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_4k_3_re
Processed	2019-01-23 06:50:39
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)	8.59 cm / 3.38 in
Area Covered	0.624 km^2 / 62.4239 ha / 0.24 sq. mi. / 154.3327 acres
Time for Initial Processing (without report)	07h:34m:52s

Quality Check

Images	median of 29623 keypoints per image	✓
Dataset	11100 out of 11585 images calibrated (95%), 5 images disabled, 3 blocks	⚠
Camera Optimization	1.16% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 4456.39 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

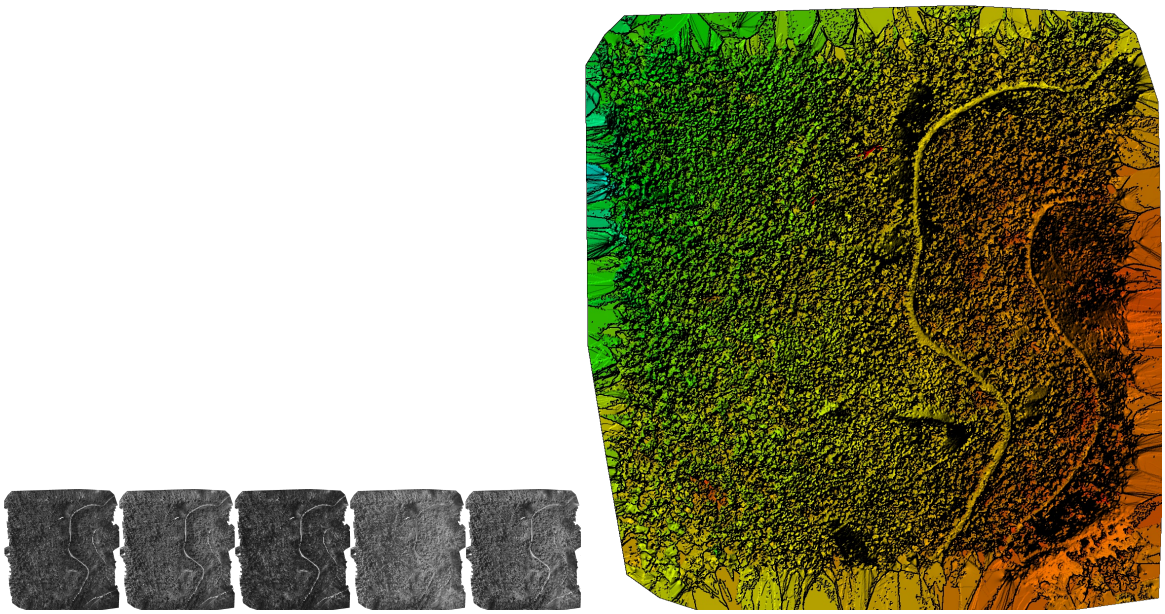


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11100 out of 11590
Number of Geolocated Images	11590 out of 11590

