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_1_re
Processed	2019-01-24 09:37:01
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)	8.24 cm / 3.24 in
Area Covered	0.522 km^2 / 52.1667 ha / 0.20 sq. mi. / 128.9734 acres
Time for Initial Processing (without report)	09h:21m:49s

Quality Check

Images	median of 30187 keypoints per image	✓
Dataset	10460 out of 10780 images calibrated (97%), 5 images disabled	✓
Camera Optimization	1.54% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 4490.99 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

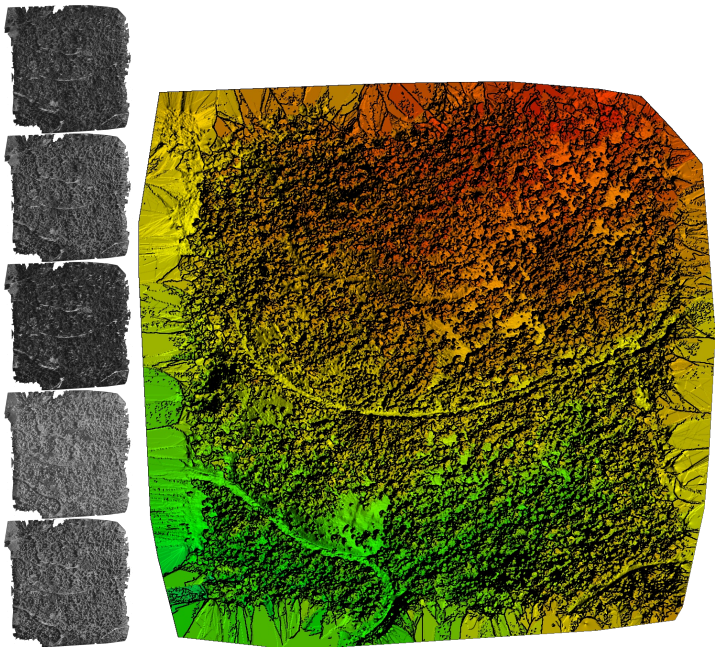


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10460 out of 10785
Number of Geolocated Images	10785 out of 10785

