Summary

Project	CCER5
Processed	2020-11-02 10:10:28
Camera Model Name(s)	FC6310_8.8_5472x3648 (RGB)
Average Ground Sampling Distance (GSD)	2.94 cm / 1.16 in
Area Covered	0.543 km^2 / 54.2661 ha / 0.21 sq. mi. / 134.1639 acres
Time for Initial Processing (without report)	03h:30m:02s

Quality Check

	Images	median of 68018 keypoints per image	✓
	Dataset	377 out of 377 images calibrated (100%), all images enabled	✓
	Camera Optimization	7.11% relative difference between initial and optimized internal camera parameters	⚠
	Matching	median of 39539.7 matches per calibrated image	✓
	Georeferencing	yes, no 3D GCP	⚠

Preview

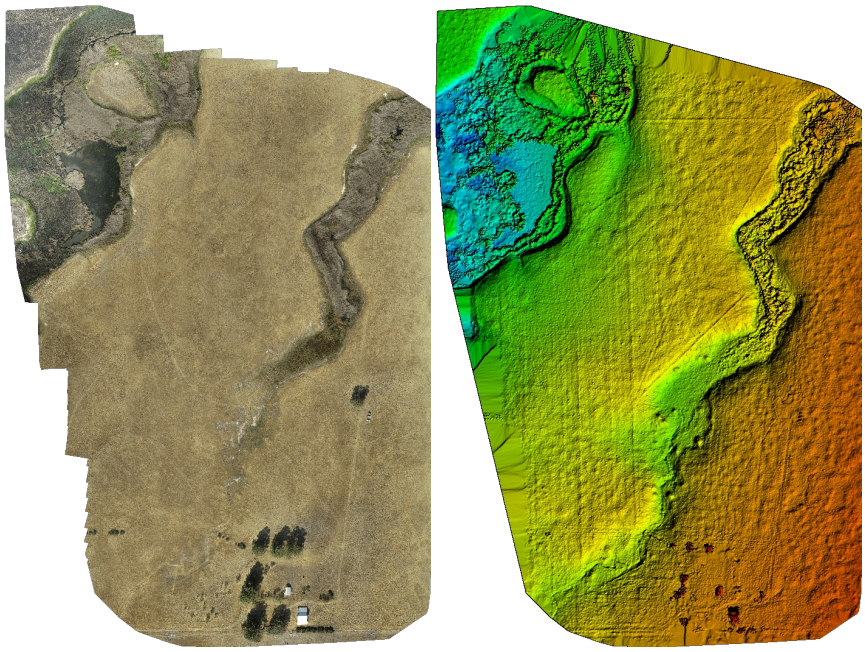


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	377 out of 377
Number of Geolocated Images	377 out of 377

