Quality Report

> ⚠ **Important**: Click on the different icons for:
>
> ❓ Help to analyze the results in the Quality Report
>
> ℹ Additional information about the sections

> 💡 Click here for additional tips to analyze the Quality Report

Summary

Project	kulim
Processed	2023-08-07 09:53:18
Camera Model Name(s)	FC6310_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	3.76 cm / 1.48 in
Area Covered	0.592 km^2 / 59.1915 ha / 0.23 sq. mi. / 146.3412 acres
Time for Initial Processing (without report)	37m:51s

Quality Check

❓ **Images**	median of 49681 keypoints per image	✅
❓ **Dataset**	576 out of 579 images calibrated (99%), all images enabled	✅
❓ **Camera Optimization**	1.37% relative difference between initial and optimized internal camera parameters	✅
❓ **Matching**	median of 10477.8 matches per calibrated image	✅
❓ **Georeferencing**	yes, no 3D GCP	⚠

❓ Preview

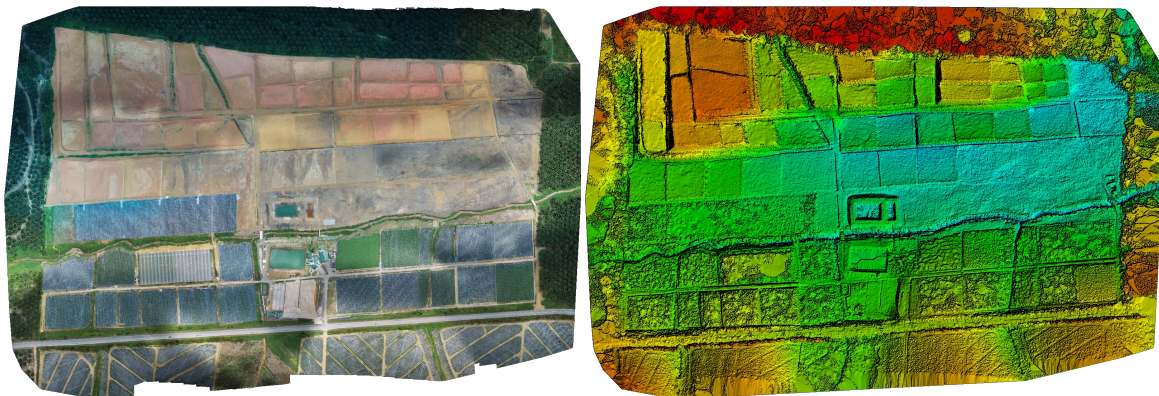**Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.**

