Quality Report

Generated with Pix4Dmapper version 4.5.6

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	plot1_16_may_2020
Processed	2020-05-17 12:40:41
Camera Model Name(s)	Sequoia_4.9_4608x3456 (PI040378AD7E003404) (RGB)
Average Ground Sampling Distance (GSD)	1.79 cm / 0.71 in
Area Covered	0.258 km^2 / 25.8184 ha / 0.10 sq. mi. / 63.8317 acres
Time for Initial Processing (without report)	21m:22s

Quality Check

Images	median of 25810 keypoints per image	✓
Dataset	716 out of 846 images calibrated (84%), 11 images disabled	⚠
Camera Optimization	2.73% relative difference between initial and optimized internal camera parameters	✓
Matching	median of 2236.35 matches per calibrated image	✓
Georeferencing	yes, no 3D GCP	⚠

Preview

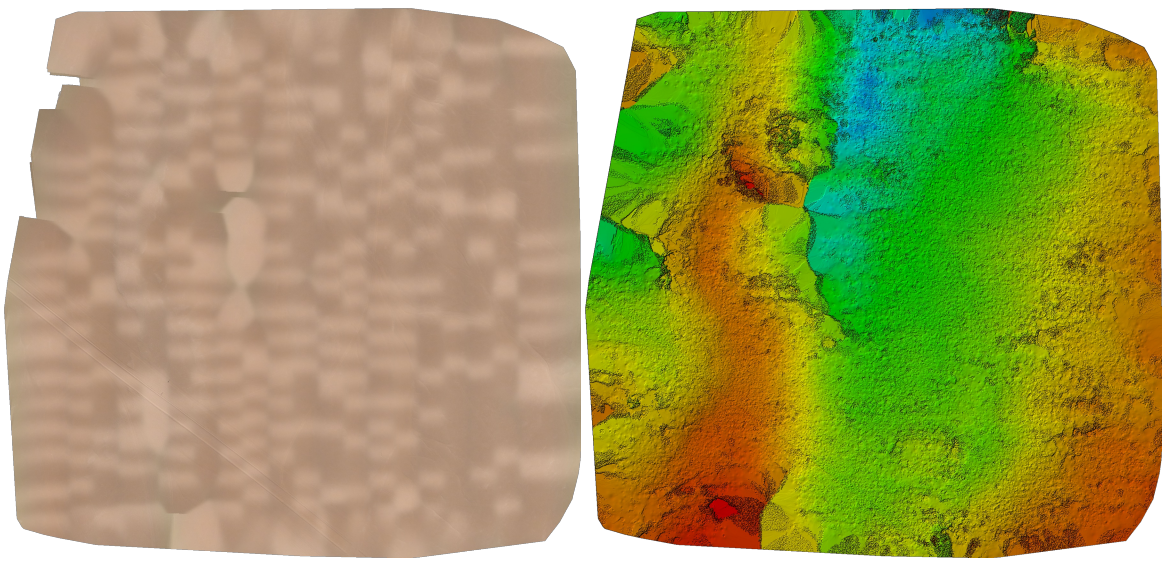


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	716 out of 857
Number of Geolocated Images	857 out of 857

