Processing Report

Summary

Project	LOOP3_st303_st308_20190523
Processed	2019-10-10 09:17:10
Camera Model Name(s)	FC6310R_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	2.26 cm / 0.89 in
Area Covered	0.023 km^2 / 2.3242 ha / 0.01 sq. mi. / 5.7463 acres
Time for Initial Processing (without report)	14m:42s

Quality Check

	Images	median of 11078 keypoints per image	✓
	Dataset	34 out of 317 images calibrated (10%), all images enabled	⚠
	Camera Optimization	55.64% relative difference between initial and optimized internal camera parameters	⚠
	Matching	median of 1137.94 matches per calibrated image	✓
	Georeferencing	yes, no 3D GCP	⚠

Preview

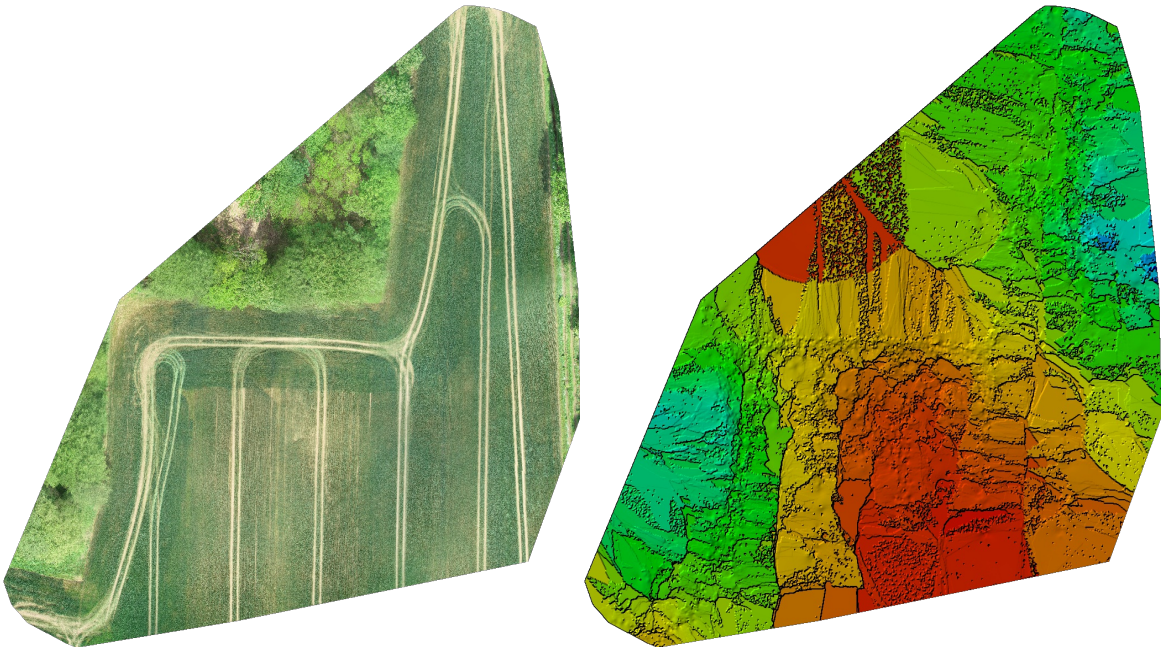


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	34 out of 317
Number of Geolocated Images	317 out of 317

