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_4k_1_re
Processed	2019-01-24 12:36:59
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_merge_eldo_4k_2_re»
Average Ground Sampling Distance (GSD)	8.31 cm / 3.27 in
Area Covered	0.611 km^2 / 61.0670 ha / 0.24 sq. mi. / 150.9780 acres
Time for Initial Processing (without report)	13h:06m:59s

Quality Check

Images	median of 33698 keypoints per image	✓
Dataset	10485 out of 10500 images calibrated (99%), all images enabled	✓
Camera Optimization	1.36% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 8432.61 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

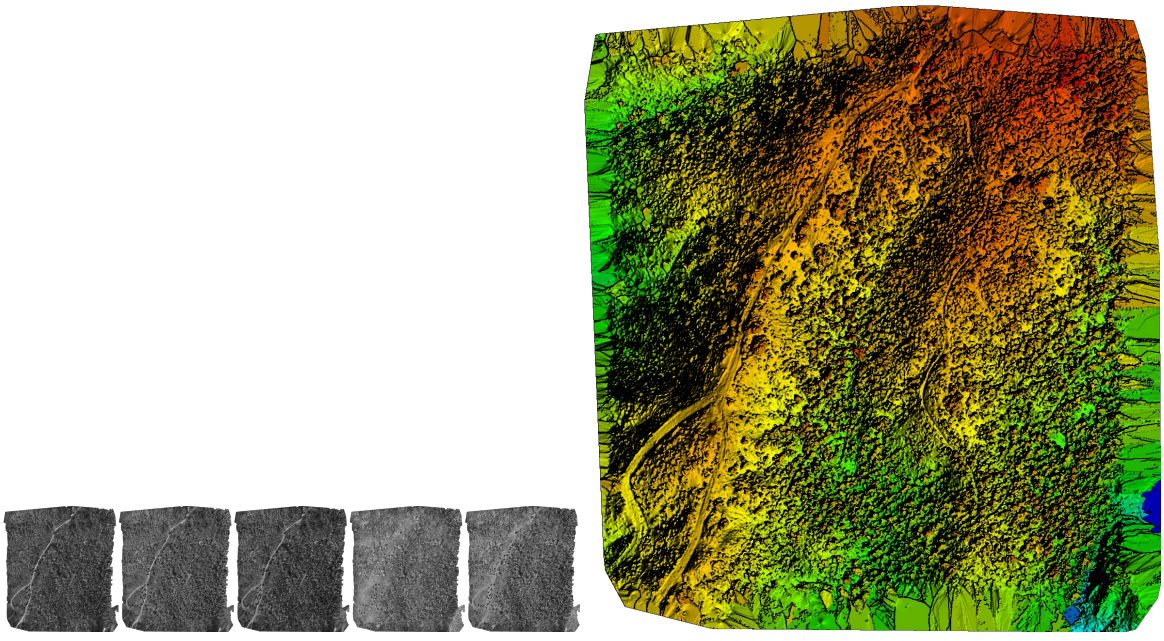


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10485 out of 10500
Number of Geolocated Images	10010 out of 10500

