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 ℹ

Project	Clear Creek Flight 2
Processed	2023-12-21 16:17:11
Camera Model Name(s)	DSC-RX1RM2_35.0_7952x5304 (RGB)
Average Ground Sampling Distance (GSD)	1.40 cm / 0.55 in
Area Covered	0.331 km^2 / 33.0793 ha / 0.13 sq. mi. / 81.7830 acres
Time for Initial Processing (without report)	03m:51s

Quality Check ℹ

❓ **Images**	median of 41517 keypoints per image		✓
❓ **Dataset**	614 out of 637 images calibrated (96%), all images enabled, 6 blocks		⚠
❓ **Camera Optimization**	1.41% relative difference between initial and optimized internal camera parameters		✓
❓ **Matching**	median of 584.375 matches per calibrated image		⚠
❓ **Georeferencing**	yes, 5 GCPs (5 3D), mean RMS error = 0.083 US survey foot		✓

❓ Preview ℹ

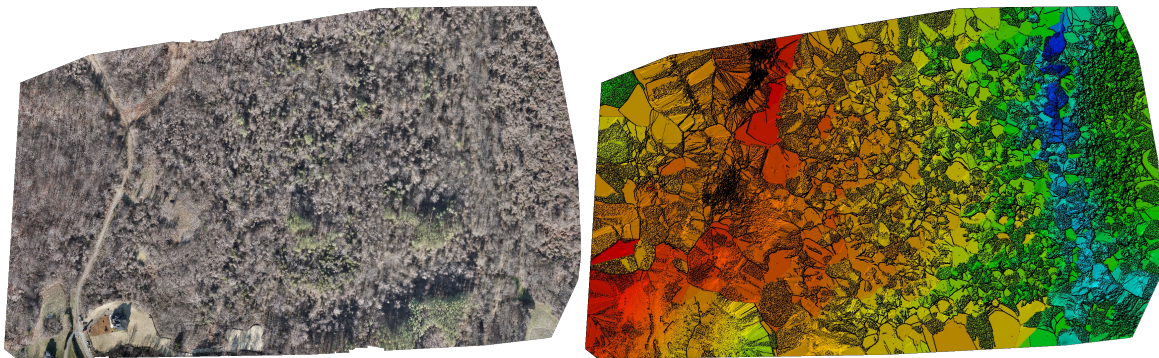**Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.**

