Quality Report

Generated with Pix4Dmapper 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	sequ_4k_1
Processed	2019-01-03 08:10:22
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), FC350_3.6_4000x3000 (RGB)
Rig name(s)	«MicaSense 5 band_merge_eldo_4k_2_re_merge_sequ_4k_1_re»
Average Ground Sampling Distance (GSD)	7.86 cm / 3.10 in
Area Covered	0.000 km^2 / 0.0000 ha / 0.00 sq. mi. / 0.0001 acres

Quality Check

Images	median of 6966 keypoints per image	⚠
Dataset	11698 out of 11793 images calibrated (99%), all images enabled	✓
Camera Optimization	1.33% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 1910.93 matches per calibrated image	✓
Georeferencing	yes, 13 GCPs (13 3D), mean RMS error = 0.058 m	✓

Preview

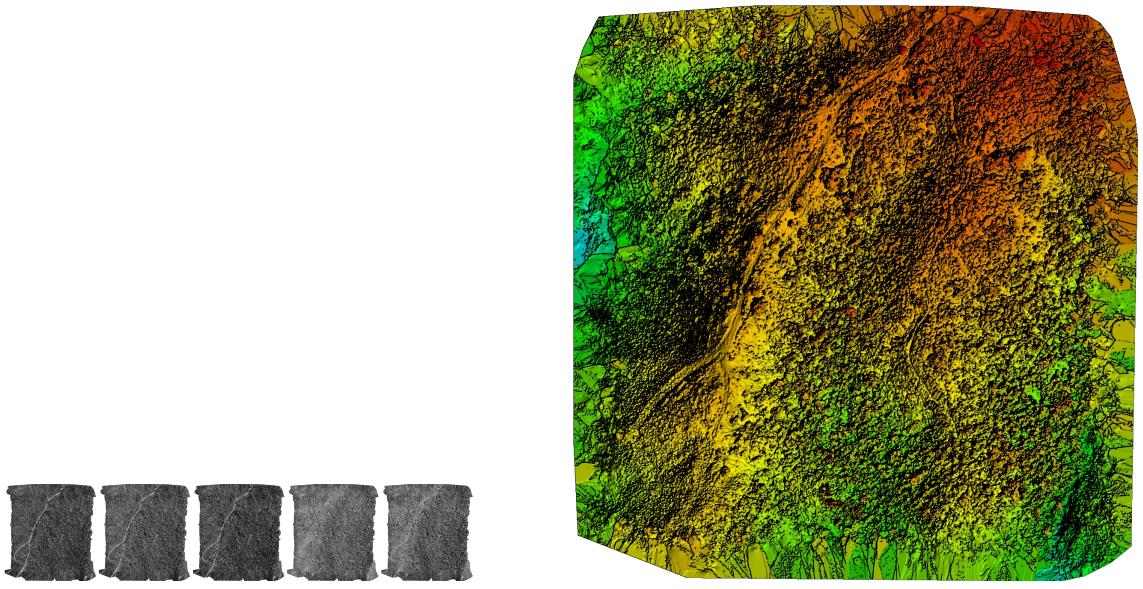


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	11698 out of 11793
Number of Geolocated Images	11303 out of 11793

