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_2_re
Processed	2019-01-24 13:26:56
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)	9.23 cm / 3.63 in
Area Covered	0.619 km^2 / 61.8797 ha / 0.24 sq. mi. / 152.9871 acres
Time for Initial Processing (without report)	13h:09m:53s

Quality Check

Images	median of 34609 keypoints per image	✓
Dataset	10875 out of 10910 images calibrated (99%), 5 images disabled	✓
Camera Optimization	1.37% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 6539.75 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

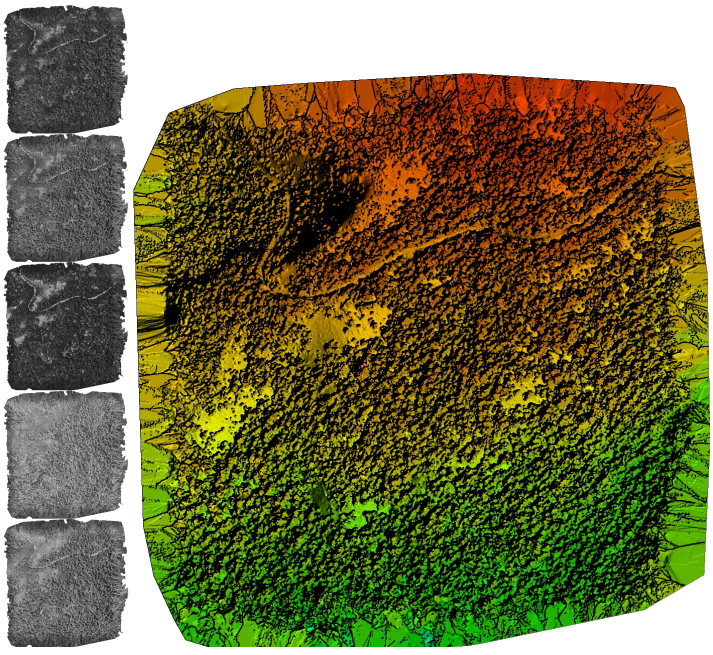


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	10875 out of 10915
Number of Geolocated Images	10915 out of 10915

