Summary

Project	Hillerød5
Processed	2017-09-20 09:28:05
Camera Model Name(s)	FC550RAW_DJIMFT15mmF1.7ASPH_15.0_4608x3456 (RGB)
Average Ground Sampling Distance (GSD)	1.09 cm / 0.43 in
Area Covered	0.068 km^2 / 6.8027 ha / 0.0263 sq. mi. / 16.8185 acres
Time for Initial Processing (without report)	38m:54s

Quality Check

Images	median of 13192 keypoints per image	✓
Dataset	437 out of 439 images calibrated (99%), all images enabled	✓
Camera Optimization	8.68% relative difference between initial and optimized internal camera parameters	⚠
Matching	median of 4860.38 matches per calibrated image	✓
Georeferencing	yes, 7 GCPs (7 3D), mean RMS error = 7.508 m	✗

Preview

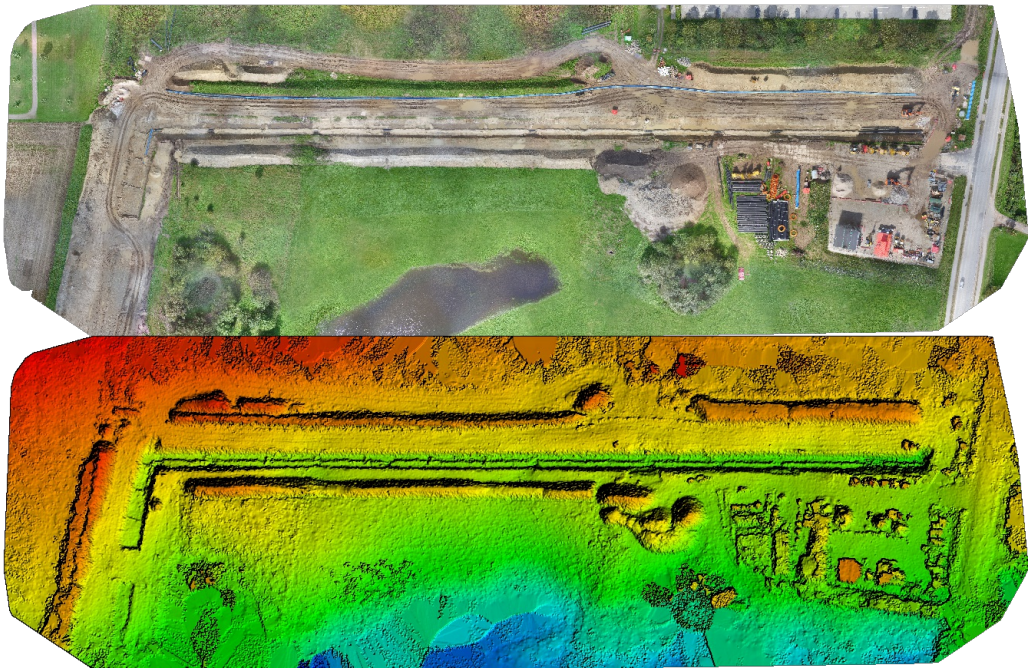


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details

Number of Calibrated Images	437 out of 439
Number of Geolocated Images	439 out of 439