Initial Image Positions

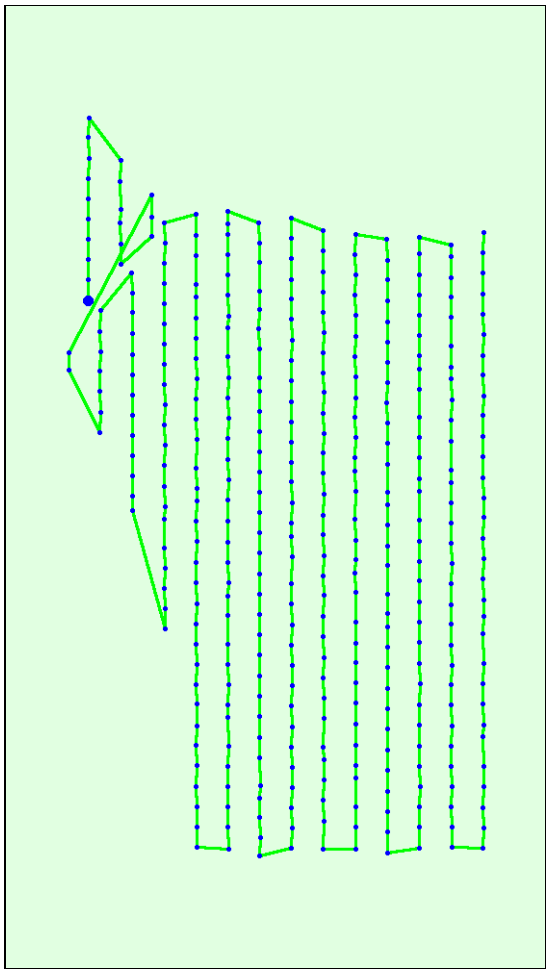


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

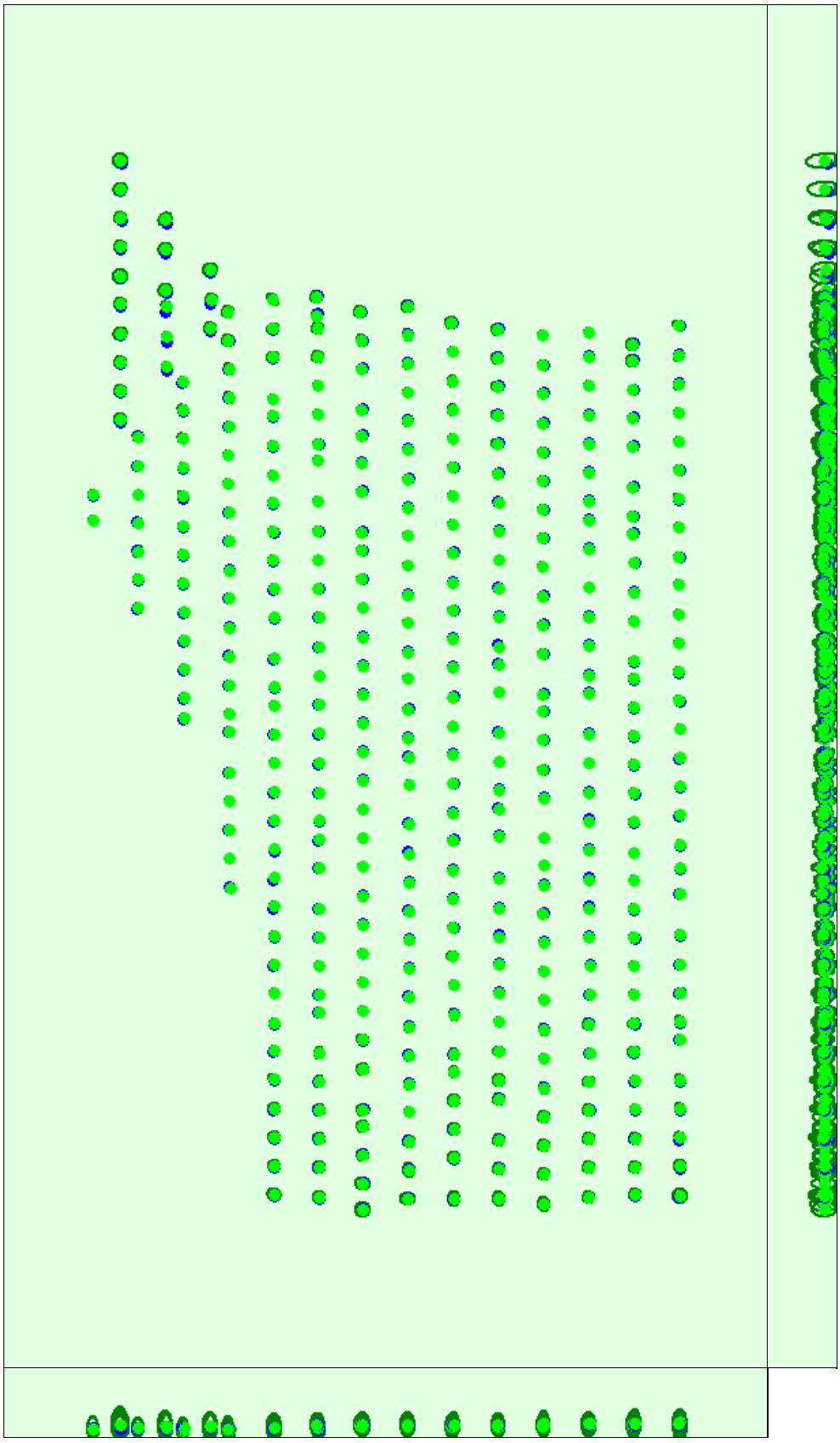


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Dark green ellipses 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	0.402	0.404	0.841	0.156	0.162	0.058