Initial Image Positions

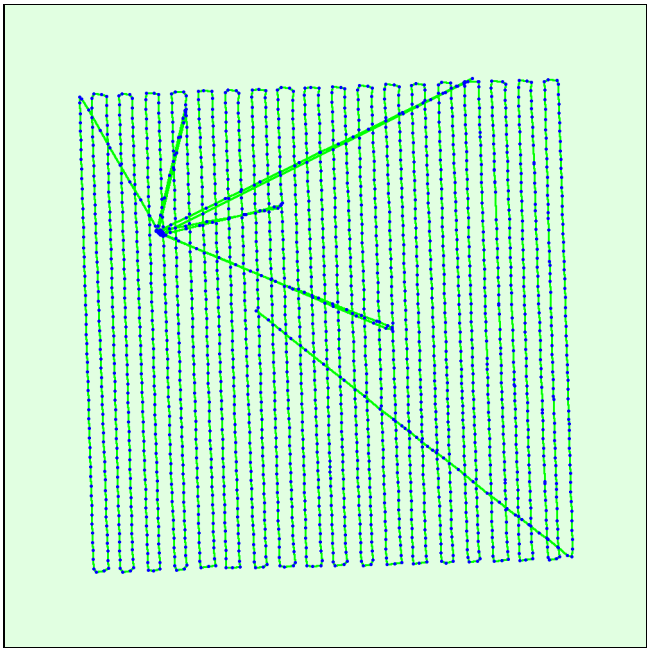
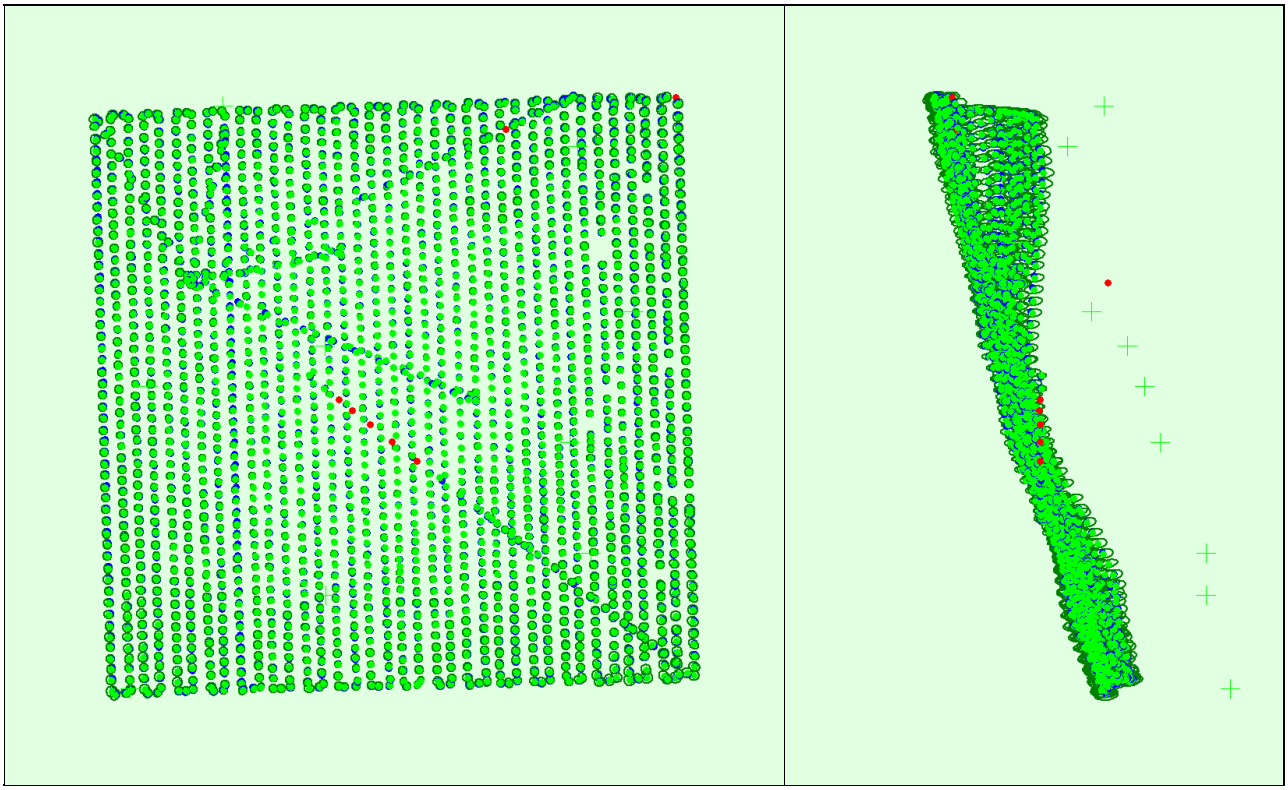
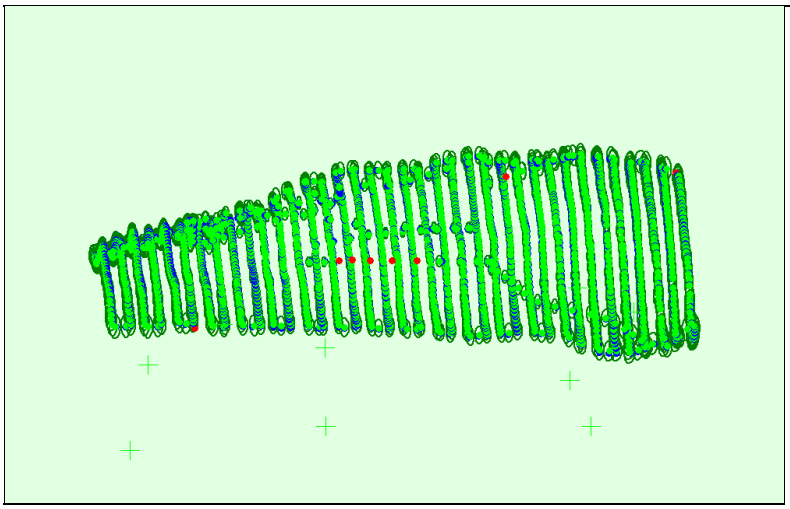