Initial Image Positions

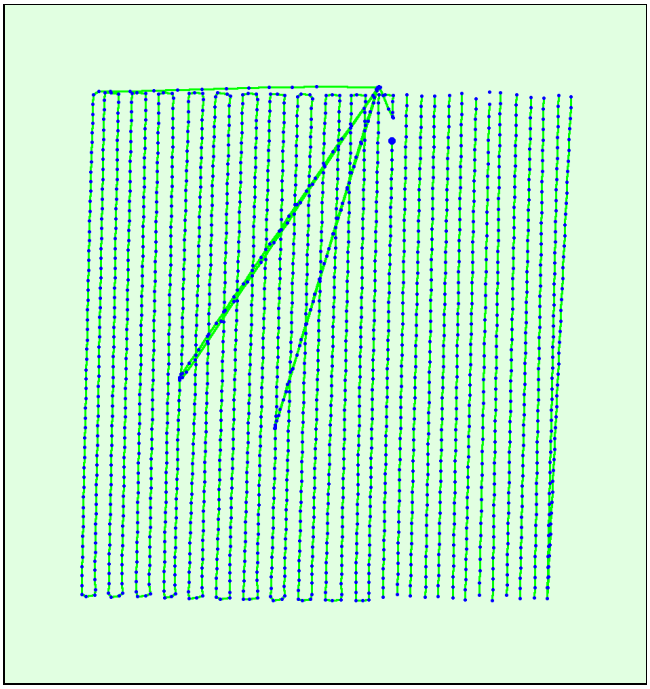
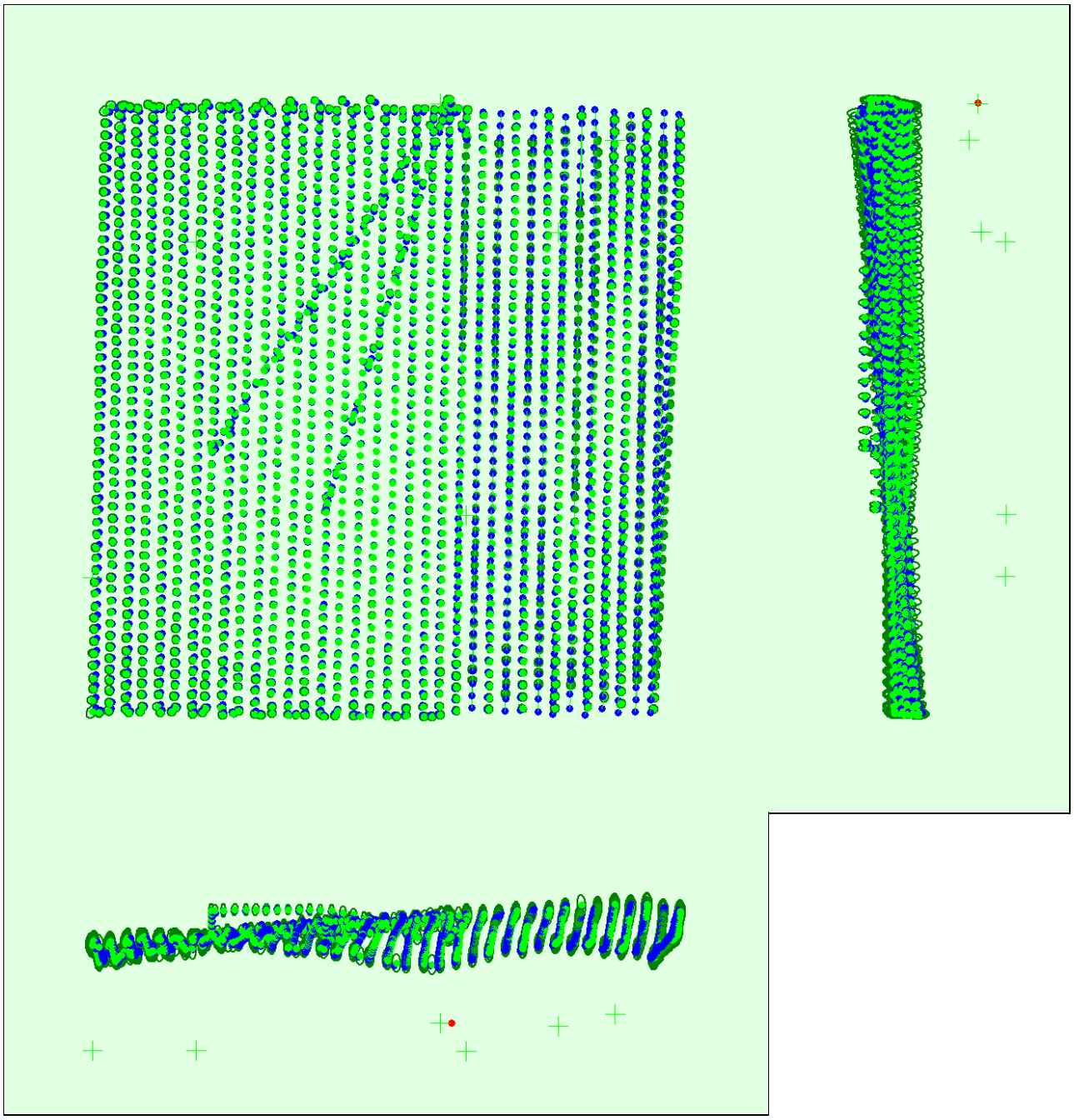