Calibration Details

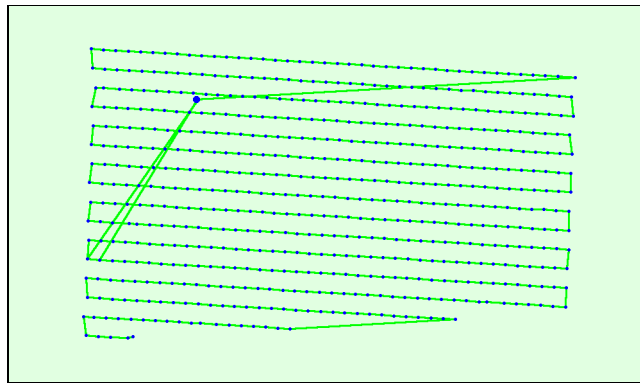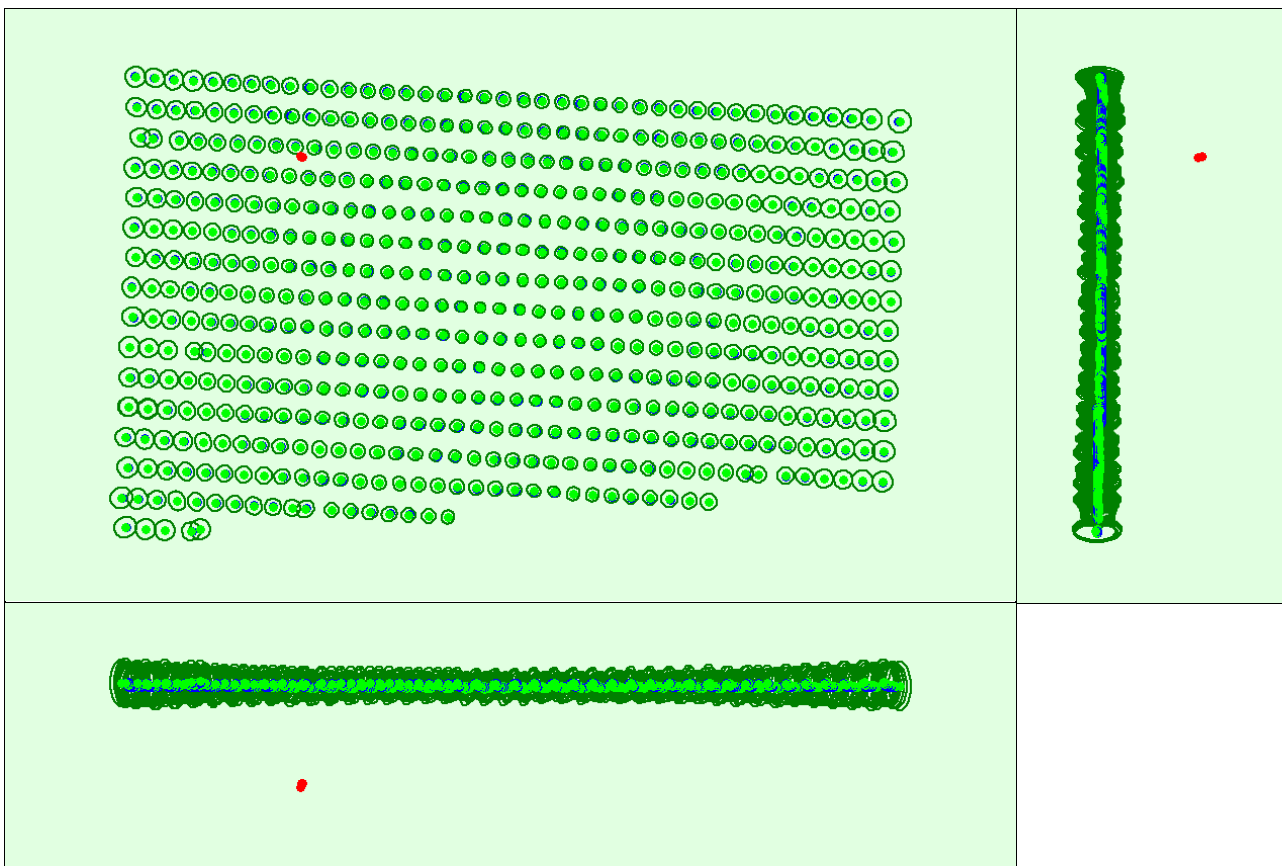|	
Number of Calibrated Images	576 out of 579
Number of Geolocated Images	579 out of 579

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 100x 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	0.085	0.084	0.174	0.033	0.033	0.012
Sigma	0.015	0.014	0.030	0.002	0.007	0.000