Calibration Details ℹ

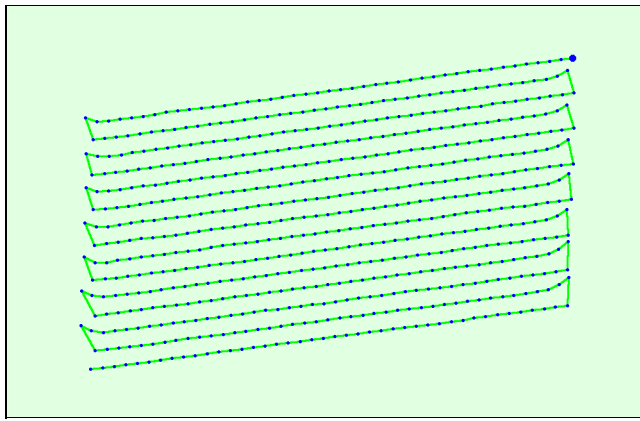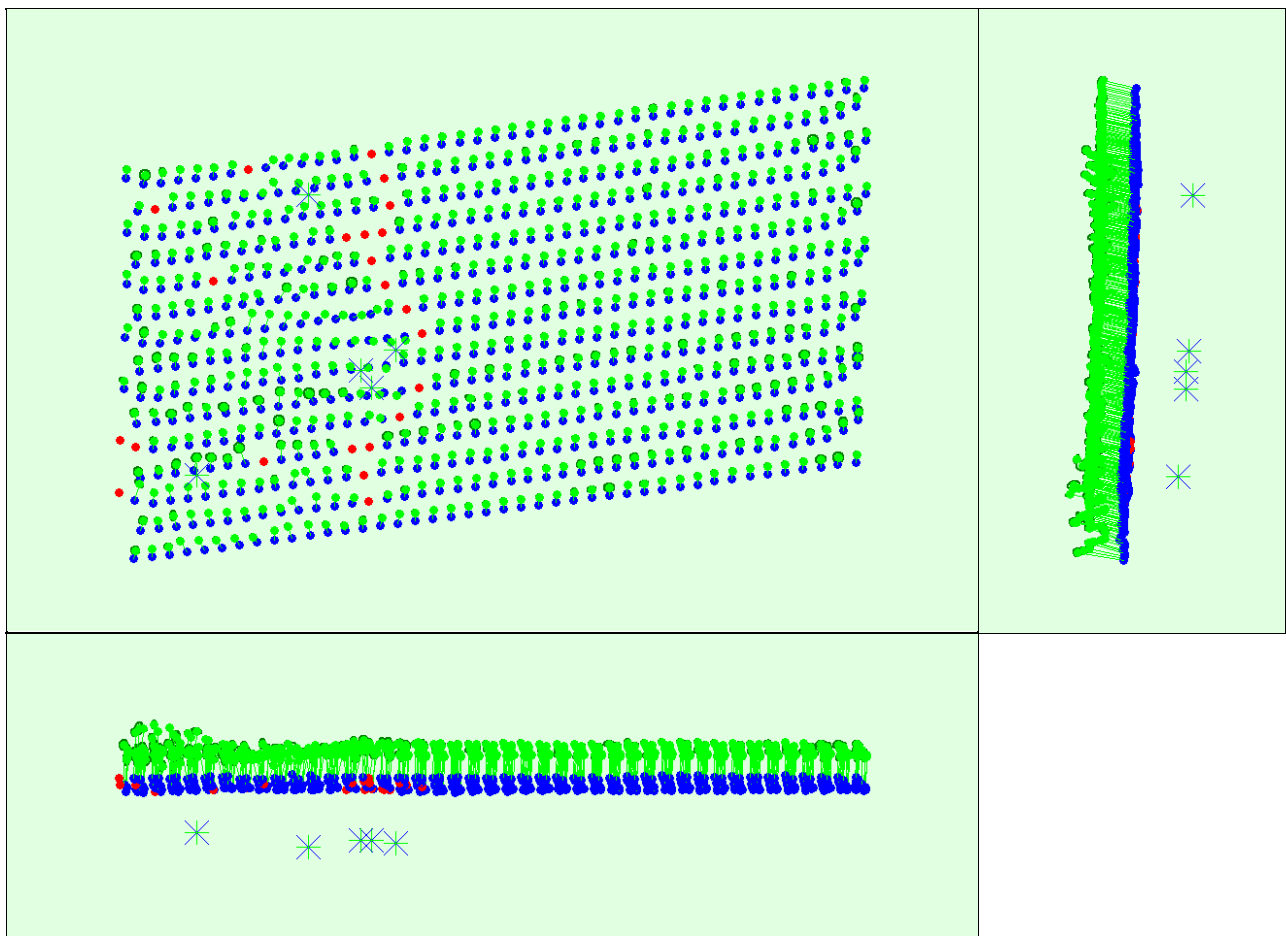|	
Number of Calibrated Images	614 out of 637
Number of Geolocated Images	637 out of 637

❓ Initial Image Positions ℹ

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.

⑦ Computed Image/GCPs/Manual Tie Points Positions ⓘ

Uncertainty ellipses 10x 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.

⑦ Absolute camera position and orientation uncertainties ⓘ

	X [US survey foot]	Y [US survey foot]	Z [US survey foot]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.964	0.974	1.029	0.217	0.229	0.230
Sigma	0.149	0.137	0.183	0.161	0.229	0.259

