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	sier_5k_2_re
Processed	2019-01-23 09:19:34
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)	8.65 cm / 3.41 in
Area Covered	0.598 km^2 / 59.8076 ha / 0.23 sq. mi. / 147.8644 acres
Time for Initial Processing (without report)	08h:42m:42s

Quality Check

Images	median of 33407 keypoints per image	✓
Dataset	9630 out of 9770 images calibrated (98%), 9 images disabled	✓
Camera Optimization	1.37% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 6536.87 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

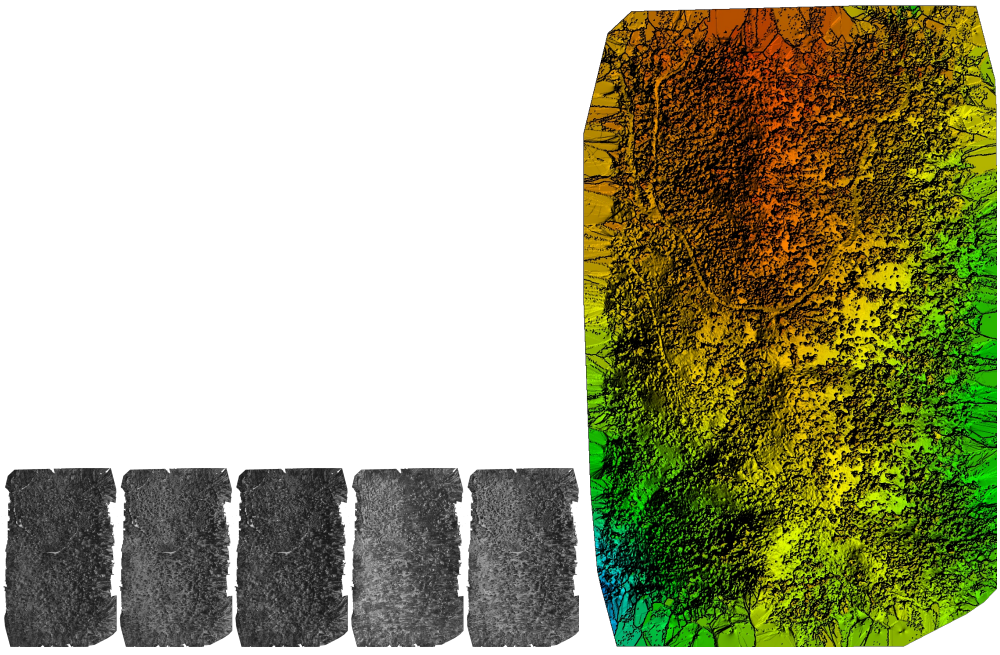


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	9630 out of 9779
Number of Geolocated Images	9779 out of 9779

