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_4k_3_re
Processed	2019-01-24 06:23:30
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)	7.57 cm / 2.98 in
Area Covered	0.550 km^2 / 54.9740 ha / 0.21 sq. mi. / 135.9141 acres
Time for Initial Processing (without report)	06h:07m:52s

Quality Check

Images	median of 33752 keypoints per image	✓
Dataset	10710 out of 11215 images calibrated (95%), 5 images disabled, 2 blocks	⚠
Camera Optimization	1.37% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 4026.57 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

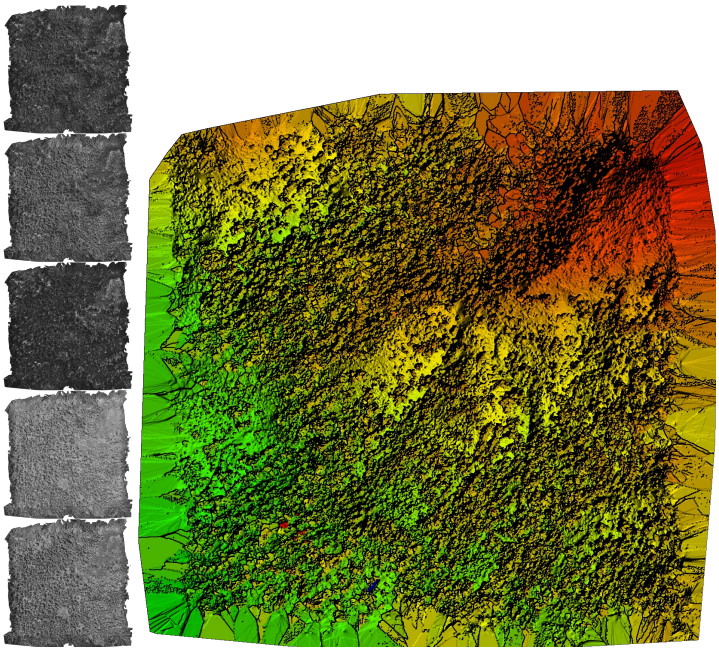


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10710 out of 11220
Number of Geolocated Images	11220 out of 11220