Sigma	0.073	0.075	0.155	0.036	0.018	0.000

Overlap

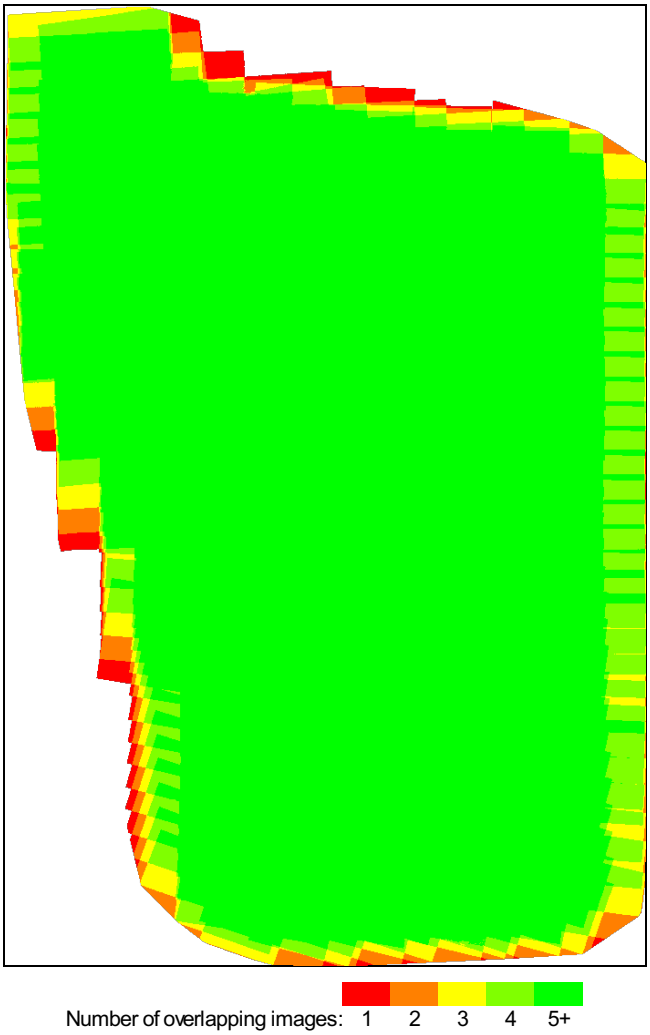


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

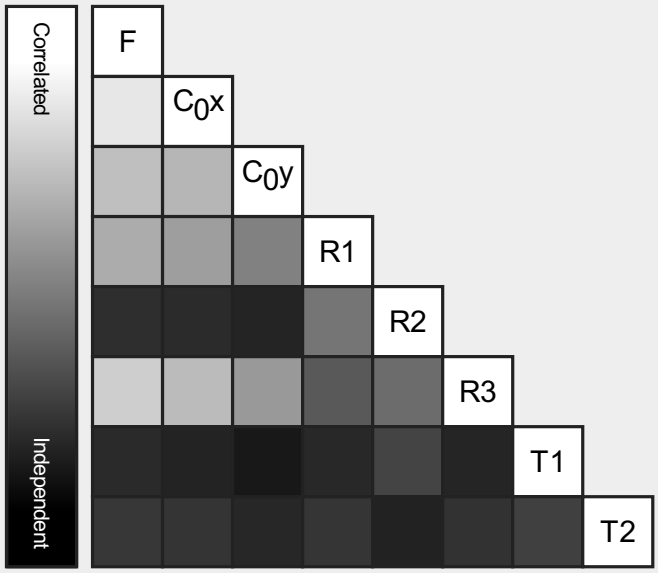
Number of 2D Keypoint Observations for Bundle Block Adjustment	14110840
Number of 3D Points for Bundle Block Adjustment	4545961
Mean Reprojection Error [pixels]	0.151

