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	stan_5k_2_re
Processed	2019-01-23 11:40:27
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)	7.47 cm / 2.94 in
Area Covered	0.541 km^2 / 54.1103 ha / 0.21 sq. mi. / 133.7786 acres
Time for Initial Processing (without report)	12h:51m:34s

Quality Check

Images	median of 31492 keypoints per image	✓
Dataset	11355 out of 11500 images calibrated (98%), 5 images disabled	✓
Camera Optimization	1.27% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 5525.63 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

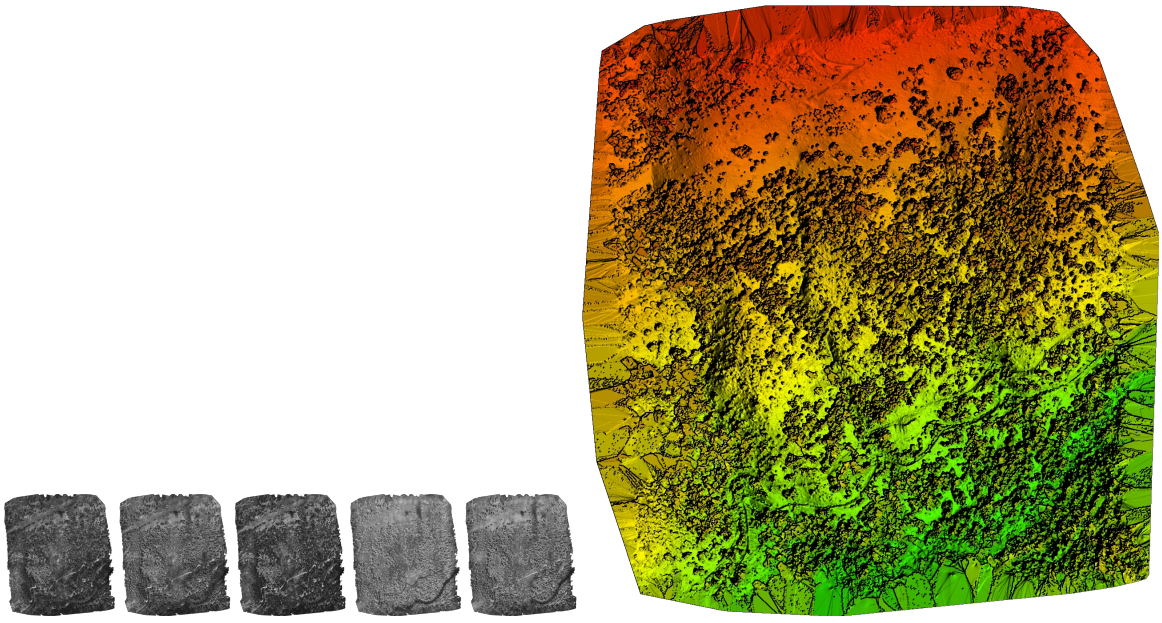


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11355 out of 11505
Number of Geolocated Images	11505 out of 11505