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.069	0.069	0.158	0.032	0.033	0.012
Sigma	0.011	0.011	0.035	0.002	0.002	0.003

Overlap

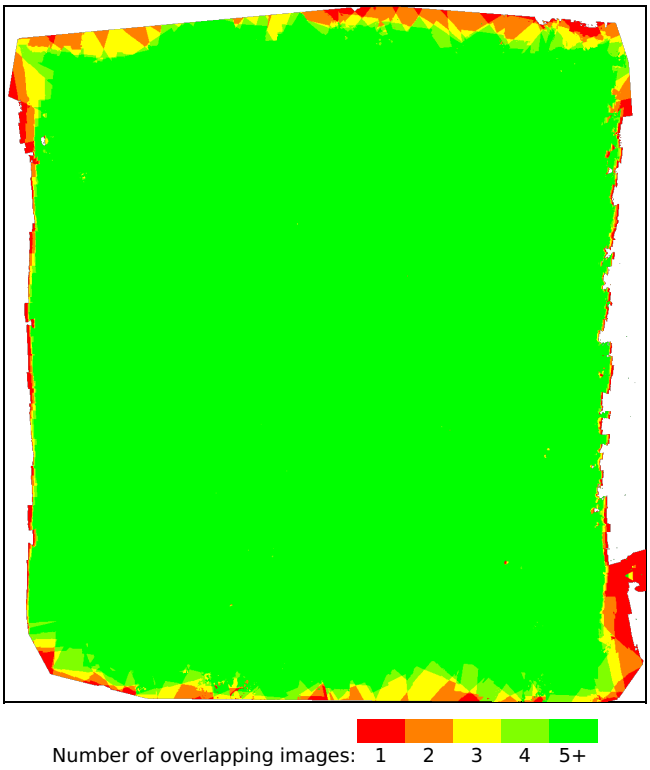


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

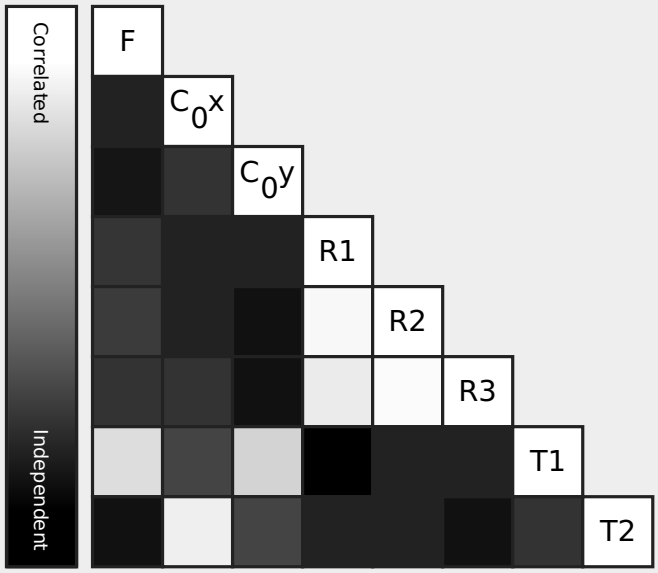
Number of 2D Keypoint Observations for Bundle Block Adjustment	26476961
Number of 3D Points for Bundle Block Adjustment	8515372
Mean Reprojection Error [pixels]	0.191

Internal Camera Parameters

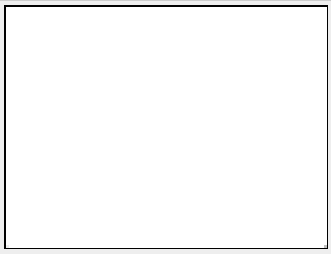
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.273 [pixel] 5.424 [mm]	654.166 [pixel] 2.453 [mm]	494.563 [pixel] 1.855 [mm]	-0.099	0.170	-0.071	0.000	-0.000
Uncertainties (Sigma)	0.122 [pixel] 0.000 [mm]	0.085 [pixel] 0.000 [mm]	0.063 [pixel] 0.000 [mm]	0.001	0.004	0.009	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.