Initial Image Positions

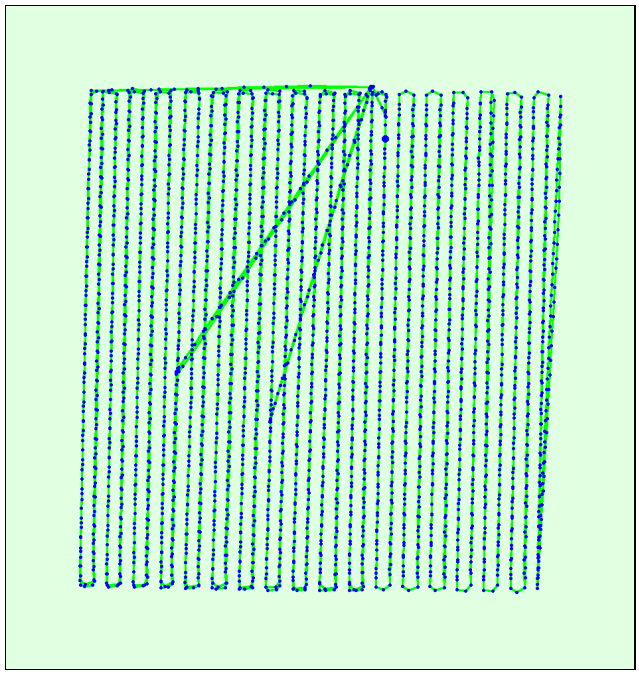
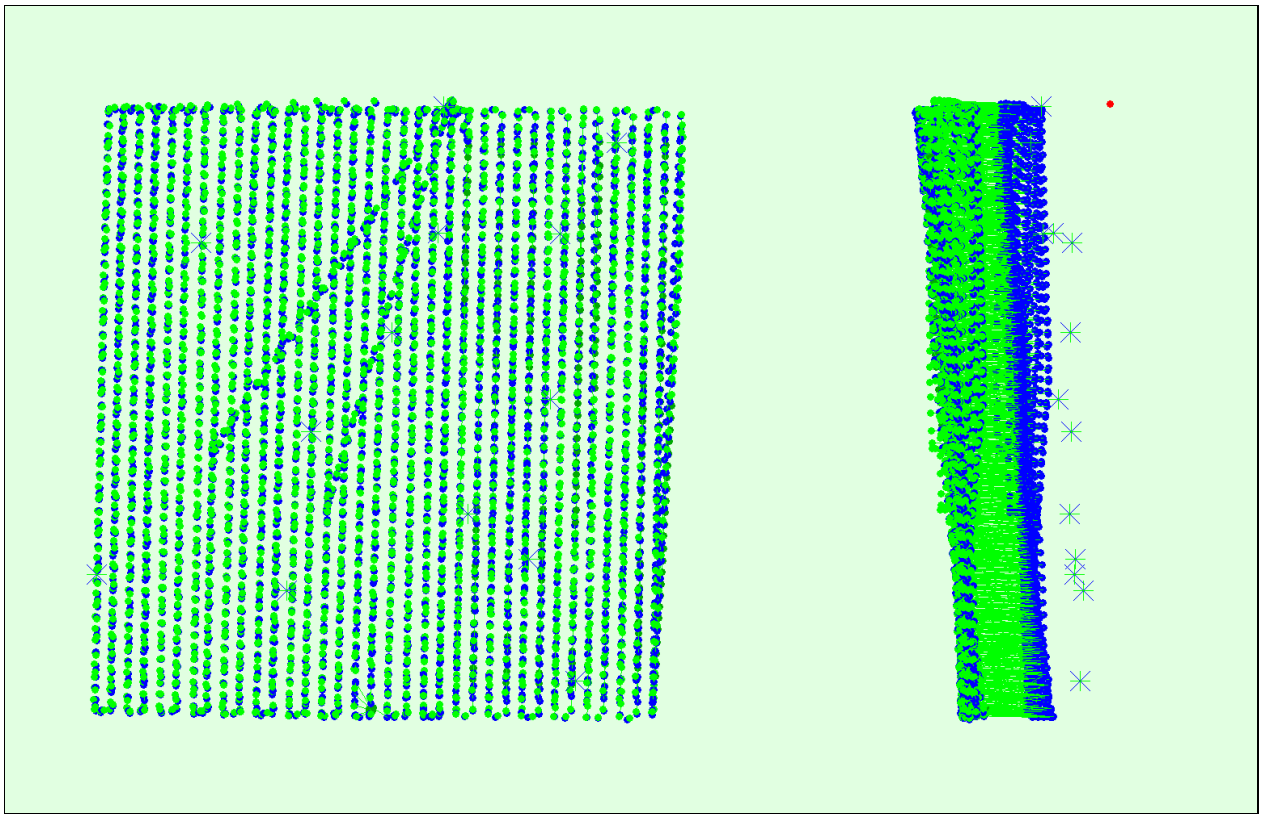


