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	eldo_5k_3_re
Processed	2019-01-24 10:02:47
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)	7.91 cm / 3.11 in
Area Covered	0.577 km^2 / 57.6794 ha / 0.22 sq. mi. / 142.6027 acres
Time for Initial Processing (without report)	09h:54m:33s

Quality Check

Images	median of 31722 keypoints per image	✓
Dataset	10255 out of 10445 images calibrated (98%), 5 images disabled	✓
Camera Optimization	1.38% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 6699.16 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

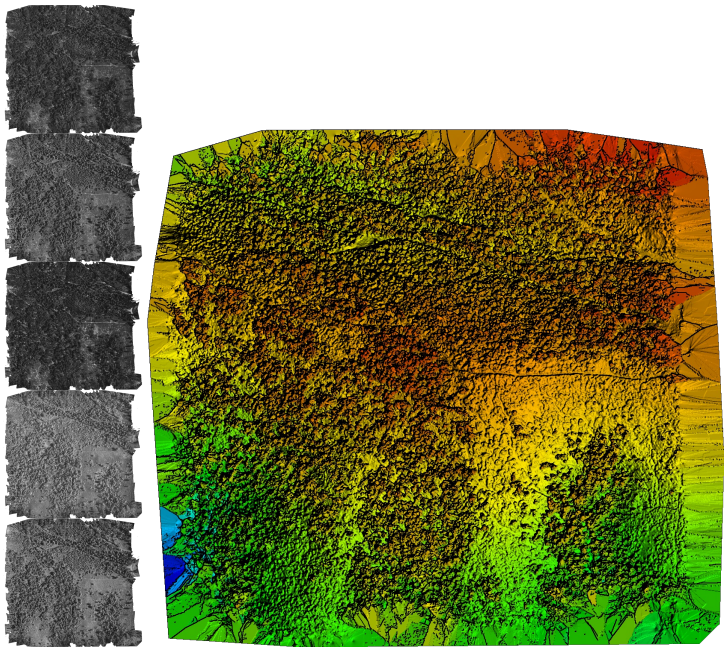


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10255 out of 10450
Number of Geolocated Images	10450 out of 10450