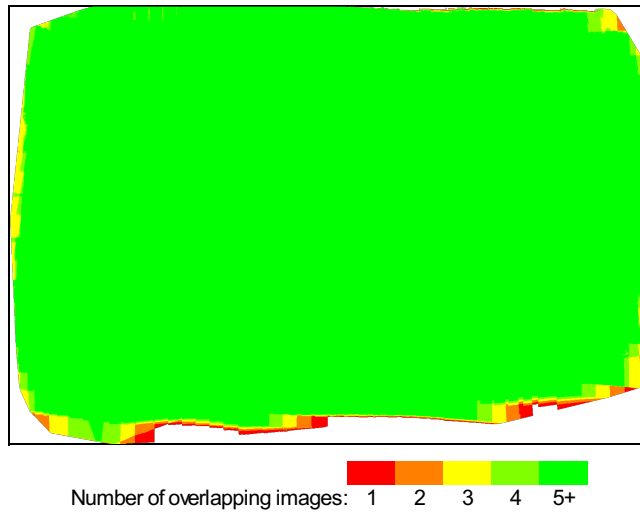## ? Overlap

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).
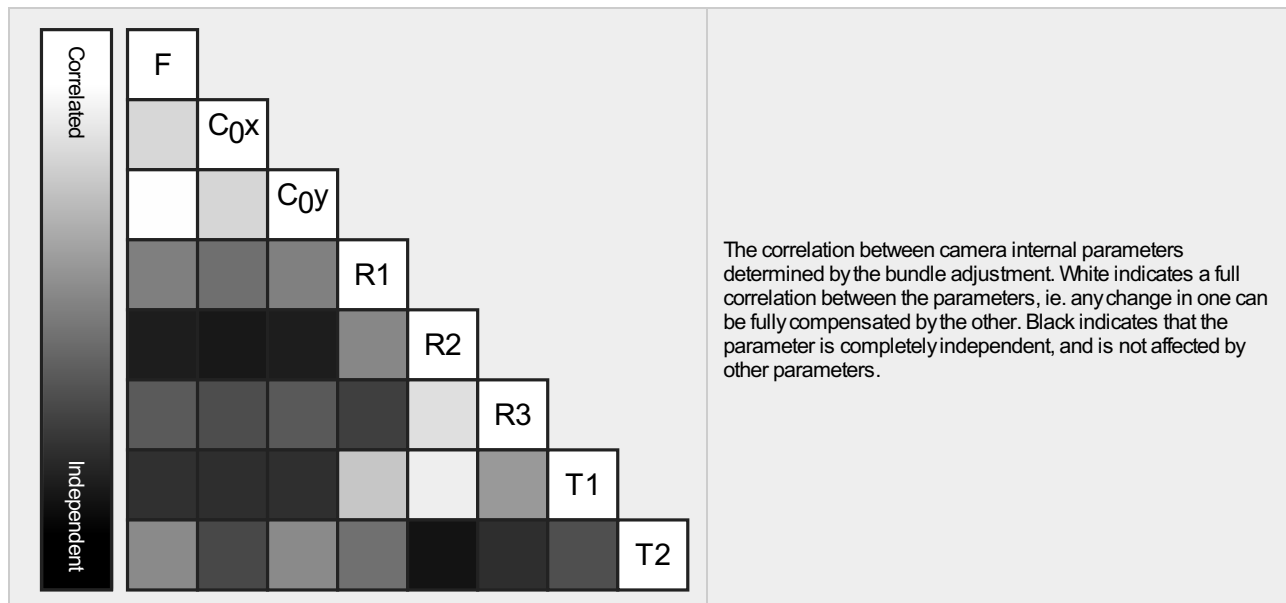
Bundle Block Adjustment Details

Number of 2D Keypoint Observations for Bundle Block Adjustment	6398631
Number of 3D Points for Bundle Block Adjustment	1817754
Mean Reprojection Error [pixels]	0.135