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



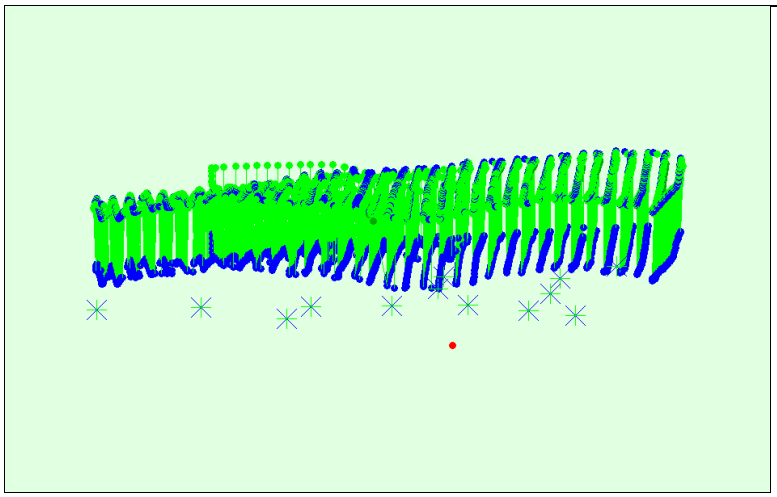


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled or uncalibrated images.

Overlap

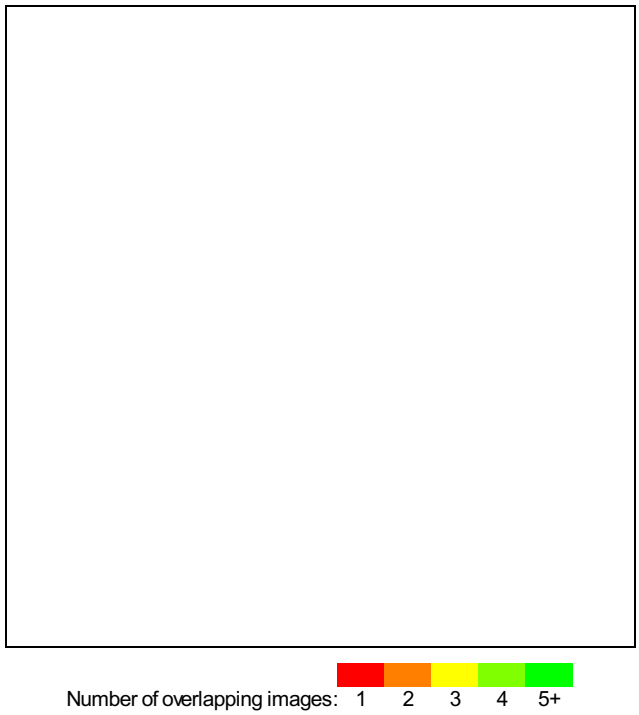


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	8662386
Number of 3D Points for Bundle Block Adjustment	2586387
Mean Reprojection Error [pixels]	0.162

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	1452.549 [pixel] 5.447 [mm]	654.428 [pixel] 2.454 [mm]	494.462 [pixel] 1.854 [mm]	-0.097	0.172	-0.067	0.000	-0.000

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	1449.291 [pixel] 5.435 [mm]	655.861 [pixel] 2.459 [mm]	481.456 [pixel] 1.805 [mm]	-0.098	0.158	-0.048	0.000	0.000

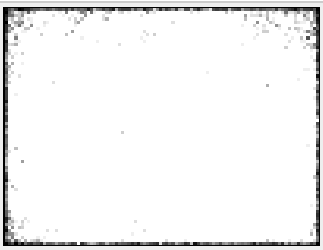
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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	1454.530 [pixel] 5.454 [mm]	654.024 [pixel] 2.453 [mm]	493.254 [pixel] 1.850 [mm]	-0.098	0.142	-0.017	-0.000	-0.000



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.