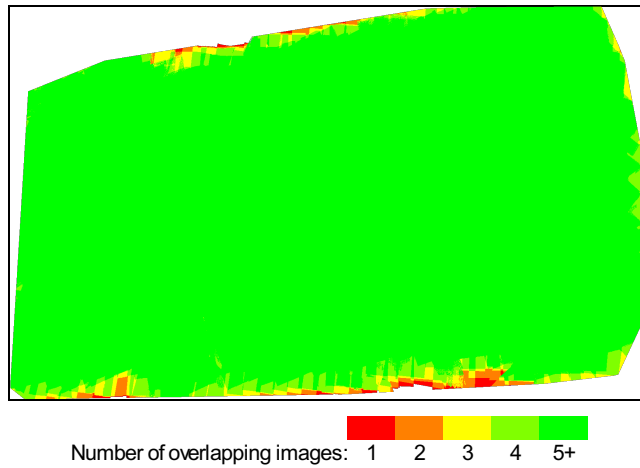## ⑦ Overlap ⓘ

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).
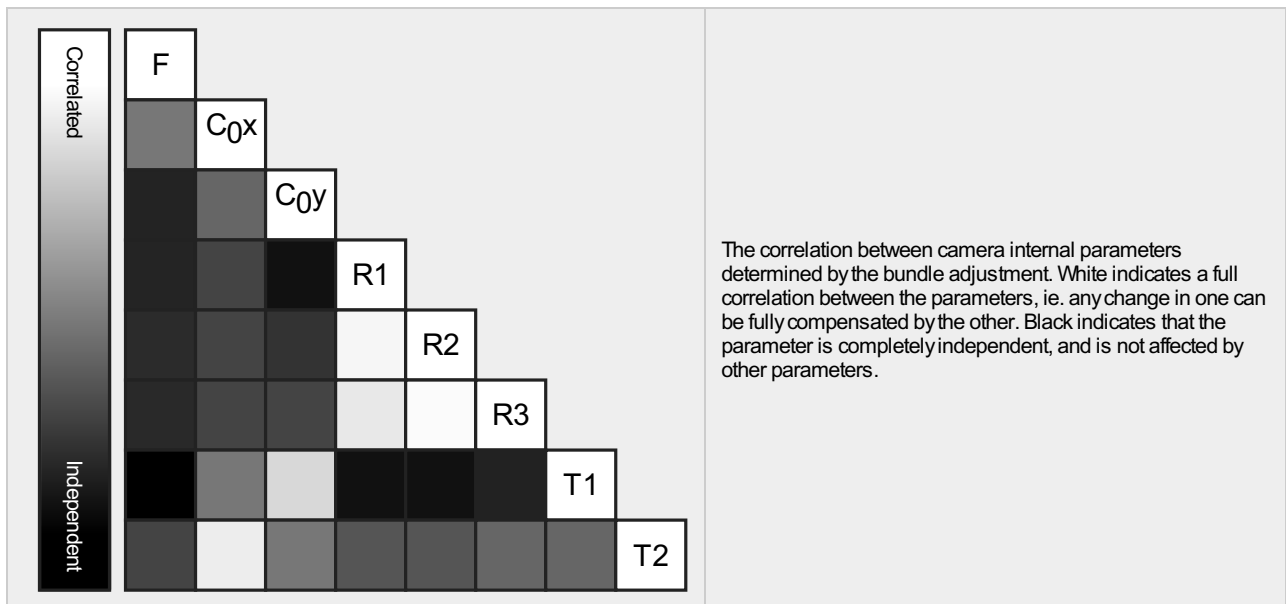
Bundle Block Adjustment Details

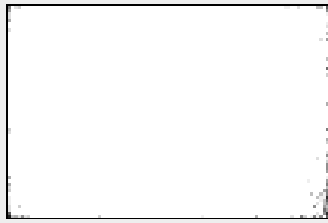|	
Number of 2D Keypoint Observations for Bundle Block Adjustment	764732
Number of 3D Points for Bundle Block Adjustment	278218
Mean Reprojection Error [pixels]	0.196

? Internal Camera Parameters

🗄 DSC-RX1RM2_35.0_7952x5304 (RGB). Sensor Dimensions: 35.000 [mm] x 23.345 [mm] ℹ

EXIF ID: DSC-RX1RM2_35.0_7952x5304

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	7451.230 [pixel] 32.796 [mm]	3949.280 [pixel] 17.382 [mm]	2642.930 [pixel] 11.633 [mm]	-0.011	0.043	-0.069	0.001	-0.000
Optimized Values	7556.385 [pixel] 33.259 [mm]	3994.662 [pixel] 17.582 [mm]	2658.132 [pixel] 11.700 [mm]	-0.012	0.058	-0.098	0.001	0.001
Uncertainties (Sigma)	16.315 [pixel] 0.072 [mm]	8.282 [pixel] 0.036 [mm]	6.509 [pixel] 0.029 [mm]	0.008	0.047	0.084	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	41517	584
Min	28454	19
Max	48708	10825
Mean	41406	1245