Initial Image Positions

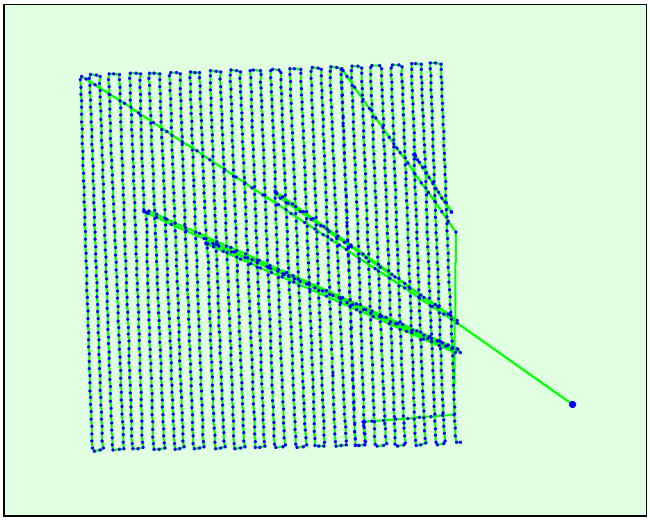
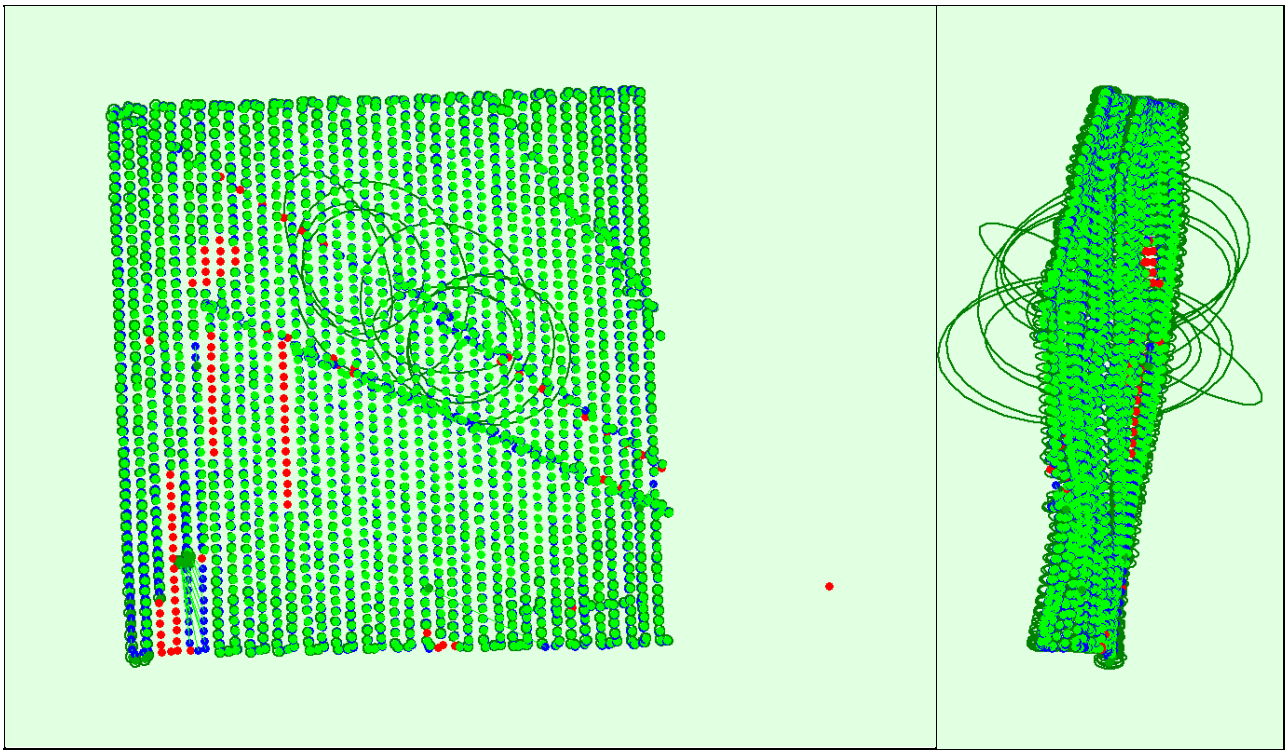
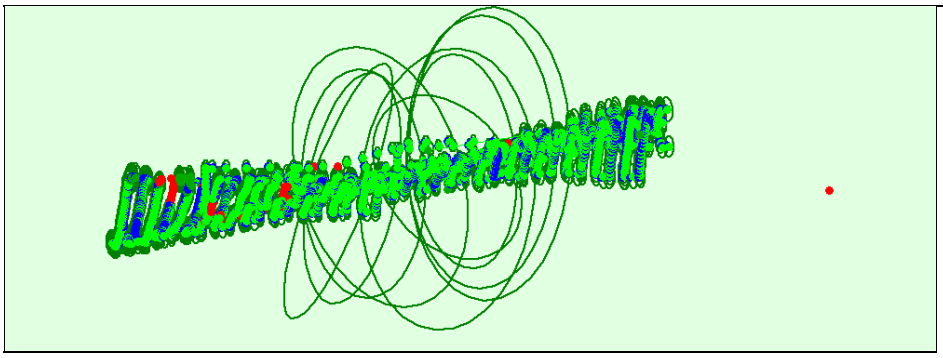