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.074	0.075	0.160	0.031	0.031	0.013
Sigma	0.013	0.013	0.033	0.002	0.002	0.002

Overlap

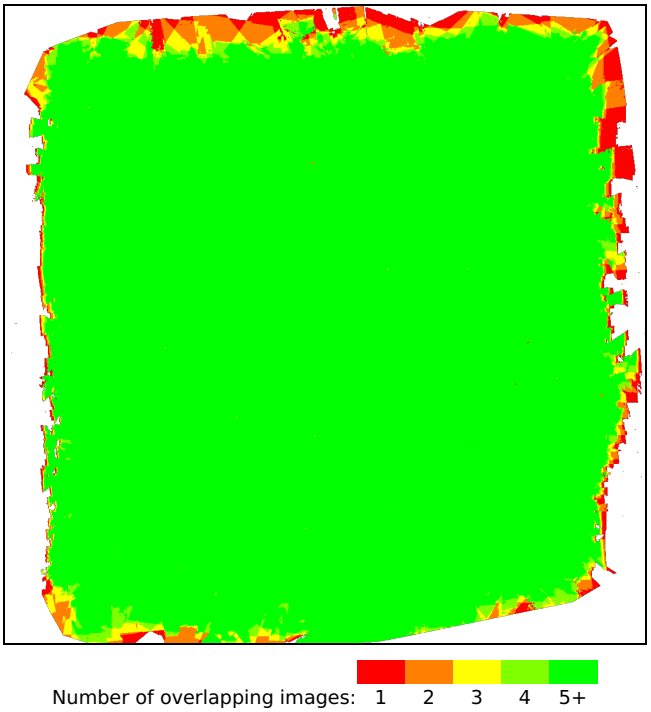


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

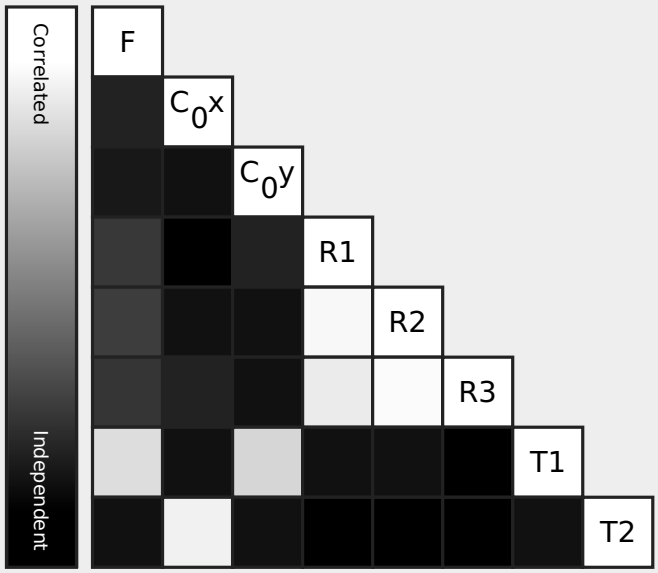
Number of 2D Keypoint Observations for Bundle Block Adjustment	22335276
Number of 3D Points for Bundle Block Adjustment	7862957
Mean Reprojection Error [pixels]	0.196

Internal Camera Parameters

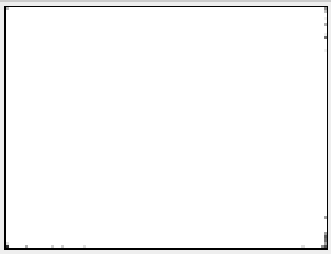
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.143 [pixel] 5.423 [mm]	654.921 [pixel] 2.456 [mm]	494.859 [pixel] 1.856 [mm]	-0.099	0.166	-0.060	0.000	-0.000
Uncertainties (Sigma)	0.126 [pixel] 0.000 [mm]	0.098 [pixel] 0.000 [mm]	0.073 [pixel] 0.000 [mm]	0.001	0.005	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.