3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	184472
In 3 Images	47040
In 4 Images	20582
In 5 Images	9920
In 6 Images	6174
In 7 Images	3984
In 8 Images	2405
In 9 Images	1433
In 10 Images	805
In 11 Images	533
In 12 Images	317
In 13 Images	222
In 14 Images	132
In 15 Images	109
In 16 Images	42
In 17 Images	16
In 18 Images	11
In 19 Images	9
In 20 Images	2
In 21 Images	3
In 22 Images	3
In 23 Images	2
In 26 Images	1
In 31 Images	1

2D Keypoint Matches

Uncertainty ellipses 10x magnified

Number of matches

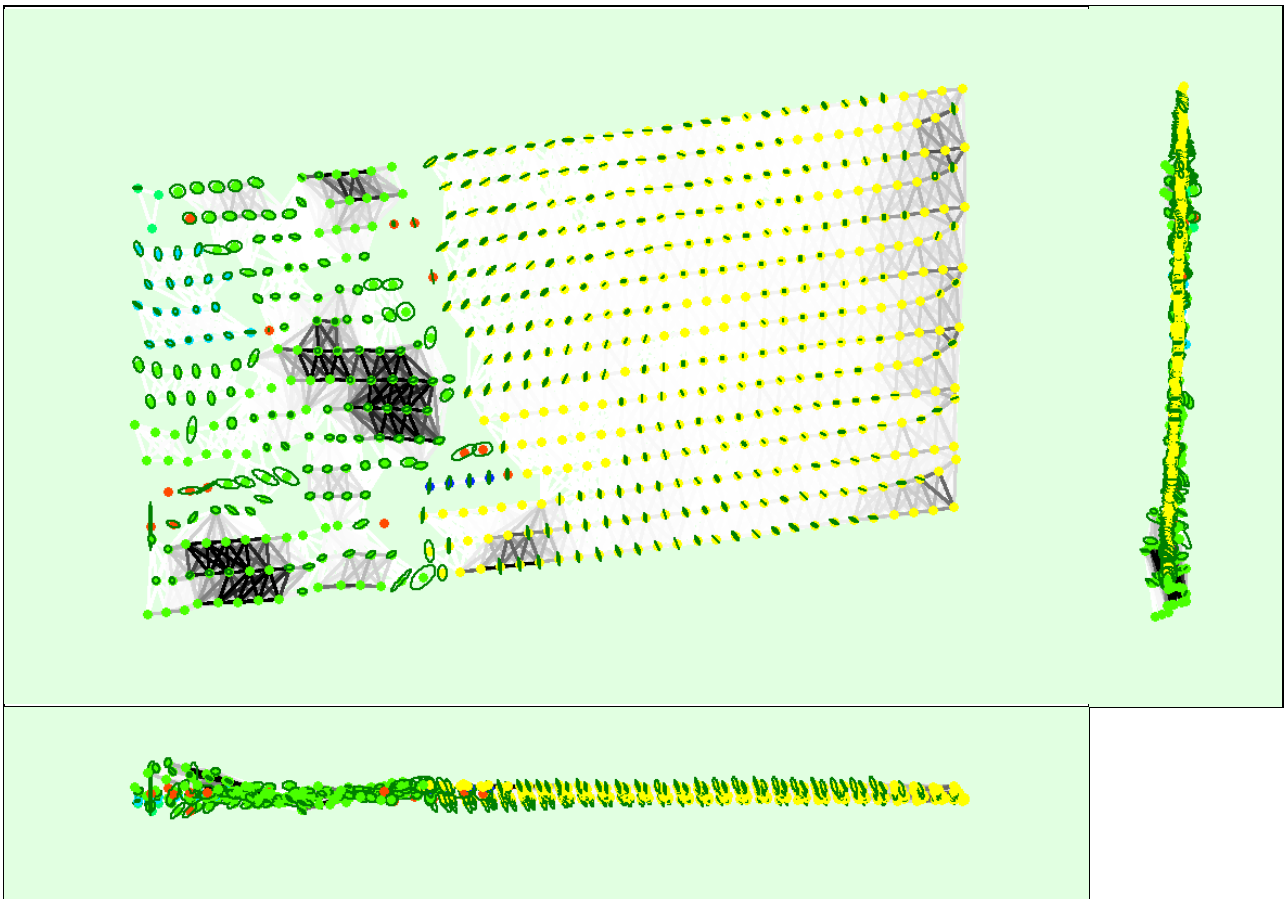**25 222 444 666 888 1111 1333 1555 1777 2000**