Initial Image Positions

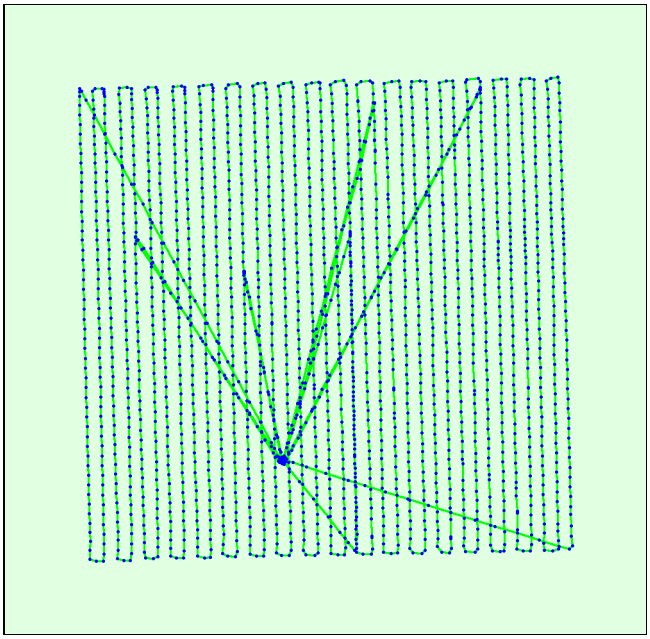
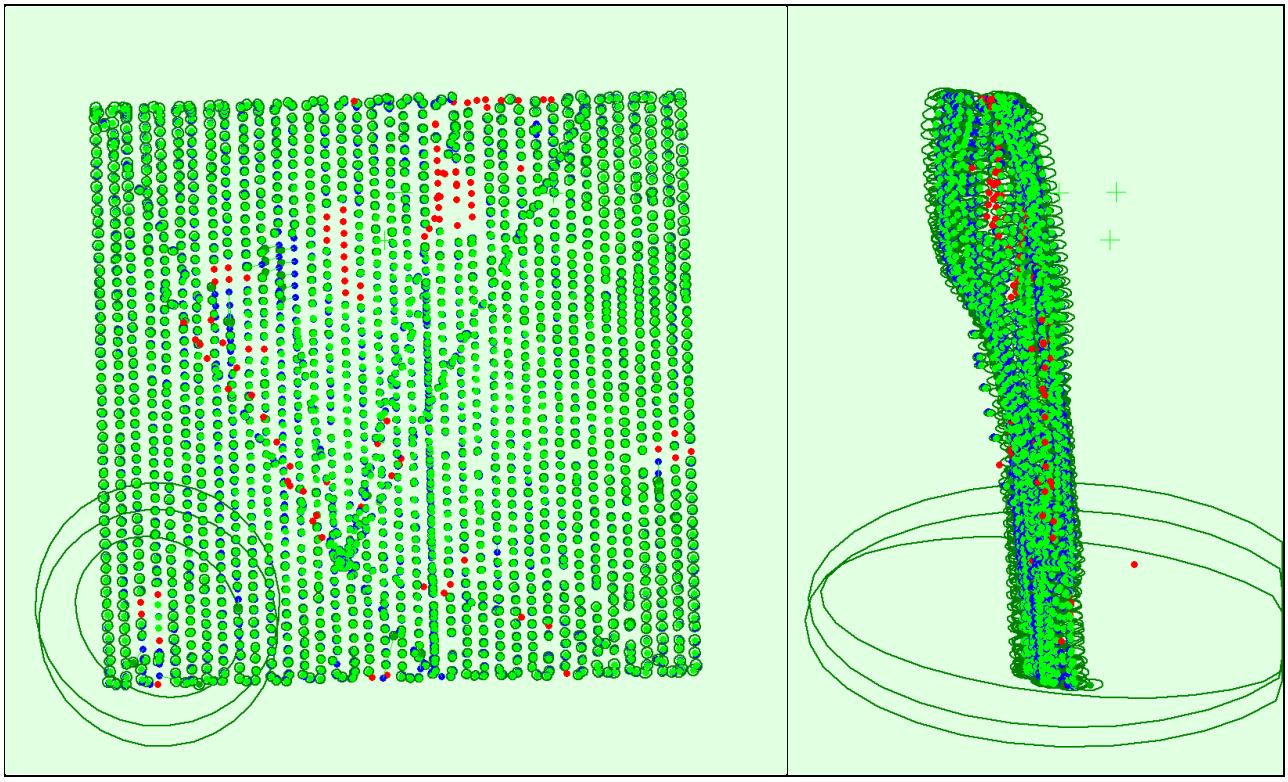
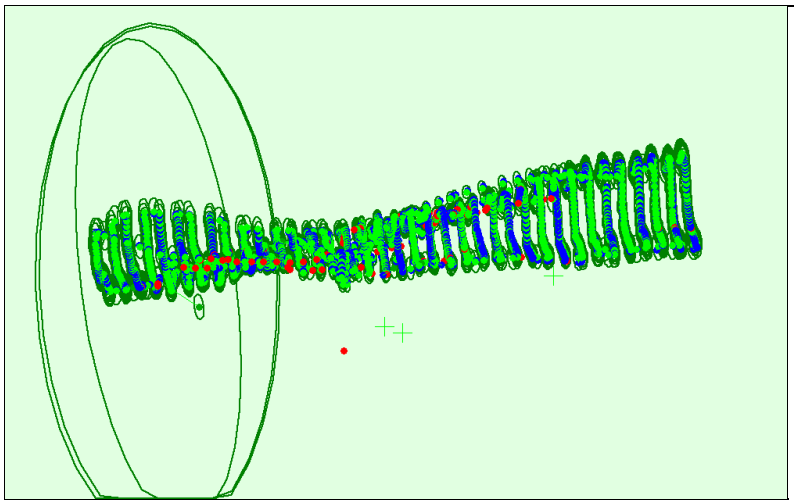


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.089	0.089	0.203	4.766	1.666	5.286
Sigma	0.072	0.072	0.169	149.366	51.562	166.299