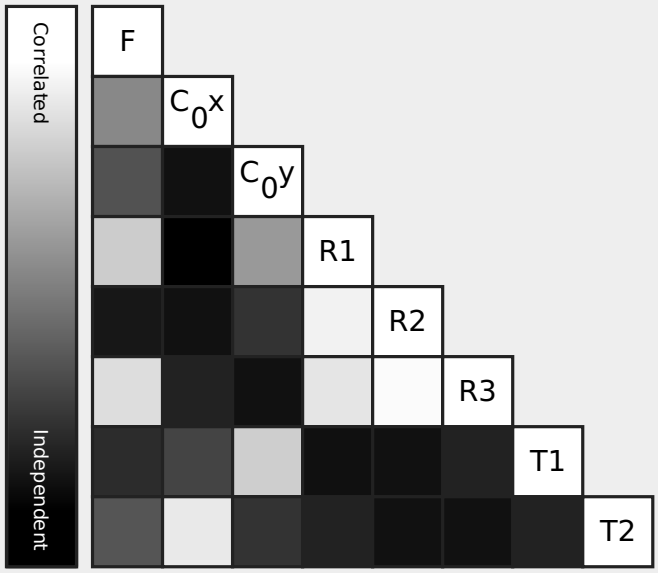
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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 (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	1442.950 [pixel] 5.411 [mm]	655.998 [pixel] 2.460 [mm]	481.319 [pixel] 1.805 [mm]	-0.100	0.154	-0.042	0.000	0.000
Uncertainties (Sigma)	0.121 [pixel] 0.000 [mm]	0.031 [pixel] 0.000 [mm]	0.025 [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.

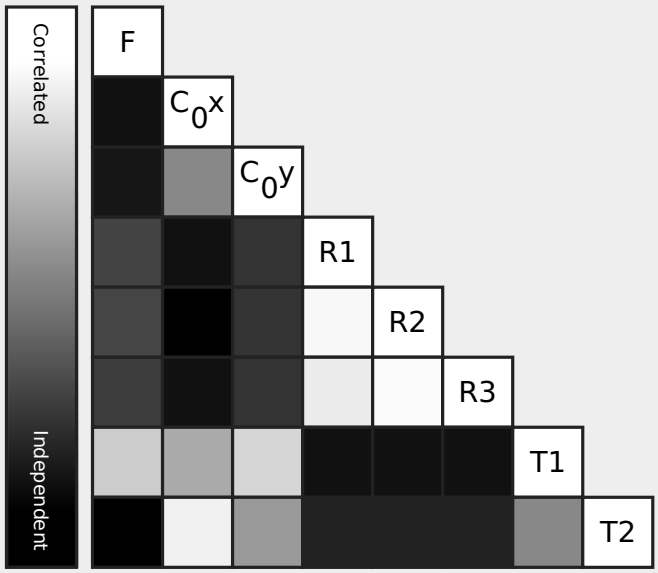
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

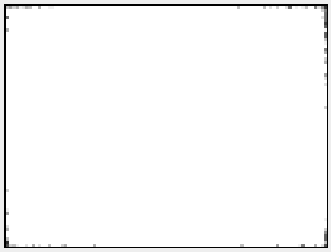
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.224 [pixel] 5.431 [mm]	654.383 [pixel] 2.454 [mm]	493.525 [pixel] 1.851 [mm]	-0.099	0.127	0.014	-0.000	-0.000
Uncertainties (Sigma)	0.128 [pixel] 0.000 [mm]	0.113 [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.