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 [US survey foot]	Y [US survey foot]	Z [US survey foot]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.837	0.855	1.185	nan	nan	nan
Sigma	0.574	0.573	0.683	nan	nan	nan

Geolocation Details

Ground Control Points

GCP Name	Accuracy XY/Z [US survey foot]	Error X [US survey foot]	Error Y [US survey foot]	Error Z [US survey foot]	Projection Error [pixel]	Verified/Marked
5011 (3D)	0.020 / 0.020	-0.015	0.019	-0.003	0.232	13 / 13
5012 (3D)	0.020 / 0.020	0.013	-0.007	0.005	0.765	13 / 14
5013 (3D)	0.020 / 0.020	0.088	-0.044	0.037	0.676	8 / 8
5014 (3D)	0.020 / 0.020	-0.136	-0.053	-0.197	1.336	13 / 13
5001 (3D)	0.020 / 0.020	0.066	0.075	0.200	1.270	10 / 10
Mean [US survey foot]		0.003056	-0.002067	0.008300		
Sigma [US survey foot]		0.078524	0.046617	0.126347		

RMS Error [US survey foot]		0.078584	0.046663	0.126620		

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 [US survey foot]	Max Error [US survey foot]	Geolocation Error X [%]	Geolocation Error Y [%]	Geolocation Error Z [%]
-	-0.30	34.36	42.02	49.84
-0.30	-0.24	2.28	3.42	1.95
-0.24	-0.18	2.12	2.77	1.63
-0.18	-0.12	2.44	3.42	2.61
-0.12	-0.06	2.61	4.40	0.98
-0.06	0.00	3.58	2.77	0.98
0.00	0.06	3.09	2.93	0.98
0.06	0.12	2.44	1.95	2.44
0.12	0.18	2.93	2.77	1.47
0.18	0.24	1.79	2.93	1.30
0.24	0.30	2.61	2.28	0.65
0.30	-	39.74	28.34	35.18
Mean [US survey foot]		-1.777038	-24.419986	-101.565482
Sigma [US survey foot]		4.875754	5.721250	10.251064
RMS Error [US survey foot]		5.189494	25.081236	102.081494

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.

Geolocation Bias	X	Y	Z
Translation [US survey foot]	-1.870220	-24.231416	-101.476538

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]	8.14	6.84	4.72
[-2.00, 2.00]	14.01	15.15	12.54
[-3.00, 3.00]	21.01	22.31	16.61
Mean of Geolocation Accuracy [US survey foot]	0.074059	0.074059	0.115791
Sigma of Geolocation Accuracy [US survey foot]	0.014464	0.014464	0.017414

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

Geolocation Orientational Variance	RMS [degree]
Omega	5.087
Phi	5.876
Kappa	4.125

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) i9-13900K RAM: 64GB GPU: NVIDIA GeForce RTX 4060 Ti (Driver: 31.0.15.3667)
Operating System	Windows 11, 64-bit

Coordinate Systems

Image Coordinate System	NAD83(2011)
Ground Control Point (GCP) Coordinate System	NAD83(2011) / Virginia North (ftUS)
Output Coordinate System	NAD83(2011) / Virginia North (ftUS)

Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Full, Image Scale: 0.5
Advanced: Matching Image Pairs	Free Flight or Terrestrial
Advanced: Matching Strategy	Use Geometrically Verified Matching: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Geolocation Based Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Auto, no