Overlap

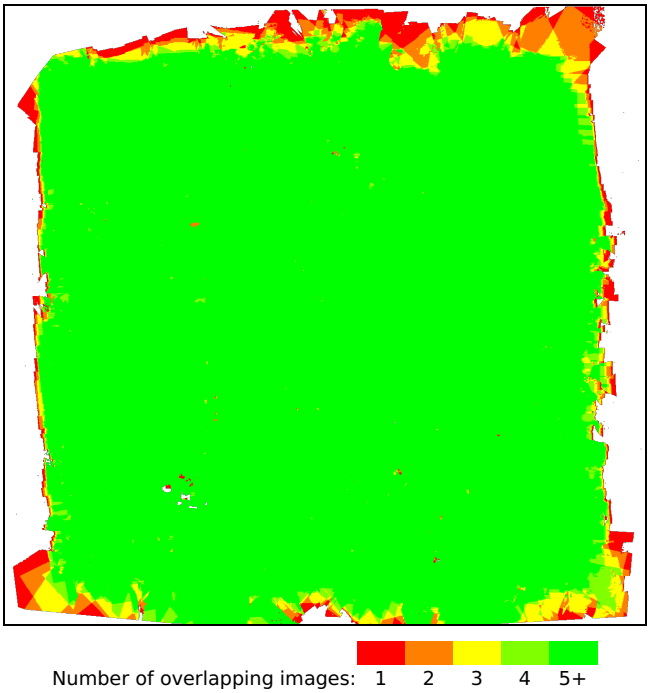


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

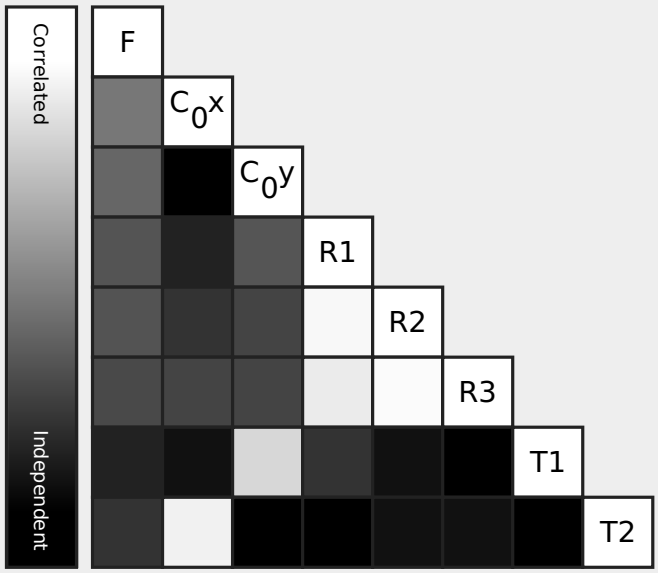
Number of 2D Keypoint Observations for Bundle Block Adjustment	17114719
Number of 3D Points for Bundle Block Adjustment	5958441
Mean Reprojection Error [pixels]	0.206

Internal Camera Parameters

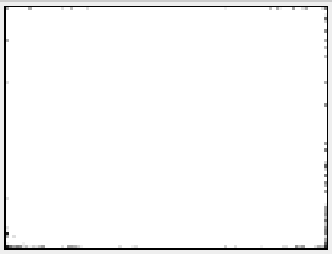
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.072 [pixel] 5.423 [mm]	654.212 [pixel] 2.453 [mm]	495.157 [pixel] 1.857 [mm]	-0.096	0.148	-0.024	0.000	-0.000
Uncertainties (Sigma)	0.126 [pixel] 0.000 [mm]	0.131 [pixel] 0.000 [mm]	0.098 [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.



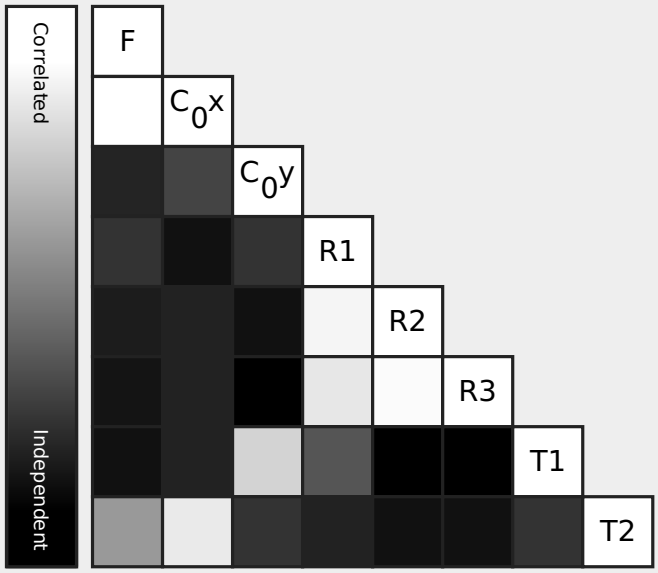
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