Initial Image Positions

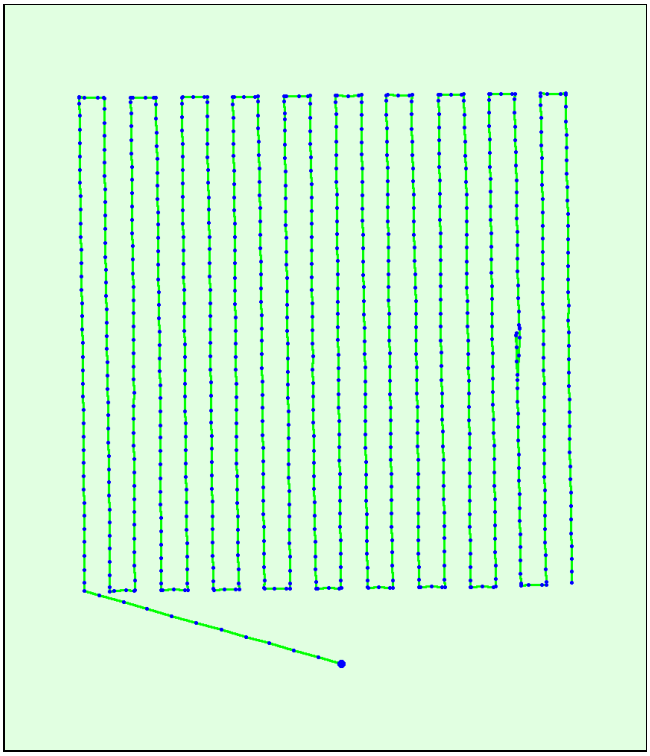
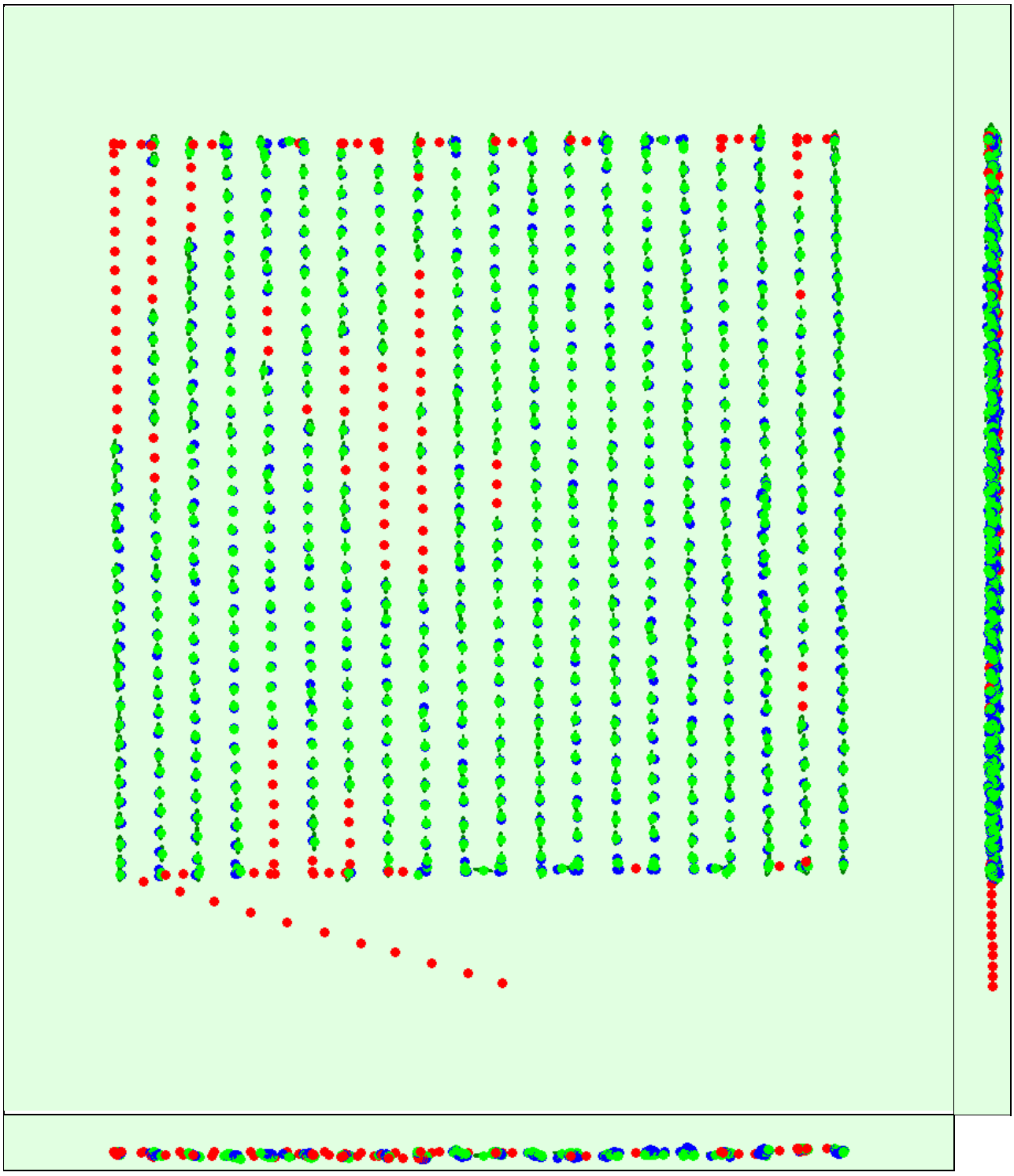