Initial Image Positions

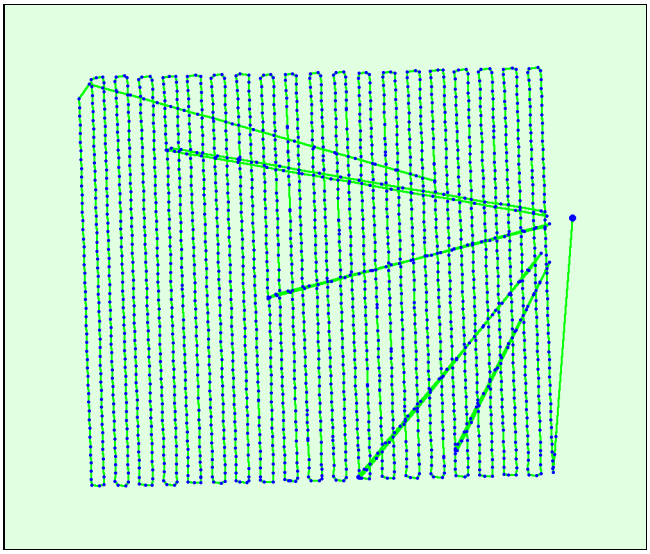
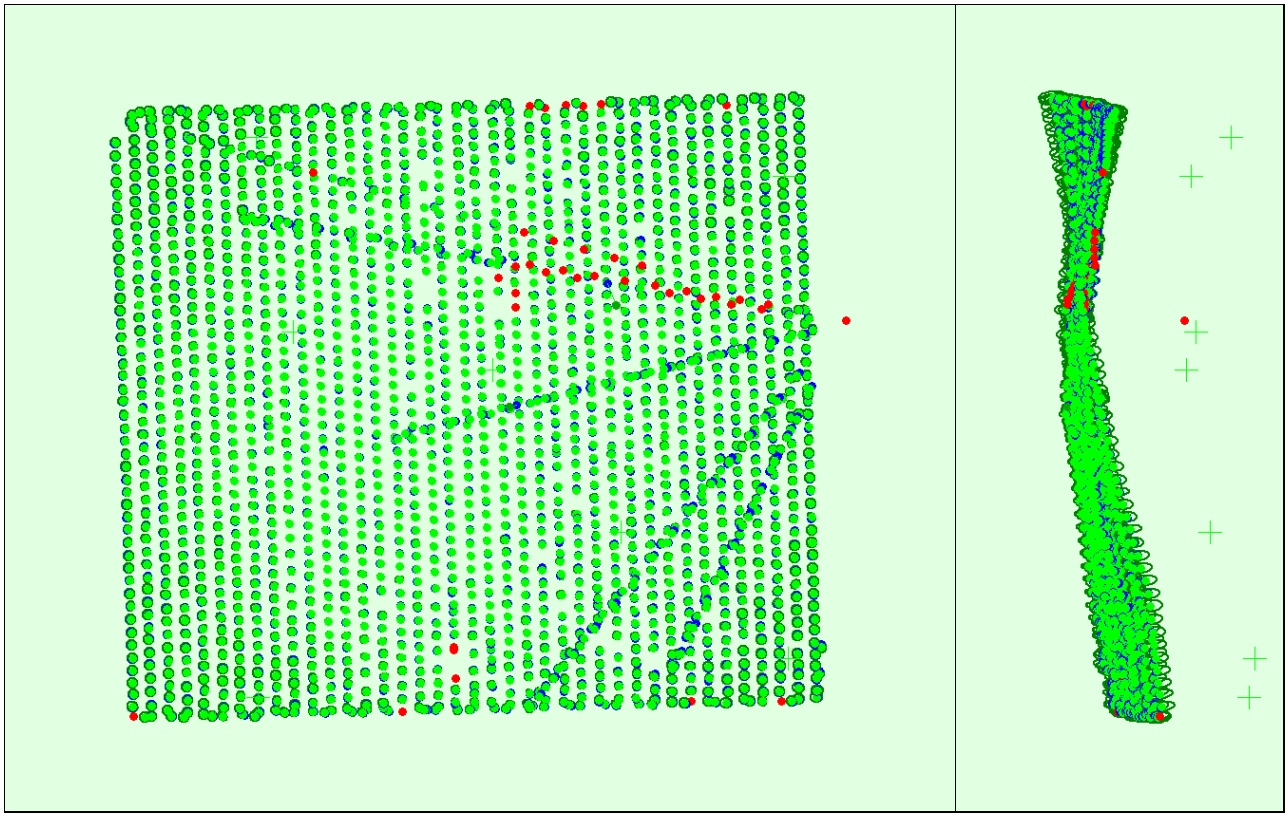
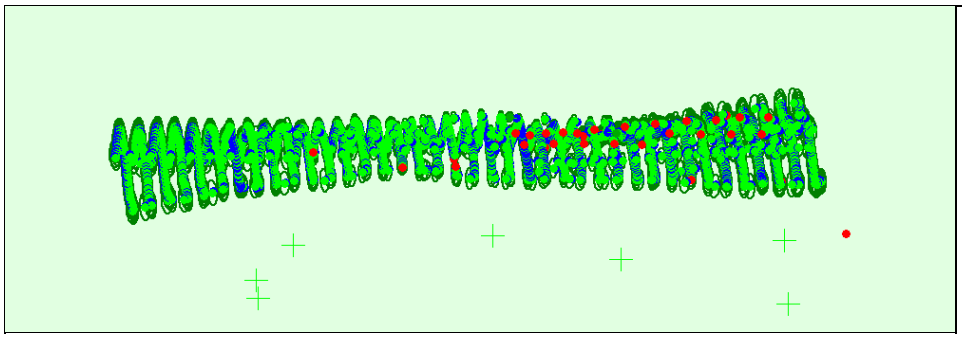