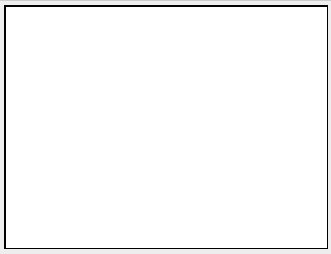
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1442.927 [pixel] 5.411 [mm]	655.684 [pixel] 2.459 [mm]	481.569 [pixel] 1.806 [mm]	-0.098	0.141	-0.017	0.000	0.000
Uncertainties (Sigma)	0.117 [pixel] 0.000 [mm]	0.038 [pixel] 0.000 [mm]	0.031 [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.



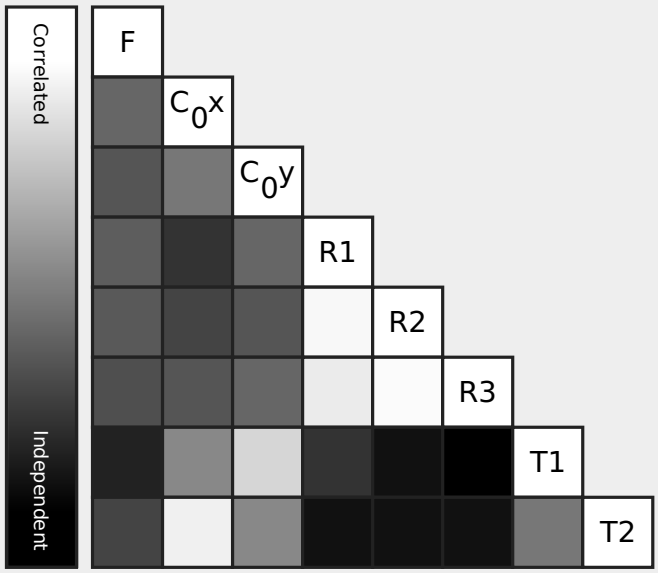
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

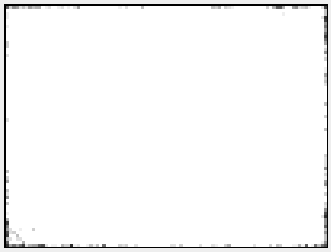
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.073 [pixel] 5.430 [mm]	653.745 [pixel] 2.452 [mm]	493.979 [pixel] 1.852 [mm]	-0.096	0.113	0.029	-0.000	-0.000
Uncertainties (Sigma)	0.128 [pixel] 0.000 [mm]	0.145 [pixel] 0.001 [mm]	0.109 [pixel] 0.000 [mm]	0.001	0.007	0.015	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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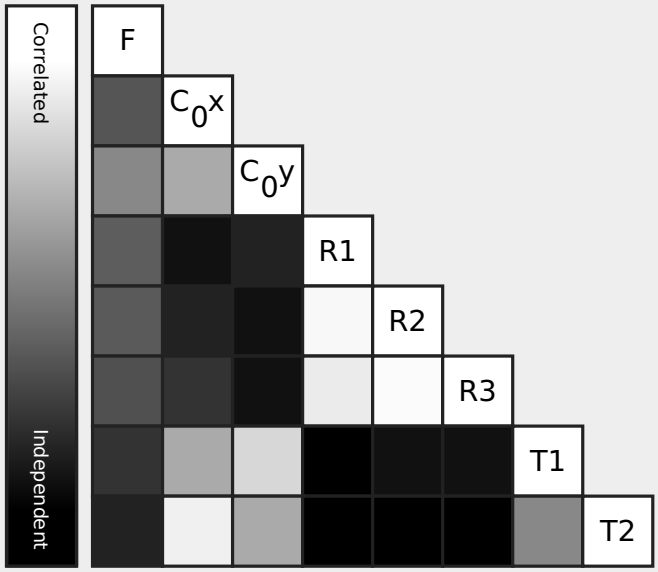
Internal Camera Parameters