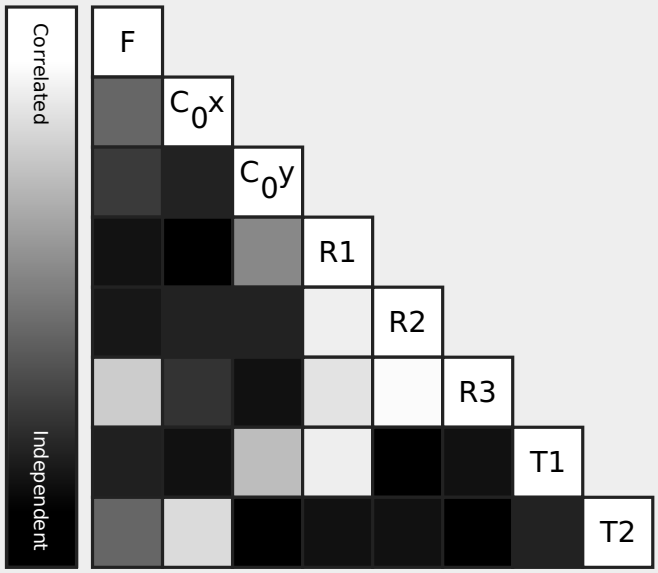
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1443.159 [pixel] 5.412 [mm]	655.687 [pixel] 2.459 [mm]	481.561 [pixel] 1.806 [mm]	-0.099	0.147	-0.026	0.000	0.000
Uncertainties (Sigma)	0.118 [pixel] 0.000 [mm]	0.026 [pixel] 0.000 [mm]	0.021 [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.

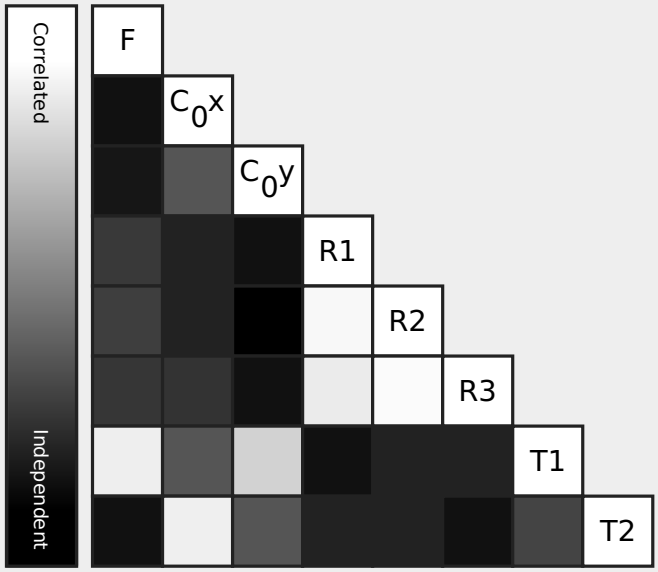
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

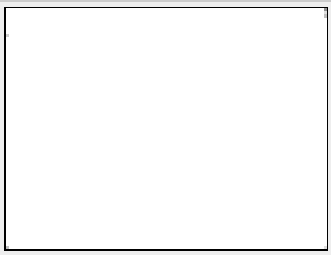
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.290 [pixel] 5.431 [mm]	653.884 [pixel] 2.452 [mm]	493.593 [pixel] 1.851 [mm]	-0.099	0.130	-0.000	-0.000	-0.000
Uncertainties (Sigma)	0.123 [pixel] 0.000 [mm]	0.091 [pixel] 0.000 [mm]	0.068 [pixel] 0.000 [mm]	0.001	0.004	0.010	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.