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.072	0.072	0.166	0.035	0.032	0.013
Sigma	0.011	0.011	0.035	0.002	0.002	0.003

Overlap

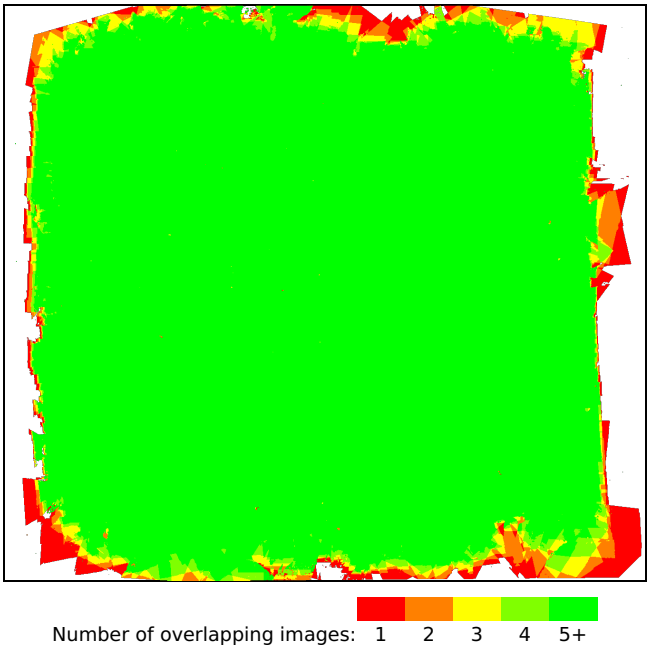


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

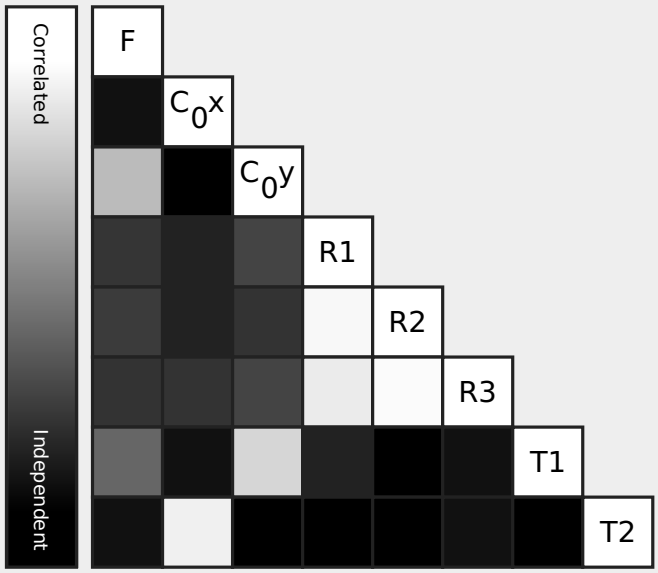
Number of 2D Keypoint Observations for Bundle Block Adjustment	25216849
Number of 3D Points for Bundle Block Adjustment	8387347
Mean Reprojection Error [pixels]	0.188

Internal Camera Parameters

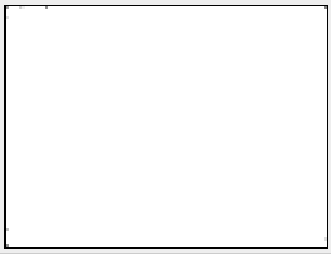
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1445.947 [pixel] 5.422 [mm]	654.428 [pixel] 2.454 [mm]	495.437 [pixel] 1.858 [mm]	-0.097	0.161	-0.055	0.000	-0.000
Uncertainties (Sigma)	0.137 [pixel] 0.001 [mm]	0.099 [pixel] 0.000 [mm]	0.075 [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.