Initial Image Positions

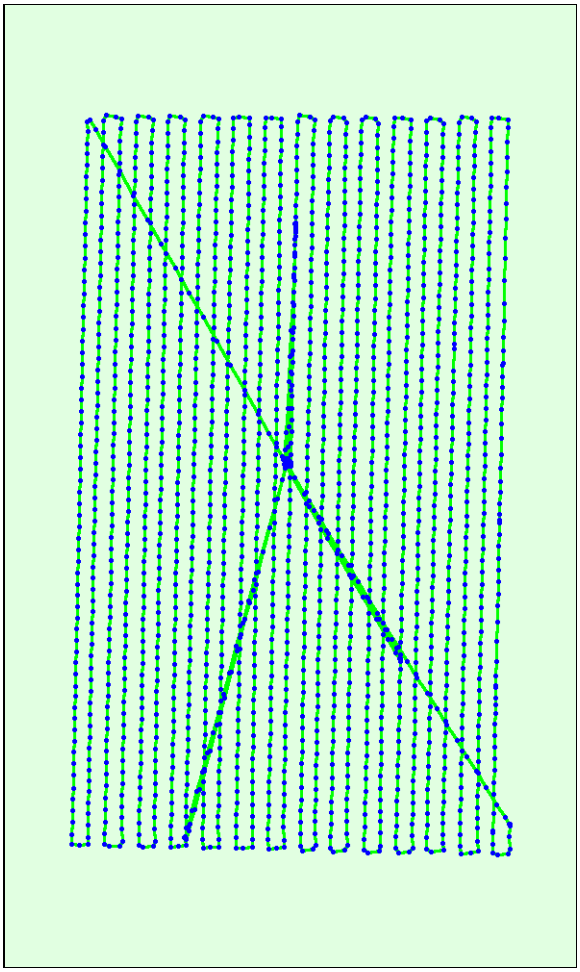
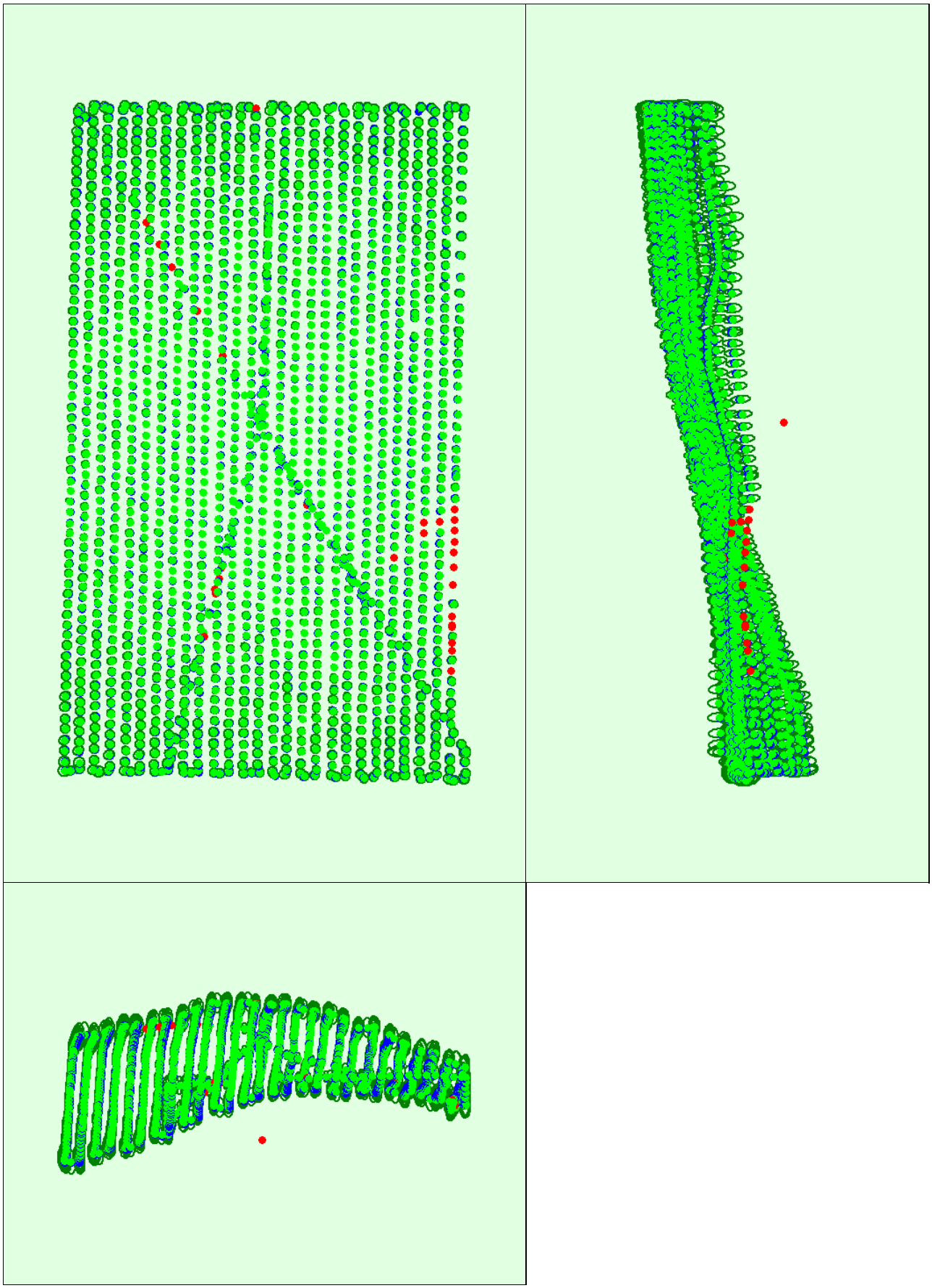