Initial Image Positions

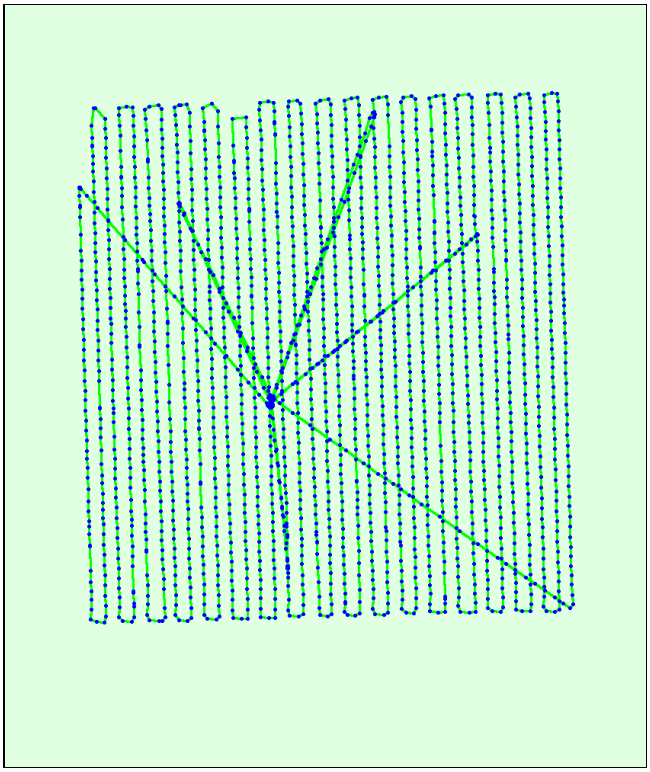
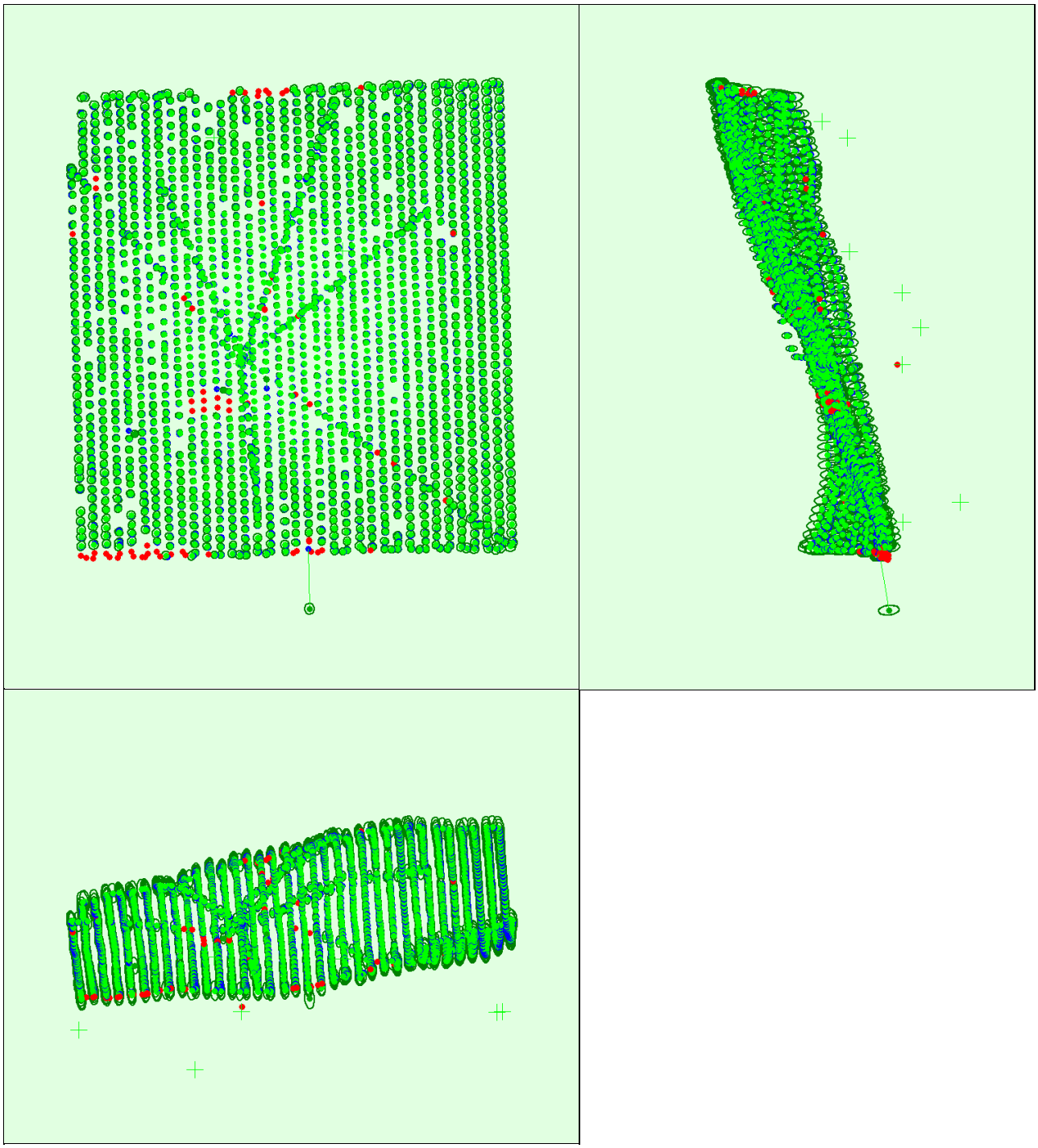


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.090	0.091	0.193	0.037	0.039	0.018
Sigma	0.017	0.017	0.042	0.002	0.002	0.002