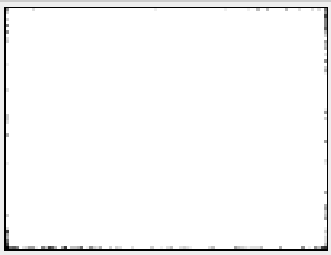
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.767 [pixel] 5.433 [mm]	662.474 [pixel] 2.484 [mm]	482.390 [pixel] 1.809 [mm]	-0.102	0.140	-0.018	0.000	-0.000
Uncertainties (Sigma)	0.128 [pixel] 0.000 [mm]	0.142 [pixel] 0.001 [mm]	0.106 [pixel] 0.000 [mm]	0.001	0.007	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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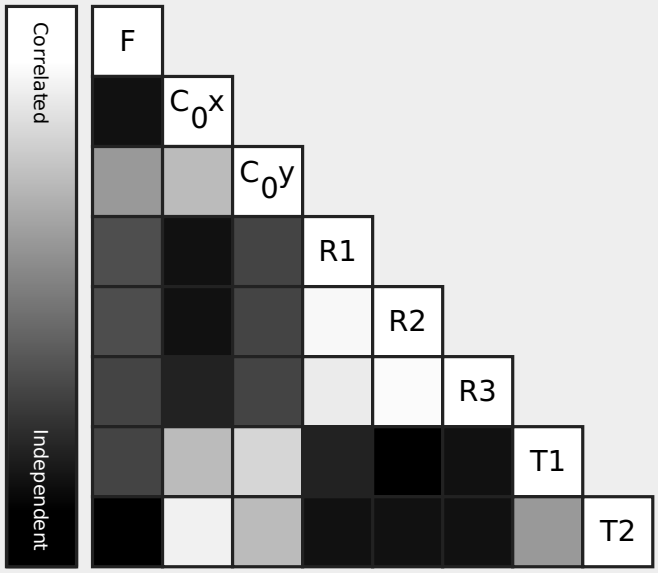
Internal Camera Parameters

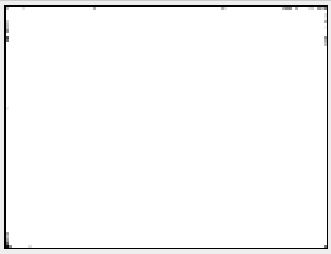
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.419 [pixel] 5.424 [mm]	657.359 [pixel] 2.465 [mm]	494.269 [pixel] 1.854 [mm]	-0.099	0.136	-0.013	0.000	-0.000
Uncertainties (Sigma)	0.125 [pixel] 0.000 [mm]	0.121 [pixel] 0.000 [mm]	0.090 [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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Camera Rig «MicaSense 5 band» Relatives. Images: 11215

	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	-0.104	0.118	-0.374
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	0.045	0.088	-0.064
Uncertainties (sigma)				0.004	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	-0.144	-0.124	0.118
Uncertainties (sigma)				0.004	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	-0.067	-0.577	-0.322
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	33752	4027
Min	18910	0
Max	43724	24460
Mean	32928	5739

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

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

Median	27894	2232
Min	19723	0
Max	37710	17187
Mean	27627	3475

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34134	4809
Min	20700	183
Max	43724	24381
Mean	34018	6350

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	22037	1830
Min	18910	0
Max	31365	16478
Mean	22903	3068

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34419	3152
Min	22566	0
Max	43086	24460
Mean	34483	4987

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	35887	3145
Min	22696	0
Max	43724	22052
Mean	35573	5200

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)	46 / 242 / 10002	23 / 105 / 10593	62 / 357 / 9505	16 / 104 / 2847	25 / 169 / 5464
RedEdge_5.5_1280x960 (Green)		41 / 216 / 19675	18 / 80 / 9398	11 / 61 / 4659	19 / 113 / 8551
RedEdge_5.5_1280x960 (Red)			41 / 273 / 10694	13 / 80 / 3298	23 / 128 / 6169
RedEdge_5.5_1280x960 (NIR)				33 / 316 / 19960	40 / 505 / 7593
RedEdge_5.5_1280x960 (Red edge)					25 / 225 / 15447