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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	0.082	0.082	0.182	0.032	0.045	0.015
Sigma	0.015	0.015	0.041	0.004	0.003	0.003

Overlap

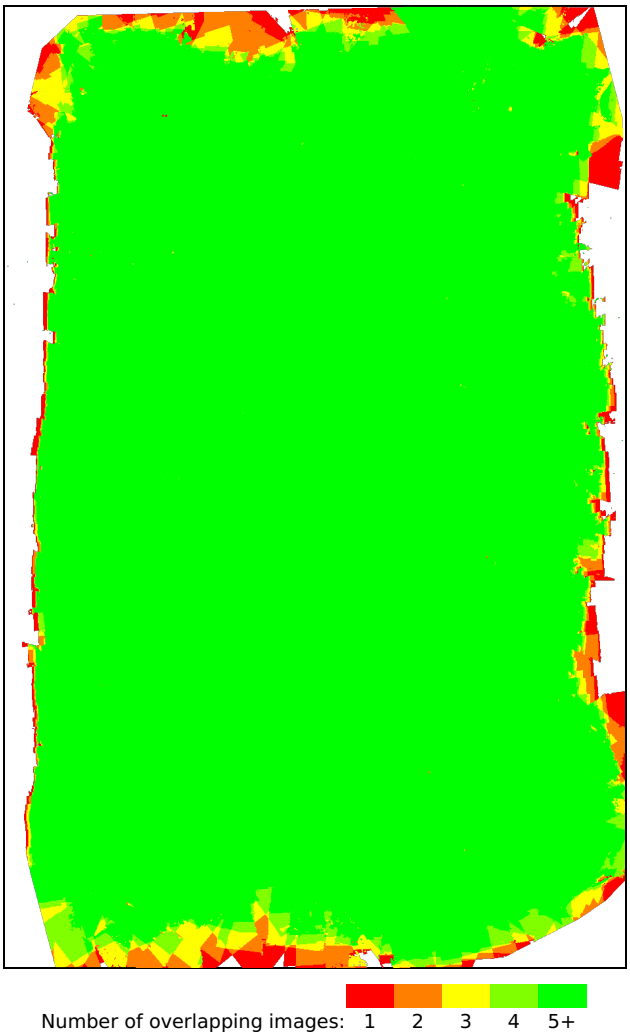


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	18474744
Number of 3D Points for Bundle Block Adjustment	6328601
Mean Reprojection Error [pixels]	0.196

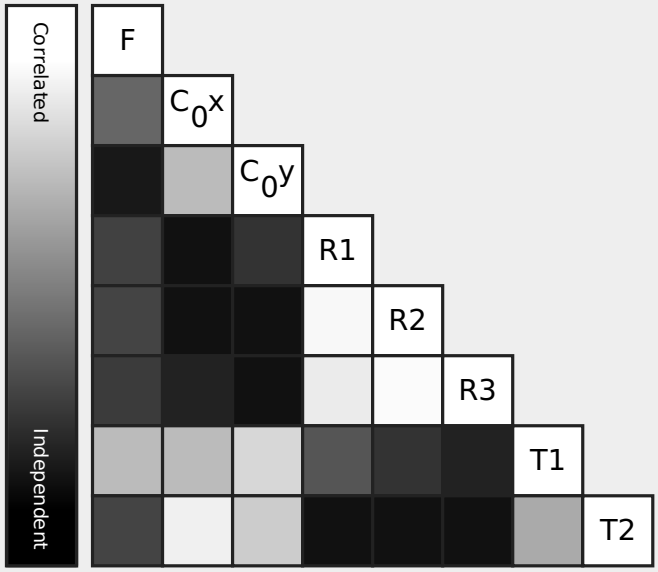
Internal Camera Parameters

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

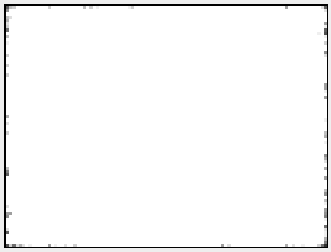
EXIF ID: RedEdge_5.5_1280x960

	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	1446.032 [pixel] 5.423 [mm]	655.160 [pixel] 2.457 [mm]	495.177 [pixel] 1.857 [mm]	-0.099	0.168	-0.068	0.000	-0.000
Uncertainties (Sigma)	0.136 [pixel] 0.001 [mm]	0.115 [pixel] 0.000 [mm]	0.087 [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.