Initial Image Positions

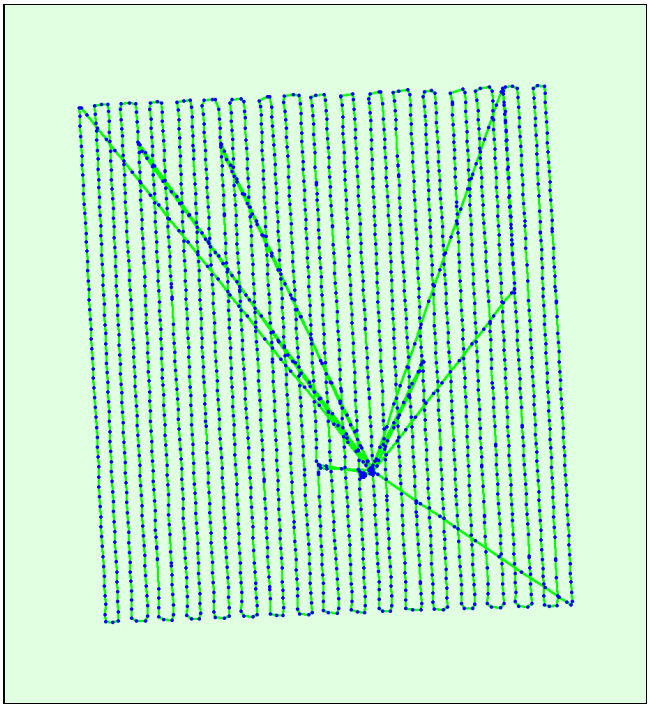
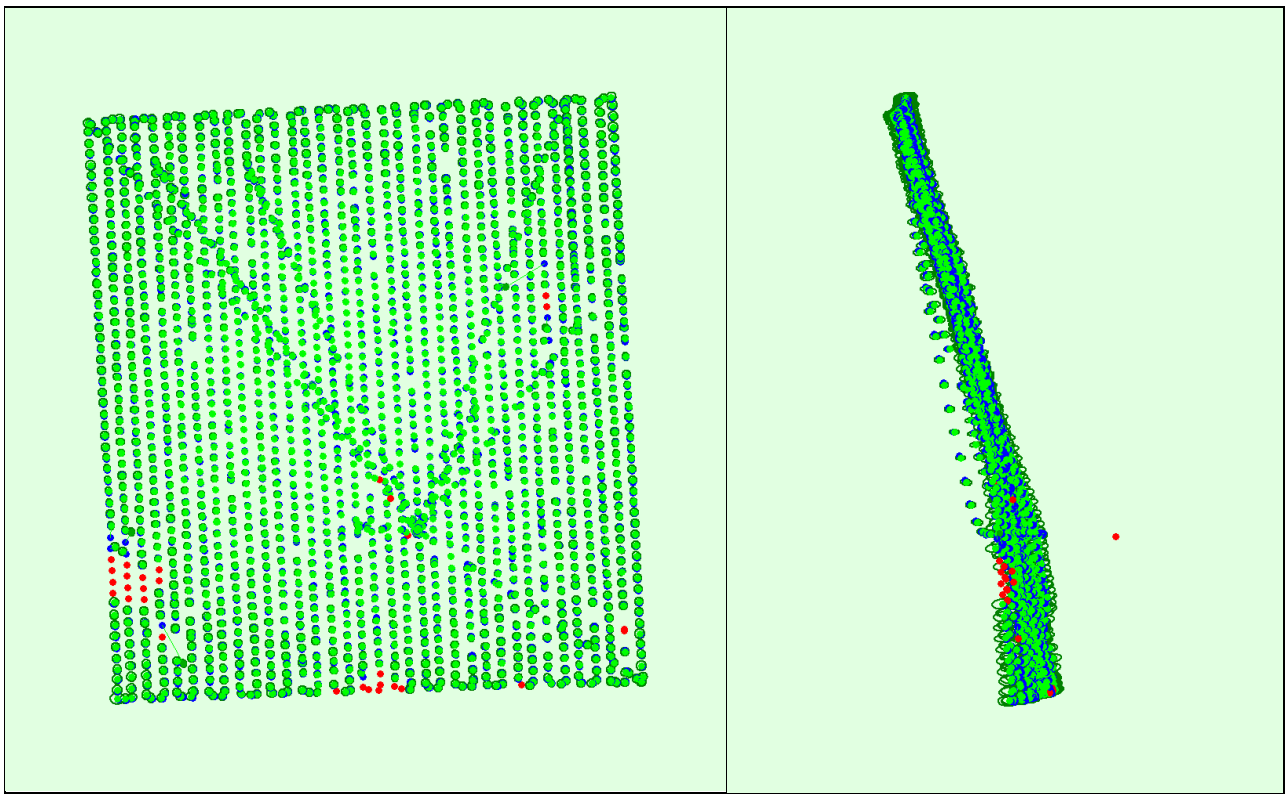
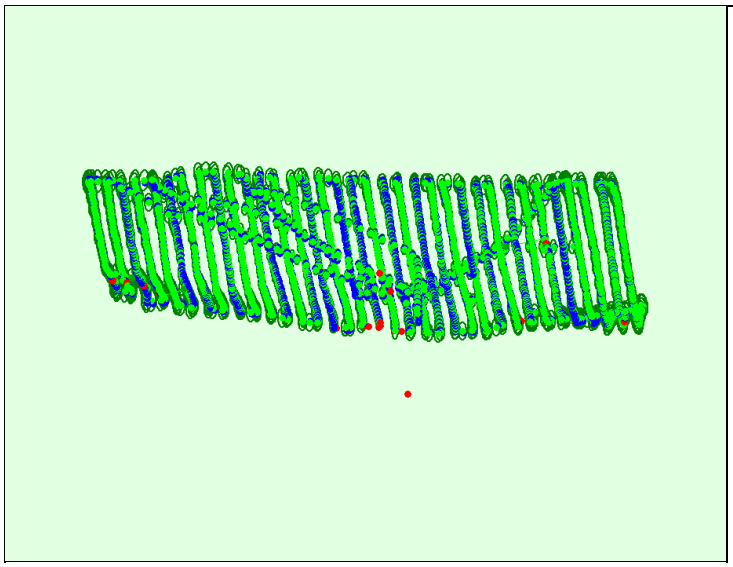