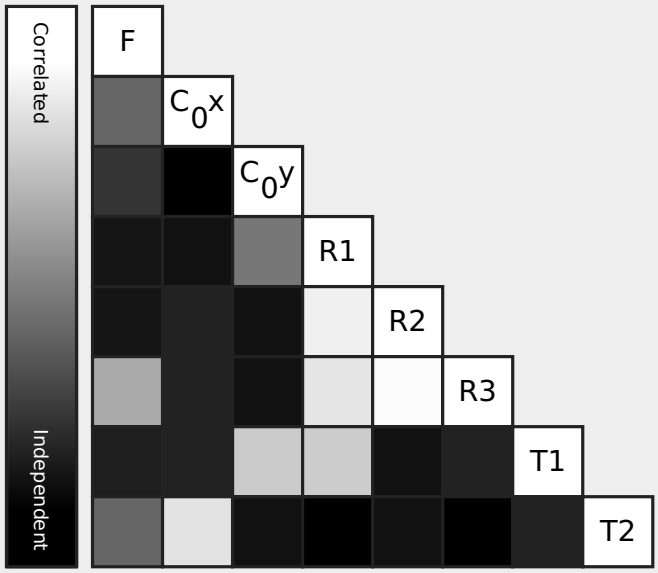
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

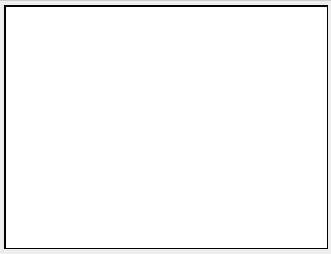
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1442.874 [pixel] 5.411 [mm]	655.800 [pixel] 2.459 [mm]	481.578 [pixel] 1.806 [mm]	-0.097	0.136	-0.003	0.000	0.000
Uncertainties (Sigma)	0.132 [pixel] 0.000 [mm]	0.029 [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.



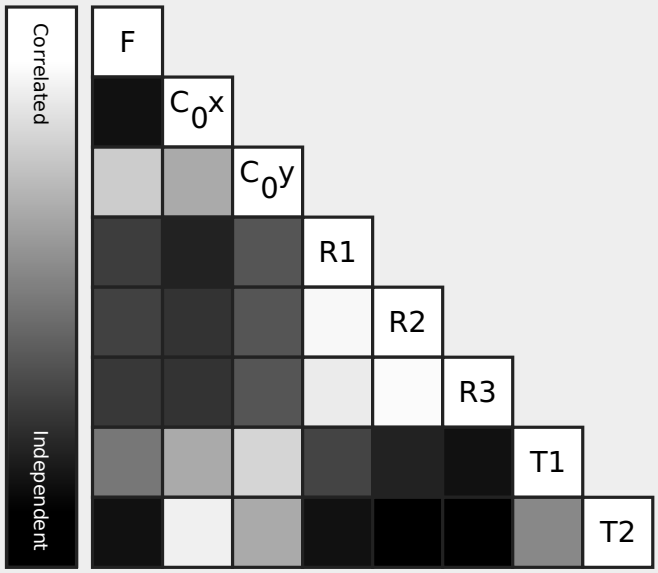
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

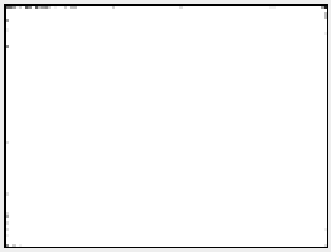
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1447.924 [pixel] 5.430 [mm]	653.576 [pixel] 2.451 [mm]	493.816 [pixel] 1.852 [mm]	-0.097	0.119	0.026	-0.000	-0.000
Uncertainties (Sigma)	0.139 [pixel] 0.001 [mm]	0.112 [pixel] 0.000 [mm]	0.084 [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.