Overlap

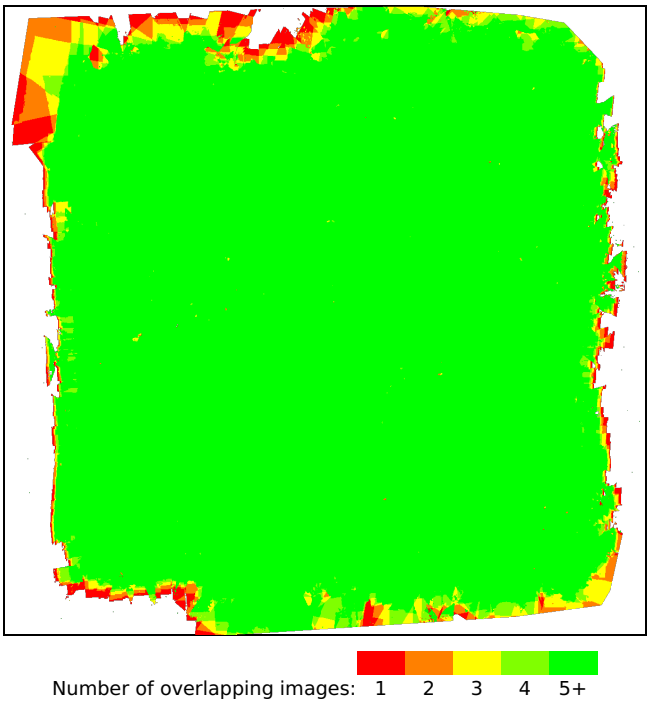


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

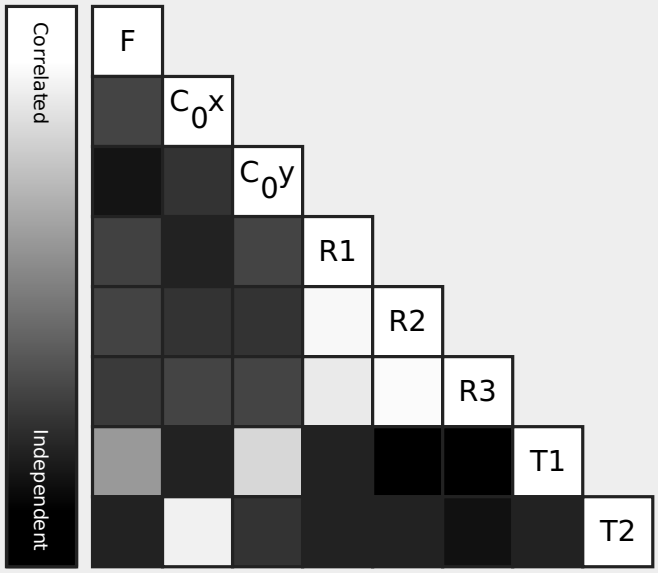
Number of 2D Keypoint Observations for Bundle Block Adjustment	16073603
Number of 3D Points for Bundle Block Adjustment	5620072
Mean Reprojection Error [pixels]	0.208

Internal Camera Parameters

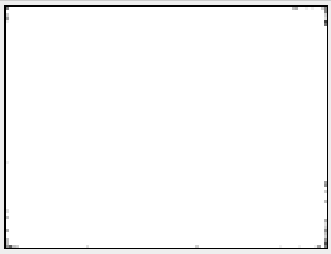
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1443.626 [pixel] 5.414 [mm]	654.704 [pixel] 2.455 [mm]	495.744 [pixel] 1.859 [mm]	-0.098	0.159	-0.054	0.000	-0.000
Uncertainties (Sigma)	0.135 [pixel] 0.001 [mm]	0.117 [pixel] 0.000 [mm]	0.088 [pixel] 0.000 [mm]	0.001	0.006	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.



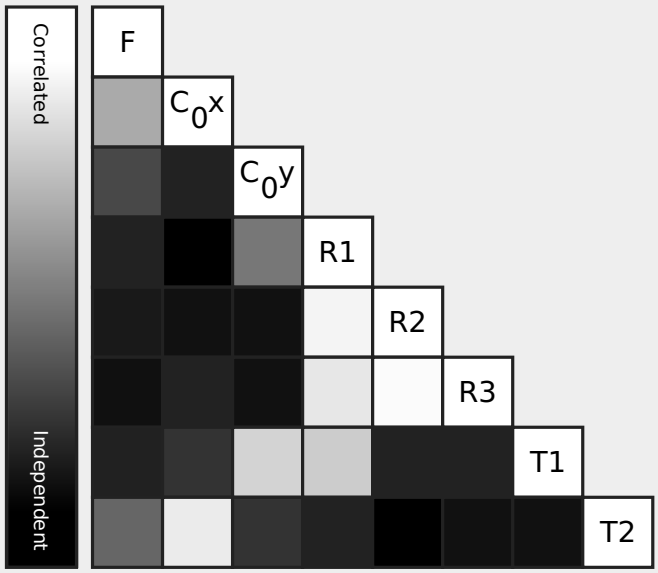
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1440.519 [pixel] 5.402 [mm]	655.931 [pixel] 2.460 [mm]	481.825 [pixel] 1.807 [mm]	-0.096	0.122	0.022	0.000	0.000
Uncertainties (Sigma)	0.129 [pixel] 0.000 [mm]	0.040 [pixel] 0.000 [mm]	0.033 [pixel] 0.000 [mm]	0.000	0.002	0.004	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.