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.073	0.074	0.161	0.031	0.033	0.015
Sigma	0.013	0.013	0.036	0.002	0.002	0.003

Overlap

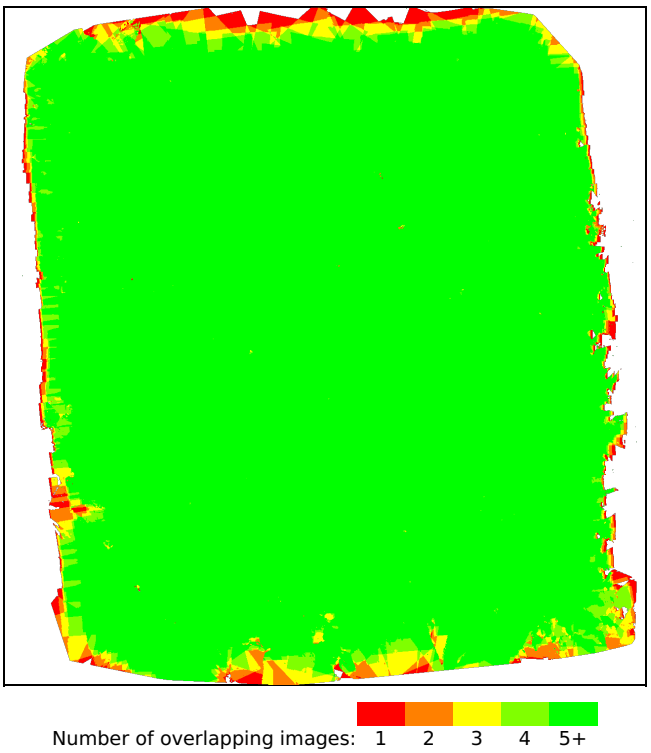


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

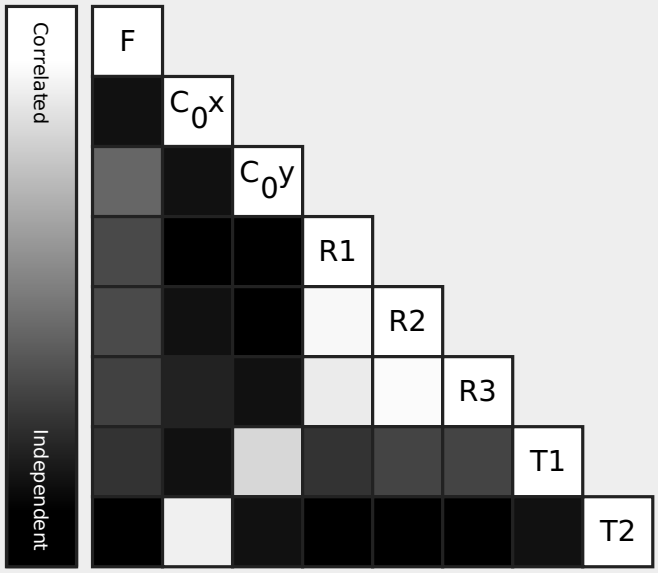
Number of 2D Keypoint Observations for Bundle Block Adjustment	20438394
Number of 3D Points for Bundle Block Adjustment	6807634
Mean Reprojection Error [pixels]	0.197