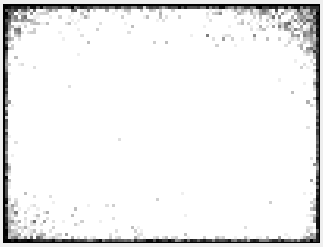
Internal Camera Parameters

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	1455.089 [pixel] 5.457 [mm]	663.221 [pixel] 2.487 [mm]	482.290 [pixel] 1.809 [mm]	-0.102	0.154	-0.042	0.000	-0.000



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	1452.838 [pixel] 5.448 [mm]	657.774 [pixel] 2.467 [mm]	494.120 [pixel] 1.853 [mm]	-0.101	0.161	-0.051	0.000	-0.000

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

FC350_3.6_4000x3000 (RGB). Sensor Dimensions: 6.317 [mm] x 4.738 [mm]

EXIF ID: FC350_3.6_4000x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	2285.722 [pixel] 3.610 [mm]	2000.006 [pixel] 3.159 [mm]	1500.003 [pixel] 2.369 [mm]	-0.130	0.106	-0.016	-0.000	0.000
Optimized Values	2360.799 [pixel] 3.729 [mm]	1984.625 [pixel] 3.134 [mm]	1502.494 [pixel] 2.373 [mm]	-0.132	0.120	-0.016	0.001	0.000

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_merge_eldo_4k_2_re_merge_sequ_4k_1_re» Relatives. Images: 10500

	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	0.000	0.000	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	0.000	0.000	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	0.000	0.000	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	0.000	0.000	0.000

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6966	1911
Min	5642	62
Max	12657	5085
Mean	8223	2063

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6363	1495
Min	5681	62
Max	8284	4139
Mean	6437	1689

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6661	2258
Min	5642	379
Max	8768	5085
Mean	6698	2374

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	6654	1448
Min	5920	136
Max	8052	4240
Mean	6700	1639

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

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	7366	1706
Min	6453	77
Max	9189	4709
Mean	7408	1893

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	7323	1886
Min	6214	130
Max	9162	4492
Mean	7357	2077

2D Keypoints Table for Camera FC350_3.6_4000x3000 (RGB)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	11493	1612
Min	10315	340
Max	12657	4458
Mean	11474	1717

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)	FC350_3.6_4000x300 (RGB)
RedEdge_5.5_1280x960 (Blue)	23 / 141 / 2833	19 / 78 / 1699	31 / 223 / 1849	11 / 65 / 336	16 / 101 / 696	
RedEdge_5.5_1280x960 (Green)		28 / 121 / 3973	18 / 71 / 1177	9 / 33 / 979	15 / 59 / 1724	
RedEdge_5.5_1280x960 (Red)			25 / 153 / 2793	11 / 53 / 315	16 / 85 / 639	
RedEdge_5.5_1280x960 (NIR)				19 / 202 / 3366	19 / 258 / 1774	
RedEdge_5.5_1280x960 (Red edge)					17 / 130 / 2827	
FC350_3.6_4000x3000 (RGB)						14 / 62 / 3386

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	1570991
In 3 Images	443655
In 4 Images	202399
In 5 Images	106385
In 6 Images	66595
In 7 Images	43016
In 8 Images	29962
In 9 Images	21923
In 10 Images	16914
In 11 Images	13106
In 12 Images	10583
In 13 Images	8217
In 14 Images	6805
In 15 Images	5674
In 16 Images	4788
In 17 Images	4021
In 18 Images	3489
In 19 Images	2900
In 20 Images	2613
In 21 Images	2285
In 22 Images	2017
In 23 Images	1759
In 24 Images	1603
In 25 Images	1452
In 26 Images	1318
In 27 Images	1179
In 28 Images	1019
In 29 Images	962
In 30 Images	866
In 31 Images	800
In 32 Images	714
In 33 Images	629
In 34 Images	573
In 35 Images	531
In 36 Images	461
In 37 Images	428
In 38 Images	399

In 39 Images	358
In 40 Images	315
In 41 Images	299
In 42 Images	287
In 43 Images	258
In 44 Images	213
In 45 Images	175
In 46 Images	163
In 47 Images	134
In 48 Images	138
In 49 Images	121
In 50 Images	110
In 51 Images	78
In 52 Images	84
In 53 Images	65
In 54 Images	69
In 55 Images	53
In 56 Images	51
In 57 Images	46
In 58 Images	25
In 59 Images	29
In 60 Images	36
In 61 Images	24
In 62 Images	31
In 63 Images	22
In 64 Images	12
In 65 Images	18
In 66 Images	17
In 67 Images	15
In 68 Images	6
In 69 Images	9
In 70 Images	11
In 71 Images	12
In 72 Images	8
In 73 Images	8
In 74 Images	8
In 75 Images	4
In 76 Images	5
In 77 Images	7
In 78 Images	1
In 79 Images	3
In 80 Images	4
In 81 Images	2
In 82 Images	6
In 84 Images	2
In 85 Images	2
In 86 Images	2
In 87 Images	4
In 88 Images	3
In 90 Images	1
In 91 Images	2