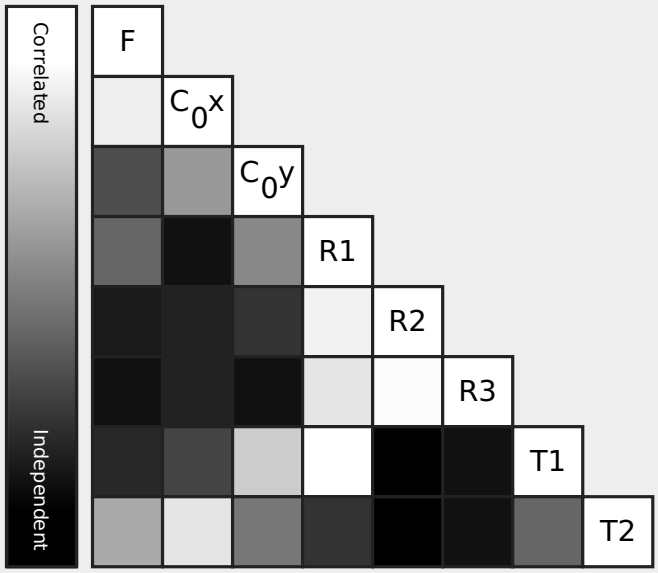
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

Internal Camera Parameters

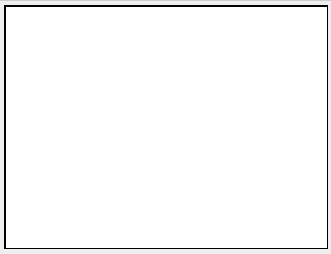
RedEdge_5.5_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1442.944 [pixel] 5.411 [mm]	655.973 [pixel] 2.460 [mm]	481.376 [pixel] 1.805 [mm]	-0.099	0.152	-0.040	0.000	0.000
Uncertainties (Sigma)	0.130 [pixel] 0.000 [mm]	0.034 [pixel] 0.000 [mm]	0.028 [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.



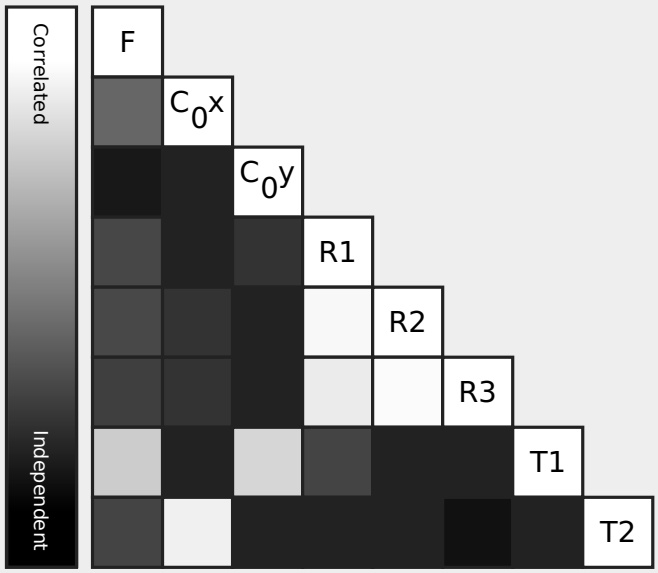
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

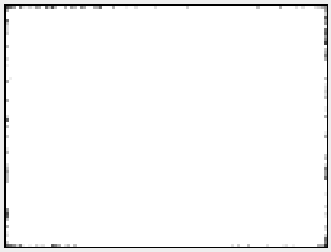
RedEdge_5.5_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.140 [pixel] 5.431 [mm]	654.156 [pixel] 2.453 [mm]	493.656 [pixel] 1.851 [mm]	-0.100	0.137	-0.010	-0.000	-0.000
Uncertainties (Sigma)	0.137 [pixel] 0.001 [mm]	0.124 [pixel] 0.000 [mm]	0.093 [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.