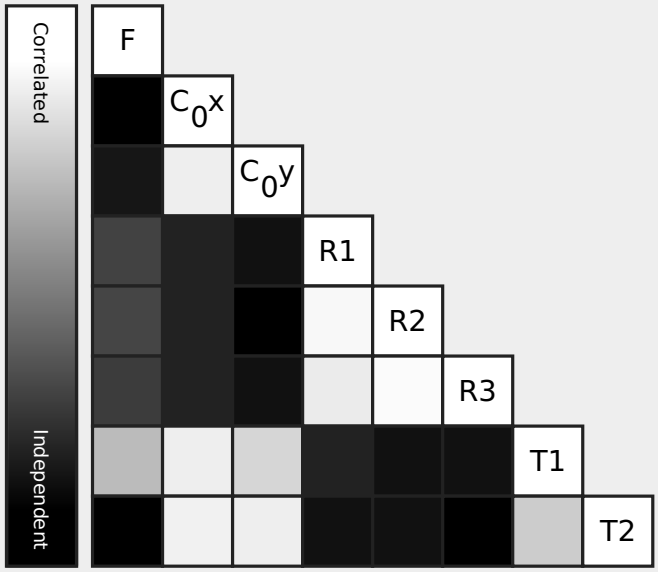
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

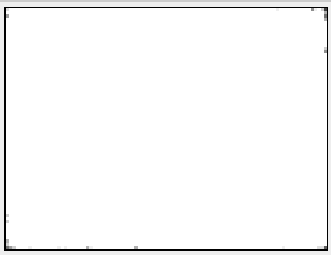
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.911 [pixel] 5.433 [mm]	662.859 [pixel] 2.486 [mm]	482.223 [pixel] 1.808 [mm]	-0.106	0.164	-0.067	0.000	-0.000
Uncertainties (Sigma)	0.127 [pixel] 0.000 [mm]	0.106 [pixel] 0.000 [mm]	0.078 [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.



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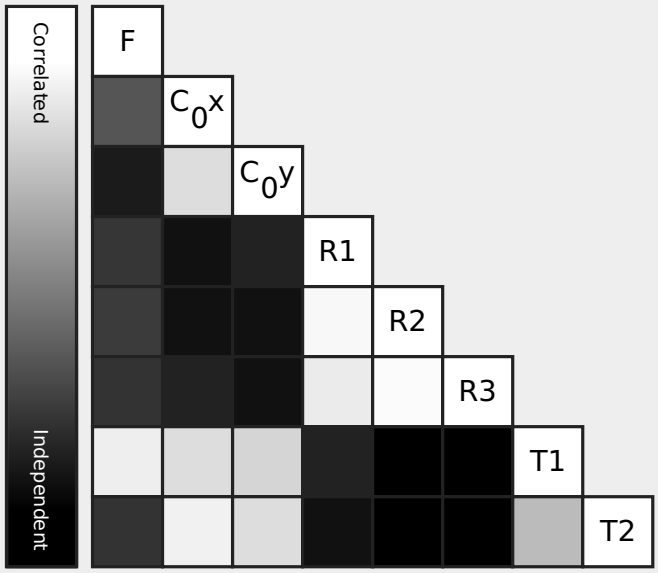
Internal Camera Parameters

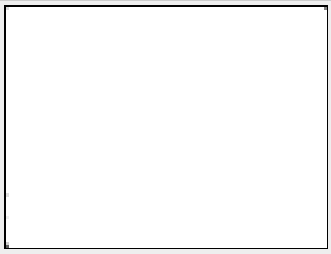
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.499 [pixel] 5.424 [mm]	658.123 [pixel] 2.468 [mm]	494.228 [pixel] 1.853 [mm]	-0.102	0.150	-0.037	0.000	0.000
Uncertainties (Sigma)	0.126 [pixel] 0.000 [mm]	0.092 [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.



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Camera Rig «MicaSense 5 band» Relatives. Images: 10910

	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	-0.102	0.134	-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	0.054	0.104	-0.063
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	-0.145	-0.121	0.120
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	-0.555	-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	34609	6540
Min	17529	614
Max	47243	30619
Mean	33780	7330

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

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

Median	28429	4660
Min	17735	625
Max	39514	18706
Mean	28431	5220

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	35493	6887
Min	21803	614
Max	47243	30619
Mean	35274	7906

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	22939	3621
Min	17529	638
Max	33040	14597
Mean	23680	4206

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	33493	6199
Min	19948	749
Max	42892	23817
Mean	33242	6839

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	35146	6825
Min	21609	1335
Max	43999	24508
Mean	34855	7312