2D Keypoint Matches

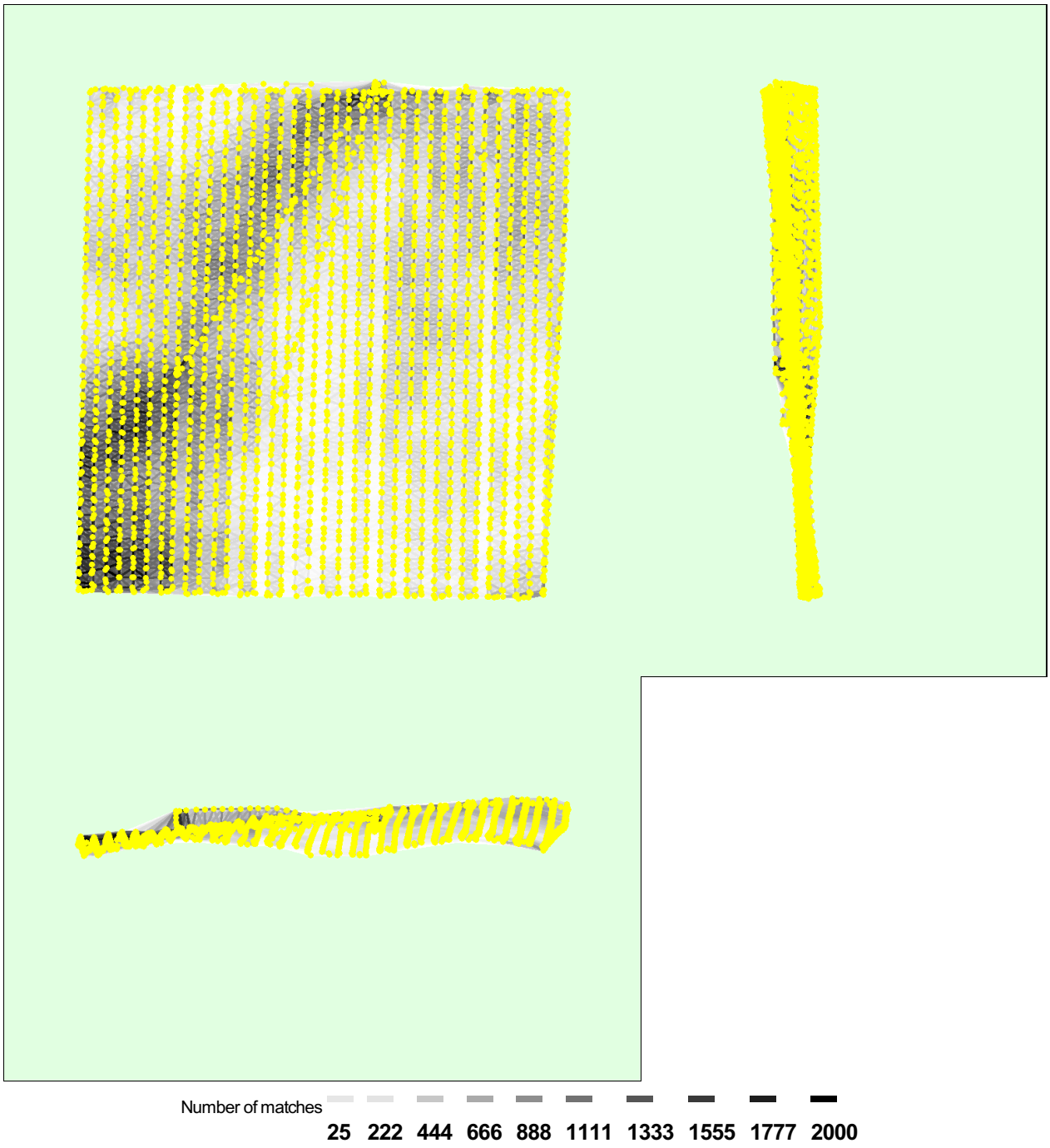


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Ground Control Points

GCP Name	Accuracy XY/Z [m]	Error X [m]	Error Y [m]	Error Z [m]	Projection Error [pixel]	Verified/Marked
"gcp_1" (3D)	0.020/ 5.000	-0.011	-0.017	-0.000	0.380	26 / 26
"gcp_2" (3D)	0.020/ 5.000	-0.009	-0.014	-0.000	0.337	12 / 12
"gcp_3" (3D)	0.020/ 5.000	0.008	-0.002	0.000	0.550	16 / 16
"gcp_4" (3D)	0.020/ 5.000	-0.003	-0.003	0.000	0.314	10 / 10
"gcp_5" (3D)	0.020/ 5.000	-573511.070	-755623.802	323300.958	n/a	0 / 27
"gcp_6" (3D)	0.020/ 5.000	-0.079	-0.047	-0.389	3.166	55 / 55
"gcp_7" (3D)	0.020/ 5.000	0.023	0.095	-0.033	1.721	79 / 79
"gcp_8" (3D)	0.020/ 5.000	0.009	0.004	0.000	0.455	26 / 26

"gcp_9" (3D)	0.020/ 5.000	-0.066	0.008	-0.106	1.415	86 / 86
"gcp_10" (3D)	0.020/ 5.000	0.053	0.004	-0.000	0.530	40 / 40
"gcp_11" (3D)	0.020/ 5.000	-0.001	0.001	0.000	0.390	41 / 41
"gcp_12" (3D)	0.020/ 5.000	0.027	0.024	0.089	1.614	83 / 83
"gcp_13" (3D)	0.020/ 5.000	-0.004	0.013	0.050	2.425	92 / 92
"gcp_14" (3D)	0.020/ 5.000	0.010	0.022	-0.006	0.548	84 / 84
Mean [m]		-0.003445	0.006651	-0.030412		
Sigma [m]		0.033994	0.030877	0.111580		
RMS Error [m]		0.034168	0.031586	0.115650		

Localisation accuracy per GCP and mean errors in the three coordinate directions. The last column counts the number of calibrated images where the GCP has been automatically verified vs. manually marked.

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-15.00	0.00	1.84	87.44