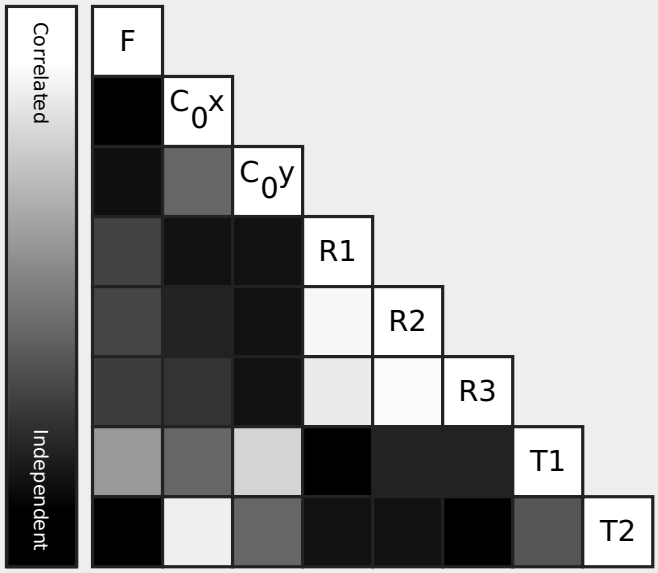
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

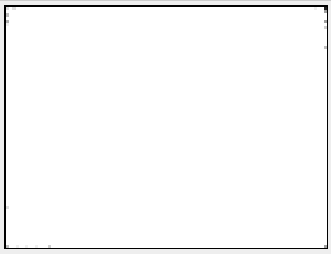
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.890 [pixel] 5.433 [mm]	662.527 [pixel] 2.484 [mm]	482.422 [pixel] 1.809 [mm]	-0.102	0.138	-0.016	0.000	-0.000
Uncertainties (Sigma)	0.125 [pixel] 0.000 [mm]	0.106 [pixel] 0.000 [mm]	0.079 [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.



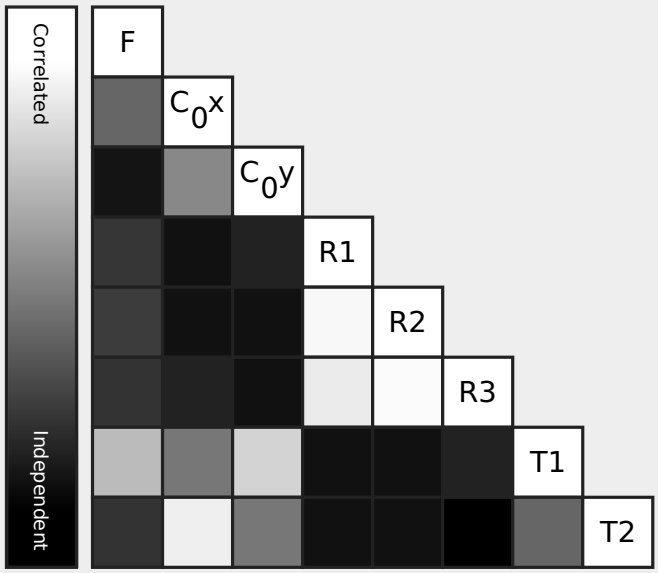
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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 (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	1446.638 [pixel] 5.425 [mm]	657.804 [pixel] 2.467 [mm]	494.249 [pixel] 1.853 [mm]	-0.101	0.145	-0.031	0.000	-0.000
Uncertainties (Sigma)	0.123 [pixel] 0.000 [mm]	0.088 [pixel] 0.000 [mm]	0.066 [pixel] 0.000 [mm]	0.001	0.004	0.009	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_merge_eldo_4k_2_re» Relatives. Images: 10500

	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	-0.088	0.090	-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	0.067	0.081	-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	-0.138	-0.156	0.119
Uncertainties (sigma)				0.003	0.004	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	-0.059	-0.589	-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	33698	8433
Min	19452	1369
Max	44166	23068
Mean	33374	9015

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	30327	6327
Min	20589	1688
Max	41309	17847
Mean	30487	7077

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34208	9041
Min	19452	1815
Max	42921	23068
Mean	34043	9533

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	30087	5712

Min	20109	1369
Max	39081	17540
Mean	29862	6784

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31560	7389
Min	20484	1376
Max	42540	21694
Mean	31533	8399

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	35282	7660
Min	24956	1587
Max	44166	21566
Mean	34936	8633