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)	29 / 217 / 14894	20 / 99 / 5692	40 / 356 / 6155	15 / 170 / 2782	17 / 153 / 4057
RedEdge_5.5_1280x960 (Green)		31 / 171 / 28579	15 / 71 / 3008	9 / 46 / 6637	13 / 65 / 11691
RedEdge_5.5_1280x960 (Red)			34 / 250 / 11477	13 / 138 / 1743	17 / 168 / 2474
RedEdge_5.5_1280x960 (NIR)				32 / 263 / 20596	23 / 346 / 8692
RedEdge_5.5_1280x960 (Red edge)					19 / 161 / 17503

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	5387124
In 3 Images	1257149
In 4 Images	517952
In 5 Images	242136
In 6 Images	138313

In 7 Images	82978
In 8 Images	55271
In 9 Images	37962
In 10 Images	28341
In 11 Images	20492
In 12 Images	15704
In 13 Images	12307
In 14 Images	9817
In 15 Images	7734
In 16 Images	6362
In 17 Images	5331
In 18 Images	4526
In 19 Images	3822
In 20 Images	3230
In 21 Images	2943
In 22 Images	2425
In 23 Images	2101
In 24 Images	1940
In 25 Images	1741
In 26 Images	1459
In 27 Images	1348
In 28 Images	1225
In 29 Images	1082
In 30 Images	997
In 31 Images	873
In 32 Images	794
In 33 Images	767
In 34 Images	674
In 35 Images	631
In 36 Images	550
In 37 Images	529
In 38 Images	492
In 39 Images	415
In 40 Images	400
In 41 Images	333
In 42 Images	302
In 43 Images	245
In 44 Images	233
In 45 Images	208
In 46 Images	174
In 47 Images	138
In 48 Images	128
In 49 Images	116
In 50 Images	101
In 51 Images	84
In 52 Images	80
In 53 Images	74
In 54 Images	69
In 55 Images	63
In 56 Images	64
In 57 Images	50
In 58 Images	46
In 59 Images	25
In 60 Images	36
In 61 Images	29
In 62 Images	30
In 63 Images	23
In 64 Images	24
In 65 Images	20

In 66 Images	29
In 67 Images	10
In 68 Images	12
In 69 Images	11
In 70 Images	15
In 71 Images	19
In 72 Images	17
In 73 Images	3
In 74 Images	11
In 75 Images	9
In 76 Images	8
In 77 Images	13
In 78 Images	10
In 79 Images	7
In 80 Images	9
In 81 Images	7
In 82 Images	8
In 83 Images	12
In 84 Images	9
In 85 Images	10
In 86 Images	13
In 87 Images	3
In 88 Images	5
In 89 Images	4
In 90 Images	6
In 91 Images	5
In 92 Images	2
In 93 Images	7
In 94 Images	6
In 95 Images	6
In 96 Images	5
In 97 Images	1
In 98 Images	1
In 99 Images	3
In 100 Images	3
In 101 Images	2
In 102 Images	2
In 103 Images	4
In 104 Images	3
In 105 Images	3
In 106 Images	2
In 107 Images	2
In 108 Images	4
In 111 Images	1
In 113 Images	1
In 116 Images	1
In 122 Images	1