Internal Camera Parameters

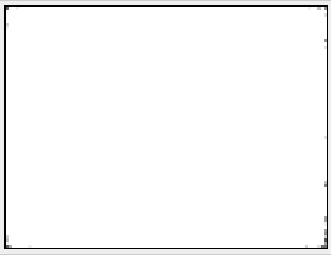
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1447.691 [pixel] 5.429 [mm]	654.306 [pixel] 2.454 [mm]	494.984 [pixel] 1.856 [mm]	-0.098	0.162	-0.056	0.000	-0.000
Uncertainties (Sigma)	0.107 [pixel] 0.000 [mm]	0.103 [pixel] 0.000 [mm]	0.079 [pixel] 0.000 [mm]	0.001	0.005	0.011	0.000	0.000



The correlation between camera internal parameters determined by the bundle adjustment. White indicates a full correlation between the parameters, ie. any change in one can be fully compensated by the other. Black indicates that the parameter is completely independent, and is not affected by other parameters.



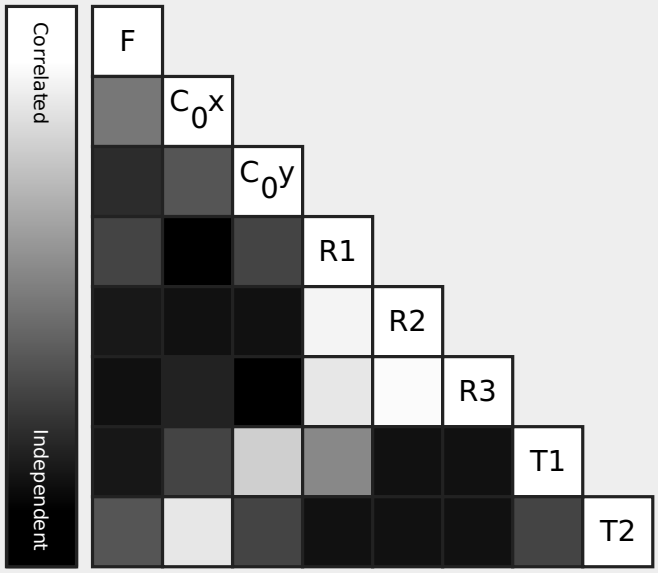
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the pixel location. Click on the image to the see the average direction and magnitude of the re-projection error for each pixel. Note that the vectors are scaled for better visualization. The scale bar indicates the magnitude of 1 pixel error.

Internal Camera Parameters

RedEdge_5.5_1280x960 (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	1444.501 [pixel] 5.417 [mm]	655.878 [pixel] 2.460 [mm]	481.389 [pixel] 1.805 [mm]	-0.099	0.144	-0.020	0.000	0.000
Uncertainties (Sigma)	0.101 [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.