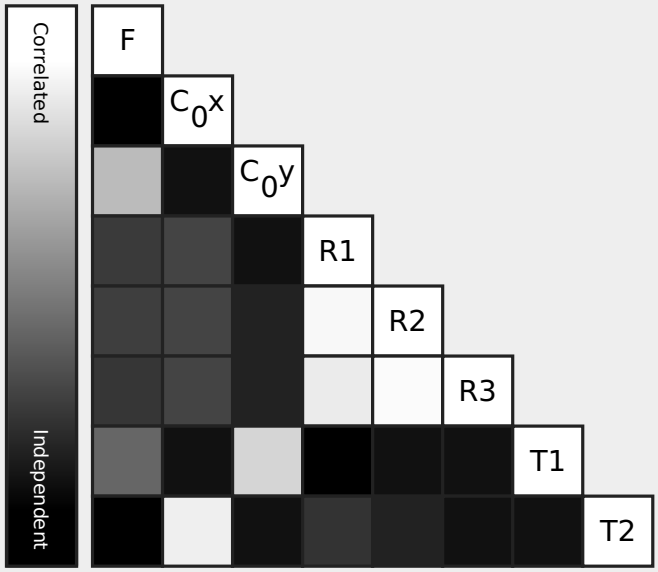
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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 (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	1448.683 [pixel] 5.433 [mm]	662.424 [pixel] 2.484 [mm]	482.686 [pixel] 1.810 [mm]	-0.103	0.144	-0.026	0.000	-0.000
Uncertainties (Sigma)	0.138 [pixel] 0.001 [mm]	0.106 [pixel] 0.000 [mm]	0.080 [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.

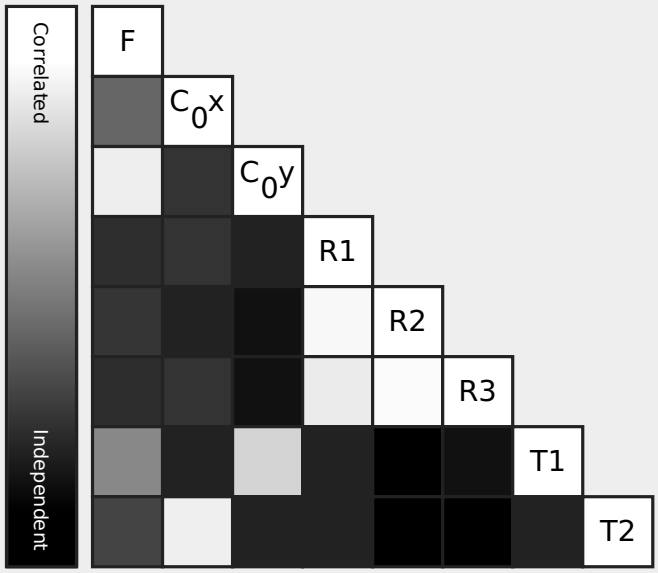
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

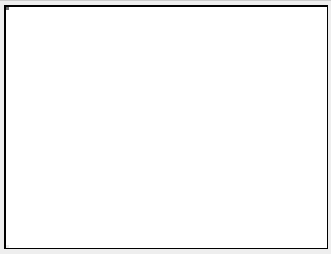
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.398 [pixel] 5.424 [mm]	657.602 [pixel] 2.466 [mm]	494.416 [pixel] 1.854 [mm]	-0.100	0.143	-0.028	0.000	-0.000
Uncertainties (Sigma)	0.136 [pixel] 0.001 [mm]	0.090 [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.