Initial Image Positions

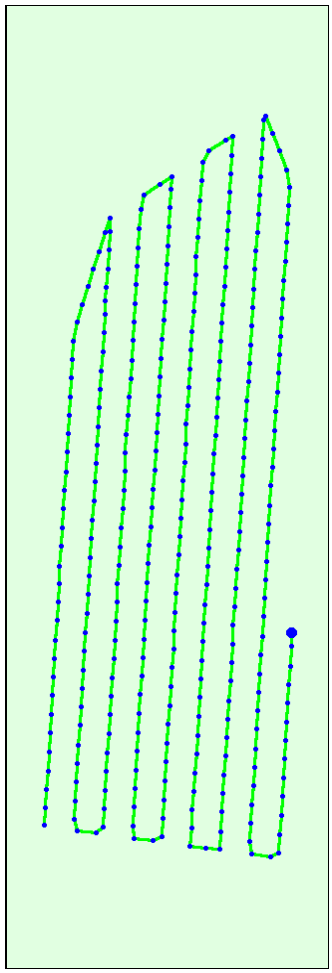


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

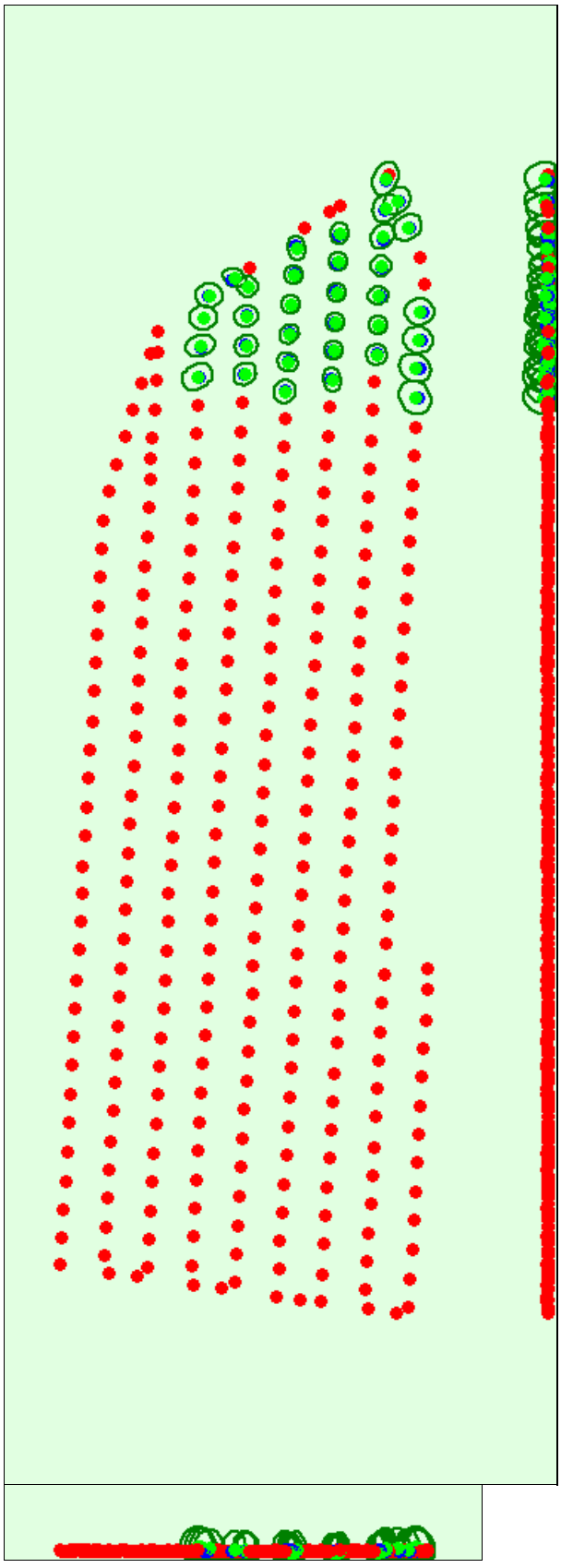


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled or uncalibrated images. 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	1.493	1.470	2.272	0.778	0.775	0.767
Sigma	0.270	0.243	0.075	0.084	0.104	0.005

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

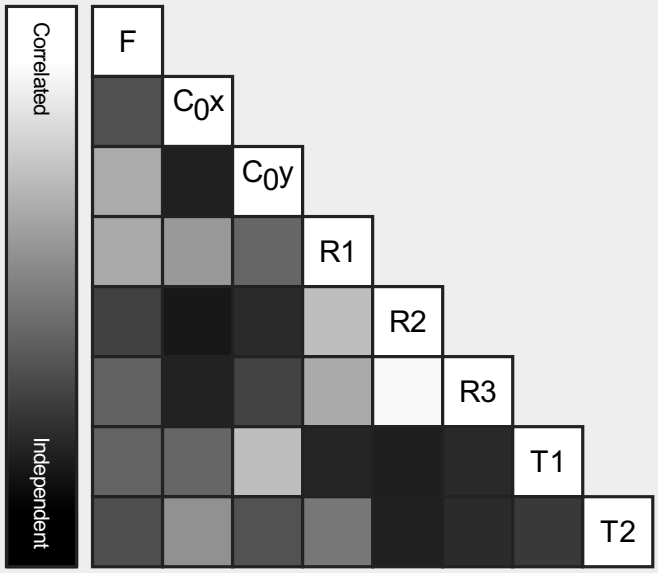
Number of 2D Keypoint Observations for Bundle Block Adjustment	38886
Number of 3D Points for Bundle Block Adjustment	15060
Mean Reprojection Error [pixels]	0.114

Internal Camera Parameters

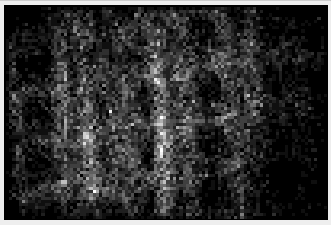
FC6310R_8.8_5472x3648 (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

EXIF ID: FC6310R_8.8_5472x3648

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3658.300 [pixel] 8.580 [mm]	2722.500 [pixel] 6.385 [mm]	1835.100 [pixel] 4.304 [mm]	-0.269	0.112	-0.033	0.000	-0.001
Optimized Values	5693.936 [pixel] 13.354 [mm]	2730.262 [pixel] 6.403 [mm]	1879.750 [pixel] 4.409 [mm]	-0.038	-0.097	0.223	0.003	-0.002
Uncertainties (Sigma)	311.665 [pixel] 0.731 [mm]	9.153 [pixel] 0.021 [mm]	9.143 [pixel] 0.021 [mm]	0.011	0.068	0.162	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	11078	1138
Min	7239	584
Max	21809	1959
Mean	11306	1144