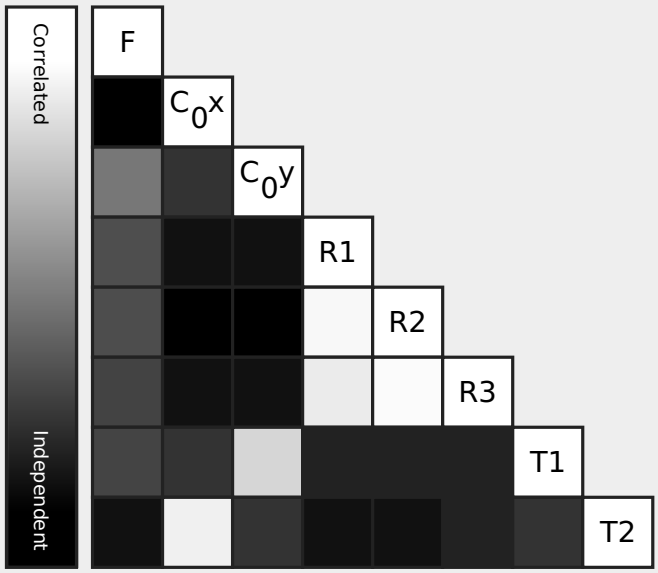
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1449.656 [pixel] 5.436 [mm]	653.778 [pixel] 2.452 [mm]	493.844 [pixel] 1.852 [mm]	-0.097	0.123	0.008	-0.000	-0.000
Uncertainties (Sigma)	0.108 [pixel] 0.000 [mm]	0.110 [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.

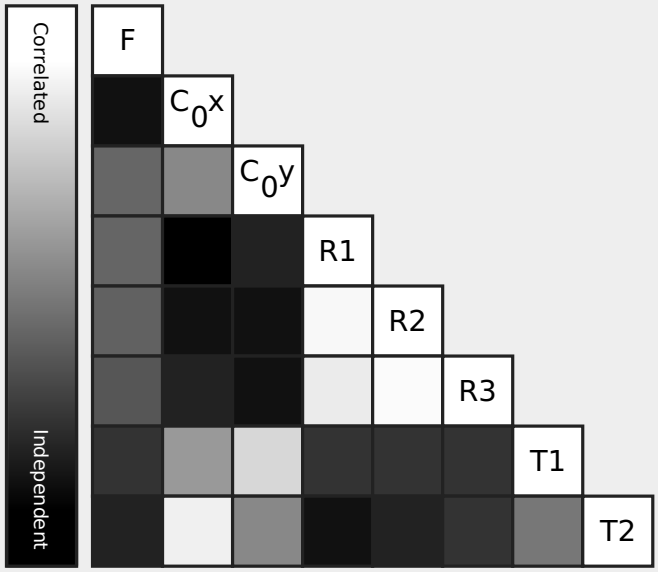
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

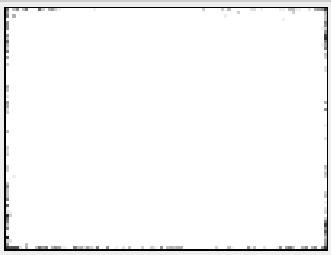
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1450.283 [pixel] 5.439 [mm]	662.588 [pixel] 2.485 [mm]	482.220 [pixel] 1.808 [mm]	-0.102	0.141	-0.022	0.000	-0.000
Uncertainties (Sigma)	0.113 [pixel] 0.000 [mm]	0.139 [pixel] 0.001 [mm]	0.105 [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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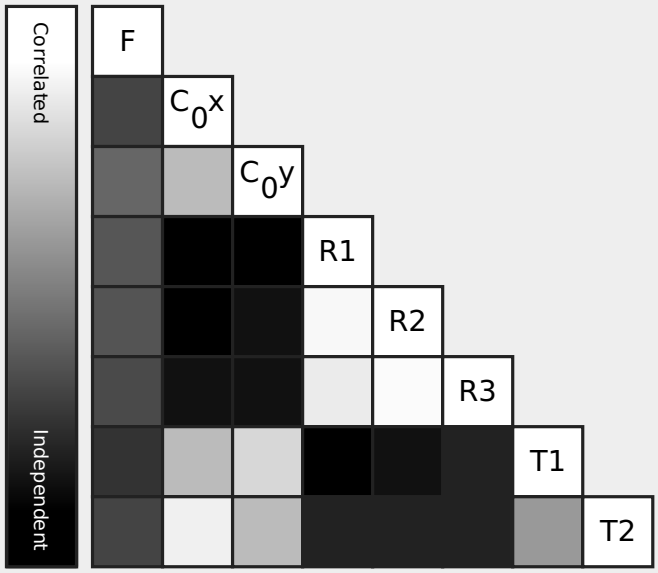
Internal Camera Parameters

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	1447.943 [pixel] 5.430 [mm]	657.848 [pixel] 2.467 [mm]	494.211 [pixel] 1.853 [mm]	-0.100	0.141	-0.024	0.000	0.000
Uncertainties (Sigma)	0.110 [pixel] 0.000 [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.