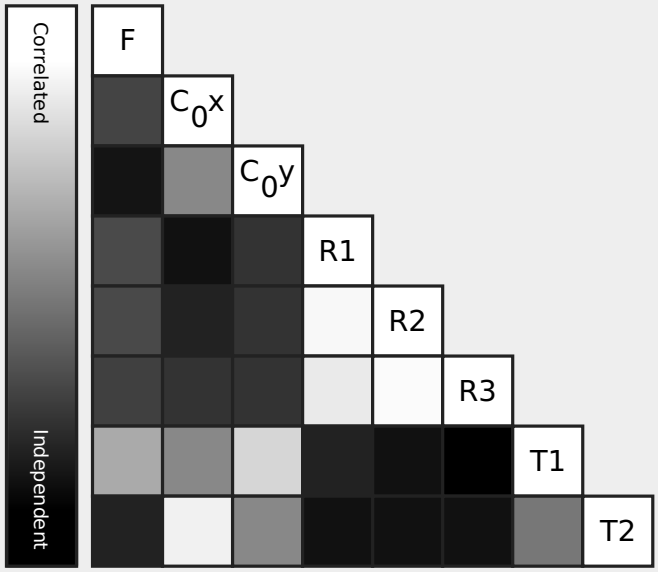
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1445.568 [pixel] 5.421 [mm]	653.789 [pixel] 2.452 [mm]	494.308 [pixel] 1.854 [mm]	-0.097	0.114	0.032	-0.000	-0.000
Uncertainties (Sigma)	0.137 [pixel] 0.001 [mm]	0.133 [pixel] 0.001 [mm]	0.099 [pixel] 0.000 [mm]	0.001	0.006	0.014	0.000	0.000



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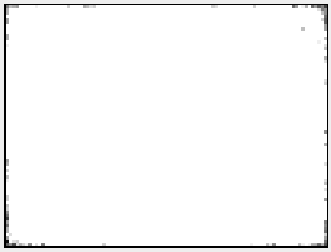


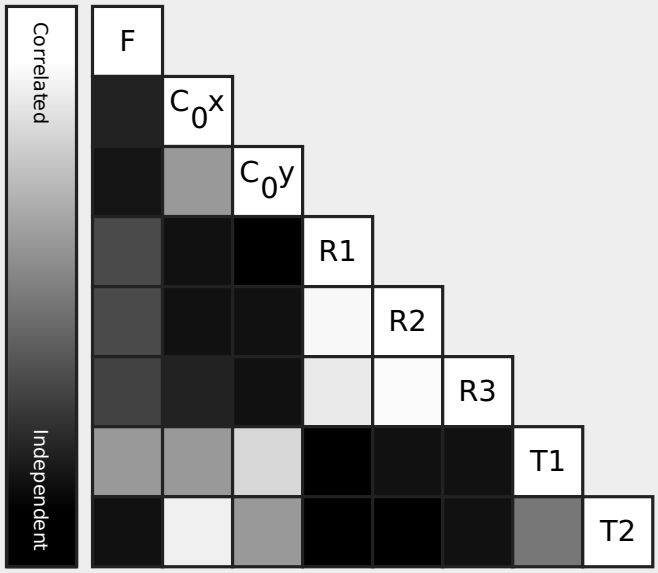
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