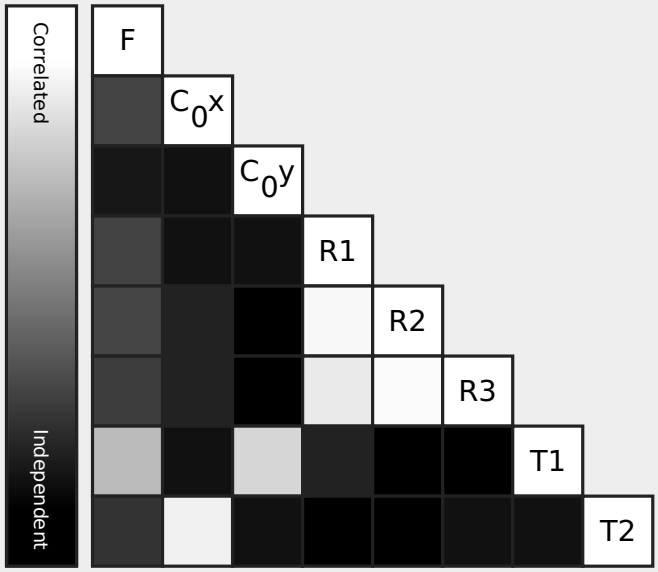
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

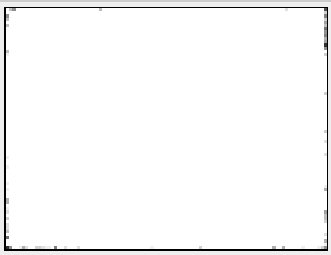
RedEdge_5.5_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1448.816 [pixel] 5.433 [mm]	663.022 [pixel] 2.486 [mm]	482.501 [pixel] 1.809 [mm]	-0.105	0.159	-0.059	0.000	-0.000
Uncertainties (Sigma)	0.137 [pixel] 0.001 [mm]	0.120 [pixel] 0.000 [mm]	0.091 [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.



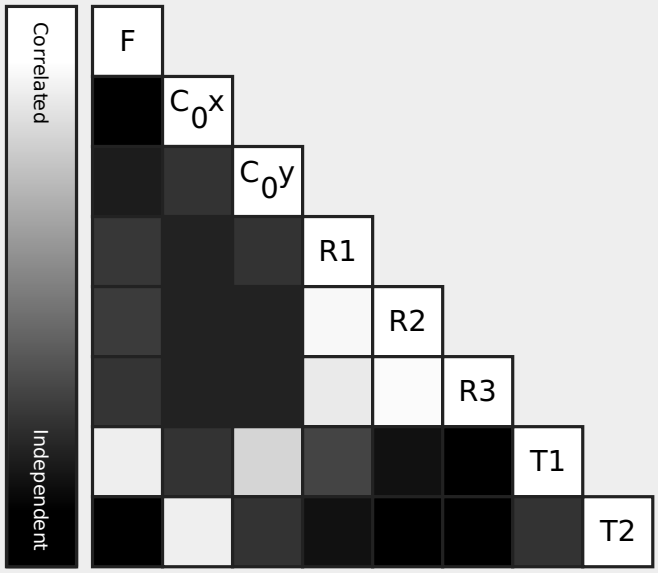
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the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

Internal Camera Parameters

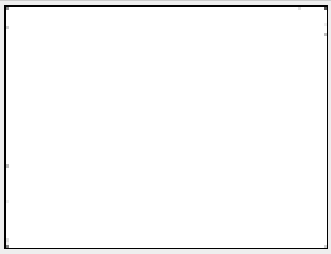
RedEdge_5.5_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

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	1446.518 [pixel] 5.424 [mm]	657.912 [pixel] 2.467 [mm]	494.201 [pixel] 1.853 [mm]	-0.103	0.158	-0.059	0.000	0.000
Uncertainties (Sigma)	0.134 [pixel] 0.001 [mm]	0.099 [pixel] 0.000 [mm]	0.076 [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.