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions



Uncertainty ellipses 5x 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]	Camera Displacement X [m]	Camera Displacement Y [m]	Camera Displacement Z [m]
Mean	0.143	0.795	0.218	0.726	0.109	0.090	0.046	0.054	0.405
Sigma	0.077	0.143	0.052	0.133	0.071	0.054	0.035	0.054	0.071

Overlap

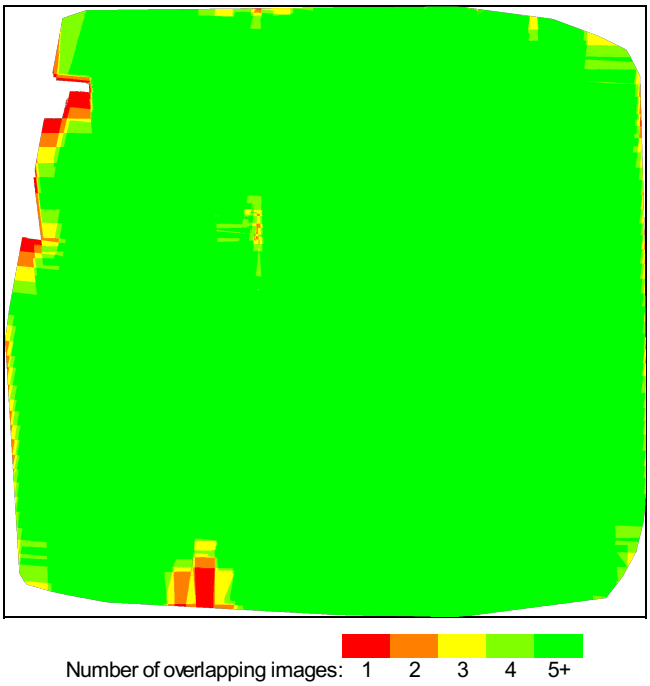


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

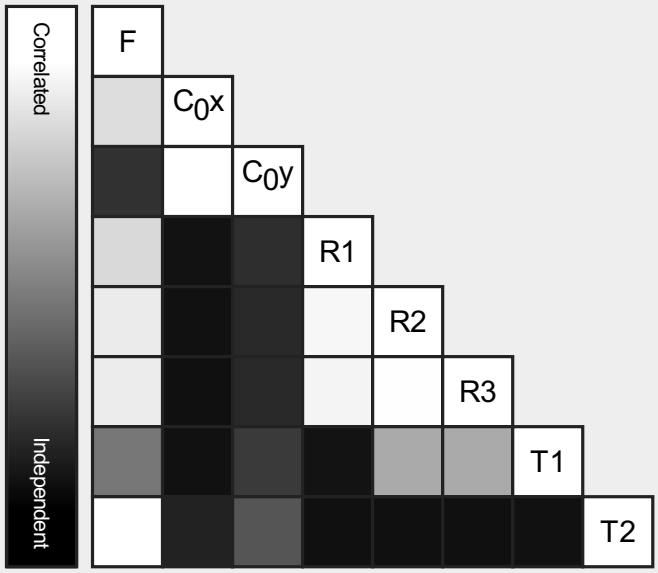
Number of 2D Keypoint Observations for Bundle Block Adjustment	1637044
Number of 3D Points for Bundle Block Adjustment	697847
Mean Reprojection Error [pixels]	0.451