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)	56 / 373 / 11174	37 / 185 / 6999	70 / 432 / 6320	20 / 99 / 1534	30 / 157 / 3030
RedEdge_5.5_1280x960 (Green)		60 / 310 / 15544	34 / 158 / 5526	16 / 65 / 2960	26 / 120 / 6449
RedEdge_5.5_1280x960 (Red)			59 / 438 / 12449	19 / 85 / 1742	29 / 147 / 3334
RedEdge_5.5_1280x960 (NIR)				45 / 405 / 17094	38 / 325 / 5977
RedEdge_5.5_1280x960 (Red edge)					36 / 282 / 15071

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	5407631
In 3 Images	1471866
In 4 Images	639961
In 5 Images	313915
In 6 Images	187105
In 7 Images	115810
In 8 Images	78720
In 9 Images	55686
In 10 Images	41916
In 11 Images	32716
In 12 Images	26099
In 13 Images	20137
In 14 Images	16352
In 15 Images	13382
In 16 Images	11301
In 17 Images	9630
In 18 Images	8380
In 19 Images	7216
In 20 Images	6236
In 21 Images	5194
In 22 Images	4623
In 23 Images	4232
In 24 Images	3629

In 25 Images	3309
In 26 Images	2895
In 27 Images	2683
In 28 Images	2420
In 29 Images	2304
In 30 Images	1979
In 31 Images	1876
In 32 Images	1644
In 33 Images	1566
In 34 Images	1461
In 35 Images	1338
In 36 Images	1175
In 37 Images	1072
In 38 Images	975
In 39 Images	867
In 40 Images	794
In 41 Images	647
In 42 Images	628
In 43 Images	527
In 44 Images	497
In 45 Images	425
In 46 Images	365
In 47 Images	306
In 48 Images	279
In 49 Images	239
In 50 Images	198
In 51 Images	169
In 52 Images	156
In 53 Images	118
In 54 Images	108
In 55 Images	84
In 56 Images	79
In 57 Images	72
In 58 Images	54
In 59 Images	57
In 60 Images	50
In 61 Images	39
In 62 Images	32
In 63 Images	22
In 64 Images	26
In 65 Images	28
In 66 Images	19
In 67 Images	10
In 68 Images	6
In 69 Images	5
In 70 Images	9
In 71 Images	5
In 72 Images	4
In 73 Images	1
In 74 Images	2
In 75 Images	2
In 76 Images	1
In 77 Images	2
In 78 Images	2
In 80 Images	1
In 81 Images	1
In 86 Images	1
In 89 Images	1