Camera Rig «MicaSense 5 band» Relatives. Images: 11500

	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	-0.106	0.102	-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	0.049	0.080	-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	-0.137	-0.143	0.120
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	-0.574	-0.321
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	31492	5526
Min	16063	71
Max	44204	23795
Mean	30496	6462

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

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

Median	27732	4350
Min	17344	77
Max	37841	17260
Mean	27428	5399

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	32262	6045
Min	18516	294
Max	44204	23795
Mean	31186	6938

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	26576	4265
Min	16063	222
Max	36395	18069
Mean	26260	5652

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	30190	3764
Min	18260	75
Max	37440	22990
Mean	29948	4998

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	32013	4087
Min	16871	71
Max	38927	23085
Mean	31323	4944

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)	94 / 644 / 13537	37 / 186 / 3856	94 / 530 / 4962	11 / 85 / 1267	17 / 117 / 2238
RedEdge_5.5_1280x960 (Green)		62 / 339 / 21921	34 / 168 / 3444	9 / 60 / 4340	14 / 82 / 10638
RedEdge_5.5_1280x960 (Red)			89 / 700 / 12845	11 / 70 / 1136	18 / 107 / 2102
RedEdge_5.5_1280x960 (NIR)				55 / 669 / 19664	36 / 308 / 7067
RedEdge_5.5_1280x960 (Red edge)					38 / 436 / 16784

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4599154
In 3 Images	1068474
In 4 Images	449711
In 5 Images	214246
In 6 Images	125864

In 7 Images	78941
In 8 Images	55160
In 9 Images	39796
In 10 Images	30769
In 11 Images	23028
In 12 Images	18677
In 13 Images	14705
In 14 Images	11975
In 15 Images	9796
In 16 Images	8403
In 17 Images	7146
In 18 Images	5909
In 19 Images	5200
In 20 Images	4668
In 21 Images	4002
In 22 Images	3408
In 23 Images	3168
In 24 Images	2775
In 25 Images	2422
In 26 Images	2138
In 27 Images	1925
In 28 Images	1653
In 29 Images	1474
In 30 Images	1293
In 31 Images	1131
In 32 Images	966
In 33 Images	857
In 34 Images	661
In 35 Images	640
In 36 Images	509
In 37 Images	463
In 38 Images	404
In 39 Images	346
In 40 Images	284
In 41 Images	266
In 42 Images	231
In 43 Images	193
In 44 Images	168
In 45 Images	159
In 46 Images	179
In 47 Images	155
In 48 Images	137
In 49 Images	149
In 50 Images	124
In 51 Images	123
In 52 Images	102
In 53 Images	112
In 54 Images	111
In 55 Images	77
In 56 Images	102
In 57 Images	91
In 58 Images	84
In 59 Images	97
In 60 Images	68
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In 63 Images	65
In 64 Images	64
In 65 Images	76

