Quality Report

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	sequ_5k_3_re
Processed	2019-01-24 16:21:42
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)	7.56 cm / 2.98 in
Area Covered	0.561 km^2 / 56.1467 ha / 0.22 sq. mi. / 138.8132 acres
Time for Initial Processing (without report)	18h:28m:34s

Quality Check

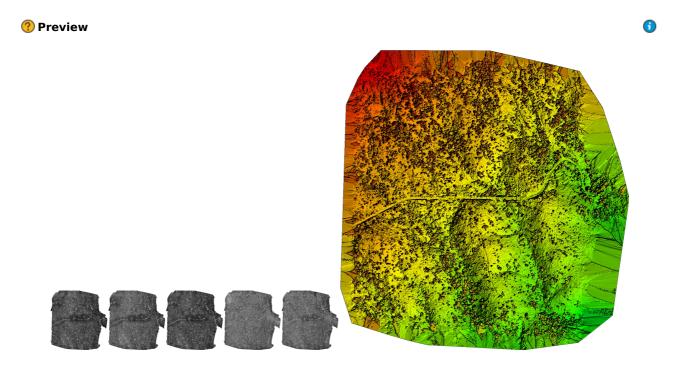|			
?	**Images**	median of 31792 keypoints per image	✓
?	**Dataset**	11520 out of 11520 images calibrated (100%), 5 images disabled	✓
?	**Camera Optimization**	1.21% relative difference between initial and optimized internal camera parameters	✓
?	**Matching**	median of 6680.64 matches per calibrated image	✓
?	**Georeferencing**	yes, no 3D GCP	⚠

Preview

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

Calibration Details

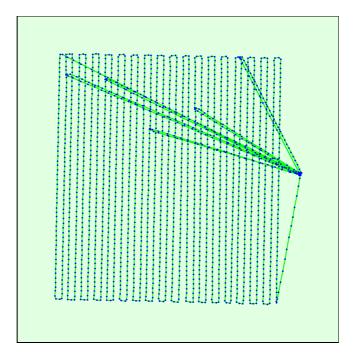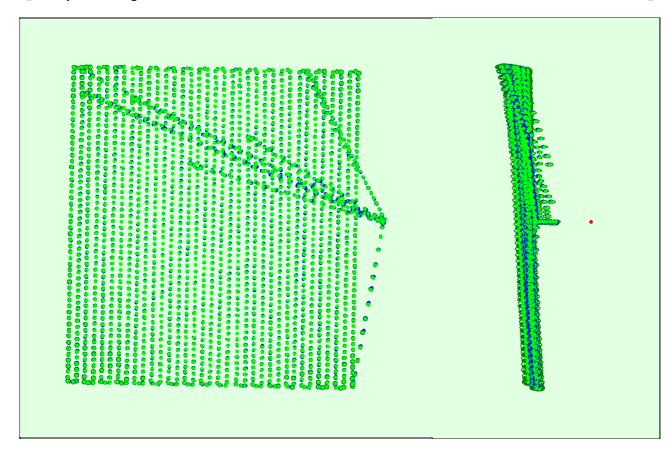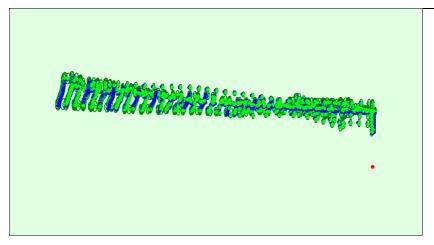| Number of Calibrated Images	11520 out of 11525
Number of Geolocated Images	11525 out of 11525

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	0.062	0.062	0.142	0.029	0.028	0.011
Sigma	0.010	0.009	0.030	0.002	0.002	0.002

Overlap

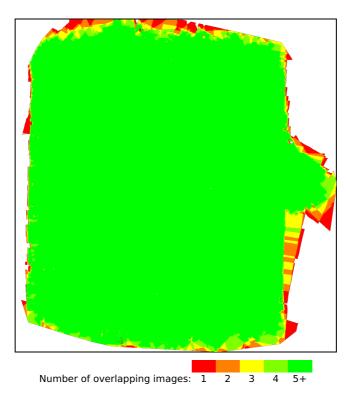Number of overlapping images: 1   2   3   4   5+