Camera Rig «MicaSense 5 band» Relatives. Images: 10445

	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	-0.116	0.118	-0.373
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	0.053	0.076	-0.062
Uncertainties (sigma)				0.003	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	-0.152	-0.139	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	-0.071	-0.575	-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	31722	6699
Min	17290	25
Max	47207	31148
Mean	31987	8759

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

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

Median	26802	3792
Min	18208	47
Max	40389	20833
Mean	27302	5902

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	32293	7030
Min	20187	675
Max	47207	31148
Mean	33064	9511

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	23208	3067
Min	18187	25
Max	34159	19632
Mean	24122	5042

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31433	5412
Min	17665	80
Max	43744	26114
Mean	31926	7965

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	33417	6670
Min	17290	58
Max	46074	26100
Mean	33930	8675

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)	49 / 401 / 16638	27 / 140 / 3410	76 / 486 / 8372	23 / 133 / 1460	34 / 194 / 2334
RedEdge_5.5_1280x960 (Green)		45 / 263 / 24671	23 / 113 / 2508	22 / 108 / 3911	31 / 166 / 8104
RedEdge_5.5_1280x960 (Red)			60 / 484 / 14796	18 / 96 / 1179	31 / 153 / 1973
RedEdge_5.5_1280x960 (NIR)				49 / 604 / 21430	58 / 532 / 8879
RedEdge_5.5_1280x960 (Red edge)					46 / 440 / 19251

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	5425718
In 3 Images	1426812
In 4 Images	620402
In 5 Images	298551
In 6 Images	174841

In 7 Images	107616
In 8 Images	73798
In 9 Images	52275
In 10 Images	39189
In 11 Images	29917
In 12 Images	22711
In 13 Images	17988
In 14 Images	14306
In 15 Images	11525
In 16 Images	9673
In 17 Images	8092
In 18 Images	6793
In 19 Images	5821
In 20 Images	4987
In 21 Images	4428
In 22 Images	3741
In 23 Images	3251
In 24 Images	2964
In 25 Images	2551
In 26 Images	2252
In 27 Images	2014
In 28 Images	1803
In 29 Images	1612
In 30 Images	1446
In 31 Images	1235
In 32 Images	1165
In 33 Images	1019
In 34 Images	893
In 35 Images	837
In 36 Images	646
In 37 Images	612
In 38 Images	555
In 39 Images	481
In 40 Images	390
In 41 Images	346
In 42 Images	301
In 43 Images	252
In 44 Images	236
In 45 Images	211
In 46 Images	164
In 47 Images	146
In 48 Images	123
In 49 Images	100
In 50 Images	103
In 51 Images	73
In 52 Images	62
In 53 Images	47
In 54 Images	56
In 55 Images	39
In 56 Images	23
In 57 Images	34
In 58 Images	16
In 59 Images	15
In 60 Images	20
In 61 Images	12
In 62 Images	17
In 63 Images	7
In 64 Images	6
In 65 Images	8

In 66 Images	6
In 67 Images	8
In 68 Images	3
In 69 Images	1
In 70 Images	1
In 71 Images	1