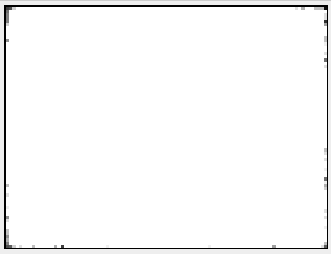
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.471 [pixel] 5.424 [mm]	662.424 [pixel] 2.484 [mm]	482.914 [pixel] 1.811 [mm]	-0.103	0.139	-0.017	0.000	-0.000
Uncertainties (Sigma)	0.137 [pixel] 0.001 [mm]	0.131 [pixel] 0.000 [mm]	0.099 [pixel] 0.000 [mm]	0.001	0.006	0.014	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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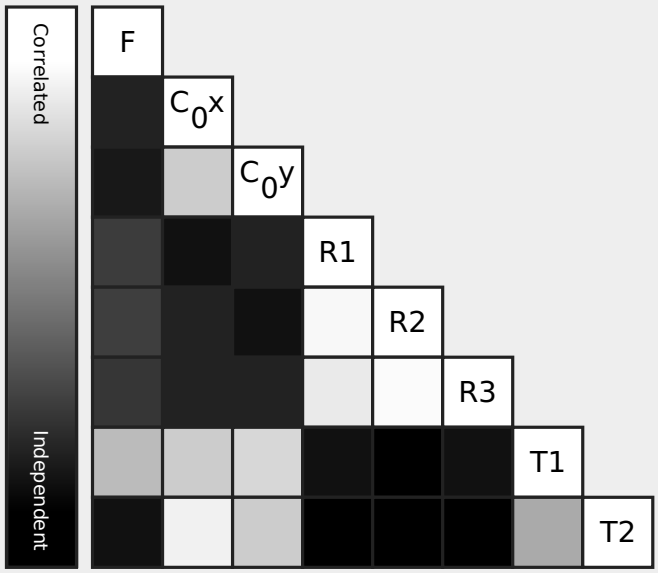
Internal Camera Parameters

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	1444.115 [pixel] 5.415 [mm]	657.601 [pixel] 2.466 [mm]	494.799 [pixel] 1.855 [mm]	-0.100	0.137	-0.016	0.000	-0.000
Uncertainties (Sigma)	0.134 [pixel] 0.001 [mm]	0.108 [pixel] 0.000 [mm]	0.081 [pixel] 0.000 [mm]	0.001	0.005	0.012	0.000	0.000



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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: 10780

	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	-0.115	0.135	-0.372
Uncertainties (sigma)				0.004	0.005	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	0.040	0.085	-0.063
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	-0.155	-0.125	0.118
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	-0.078	-0.567	-0.322
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	30187	4491
Min	16998	12
Max	40039	23997
Mean	29467	5460

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	26152	3143
Min	17152	13
Max	35788	17888
Mean	25819	4162

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	31051	4834
Min	18508	88
Max	40039	23997
Mean	30715	5850

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	21207	2520

Min	16998	12
Max	32539	15136
Mean	22007	3297

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	28118	3479
Min	17456	21
Max	38715	21724
Mean	27521	4836

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	30709	4343
Min	17537	15
Max	38100	22738
Mean	30267	5710

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)	63 / 309 / 10654	29 / 140 / 6425	67 / 385 / 7439	33 / 177 / 2410	48 / 304 / 4268
RedEdge_5.5_1280x960 (Green)		30 / 158 / 21569	26 / 111 / 4050	18 / 78 / 5220	28 / 136 / 12030
RedEdge_5.5_1280x960 (Red)			51 / 229 / 9667	33 / 140 / 2469	47 / 234 / 4027
RedEdge_5.5_1280x960 (NIR)				41 / 368 / 14381	46 / 434 / 7932
RedEdge_5.5_1280x960 (Red edge)					47 / 308 / 12508