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.093	0.093	0.205	0.046	0.046	0.026
Sigma	0.085	0.089	0.151	0.143	0.135	0.217

Overlap

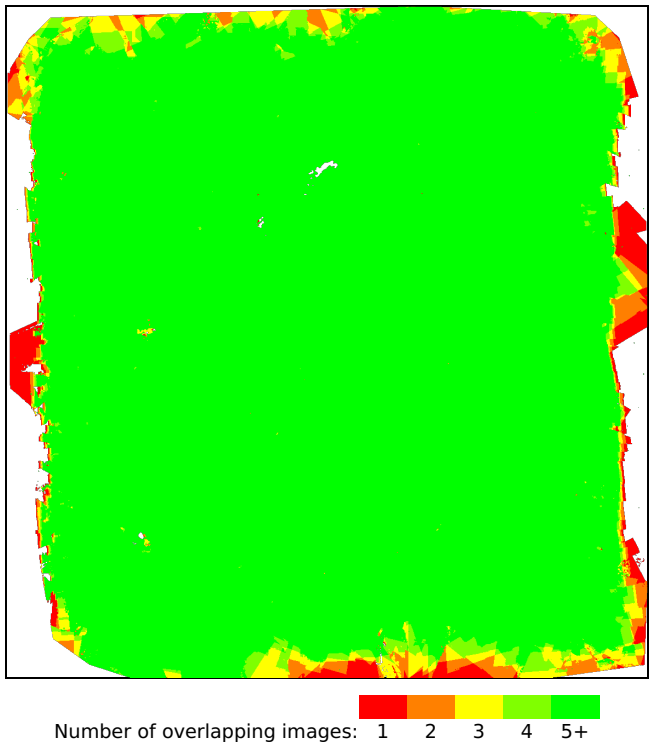


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

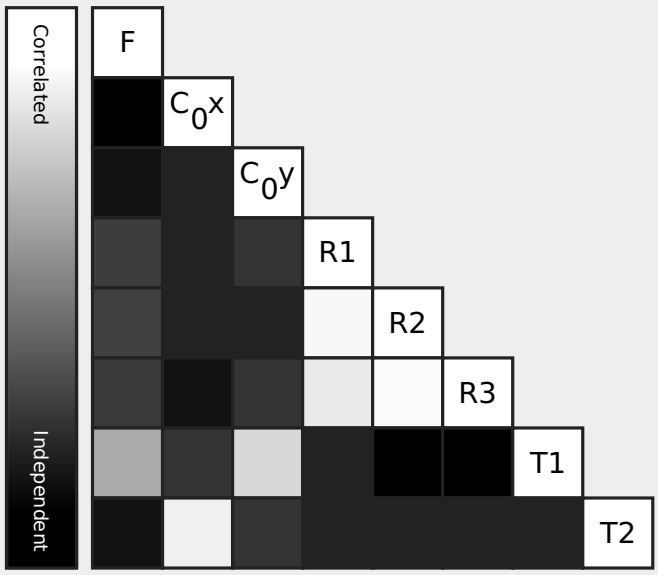
Number of 2D Keypoint Observations for Bundle Block Adjustment	14876404
Number of 3D Points for Bundle Block Adjustment	5380165
Mean Reprojection Error [pixels]	0.212

Internal Camera Parameters

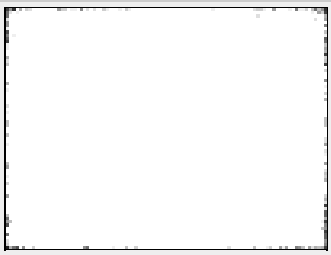
RedEdge_5.5_1280x960 (Blue). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1449.223 [pixel] 5.435 [mm]	654.596 [pixel] 2.455 [mm]	494.398 [pixel] 1.854 [mm]	-0.099	0.170	-0.071	0.000	-0.000
Uncertainties (Sigma)	0.150 [pixel] 0.001 [mm]	0.123 [pixel] 0.000 [mm]	0.094 [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.