Camera Rig «MicaSense 5 band» Relatives. Images: 9770

	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	-0.112	0.147	-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	0.051	0.095	-0.061
Uncertainties (sigma)				0.004	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	-0.156	-0.109	0.119
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	-0.072	-0.562	-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	33407	6537
Min	17673	159
Max	44157	26417
Mean	32822	6827

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

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

Median	26990	3615
Min	18356	198
Max	35591	14880
Mean	27193	4069

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	34617	7040
Min	19647	1289
Max	44157	26417
Mean	34168	7504

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	27404	3363
Min	17673	159
Max	36392	16142
Mean	27300	3872

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	29626	5754
Min	19719	202
Max	38633	19149
Mean	28990	6033

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	35347	6207
Min	21907	271
Max	41657	21596
Mean	34504	6650

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)	32 / 184 / 9100	16 / 84 / 7353	40 / 298 / 5690	14 / 94 / 1560	20 / 130 / 3492
RedEdge_5.5_1280x960 (Green)		26 / 147 / 19552	13 / 63 / 5877	13 / 62 / 3277	18 / 94 / 8974
RedEdge_5.5_1280x960 (Red)			33 / 210 / 11244	13 / 88 / 1734	19 / 142 / 3757
RedEdge_5.5_1280x960 (NIR)				38 / 233 / 14920	32 / 264 / 6150
RedEdge_5.5_1280x960 (Red edge)					27 / 171 / 14082

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	4117230
In 3 Images	1083153
In 4 Images	464661
In 5 Images	229315
In 6 Images	135451

In 7 Images	81757
In 8 Images	53638
In 9 Images	37512
In 10 Images	27185
In 11 Images	20524
In 12 Images	15358
In 13 Images	11928
In 14 Images	9601
In 15 Images	7672
In 16 Images	5889
In 17 Images	4549
In 18 Images	3757
In 19 Images	3162
In 20 Images	2621
In 21 Images	2124
In 22 Images	1734
In 23 Images	1407
In 24 Images	1205
In 25 Images	965
In 26 Images	817
In 27 Images	643
In 28 Images	601
In 29 Images	507
In 30 Images	427
In 31 Images	345
In 32 Images	316
In 33 Images	273
In 34 Images	213
In 35 Images	202
In 36 Images	152
In 37 Images	155
In 38 Images	123
In 39 Images	114
In 40 Images	105
In 41 Images	85
In 42 Images	72
In 43 Images	50
In 44 Images	60
In 45 Images	48
In 46 Images	43
In 47 Images	40
In 48 Images	43
In 49 Images	30
In 50 Images	36
In 51 Images	28
In 52 Images	27
In 53 Images	29
In 54 Images	22
In 55 Images	24
In 56 Images	19
In 57 Images	19
In 58 Images	13
In 59 Images	12
In 60 Images	15
In 61 Images	12
In 62 Images	14
In 63 Images	16
In 64 Images	12
In 65 Images	13

In 66 Images	10
In 67 Images	13
In 68 Images	13
In 69 Images	16
In 70 Images	11
In 71 Images	8
In 72 Images	10
In 73 Images	8
In 74 Images	15
In 75 Images	11
In 76 Images	12
In 77 Images	12
In 78 Images	9
In 79 Images	11
In 80 Images	12
In 81 Images	5
In 82 Images	9
In 83 Images	11
In 84 Images	13
In 85 Images	3
In 86 Images	6
In 87 Images	8
In 88 Images	11
In 89 Images	5
In 90 Images	8
In 91 Images	7
In 92 Images	7
In 93 Images	9
In 94 Images	4
In 95 Images	5
In 96 Images	10
In 97 Images	10
In 98 Images	6
In 99 Images	8
In 100 Images	9
In 101 Images	8
In 102 Images	6
In 103 Images	5
In 104 Images	15
In 105 Images	3
In 106 Images	11
In 107 Images	2
In 108 Images	2
In 109 Images	8
In 110 Images	4
In 111 Images	5
In 112 Images	3
In 113 Images	3
In 114 Images	3
In 115 Images	3
In 116 Images	2
In 117 Images	1
In 118 Images	4
In 119 Images	2
In 120 Images	2
In 121 Images	2
In 123 Images	1
In 124 Images	2
In 128 Images	1