2D Keypoint Matches

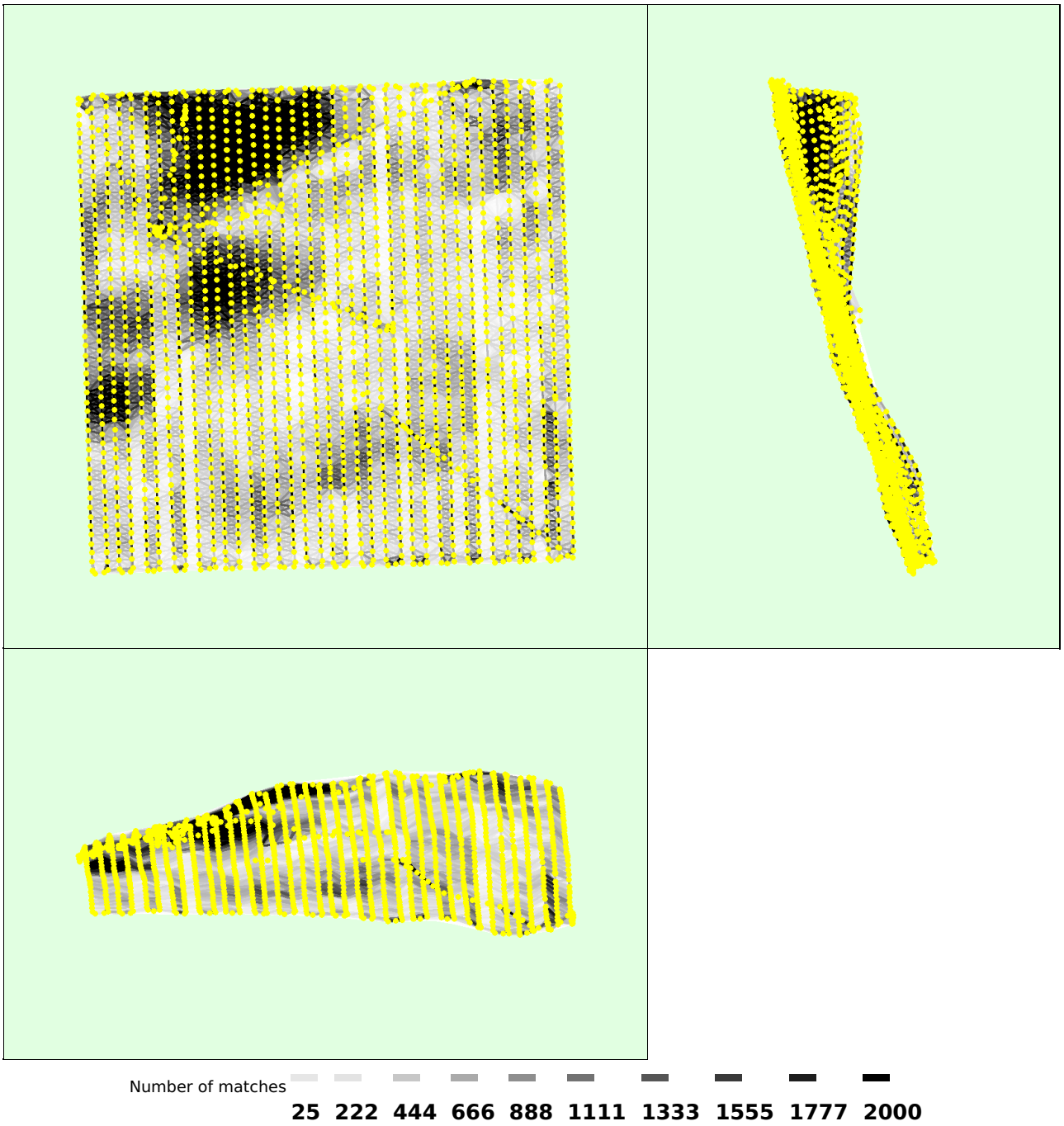

Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Manual Tie Points

MTP Name	Projection Error [pixel]	Verified/Marked
mtp1	0.267	177 / 177
mtp2	0.422	247 / 247
mtp3	0.242	110 / 110
mtp4	0.325	176 / 176
mtp5	0.524	214 / 214
mtp6	0.414	148 / 148
mtp7	0.495	198 / 198
mtp8	0.776	80 / 80
mtp9	0.576	62 / 62

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	0.00	0.00	0.00
-6.00	-3.00	0.00	0.05	0.00
-3.00	0.00	45.64	49.92	50.80
0.00	3.00	54.36	49.89	49.20
3.00	6.00	0.00	0.14	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]		-0.013869	0.005054	-0.004041
Sigma [m]		0.577907	1.020988	0.750750
RMS Error [m]		0.578074	1.021000	0.750761

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 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	11m:00s
Time for Point Cloud Classification	50s
Time for 3D Textured Mesh Generation	11m:30s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	12114596
Average Density (per m^3)	3.6

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (9.23 [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 (9.23 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	58s
Time for Orthomosaic Generation	01h:16m:49s

Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:34m:26s
Time for Index Map Generation	31s

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	✓