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

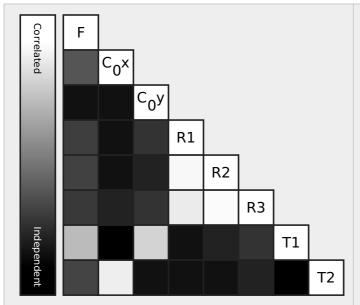|		
Number of 2D Keypoint Observations for Bundle Block Adjustment		22406812
Number of 3D Points for Bundle Block Adjustment		6686638
Mean Reprojection Error [pixels]		0.200

⁇ 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	1448.524 [pixel] 5.432 [mm]	654.328 [pixel] 2.454 [mm]	494.368 [pixel] 1.854 [mm]	-0.098	0.163	-0.059	0.000	-0.000
Uncertainties (Sigma)	0.089 [pixel] 0.000 [mm]	0.074 [pixel] 0.000 [mm]	0.056 [pixel] 0.000 [mm]	0.000	0.004	0.008	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.
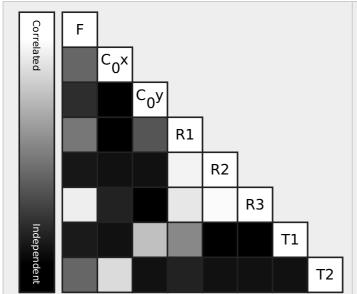
⁇ Internal Camera Parameters

🗎 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	1445.286 [pixel] 5.420 [mm]	655.523 [pixel] 2.458 [mm]	481.523 [pixel] 1.806 [mm]	-0.098	0.143	-0.021	0.000	0.000
Uncertainties (Sigma)	0.085 [pixel] 0.000 [mm]	0.024 [pixel] 0.000 [mm]	0.020 [pixel] 0.000 [mm]	0.000	0.001	0.002	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.
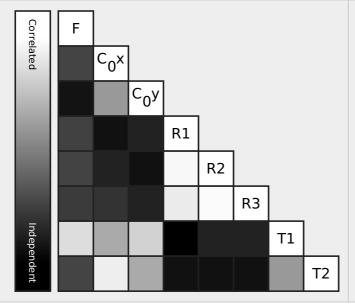

The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1450.564 [pixel] 5.440 [mm]	653.969 [pixel] 2.452 [mm]	493.065 [pixel] 1.849 [mm]	-0.098	0.123	0.014	-0.000	-0.000
Uncertainties (Sigma)	0.090 [pixel] 0.000 [mm]	0.079 [pixel] 0.000 [mm]	0.059 [pixel] 0.000 [mm]	0.000	0.004	0.008	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.
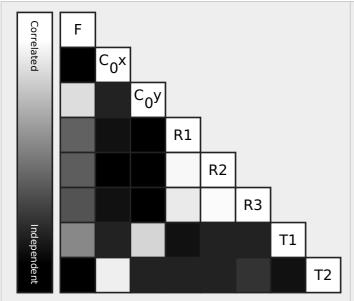
Internal Camera Parameters

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	1451.228 [pixel] 5.442 [mm]	662.676 [pixel] 2.485 [mm]	482.003 [pixel] 1.808 [mm]	-0.104	0.156	-0.051	0.000	-0.000
Uncertainties (Sigma)	0.095 [pixel] 0.000 [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.

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	1448.828 [pixel] 5.433 [mm]	657.881 [pixel] 2.467 [mm]	493.979 [pixel] 1.852 [mm]	-0.101	0.148	-0.036	0.000	0.000
Uncertainties (Sigma)	0.092 [pixel] 0.000 [mm]	0.092 [pixel] 0.000 [mm]	0.069 [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.