2D Keypoint Matches

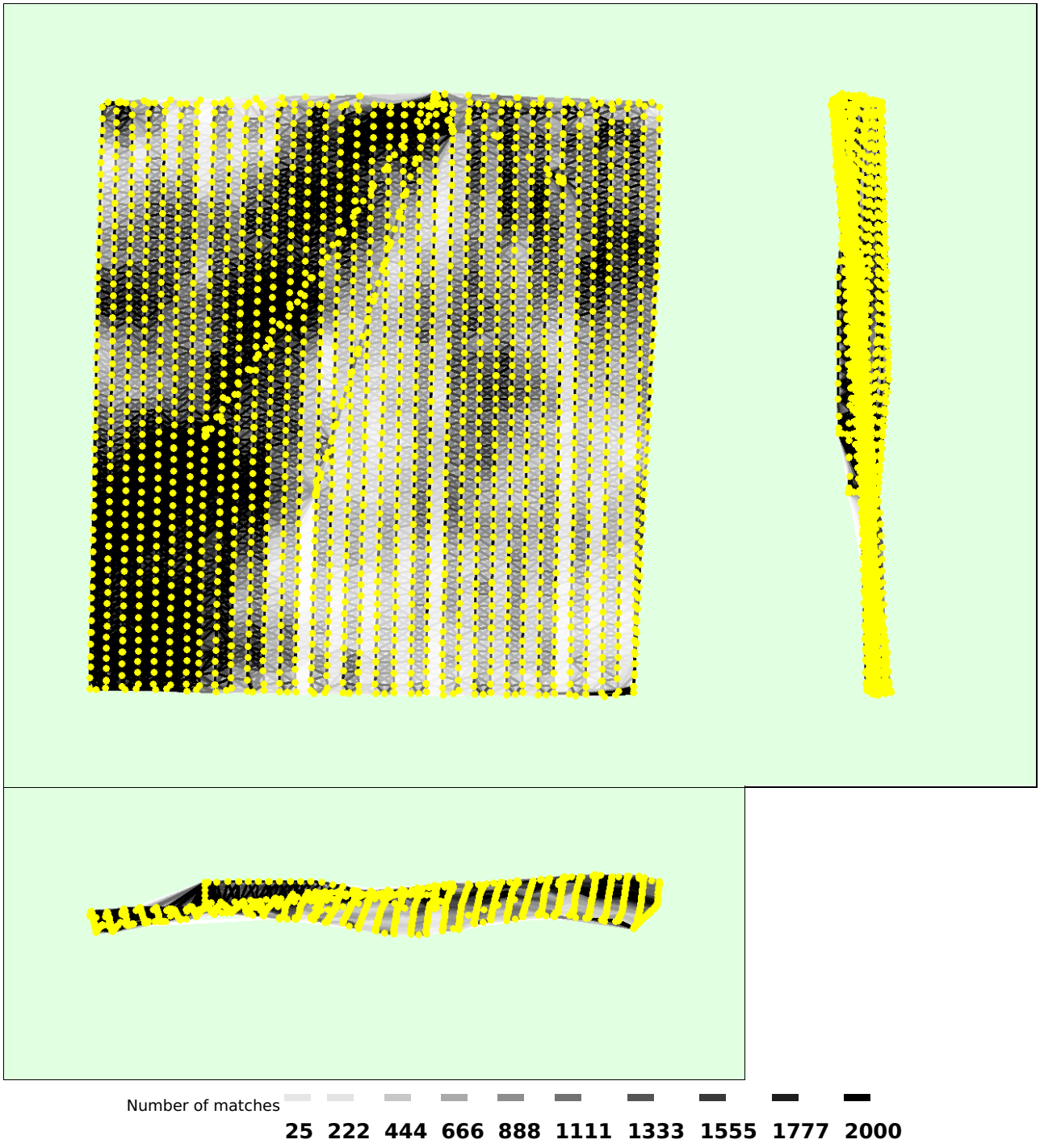


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Manual Tie Points

MTP Name	Projection Error [pixel]	Verified/Marked
"gcp_6"	0.474	30 / 30
"gcp_7"	0.777	33 / 33
"gcp_9"	0.707	20 / 20
"gcp_12"	0.605	25 / 25
"gcp_13"	0.407	53 / 53
"gcp_14"	1.073	6 / 6

Projection errors for manual tie points.The last column counts the number of images where the manual tie point has been automatically verified vs. manually marked.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	1.19	0.00
-15.00	-12.00	0.00	1.22	0.00
-12.00	-9.00	0.00	1.93	0.00
-9.00	-6.00	0.69	2.93	0.00
-6.00	-3.00	2.60	10.30	1.23
-3.00	0.00	39.34	38.40	47.54
0.00	3.00	54.46	33.83	48.93
3.00	6.00	2.84	3.81	2.30
6.00	9.00	0.08	2.65	0.00
9.00	12.00	0.00	1.60	0.00
12.00	15.00	0.00	0.85	0.00
15.00	-	0.00	1.27	0.00
Mean [m]		0.156509	-0.361810	0.036989
Sigma [m]		1.682010	5.913865	1.392673
RMS Error [m]		1.689276	5.924922	1.393164

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]	98.77	83.91	100.00
[-2.00, 2.00]	100.00	92.92	100.00
[-3.00, 3.00]	100.00	97.53	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_merge_eldo_4k_2_re» 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:43s
Time for Point Cloud Classification	01m:05s
Time for 3D Textured Mesh Generation	09m:46s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	10751790
Average Density (per m^3)	5.99

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.31 [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 (8.31 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	46s
Time for Orthomosaic Generation	51m:04s

Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	58m:41s
Time for Index Map Generation	36s

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	✓