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4102223
In 3 Images	930410
In 4 Images	384897
In 5 Images	179780
In 6 Images	102164

In 7 Images	61641
In 8 Images	42182
In 9 Images	30056
In 10 Images	22471
In 11 Images	16878
In 12 Images	13204
In 13 Images	10363
In 14 Images	8442
In 15 Images	6995
In 16 Images	5885
In 17 Images	5150
In 18 Images	4457
In 19 Images	3965
In 20 Images	3450
In 21 Images	2995
In 22 Images	2713
In 23 Images	2392
In 24 Images	1965
In 25 Images	1720
In 26 Images	1413
In 27 Images	1228
In 28 Images	1069
In 29 Images	1062
In 30 Images	832
In 31 Images	716
In 32 Images	663
In 33 Images	515
In 34 Images	457
In 35 Images	397
In 36 Images	320
In 37 Images	288
In 38 Images	272
In 39 Images	230
In 40 Images	191
In 41 Images	186
In 42 Images	187
In 43 Images	142
In 44 Images	136
In 45 Images	124
In 46 Images	118
In 47 Images	120
In 48 Images	95
In 49 Images	88
In 50 Images	67
In 51 Images	76
In 52 Images	61
In 53 Images	63
In 54 Images	56
In 55 Images	53
In 56 Images	52
In 57 Images	43
In 58 Images	49
In 59 Images	42
In 60 Images	38
In 61 Images	39
In 62 Images	30
In 63 Images	27
In 64 Images	27
In 65 Images	33

In 66 Images	30
In 67 Images	29
In 68 Images	16
In 69 Images	29
In 70 Images	22
In 71 Images	16
In 72 Images	17
In 73 Images	12
In 74 Images	14
In 75 Images	10
In 76 Images	16
In 77 Images	10
In 78 Images	9
In 79 Images	12
In 80 Images	15
In 81 Images	7
In 82 Images	6
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In 92 Images	4
In 93 Images	1
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In 95 Images	2
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In 99 Images	3
In 100 Images	4
In 101 Images	2
In 102 Images	4
In 103 Images	4
In 104 Images	4
In 105 Images	2
In 106 Images	2
In 107 Images	6
In 108 Images	3
In 109 Images	2
In 110 Images	1
In 111 Images	5
In 112 Images	1
In 113 Images	4
In 114 Images	3
In 115 Images	2
In 116 Images	2
In 117 Images	1
In 118 Images	1
In 120 Images	2
In 121 Images	2
In 122 Images	1
In 123 Images	3
In 128 Images	1
In 129 Images	1

In 130 Images	1
In 131 Images	1
In 132 Images	1
In 133 Images	1
In 134 Images	1
In 135 Images	1
In 136 Images	3
In 137 Images	1
In 138 Images	2
In 139 Images	1
In 142 Images	3
In 148 Images	1
In 150 Images	2
In 151 Images	2
In 152 Images	1
In 158 Images	1
In 166 Images	1
In 168 Images	1
In 171 Images	1
In 177 Images	2