3D Points from 2D Keypoint Matches

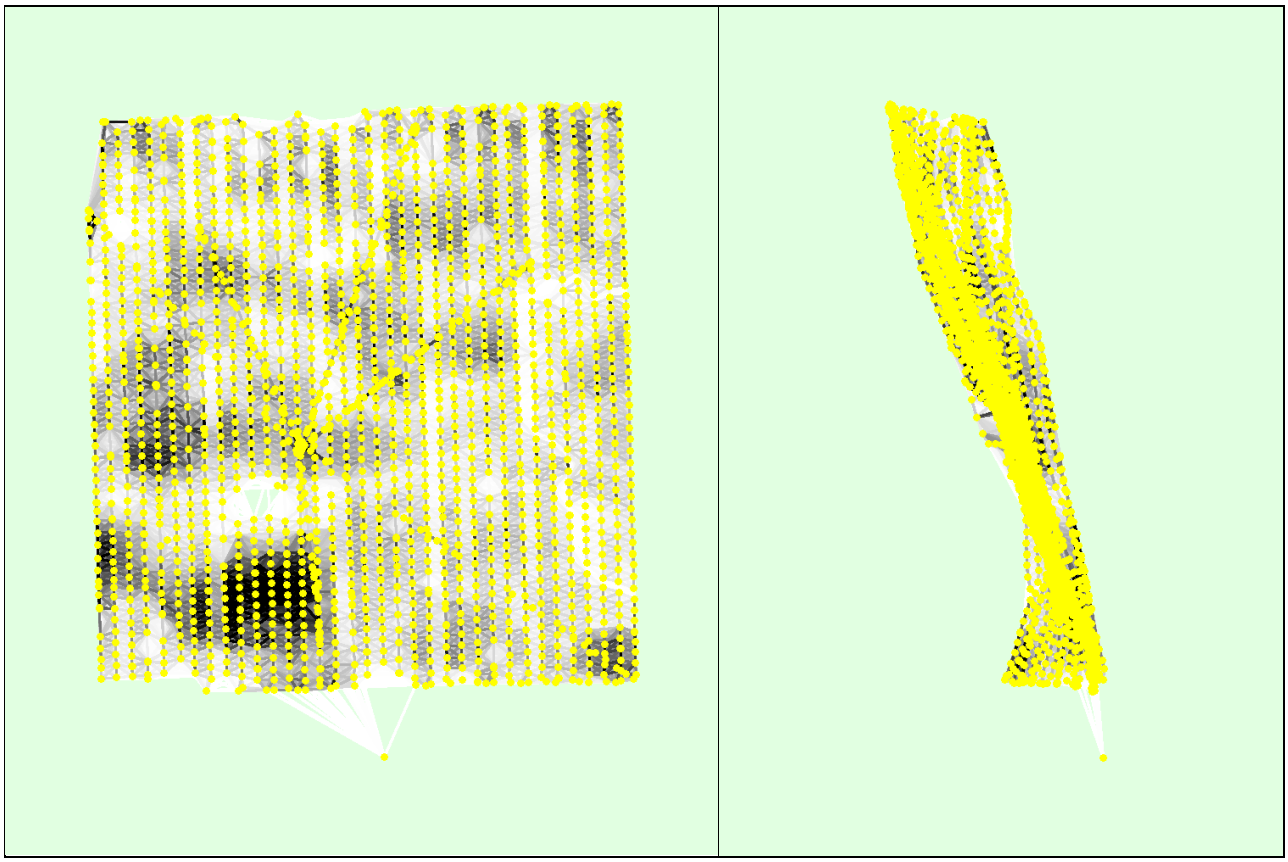
	Number of 3D Points Observed
In 2 Images	3894891
In 3 Images	852581
In 4 Images	353487
In 5 Images	173531
In 6 Images	101257
In 7 Images	61298
In 8 Images	41522
In 9 Images	28935
In 10 Images	22044
In 11 Images	16157
In 12 Images	12567
In 13 Images	9882
In 14 Images	7982
In 15 Images	6399
In 16 Images	5092
In 17 Images	4177
In 18 Images	3671
In 19 Images	3054
In 20 Images	2582
In 21 Images	2274
In 22 Images	1937
In 23 Images	1485
In 24 Images	1309

In 25 Images	1148
In 26 Images	1036
In 27 Images	921
In 28 Images	787
In 29 Images	688
In 30 Images	663
In 31 Images	561
In 32 Images	518
In 33 Images	483
In 34 Images	469
In 35 Images	366
In 36 Images	344
In 37 Images	311
In 38 Images	283
In 39 Images	266
In 40 Images	212
In 41 Images	183
In 42 Images	182
In 43 Images	176
In 44 Images	154
In 45 Images	131
In 46 Images	126
In 47 Images	127
In 48 Images	110
In 49 Images	108
In 50 Images	94
In 51 Images	90
In 52 Images	82
In 53 Images	81
In 54 Images	69
In 55 Images	62
In 56 Images	57
In 57 Images	56
In 58 Images	43
In 59 Images	51
In 60 Images	57
In 61 Images	46
In 62 Images	40
In 63 Images	38
In 64 Images	37
In 65 Images	32
In 66 Images	32
In 67 Images	33
In 68 Images	25
In 69 Images	22
In 70 Images	29
In 71 Images	18
In 72 Images	20
In 73 Images	20
In 74 Images	27
In 75 Images	25
In 76 Images	17
In 77 Images	13
In 78 Images	19
In 79 Images	11
In 80 Images	16
In 81 Images	13
In 82 Images	8
In 83 Images	14