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	11214
In 3 Images	2049
In 4 Images	753
In 5 Images	360
In 6 Images	215
In 7 Images	150
In 8 Images	101
In 9 Images	62
In 10 Images	50
In 11 Images	42
In 12 Images	27
In 13 Images	20
In 14 Images	12
In 15 Images	3
In 17 Images	2

2D Keypoint Matches

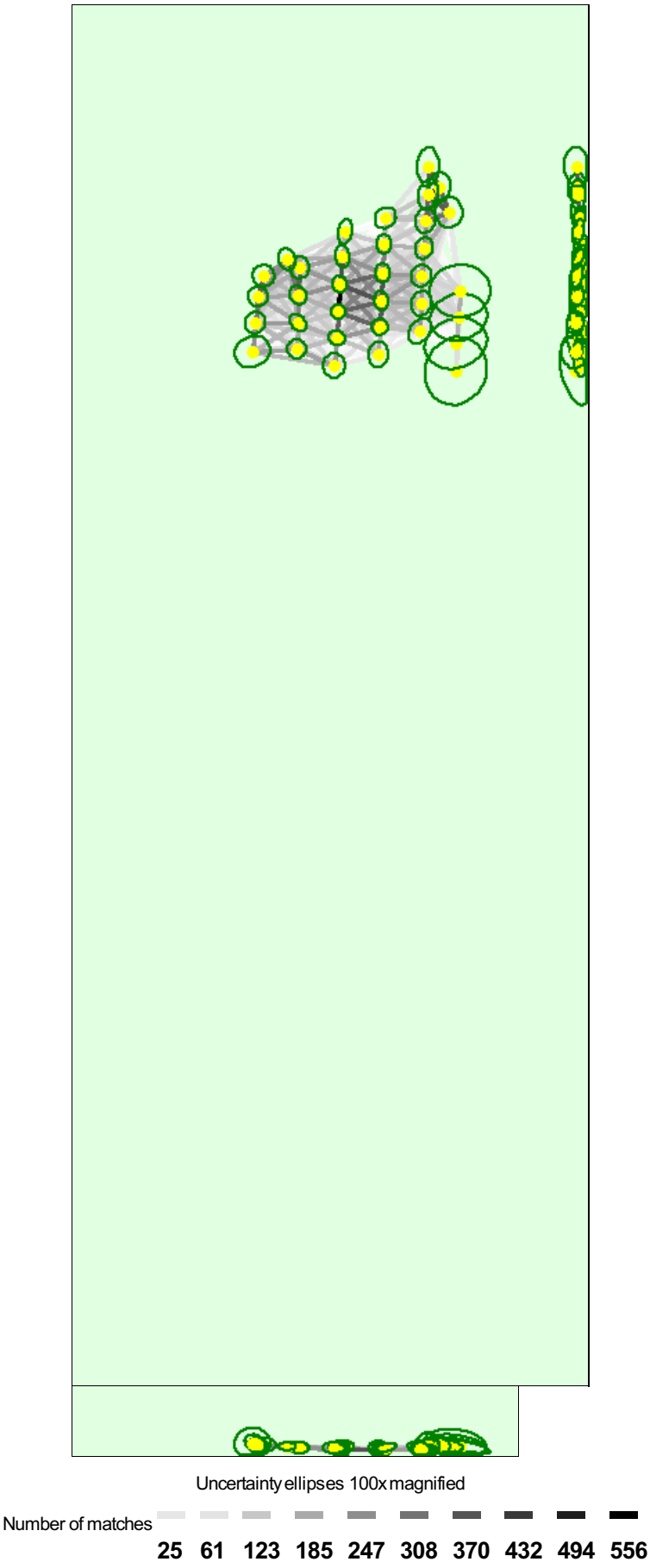


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.083	0.090	0.049	0.091	0.095	0.041
Sigma	0.046	0.040	0.019	0.040	0.046	0.001

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	58.82	50.00	44.12
0.00	3.00	41.18	50.00	55.88
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	-0.000001	0.000040
Sigma [m]		0.834181	0.768219	1.212570
RMS Error [m]		0.834181	0.768219	1.212570

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	2.130
Phi	3.027
Kappa	136.149

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) i5-6300U CPU @ 2.40GHz RAM: 16GB GPU: Intel(R) HD Graphics 520 (Driver: 22.20.16.4836)
Operating System	Windows 10 Enterprise 2016 LTSB, 64-bit

Coordinate Systems

Image Coordinate System	WGS 84
Output Coordinate System	WGS_1984_UTM_Zone_32N (EGM96 Geoid)

Processing Options

Detected Template	2D Rapid
Keypoints Image Scale	Rapid, Image Scale: 0.5
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, yes

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	4 x GSD (2.26 [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
Raster DTM	Generated: yes Merge Tiles: yes
DTM Resolution	5 x GSD (2.26 [cm/pixel])
Time for DSM Generation	09s
Time for Orthomosaic Generation	11m:33s
Time for DTM Generation	03m:39s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s