Internal Camera Parameters

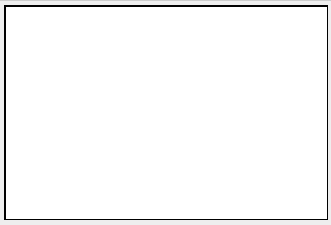
FC6310_8.8_5472x3648 (RGB). Sensor Dimensions: 12.833 [mm] x 8.556 [mm]

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	3929.704 [pixel] 9.216 [mm]	2752.581 [pixel] 6.456 [mm]	1822.984 [pixel] 4.275 [mm]	-0.014	0.002	0.010	-0.000	0.000
Uncertainties (Sigma)	69.133 [pixel] 0.162 [mm]	2.504 [pixel] 0.006 [mm]	1.262 [pixel] 0.003 [mm]	0.001	0.001	0.001	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.

2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	68018	39540
Min	51111	6660
Max	79947	52344
Mean	67591	37429

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	2585302
In 3 Images	877241
In 4 Images	425265
In 5 Images	224757
In 6 Images	140229
In 7 Images	94117
In 8 Images	64289
In 9 Images	41931
In 10 Images	29754
In 11 Images	21328
In 12 Images	15256
In 13 Images	10321
In 14 Images	6810
In 15 Images	4799
In 16 Images	2920
In 17 Images	1295
In 18 Images	286
In 19 Images	41
In 20 Images	17
In 21 Images	2
In 22 Images	1

