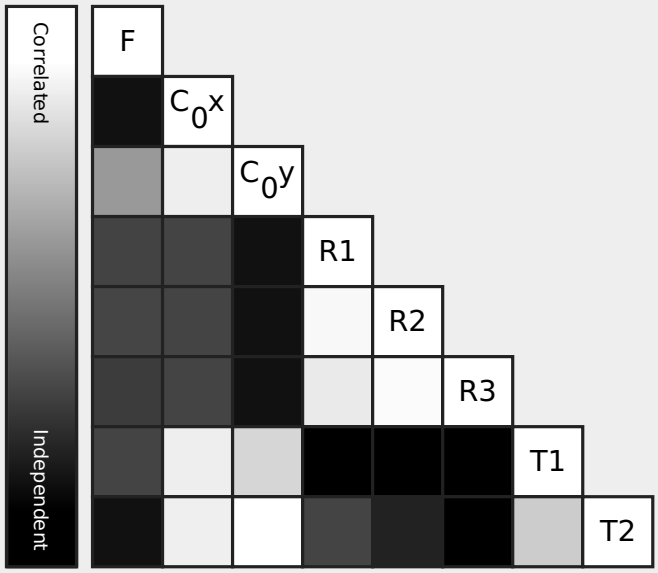
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

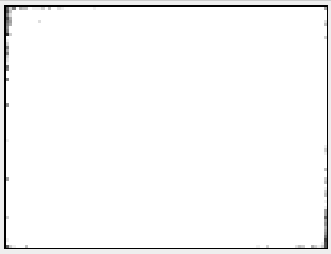
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.485 [pixel] 5.432 [mm]	662.689 [pixel] 2.485 [mm]	482.559 [pixel] 1.810 [mm]	-0.105	0.161	-0.067	0.000	-0.000
Uncertainties (Sigma)	0.144 [pixel] 0.001 [mm]	0.123 [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.



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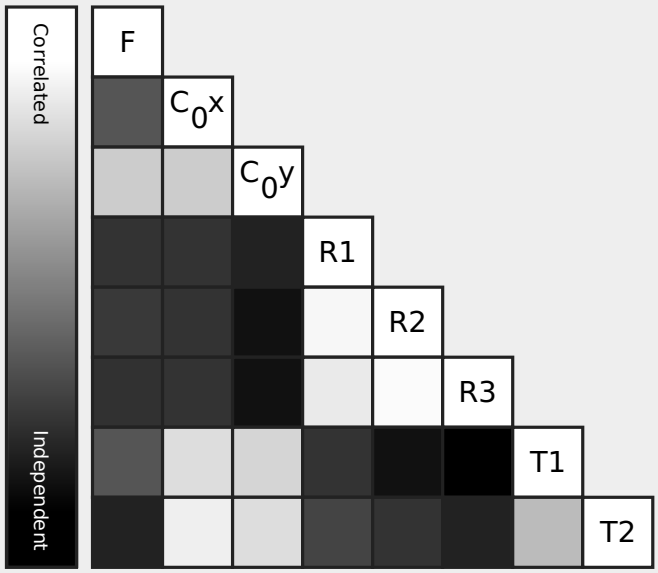
Internal Camera Parameters

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	1446.178 [pixel] 5.423 [mm]	657.429 [pixel] 2.465 [mm]	494.283 [pixel] 1.854 [mm]	-0.102	0.155	-0.054	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



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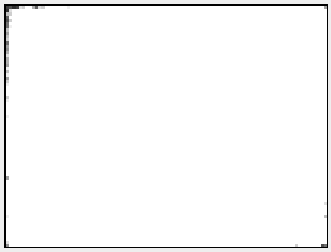

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Camera Rig «MicaSense 5 band» Relatives. Images: 9420

	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	-0.113	0.140	-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	0.044	0.089	-0.062
Uncertainties (sigma)				0.004	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	-0.150	-0.113	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	-0.067	-0.573	-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	34160	7213
Min	19624	518
Max	44950	27266
Mean	33857	7252

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	28345	4627
Min	19624	748
Max	37673	10494
Mean	28629	4778

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34740	7673
Min	22250	2232
Max	44950	27266
Mean	34745	7737

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	29057	4524

Min	19966	578
Max	38022	10797
Mean	28888	4731

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31983	7033
Min	23415	518
Max	40989	16301
Mean	31957	7327

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	37679	7108
Min	28981	987
Max	43861	14521
Mean	37148	7368

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)	42 / 287 / 5489	27 / 100 / 2513	42 / 330 / 3303	12 / 69 / 723	18 / 112 / 1153
RedEdge_5.5_1280x960 (Green)		40 / 170 / 20221	21 / 78 / 2144	12 / 51 / 1813	21 / 90 / 4335
RedEdge_5.5_1280x960 (Red)			39 / 324 / 5794	12 / 63 / 866	18 / 116 / 1440
RedEdge_5.5_1280x960 (NIR)				44 / 407 / 9830	32 / 261 / 3218
RedEdge_5.5_1280x960 (Red edge)					26 / 236 / 7053

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4528687
In 3 Images	1114712
In 4 Images	448477
In 5 Images	208076
In 6 Images	117701
In 7 Images	71282
In 8 Images	47319
In 9 Images	32699
In 10 Images	24137
In 11 Images	18209
In 12 Images	14156
In 13 Images	11268
In 14 Images	8887
In 15 Images	7096
In 16 Images	5898
In 17 Images	4958
In 18 Images	4124
In 19 Images	3486
In 20 Images	3166
In 21 Images	2699
In 22 Images	2290
In 23 Images	2004
In 24 Images	1806