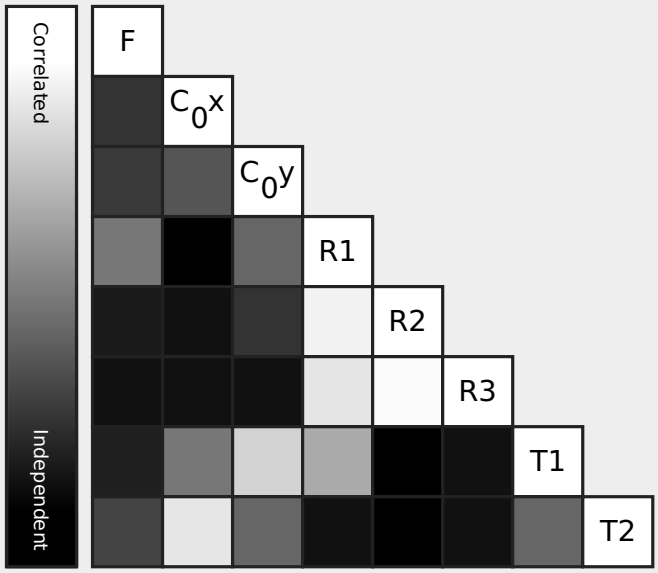
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

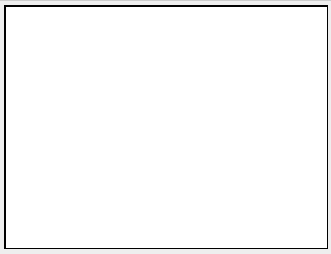
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.097 [pixel] 5.423 [mm]	655.804 [pixel] 2.459 [mm]	481.176 [pixel] 1.804 [mm]	-0.100	0.155	-0.040	0.000	0.000
Uncertainties (Sigma)	0.143 [pixel] 0.001 [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.



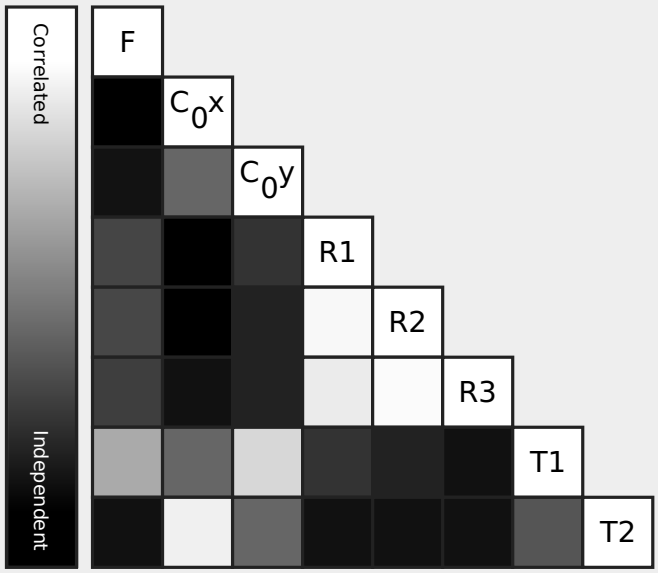
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1451.194 [pixel] 5.442 [mm]	653.849 [pixel] 2.452 [mm]	493.110 [pixel] 1.849 [mm]	-0.098	0.124	0.021	-0.000	-0.000
Uncertainties (Sigma)	0.151 [pixel] 0.001 [mm]	0.137 [pixel] 0.001 [mm]	0.104 [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.