-15.00	-12.00	0.00	1.89	0.00
-12.00	-9.00	0.05	1.94	0.00
-9.00	-6.00	0.21	3.20	0.00
-6.00	-3.00	1.24	31.37	0.00
-3.00	0.00	57.56	44.11	6.59
0.00	3.00	40.78	7.26	5.90
3.00	6.00	0.15	3.87	0.08
6.00	9.00	0.00	2.28	0.00
9.00	12.00	0.00	0.99	0.00
12.00	15.00	0.00	0.19	0.00
15.00	-	0.00	1.06	0.00
Mean [m]		-0.272743	-2.240204	-60.711864
Sigma [m]		1.033949	5.726056	23.160828
RMS Error [m]		1.069317	6.148677	64.979646

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]	99.16	84.36	12.56
[-2.00, 2.00]	99.95	93.34	12.56
[-3.00, 3.00]	100.00	97.10	12.56
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.

Geolocation Orientational Variance	RMS [degree]
Omega	0.537
Phi	1.450
Kappa	4.615

Geolocation RMS error of the orientation angles given by the difference between the initial and computed image orientation angles.

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Core(TM) i7-8700K CPU @ 3.70GHz RAM: 64GB GPU: NVIDIA GeForce GTX 1080 Ti (Driver: 25.21.14.1735), Intel(R) UHD Graphics 630 (Driver: 22.20.16.4758)
Operating System	Windows 10 Education, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Ground Control Point (GCP) Coordinate System	WGS 84 / UTM zone 11N (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 11N (EGM96 Geoid)

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Custom, Image Scale: 1
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_merge_eldo_4k_2_re_merge_sequ_4k_1_re» processing	optimize relative rotation using a subset of secondary cameras