Internal Camera Parameters

Sequoia_4.9_4608x3456 (PI040378AD7E003404) (RGB). Sensor Dimensions: 6.100 [mm] x 4.575 [mm]

EXIF ID: Sequoia_4.9_4608x3456

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3627.333 [pixel] 4.802 [mm]	2307.540 [pixel] 3.055 [mm]	1709.109 [pixel] 2.262 [mm]	0.178	-0.492	0.415	-0.000	0.000
Optimized Values	3528.072 [pixel] 4.670 [mm]	2331.522 [pixel] 3.086 [mm]	1729.955 [pixel] 2.290 [mm]	0.161	-0.410	0.323	0.001	-0.000
Uncertainties (Sigma)	12.452 [pixel] 0.016 [mm]	1.359 [pixel] 0.002 [mm]	1.425 [pixel] 0.002 [mm]	0.001	0.006	0.007	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	25810	2236
Min	24748	287
Max	26229	5236
Mean	25761	2286

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	555882
In 3 Images	91644
In 4 Images	27800
In 5 Images	10957
In 6 Images	5143
In 7 Images	2772
In 8 Images	1564
In 9 Images	864
In 10 Images	507
In 11 Images	299
In 12 Images	190
In 13 Images	110
In 14 Images	50
In 15 Images	28
In 16 Images	19
In 17 Images	8
In 18 Images	6
In 19 Images	4