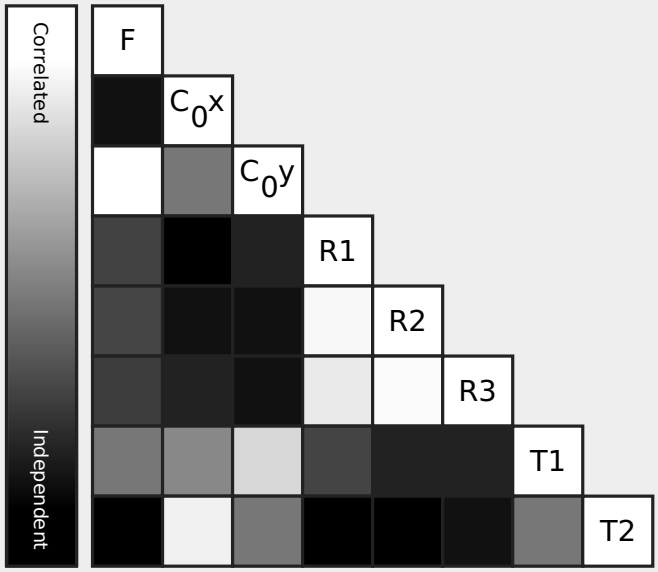
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

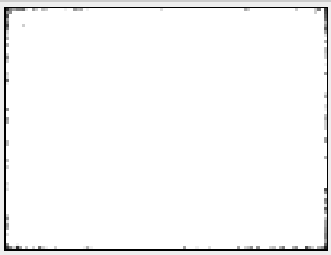
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1451.958 [pixel] 5.445 [mm]	662.532 [pixel] 2.484 [mm]	482.008 [pixel] 1.808 [mm]	-0.104	0.149	-0.031	0.000	-0.000
Uncertainties (Sigma)	0.151 [pixel] 0.001 [mm]	0.134 [pixel] 0.001 [mm]	0.101 [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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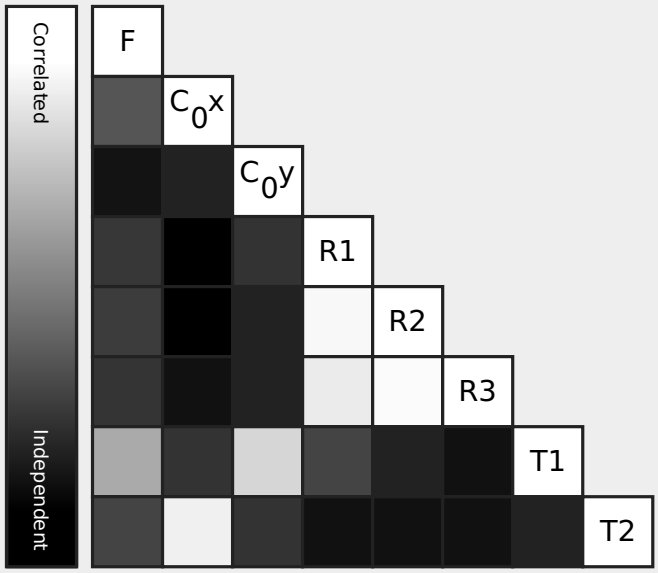
Internal Camera Parameters

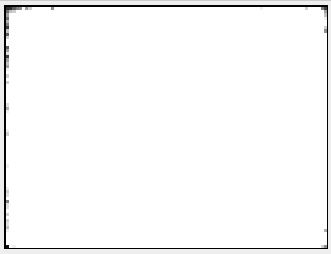
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1449.574 [pixel] 5.436 [mm]	657.670 [pixel] 2.466 [mm]	493.917 [pixel] 1.852 [mm]	-0.101	0.144	-0.024	0.000	-0.000
Uncertainties (Sigma)	0.149 [pixel] 0.001 [mm]	0.113 [pixel] 0.000 [mm]	0.085 [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.