Initial Image Positions

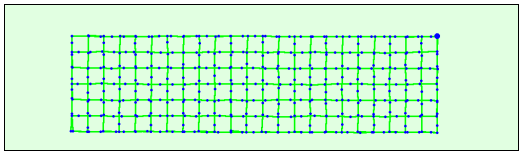


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

Computed Image/GCPs/Manual Tie Points Positions

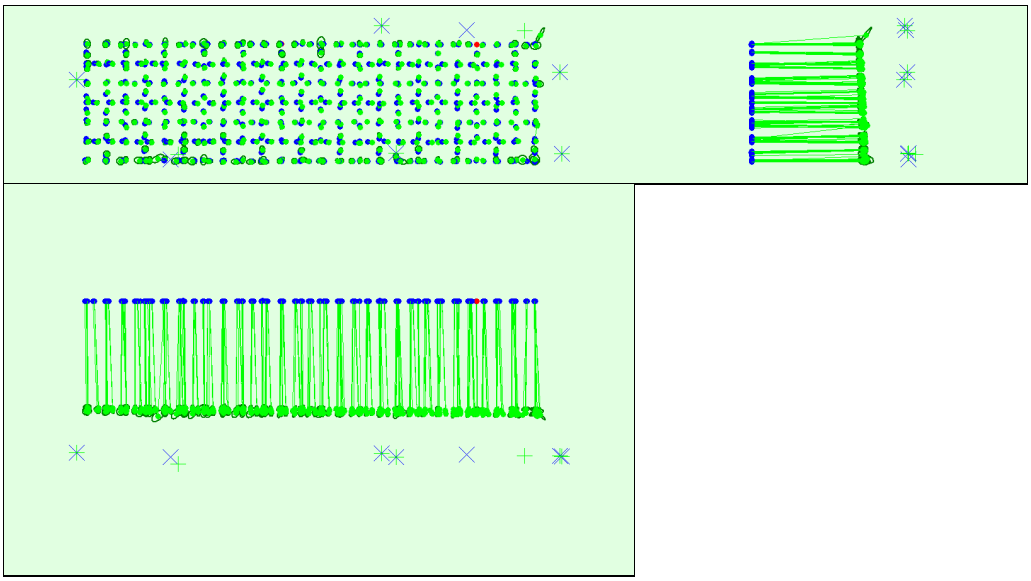


Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GCPs initial positions (blue crosses) and their computed positions (green crosses) in the top-view (XY plane), front-view (XZ plane), and side-view (YZ plane). Red dots indicate disabled 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	0.020	0.023	0.026	0.027	0.023	0.012
Sigma	0.007	0.006	0.007	0.009	0.008	0.004

Overlap

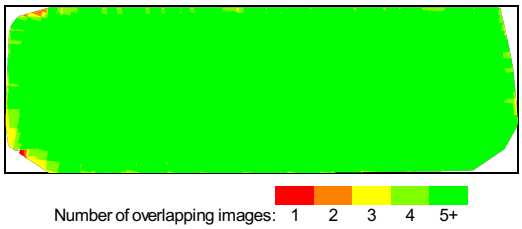


**Figure 4: Number of overlapping images computed for each pixel of the orthomosaic.
Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint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

Bundle Block Adjustment Details

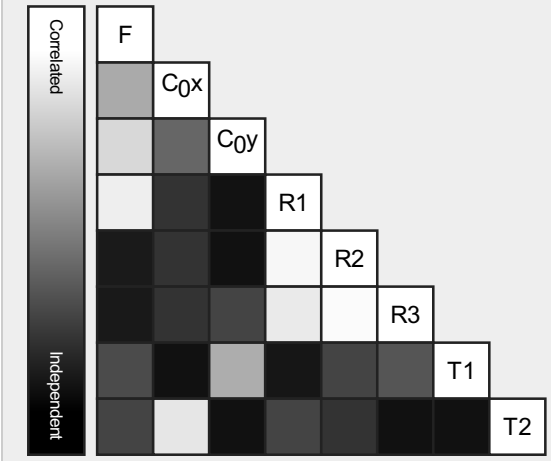
Number of 2D Keypoint Observations for Bundle Block Adjustment	2036765
Number of 3D Points for Bundle Block Adjustment	747768
Mean Reprojection Error [pixels]	0.154

Internal Camera Parameters

FC550RAW_DJIMFT15mmF1.7ASPH_15.0_4608x3456 (RGB). Sensor Dimensions: 17.500 [mm] x 13.125 [mm]

EXIF ID: FC550RAW_DJIMFT15mmF1.7ASPH_15.0_4608x3456

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	3949.717 [pixel] 15.000 [mm]	2304.002 [pixel] 8.750 [mm]	1728.001 [pixel] 6.562 [mm]	0.002	0.006	-0.008	-0.001	0.004
Optimized Values	4292.619 [pixel] 16.302 [mm]	2303.097 [pixel] 8.747 [mm]	1527.769 [pixel] 5.802 [mm]	-0.001	-0.007	0.007	0.000	0.000
Uncertainties (Sigma)	0.828 [pixel] 0.003 [mm]	0.246 [pixel] 0.001 [mm]	0.454 [pixel] 0.002 [mm]	0.000	0.002	0.003	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.