2D Keypoint Matches

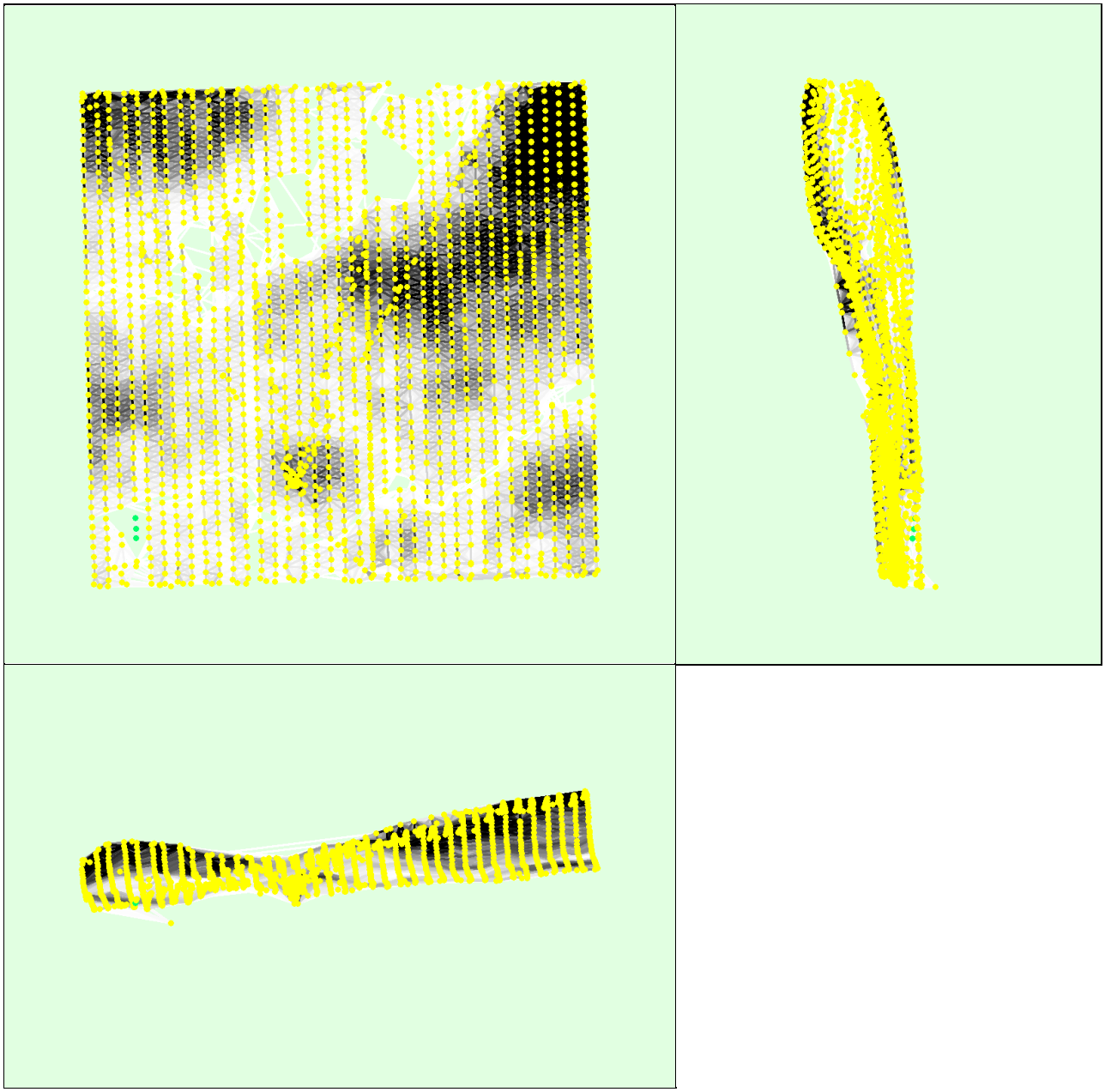

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Manual Tie Points

MTP Name	Projection Error [pixel]	Verified/Marked
mtp1	0.290	9 / 9
mtp2	0.739	19 / 19
mtp3	0.367	91 / 91

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	0.02	0.00
-15.00	-12.00	0.00	0.02	0.00
-12.00	-9.00	0.01	0.01	0.00
-9.00	-6.00	0.00	0.01	0.06
-6.00	-3.00	0.01	0.37	4.75
-3.00	0.00	56.80	50.73	42.08
0.00	3.00	42.98	48.35	51.78
3.00	6.00	0.10	0.44	1.34
6.00	9.00	0.01	0.00	0.00
9.00	12.00	0.01	0.01	0.00
12.00	15.00	0.08	0.01	0.00
15.00	-	0.00	0.04	0.00
Mean [m]		-0.049426	-0.018506	0.006779
Sigma [m]		0.729700	1.299253	1.802046
RMS Error [m]		0.731372	1.299384	1.802059

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]	99.89	99.74	100.00
[-2.00, 2.00]	99.91	99.91	100.00
[-3.00, 3.00]	100.00	99.94	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	08m:28s
Time for Point Cloud Classification	53s
Time for 3D Textured Mesh Generation	10m:33s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	10876841
Average Density (per m^3)	5.79

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (7.57 [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 (7.57 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	49s
Time for Orthomosaic Generation	01h:03m:16s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:09m:59s
Time for Index Map Generation	44s

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	✓