2D Keypoint Matches

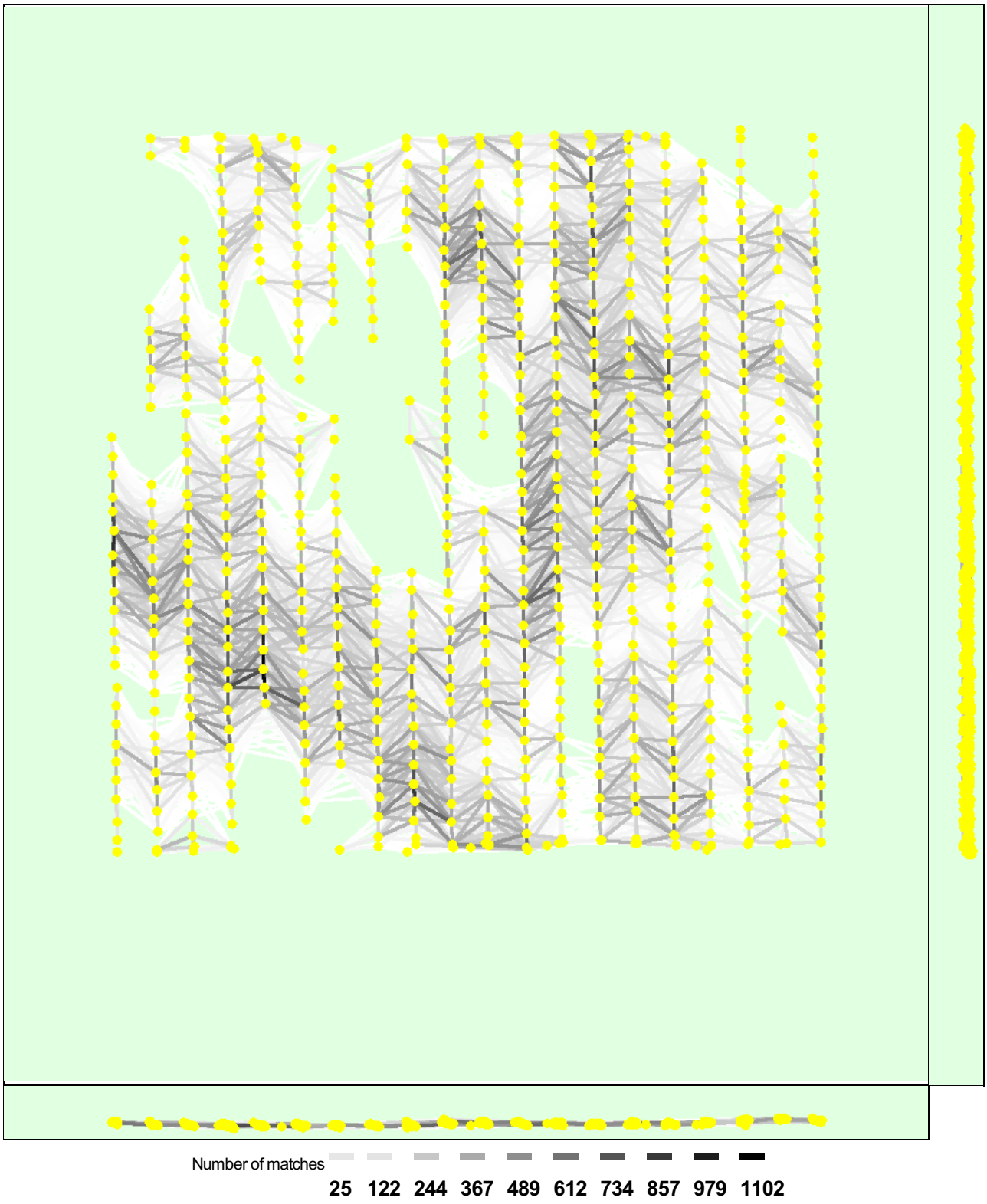


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images.

Geolocation Details

Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-1.88	1.68	8.52	2.65
-1.88	-1.50	2.37	4.61	6.28

-1.50	-1.12	4.05	6.70	7.82
-1.12	-0.75	8.52	8.10	8.52
-0.75	-0.38	12.29	9.64	13.41
-0.38	0.00	17.04	12.85	14.94
0.00	0.38	24.58	12.15	13.83
0.38	0.75	13.55	10.06	11.45
0.75	1.12	9.92	9.78	5.87
1.12	1.50	2.37	5.31	4.19
1.50	1.88	2.93	4.33	4.75
1.88	-	0.70	7.96	6.28
Mean [m]		-0.002783	-0.000310	-0.015281
Sigma [m]		0.816710	1.380640	1.102505
RMS Error [m]		0.816714	1.380640	1.102611

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]	56.15	35.61	59.78
[-2.00, 2.00]	84.08	62.57	88.83
[-3.00, 3.00]	96.37	78.91	98.60
Mean of Geolocation Accuracy [m]	0.559371	0.559371	0.906468
Sigma of Geolocation Accuracy [m]	0.026770	0.026770	0.086398

Images X, Y, Z represent the percentage of images with a relative geolocation error in X, Y, Z.

Geolocation Orientational Variance	RMS [degree]
Omega	15.054
Phi	40.460
Kappa	93.728