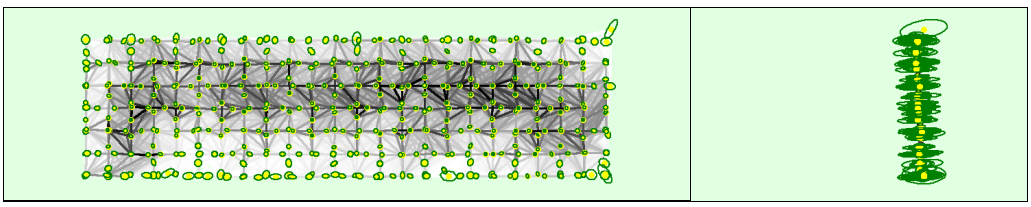
2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	13192	4860
Min	10689	73
Max	21645	8804
Mean	13309	4661

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	509684
In 3 Images	122605
In 4 Images	48951
In 5 Images	25192
In 6 Images	14254
In 7 Images	8885
In 8 Images	5915
In 9 Images	3924
In 10 Images	2683
In 11 Images	2094
In 12 Images	1341
In 13 Images	950
In 14 Images	634
In 15 Images	343
In 16 Images	209
In 17 Images	83
In 18 Images	18
In 19 Images	3

2D Keypoint Matches



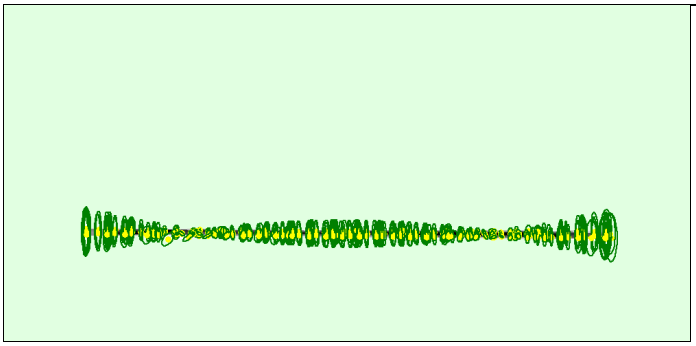


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.019	0.018	0.073	0.036	0.074	0.031
Sigma	0.007	0.007	0.040	0.018	0.037	0.015

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
7 (3D)	0.020/ 0.020	-7.571	-4.606	6.087	0.277	3 / 3
5 (3D)	0.020/ 0.020	0.013	0.020	0.002	1.009	3 / 3
4 (3D)	0.020/ 0.020	-0.121	0.049	-0.003	0.479	3 / 3
3 (3D)	0.020/ 0.020	-54.356	0.585	1.471	1.223	3 / 3
6 (3D)	0.020/ 0.020	0.097	-0.026	-0.002	0.453	3 / 3
2 (3D)	0.020/ 0.020	0.016	-0.084	-0.005	0.471	3 / 3
1 (3D)	0.020/ 0.020	-0.006	0.043	0.005	0.193	3 / 3
Mean [m]		-8.846914	-0.574061	1.079275		
Sigma [m]		18.761775	1.658704	2.106445		
RMS Error [m]		20.743001	1.755234	2.366842		

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	0.00	0.00
-15.00	-12.00	0.00	0.23	0.00
-12.00	-9.00	0.00	0.00	0.00
-9.00	-6.00	0.00	0.23	0.00
-6.00	-3.00	0.46	1.37	2.75
-3.00	0.00	45.31	29.98	48.28
0.00	3.00	53.55	67.73	44.16
3.00	6.00	0.46	0.46	4.81
6.00	9.00	0.23	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]		-0.885863	-0.140820	102.516878
Sigma [m]		1.535715	1.561689	1.753256
RMS Error [m]		1.772900	1.568025	102.531869

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 intial and computed image positions. Note that the image geolocation errors do not correspond to the accuracy of the observed 3D points.

Geolocation Bias	X	Y	Z

Translation [m]	-0.885863	-0.140820	102.516878

Bias between image initial and computed geolocation given in output coordinate system.

Relative Geolocation Variance

Relative Geolocation Error	Images X [%]	Images Y [%]	Images Z [%]
[-1.00, 1.00]	99.77	99.54	100.00
[-2.00, 2.00]	100.00	99.77	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.

Initial Processing Details

System Information

Hardware	CPU: Intel(R) Core(TM) i7 CPU 920 @ 2.67GHz RAM: 12GB GPU: RDPUDD Chained DD (Driver: unknown)
Operating System	Windows 10 Enterprise 2015 LTSB, 64-bit

Coordinate Systems

Image Coordinate System	GCS_WGS_1984 (egm96)
Ground Control Point (GCP) Coordinate System	WGS_1984_UTM_Zone_33N (egm96)
Output Coordinate System	WGS_1984_UTM_Zone_33N (egm96)

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Custom, Image Scale: 0.5
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 Lever-Arm Parameters Optimization: None Rematch: Auto, yes Bundle Adjustment: Ceres