In 25 Images	1555
In 26 Images	1384
In 27 Images	1229
In 28 Images	1100
In 29 Images	953
In 30 Images	855
In 31 Images	764
In 32 Images	730
In 33 Images	617
In 34 Images	571
In 35 Images	511
In 36 Images	475
In 37 Images	416
In 38 Images	380
In 39 Images	343
In 40 Images	310
In 41 Images	276
In 42 Images	273
In 43 Images	243
In 44 Images	232
In 45 Images	189
In 46 Images	181
In 47 Images	137
In 48 Images	109
In 49 Images	110
In 50 Images	116
In 51 Images	62
In 52 Images	83
In 53 Images	66
In 54 Images	60
In 55 Images	57
In 56 Images	45
In 57 Images	39
In 58 Images	35
In 59 Images	25
In 60 Images	31
In 61 Images	33
In 62 Images	13
In 63 Images	28
In 64 Images	17
In 65 Images	18
In 66 Images	12
In 67 Images	11
In 68 Images	11
In 69 Images	13
In 70 Images	11
In 71 Images	2
In 72 Images	9
In 73 Images	5
In 74 Images	4
In 75 Images	3
In 77 Images	1
In 78 Images	1
In 80 Images	2
In 81 Images	3
In 83 Images	1
In 84 Images	3
In 85 Images	2
In 86 Images	2

2D Keypoint Matches

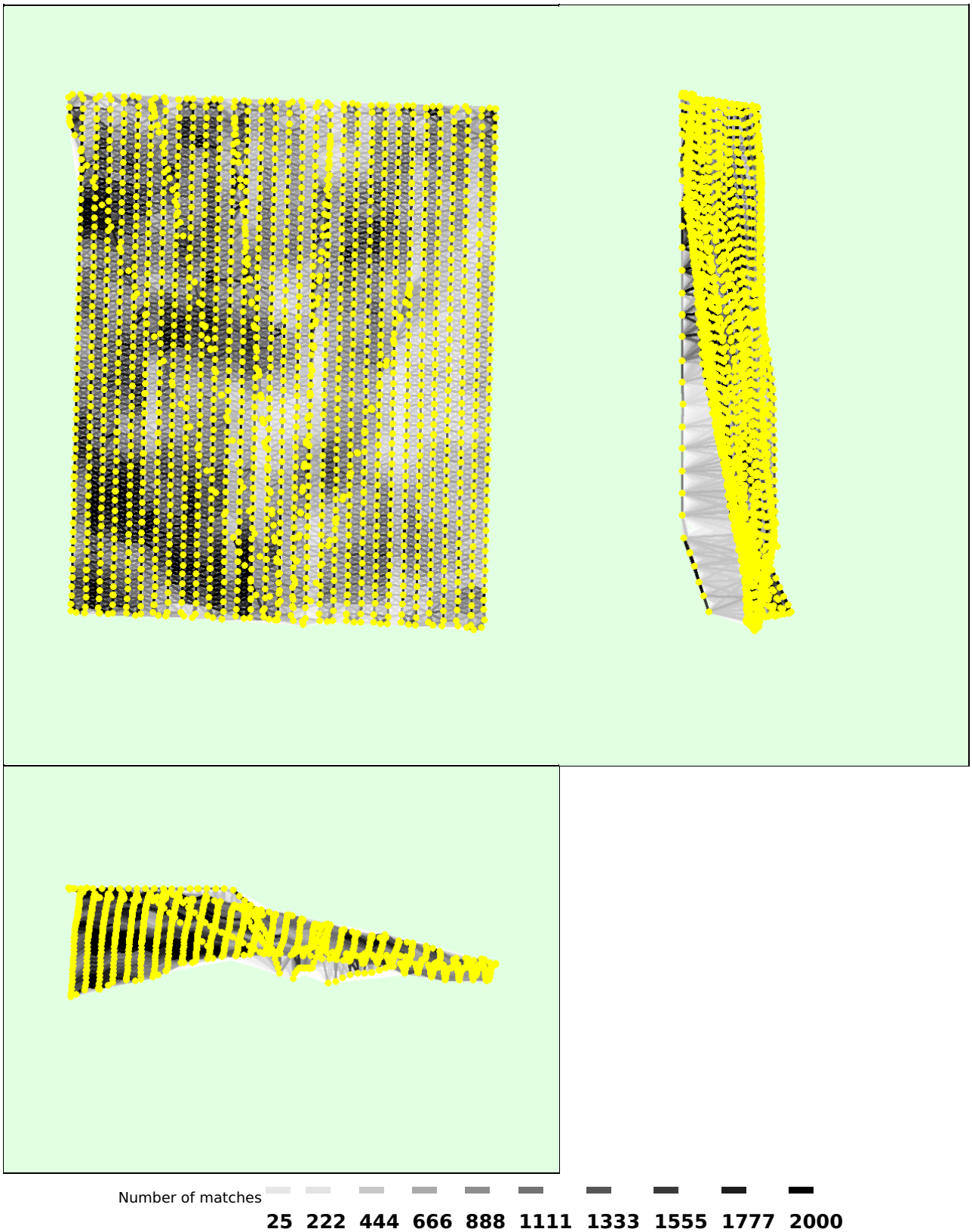

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.31	0.00
-3.00	0.00	52.76	50.14	45.54
0.00	3.00	47.24	49.27	54.46
3.00	6.00	0.00	0.29	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]		-0.000388	0.000175	0.000159
Sigma [m]		0.396850	0.901271	0.436935
RMS Error [m]		0.396850	0.901271	0.436935

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:03s
Time for Point Cloud Classification	57s
Time for 3D Textured Mesh Generation	09m:19s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	10036699
Average Density (per m^3)	4.65

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.75 [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 (8.75 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	45s
Time for Orthomosaic Generation	50m:17s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:02m:00s
Time for Index Map Generation	30s

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	✓