2D Keypoint Matches

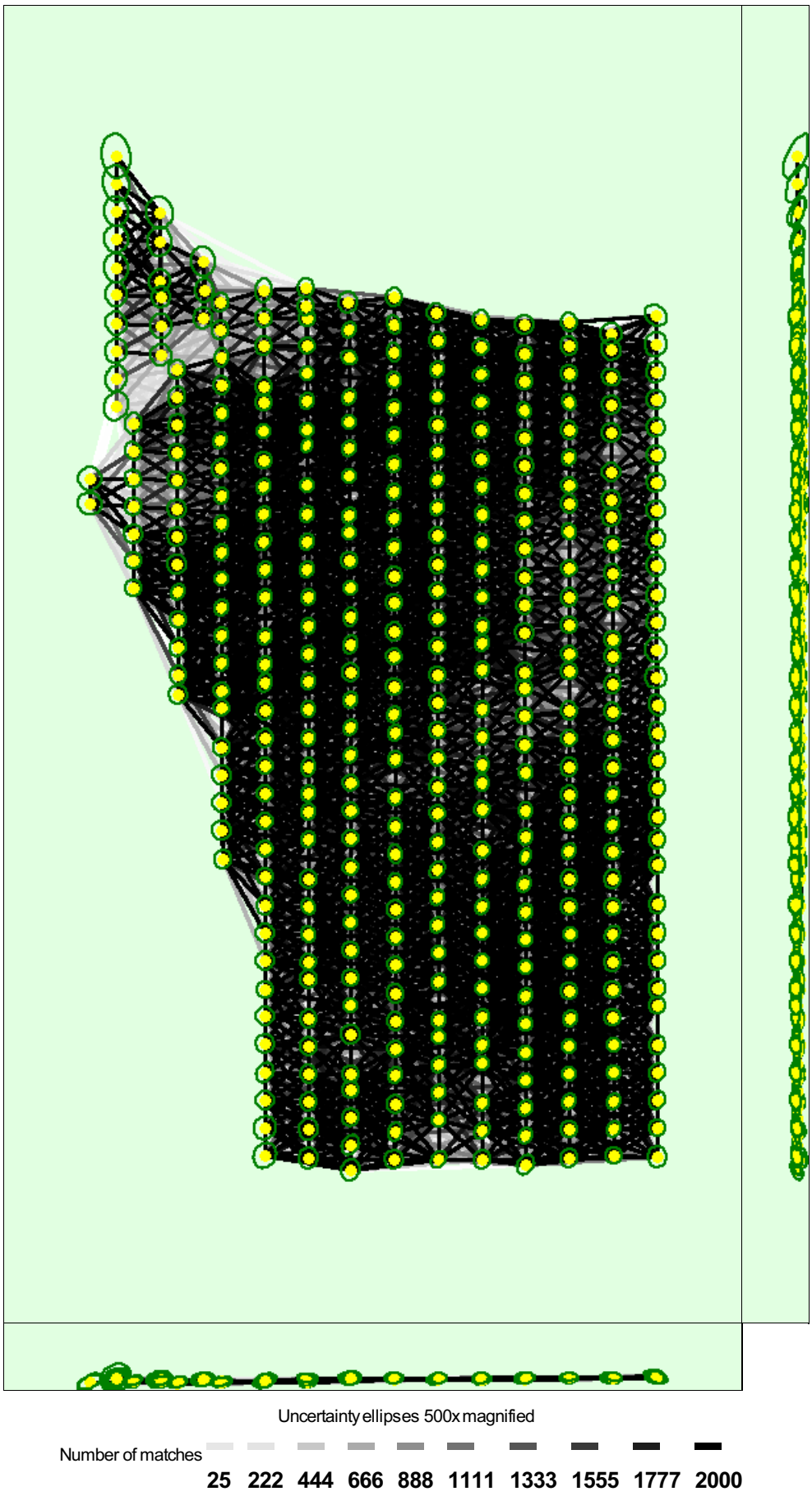


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.015	0.017	0.007	0.006	0.005	0.002
Sigma	0.002	0.003	0.002	0.001	0.001	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	1.33	0.27
-3.00	0.00	52.79	44.30	50.40
0.00	3.00	47.21	54.38	49.34
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]		0.000002	-0.000000	-0.000490
Sigma [m]		0.530724	0.996165	0.798614
RMS Error [m]		0.530724	0.996165	0.798614

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	0.481
Phi	1.278
Kappa	95.770

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) Xeon(R) CPU E5-1603 v3 @ 2.80GHz RAM: 16GB GPU: NVIDIA Quadro K2200 (Driver: 21.21.13.7711)

Operating System	Windows 10 Enterprise, 64-bit

Coordinate Systems

Image Coordinate System	GCS_WGS_1984 (EGM96 Geoid)
Output Coordinate System	WGS_1984_UTM_Zone_10N (EGM96 Geoid)

Processing Options

Detected Template	2D Full
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, yes

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	no
LOD	Generated: no
Advanced: Image Groups	group1
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Time for Point Cloud Densification	01h:49m:43s
Time for Point Cloud Classification	16m:21s
Time for 3D Textured Mesh Generation	NA

Results

Number of Processed Clusters	3
Number of Generated Tiles	4
Number of 3D Densified Points	44966393
Average Density (per m^3)	138.81

DSM, Orthomosaic and Index Details

Processing Options

DSM and Orthomosaic Resolution	1 x GSD (2.94 [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 (2.94 [cm/pixel])
Time for DSM Generation	49m:48s
Time for Orthomosaic Generation	01h:09m:42s

Time for DTM Generation	19m:58s
Time for Contour Lines Generation	00s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s