Internal Camera Parameters

FC6310_8.8_5472x3648 (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6310S_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3668.759 [pixel] 8.604 [mm]	2736.001 [pixel] 6.417 [mm]	1823.999 [pixel] 4.278 [mm]	0.003	-0.008	0.008	-0.000	0.000
Optimized Values	3719.174 [pixel] 8.722 [mm]	2721.691 [pixel] 6.383 [mm]	1805.827 [pixel] 4.235 [mm]	-0.015	0.002	0.007	-0.001	-0.001
Uncertainties (Sigma)	7.113 [pixel] 0.017 [mm]	0.198 [pixel] 0.000 [mm]	1.127 [pixel] 0.003 [mm]	0.000	0.000	0.000	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.
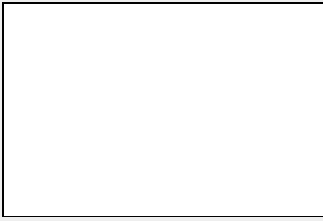
The number of Automatic Tie Points (ATPs) per pixel, averaged over all images of the camera model, is color coded between black and white. White indicates that, on average, more than 16 ATPs have been extracted at the pixel location. Black indicates that, on average, 0 ATPs have been extracted at the 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.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	49681	10478
Min	20587	2432
Max	77219	24785
Mean	47111	11109

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	1038412
In 3 Images	325083
In 4 Images	150664
In 5 Images	85064
In 6 Images	55213
In 7 Images	34482
In 8 Images	23894
In 9 Images	17990
In 10 Images	14068
In 11 Images	11251
In 12 Images	9385
In 13 Images	7272
In 14 Images	5972
In 15 Images	5094
In 16 Images	4464
In 17 Images	3831
In 18 Images	3466
In 19 Images	2788
In 20 Images	2424
In 21 Images	2159
In 22 Images	1850
In 23 Images	1610
In 24 Images	1531
In 25 Images	1208
In 26 Images	1061
In 27 Images	906
In 28 Images	879
In 29 Images	811
In 30 Images	694
In 31 Images	581
In 32 Images	544
In 33 Images	466
In 34 Images	412
In 35 Images	428
In 36 Images	378
In 37 Images	308
In 38 Images	271
In 39 Images	206
In 40 Images	178

In 41 Images	135
In 42 Images	99
In 43 Images	70
In 44 Images	51
In 45 Images	37
In 46 Images	26
In 47 Images	24
In 48 Images	13
In 49 Images	1

2D Keypoint Matches

Uncertainty ellipses 500x magnified
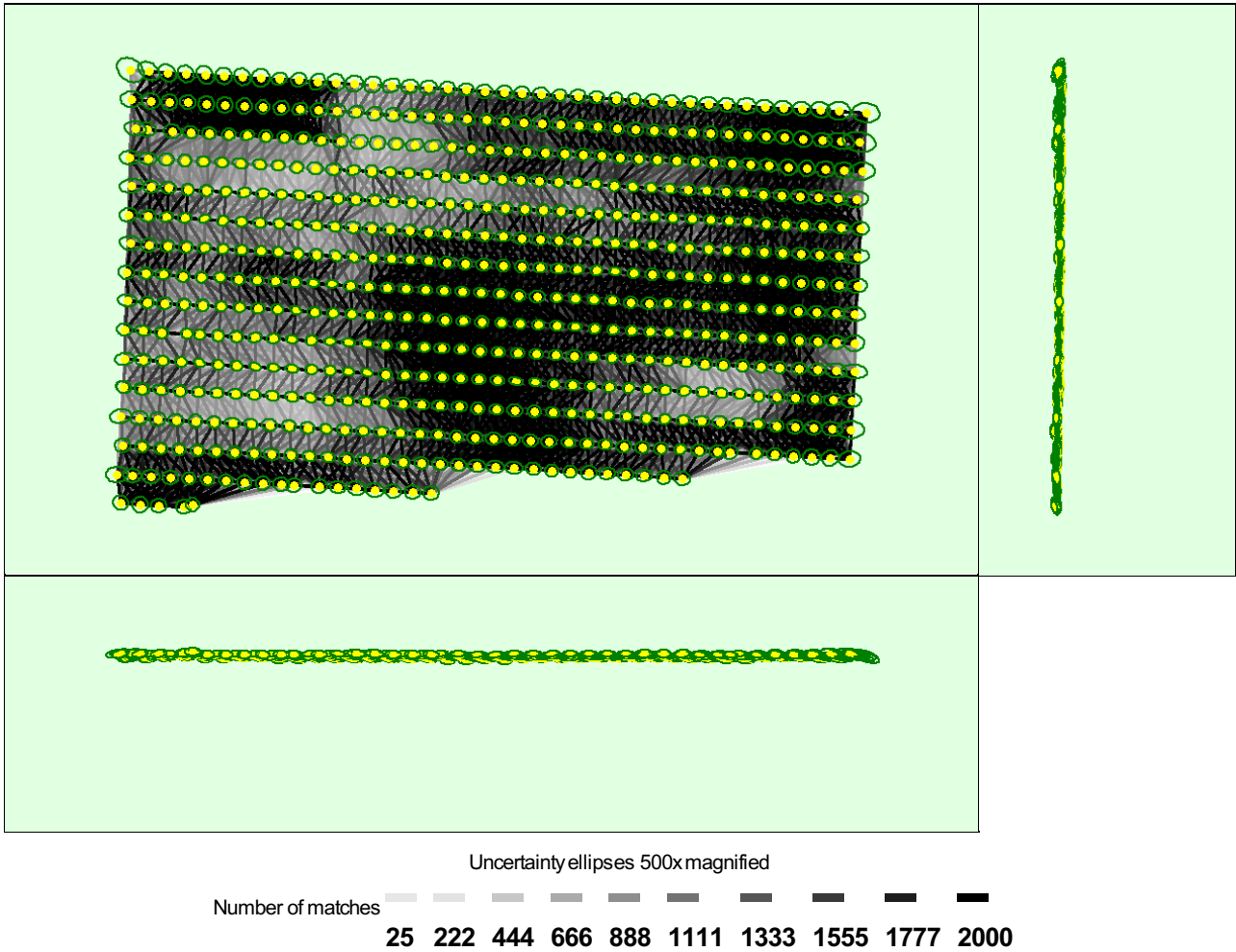
Number of matches