In 66 Images	63
In 67 Images	65
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In 74 Images	53
In 75 Images	54
In 76 Images	47
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In 80 Images	49
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In 134 Images	13
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In 136 Images	10
In 137 Images	13
In 138 Images	9
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In 140 Images	15
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In 144 Images	9
In 145 Images	8
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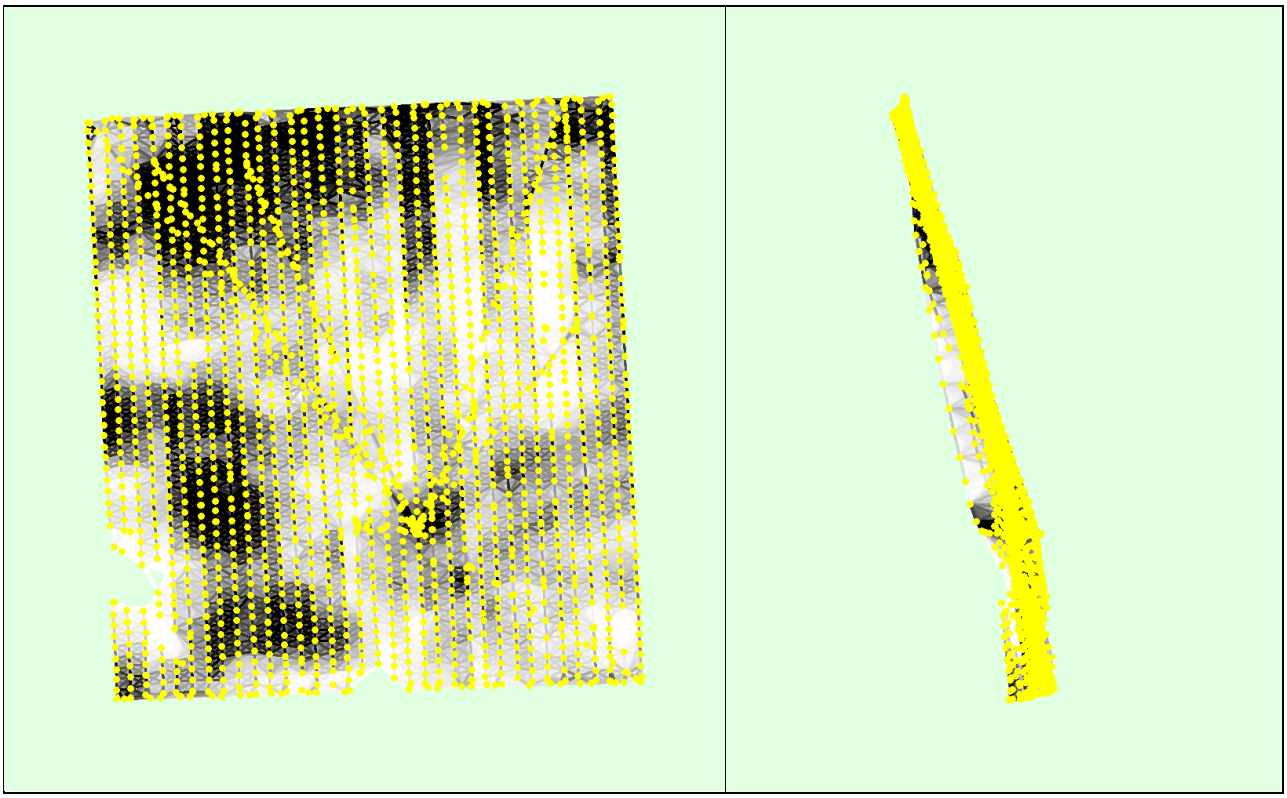
In 148 Images	7
In 149 Images	12
In 150 Images	9
In 151 Images	7
In 152 Images	11
In 153 Images	12
In 154 Images	8
In 155 Images	7
In 156 Images	2
In 157 Images	6
In 158 Images	5
In 159 Images	6
In 160 Images	9
In 161 Images	7
In 162 Images	8
In 163 Images	4
In 164 Images	9
In 165 Images	4
In 166 Images	8
In 167 Images	6
In 168 Images	6
In 169 Images	11
In 170 Images	11
In 171 Images	8
In 172 Images	2
In 173 Images	9
In 174 Images	4
In 175 Images	5
In 176 Images	3
In 177 Images	3
In 178 Images	6
In 179 Images	4
In 180 Images	1
In 181 Images	4
In 182 Images	4
In 183 Images	6

In 184 Images	4
In 185 Images	7
In 186 Images	1
In 187 Images	5
In 188 Images	6
In 189 Images	2
In 190 Images	3
In 191 Images	2
In 192 Images	4
In 193 Images	1
In 194 Images	2
In 195 Images	4
In 196 Images	3
In 198 Images	3
In 199 Images	2
In 200 Images	2
In 201 Images	3
In 203 Images	2
In 204 Images	2
In 205 Images	2
In 207 Images	1
In 208 Images	1
In 209 Images	1
In 210 Images	1
In 211 Images	1
In 212 Images	1
In 218 Images	1
In 219 Images	1