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

Rolling Shutter Statistics

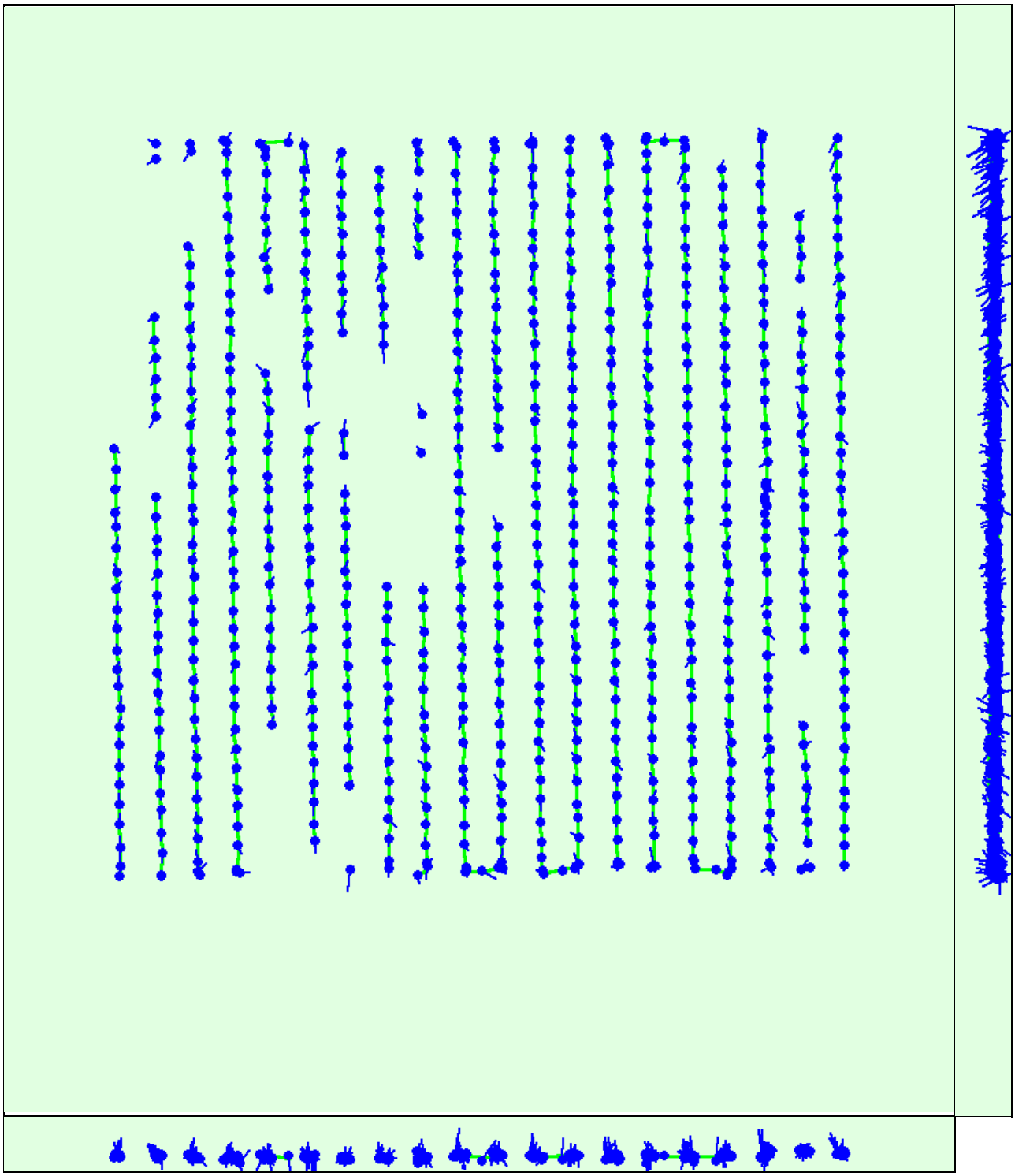


Figure 6: Camera movement estimated by the rolling shutter camera model. The green line follows the computed image positions. The blue dots represent the camera position at the start of the exposure. The blue lines represent the camera motion during the rolling shutter readout, re-scaled by a project dependant scaling factor for better visibility.

Median Camera Speed	5.4735 [m/s]
Median Camera Displacement During Sensor Readout)	2.016 [m]
Median Rolling Shutter Readout Time	377.2011 [ms]

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Core(TM) i7-7700HQ CPU @ 2.80GHz RAM: 16GB GPU: Intel(R) HD Graphics 630 (Driver: 21.20.16.4550)
Operating System	Windows 10 Home Single Language, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84 (EGM96 Geoid)
Output Coordinate System	WGS 84 / UTM zone 33S (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: yes
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Alternative 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	Low (Fast)
Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: yes
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	02h:24m:41s
Time for Point Cloud Classification	04m:13s
Time for 3D Textured Mesh Generation	38m:03s

Results

Number of Generated Tiles	1
Number of 3D Densified Points	14150042
Average Density (per m^3)	153.48

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (1.79 [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: yes 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 (1.79 [cm/pixel])
Time for DSM Generation	32m:23s
Time for Orthomosaic Generation	02h:31m:09s
Time for DTM Generation	35m:47s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s