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.
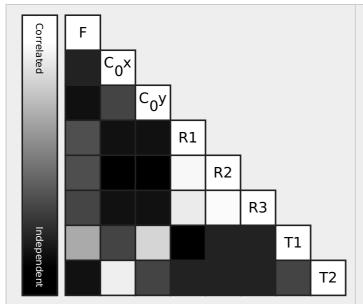
Camera Rig «MicaSense 5 band» Relatives. Images: 11520

	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	-0.083	0.106	-0.372
Uncertainties (sigma)				0.002	0.003	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	0.086	0.095	-0.061
Uncertainties (sigma)				0.002	0.003	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	-0.127	-0.132	0.120
Uncertainties (sigma)				0.003	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	-0.053	-0.572	-0.320
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	31792	6681
Min	18256	111
Max	45581	23025
Mean	31016	6933

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

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

Median	30399	5886
Min	18864	763
Max	41392	13440
Mean	28983	6233

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	32664	7303
Min	19058	1162
Max	45581	23025
Mean	31847	7404

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	28557	5708
Min	19767	743
Max	39000	16323
Mean	28252	6392

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	27794	3496
Min	18884	111
Max	37360	18825
Mean	27519	4944

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	31587	4555
Min	18256	362
Max	41251	20769
Mean	31052	5487

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)	117 / 853 / 9112	61 / 272 / 6076	139 / 938 / 7744	23 / 151 / 1477	37 / 252 / 2446
RedEdge_5.5_1280x960 (Green)		71 / 322 / 13615	55 / 245 / 5692	15 / 86 / 2598	24 / 136 / 5606
RedEdge_5.5_1280x960 (Red)			122 / 946 / 11523	23 / 171 / 1787	40 / 279 / 3515
RedEdge_5.5_1280x960 (NIR)				62 / 1003 / 14867	69 / 654 / 5835
RedEdge_5.5_1280x960 (Red edge)					61 / 857 / 13941

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4139351
In 3 Images	1118080
In 4 Images	503297
In 5 Images	262591
In 6 Images	163692

In 7 Images	105969
In 8 Images	76554
In 9 Images	56608
In 10 Images	43483
In 11 Images	33888
In 12 Images	26943
In 13 Images	21432
In 14 Images	17936
In 15 Images	14435
In 16 Images	12735
In 17 Images	10521
In 18 Images	9303
In 19 Images	7893
In 20 Images	6850
In 21 Images	5775
In 22 Images	5087
In 23 Images	4396
In 24 Images	3800
In 25 Images	3438
In 26 Images	3059
In 27 Images	2734
In 28 Images	2271
In 29 Images	2055
In 30 Images	1875
In 31 Images	1611
In 32 Images	1461
In 33 Images	1294
In 34 Images	1149
In 35 Images	1072
In 36 Images	886
In 37 Images	833
In 38 Images	725
In 39 Images	643
In 40 Images	631
In 41 Images	530
In 42 Images	502
In 43 Images	514
In 44 Images	412
In 45 Images	391
In 46 Images	344
In 47 Images	352
In 48 Images	333
In 49 Images	314
In 50 Images	303
In 51 Images	265
In 52 Images	239
In 53 Images	232
In 54 Images	202
In 55 Images	188
In 56 Images	170
In 57 Images	182
In 58 Images	152
In 59 Images	146
In 60 Images	172
In 61 Images	130
In 62 Images	137
In 63 Images	124
In 64 Images	135
In 65 Images	127
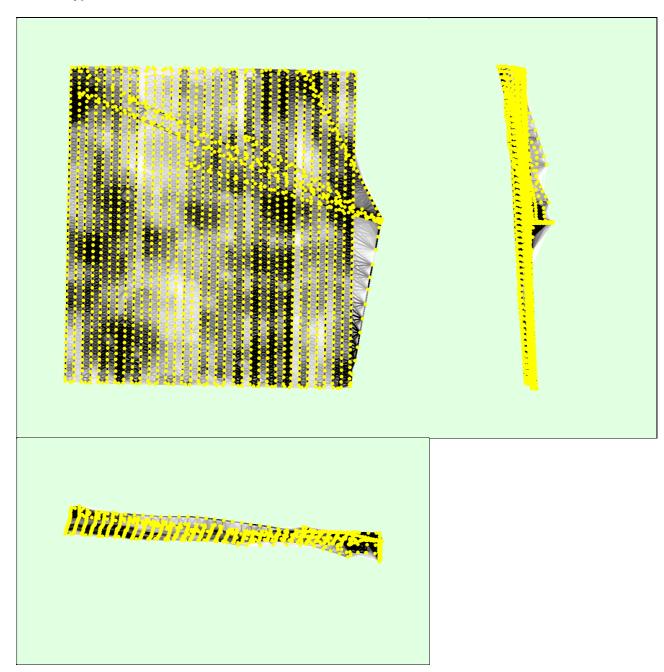
In 66 Images	124
In 67 Images	102
In 68 Images	95
In 69 Images	86
In 70 Images	88
In 71 Images	77
In 72 Images	100
In 73 Images	92
In 74 Images	71
In 75 Images	83
In 76 Images	80
In 77 Images	85
In 78 Images	77
In 79 Images	81
In 80 Images	62
In 81 Images	71
In 82 Images	68
In 83 Images	52
In 84 Images	60
In 85 Images	38
In 86 Images	54
In 87 Images	64
In 88 Images	46
In 89 Images	65
In 90 Images	55
In 91 Images	42
In 92 Images	47
In 93 Images	50
In 94 Images	48
In 95 Images	45
In 96 Images	46
In 97 Images	47
In 98 Images	50
In 99 Images	47
In 100 Images	35
In 101 Images	51
In 102 Images	38
In 103 Images	36
In 104 Images	41
In 105 Images	26
In 106 Images	30
In 107 Images	25
In 108 Images	38
In 109 Images	35
In 110 Images	29
In 111 Images	34
In 112 Images	29
In 113 Images	31
In 114 Images	25
In 115 Images	29
In 116 Images	29
In 117 Images	32
In 118 Images	25
In 119 Images	32
In 120 Images	25
In 121 Images	22
In 122 Images	20
In 123 Images	22
In 124 Images	19