2D Keypoint Matches



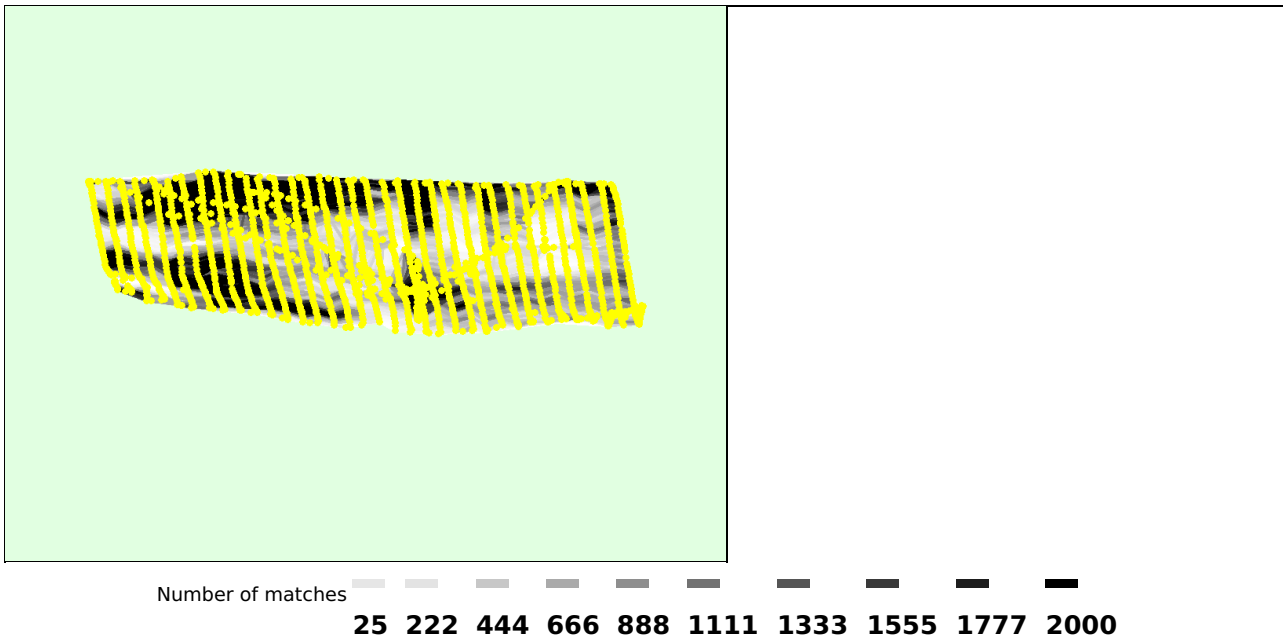


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.01	0.00
-12.00	-9.00	0.00	0.01	0.00
-9.00	-6.00	0.01	0.00	0.00
-6.00	-3.00	0.04	0.16	8.89
-3.00	0.00	52.68	48.61	35.79
0.00	3.00	47.18	51.16	55.33
3.00	6.00	0.09	0.04	0.00
6.00	9.00	0.00	0.00	0.00
9.00	12.00	0.00	0.01	0.00
12.00	15.00	0.00	0.00	0.00
15.00	-	0.00	0.00	0.00
Mean [m]		0.002471	0.004188	0.002195
Sigma [m]		0.470231	1.160964	1.965929
RMS Error [m]		0.470237	1.160972	1.965930

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]	99.90	99.97	100.00
[-2.00, 2.00]	100.00	99.97	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:25s
Time for Point Cloud Classification	01m:03s
Time for 3D Textured Mesh Generation	10m:52s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11879535
Average Density (per m^3)	6.66

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (7.47 [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 (7.47 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	52s
Time for Orthomosaic Generation	54m:44s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:04m:56s
Time for Index Map Generation	46s

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	✓