In 129 Images	1
In 130 Images	1
In 132 Images	1
In 134 Images	1
In 135 Images	1

2D Keypoint Matches

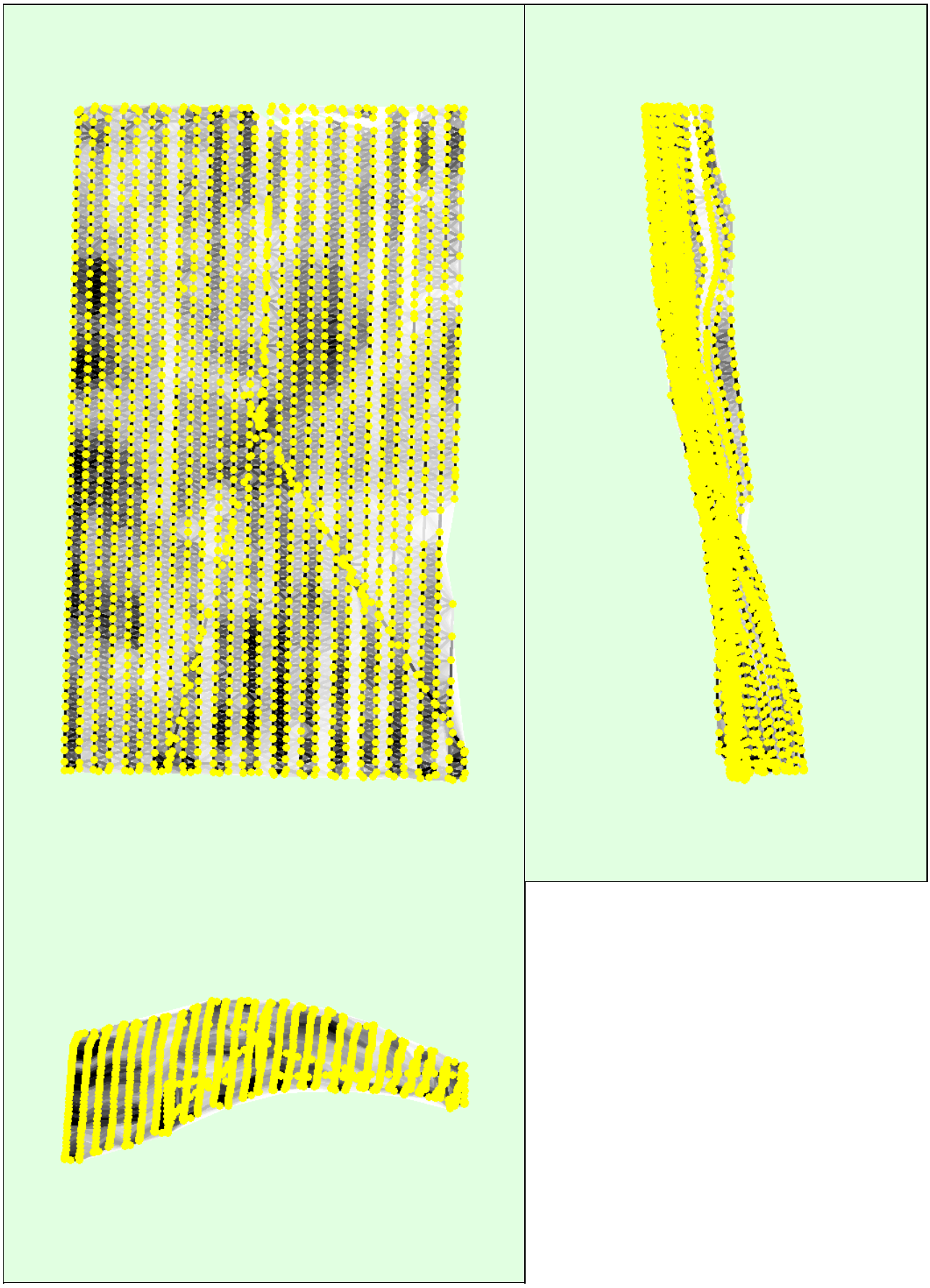


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

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	0.00	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	0.05	0.05	0.00
-3.00	0.00	48.68	52.67	48.47
0.00	3.00	51.27	47.23	51.53
3.00	6.00	0.00	0.05	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]		0.000658	0.000980	0.000326
Sigma [m]		0.699450	0.698161	0.857826
RMS Error [m]		0.699451	0.698161	0.857826

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	08m:56s
Time for Point Cloud Classification	53s
Time for 3D Textured Mesh Generation	09m:41s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	10352363
Average Density (per m^3)	4.97

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (8.65 [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 (8.65 [cm/pixel]) Merge Tiles: yes
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for DSM Generation	40s
Time for Orthomosaic Generation	45m:10s
Time for DTM Generation	00s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	51m:58s
Time for Index Map Generation	32s

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	✓