Camera Rig «MicaSense 5 band» Relatives. Images: 11585

	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	-0.092	0.117	-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	0.065	0.084	-0.062
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	-0.143	-0.143	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	-0.065	-0.581	-0.321
Uncertainties (sigma)				0.003	0.005	0.000

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	29623	4456
Min	15457	36
Max	41781	25805
Mean	28984	4768

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

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

Median	24489	3073
Min	16965	65
Max	33929	18410
Mean	24738	3309

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	30611	4717
Min	16739	114
Max	41781	25805
Mean	29976	5042

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	22923	2608
Min	15457	36
Max	32106	16335
Mean	23476	3083

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	27971	4529
Min	18063	108
Max	35932	17104
Mean	27732	4718

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	31016	5072
Min	16145	156
Max	38074	20388
Mean	30203	5259

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)	33 / 249 / 13644	18 / 72 / 7633	33 / 298 / 6376	14 / 73 / 2541	17 / 106 / 4901
RedEdge_5.5_1280x960 (Green)		22 / 114 / 18735	13 / 59 / 5515	9 / 41 / 5227	13 / 61 / 10544
RedEdge_5.5_1280x960 (Red)			31 / 243 / 11924	13 / 67 / 2203	16 / 95 / 4367
RedEdge_5.5_1280x960 (NIR)				36 / 325 / 14130	34 / 349 / 7734
RedEdge_5.5_1280x960 (Red edge)					27 / 221 / 13937

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	3764055
In 3 Images	844487
In 4 Images	338121
In 5 Images	152919
In 6 Images	85093

In 7 Images	50253
In 8 Images	33203
In 9 Images	23167
In 10 Images	17405
In 11 Images	13176
In 12 Images	10263
In 13 Images	8190
In 14 Images	6466
In 15 Images	5449
In 16 Images	4295
In 17 Images	3568
In 18 Images	2947
In 19 Images	2369
In 20 Images	2069
In 21 Images	1610
In 22 Images	1334
In 23 Images	1091
In 24 Images	895
In 25 Images	843
In 26 Images	714
In 27 Images	627
In 28 Images	589
In 29 Images	472
In 30 Images	411
In 31 Images	418
In 32 Images	345
In 33 Images	332
In 34 Images	301
In 35 Images	265
In 36 Images	210
In 37 Images	217
In 38 Images	215
In 39 Images	174
In 40 Images	163
In 41 Images	120
In 42 Images	143
In 43 Images	121
In 44 Images	103
In 45 Images	97
In 46 Images	90
In 47 Images	96
In 48 Images	81
In 49 Images	66
In 50 Images	74
In 51 Images	50
In 52 Images	37
In 53 Images	34
In 54 Images	40
In 55 Images	33
In 56 Images	27
In 57 Images	29
In 58 Images	21
In 59 Images	23
In 60 Images	25
In 61 Images	7
In 62 Images	15
In 63 Images	13
In 64 Images	9
In 65 Images	11

In 66 Images	8
In 67 Images	8
In 68 Images	6
In 69 Images	3
In 70 Images	7
In 71 Images	6
In 72 Images	2
In 73 Images	3
In 74 Images	3
In 75 Images	1
In 76 Images	6
In 77 Images	3
In 78 Images	3
In 79 Images	6
In 80 Images	2
In 81 Images	2
In 82 Images	2
In 83 Images	2
In 84 Images	1
In 85 Images	2
In 87 Images	1
In 88 Images	2