2D Keypoint Matches

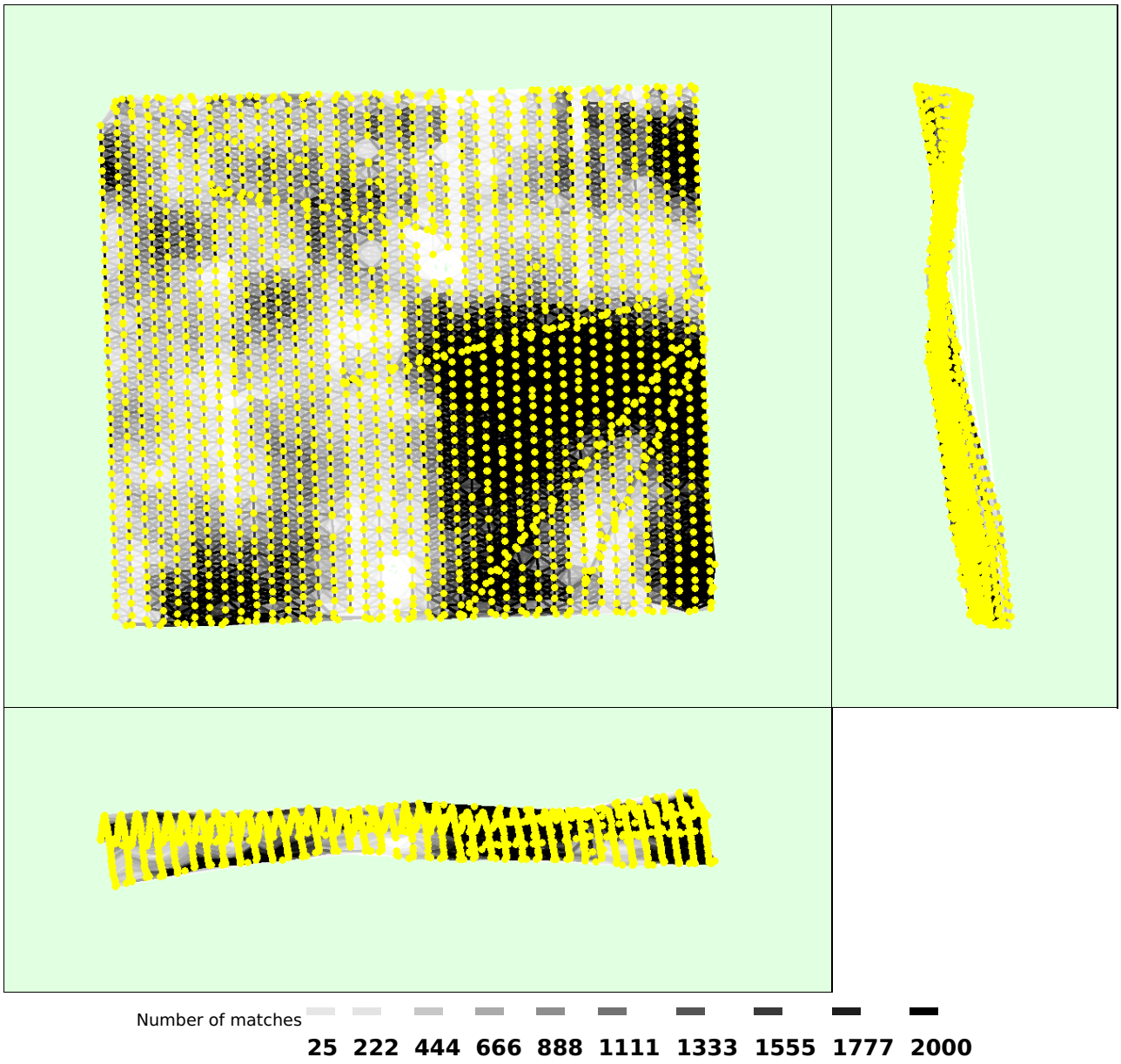


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Manual Tie Points

MTP Name	Projection Error [pixel]	Verified/Marked
mtp1	0.274	130 / 130
mtp2	0.307	107 / 107
mtp3	0.869	166 / 166
mtp4	0.605	119 / 119
mtp5	0.660	18 / 18
mtp6	0.573	75 / 75
mtp7	0.634	103 / 103

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	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	0.01	0.00	0.00
-6.00	-3.00	0.00	0.00	0.00
-3.00	0.00	44.44	51.59	44.97
0.00	3.00	55.34	47.97	55.03
3.00	6.00	0.20	0.44	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	0.01	0.00
Mean [m]		0.000569	-0.008557	0.000441
Sigma [m]		0.621572	0.945283	0.922706
RMS Error [m]		0.621572	0.945321	0.922706

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]	99.98	99.99	100.00
[-2.00, 2.00]	100.00	99.99	100.00
[-3.00, 3.00]	100.00	99.99	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 10N (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:51s
Time for Point Cloud Classification	01m:04s
Time for 3D Textured Mesh Generation	10m:35s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	12404758
Average Density (per m^3)	5.64

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (7.91 [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 (7.91 [cm/pixel]) Merge Tiles: yes

Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	55s
Time for Orthomosaic Generation	01h:04m:38s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:10m:50s
Time for Index Map Generation	41s

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	✓