In 84 Images	14
In 85 Images	14
In 86 Images	12
In 87 Images	11
In 88 Images	12
In 89 Images	4
In 90 Images	8
In 91 Images	1
In 92 Images	11
In 93 Images	7
In 94 Images	4
In 95 Images	3
In 96 Images	7
In 97 Images	3
In 98 Images	10
In 99 Images	8
In 100 Images	1
In 101 Images	5
In 102 Images	4
In 103 Images	7
In 104 Images	1
In 105 Images	7
In 106 Images	4
In 107 Images	3
In 108 Images	8
In 109 Images	1
In 110 Images	5
In 111 Images	4
In 112 Images	5
In 113 Images	4
In 114 Images	6
In 115 Images	5
In 116 Images	2
In 117 Images	3
In 118 Images	1
In 119 Images	3
In 120 Images	1
In 121 Images	3
In 122 Images	2
In 123 Images	3
In 125 Images	5
In 126 Images	2
In 127 Images	6
In 128 Images	2
In 129 Images	2
In 130 Images	2
In 131 Images	1
In 132 Images	1
In 133 Images	3
In 134 Images	3
In 135 Images	1
In 136 Images	1
In 137 Images	5
In 138 Images	1
In 139 Images	4
In 140 Images	1
In 141 Images	2
In 142 Images	3
In 143 Images	4

In 145 Images	2
In 146 Images	2
In 147 Images	1
In 150 Images	1
In 151 Images	2
In 153 Images	1
In 155 Images	2
In 156 Images	3
In 157 Images	2
In 158 Images	1
In 160 Images	2
In 161 Images	1
In 162 Images	2
In 165 Images	1
In 166 Images	3
In 167 Images	1
In 170 Images	2
In 171 Images	1
In 174 Images	1
In 176 Images	1
In 177 Images	1
In 179 Images	2
In 182 Images	1
In 183 Images	1
In 186 Images	1
In 187 Images	2
In 191 Images	1
In 197 Images	1

2D Keypoint Matches



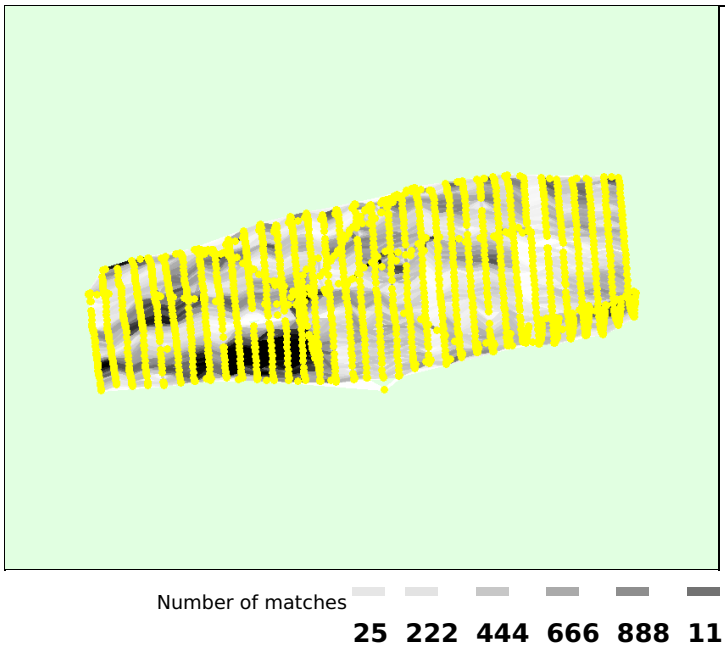


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Manual Tie Points

MTP Name	Projection Error [pixel]	Verified/Marked
mtp1	0.399	618 / 618
mtp2	0.444	161 / 161
mtp3	0.326	122 / 122
mtp4	0.926	138 / 138
mtp5	0.408	65 / 65
mtp6	0.430	84 / 84
mtp7	0.348	139 / 139
mtp8	0.579	55 / 55

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	0.01	0.01	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	48.05	51.97	46.81
0.00	3.00	51.93	48.01	53.18
3.00	6.00	0.00	0.01	0.01
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]		0.006456	0.002192	0.000385

Sigma [m]	0.639365	0.777485	0.857414
RMS Error [m]	0.639397	0.777488	0.857414

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	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 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:19s
Time for Point Cloud Classification	50s
Time for 3D Textured Mesh Generation	11m:04s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11545119
Average Density (per m^3)	4.73

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.24 [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 (8.24 [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:32m:34s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:46m:07s
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	✓