2D Keypoint Matches

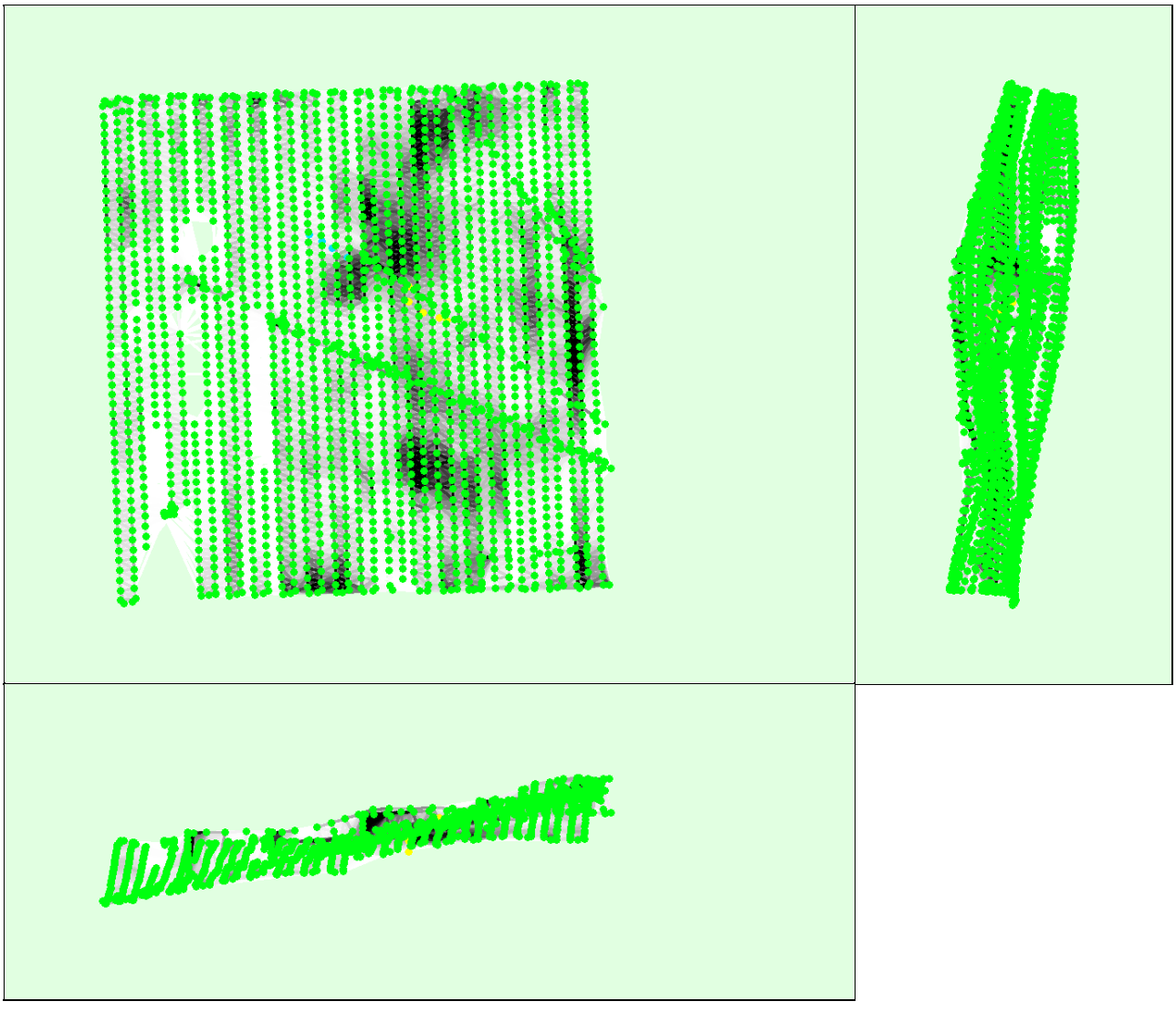


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	0.11	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	0.50	0.14	0.05
-3.00	0.00	47.05	45.33	48.57
0.00	3.00	51.95	52.36	51.20
3.00	6.00	0.33	1.66	0.05
6.00	9.00	0.05	0.34	0.00
9.00	12.00	0.03	0.01	0.05
12.00	15.00	0.03	0.00	0.01
15.00	-	0.05	0.02	0.01
Mean [m]		-0.062507	0.203570	0.008456
Sigma [m]		1.053218	2.152585	0.908315
RMS Error [m]		1.055071	2.162189	0.908355

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]	99.84	98.96	99.94
[-2.00, 2.00]	99.92	99.84	100.00
[-3.00, 3.00]	99.95	99.87	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:39s
Time for Point Cloud Classification	49s
Time for 3D Textured Mesh Generation	10m:29s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11558814
Average Density (per m^3)	4.2

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.59 [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 (8.59 [cm/pixel]) Merge Tiles: yes

Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	51s
Time for Orthomosaic Generation	01h:13m:01s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:27m:24s
Time for Index Map Generation	37s

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	✓