In 125 Images	18
In 126 Images	19
In 127 Images	24
In 128 Images	15
In 129 Images	25
In 130 Images	21
In 131 Images	25
In 132 Images	20
In 133 Images	16
In 134 Images	20
In 135 Images	15
In 136 Images	14
In 137 Images	22
In 138 Images	13
In 139 Images	19
In 140 Images	13
In 141 Images	14
In 142 Images	20
In 143 Images	11
In 144 Images	18
In 145 Images	13
In 146 Images	12
In 147 Images	8
In 148 Images	13
In 149 Images	10
In 150 Images	15
In 151 Images	10
In 152 Images	13
In 153 Images	8
In 154 Images	3
In 155 Images	4
In 156 Images	10
In 157 Images	7
In 158 Images	8
In 159 Images	5
In 160 Images	4
In 161 Images	5
In 162 Images	6
In 163 Images	6
In 164 Images	7
In 165 Images	10
In 166 Images	3
In 167 Images	6
In 168 Images	8
In 169 Images	4
In 170 Images	7
In 171 Images	2
In 172 Images	6
In 173 Images	4
In 174 Images	5
In 175 Images	4
In 176 Images	7
In 177 Images	2
In 178 Images	2
In 179 Images	4
In 180 Images	2
In 181 Images	2
In 182 Images	5
In 183 Images	2

In 184 Images	2
In 188 Images	3
In 189 Images	2
In 191 Images	1
In 192 Images	3
In 196 Images	1
In 197 Images	1
In 199 Images	1
In 204 Images	1
In 207 Images	1

2D Keypoint Matches

Number of matches

25 222 444 666 888 1111 1333 1555 1777 2000

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	0.00	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	0.36	0.00	7.60
-3.00	0.00	51.82	50.38	27.60
0.00	3.00	47.37	49.49	64.80
3.00	6.00	0.45	0.13	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]		-0.000336	-0.000372	0.000129
Sigma [m]		0.772522	1.041771	1.608701
RMS Error [m]		0.772522	1.041771	1.608701

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 11N (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:33s
Time for Point Cloud Classification	01m:05s
Time for 3D Textured Mesh Generation	10m:33s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	11898722
Average Density (per m^3)	7.13

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (7.56 [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 (7.56 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	50s
Time for Orthomosaic Generation	56m:17s

Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	01h:03m:05s
Time for Index Map Generation	45s

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	✓