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. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result.

Relative camera position and orientation uncertainties

	X [m]	Y [m]	Z [m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.017	0.013	0.007	0.005	0.006	0.002
Sigma	0.003	0.002	0.002	0.001	0.001	0.000

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	0.00	0.00	0.00
-3.00	0.00	43.75	49.31	52.08
0.00	3.00	56.25	50.69	47.92
3.00	6.00	0.00	0.00	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]		-0.000000	-0.000000	-0.000000
Sigma [m]		0.680532	0.540187	1.053807
RMS Error [m]		0.680532	0.540187	1.053807

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.

Geolocation Orientational Variance	RMS [degree]
Omega	0.773
Phi	0.654
Kappa	3.799

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: 13th Gen Intel(R) Core(TM) i5-13400 RAM: 64GB GPU: NVIDIA T600 (Driver: 31.0.15.2824)
Operating System	Windows 10 Home, 64-bit

Coordinate Systems ⓘ

Image Coordinate System	WGS 84 (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 48N (EGM96 Geoid)

Processing Options ⓘ

Detected Template	No Template Available

Keypoints Image Scale	Full, 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: Auto, no

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	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	03h:20m:44s
Time for Point Cloud Classification	27m:33s
Time for 3D Textured Mesh Generation	26m:17s

Results

Number of Generated Tiles	4
Number of 3D Densified Points	51741429
Average Density (per m^3)	59.48

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (3.76 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Raster DSM	Generated: yes Method: Inverse Distance Weighting Merge Tiles: yes
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: yes
Grid DSM	Generated: yes, Spacing [cm]: 100
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	5 x GSD (3.76 [cm/pixel])
Contour Lines Generation	Generated: yes Contour Base [m]: 0 Elevation Interval [m]: 5 Resolution [cm]: 100 Minimum Line Size [vertices]: 20
Time for DSM Generation	33m:59s
Time for Orthomosaic Generation	59m:31s

Time for DTM Generation	09m:21s
Time for Contour Lines Generation	03s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s