

Quality Report



Generated with Pix4Dmapper version 4.4.12



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Additional information about the sections



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Summary



Project	SF_Toutle_Survey_take2_dxf_output_FT_take1
Processed	2019-08-05 15:33:13
Camera Model Name(s)	FC330_3.6_4000x3000 (RGB)
Average Ground Sampling Distance (GSD)	5.19 cm / 2.04 in
Area Covered	1.397 km ² / 139.7445 ha / 0.54 sq. mi. / 345.4948 acres

Quality Check



Images	median of 41737 keypoints per image	
Dataset	763 out of 783 images calibrated (97%), 6 images disabled	
Camera Optimization	3.75% relative difference between initial and optimized internal camera parameters	
Matching	median of 4810.07 matches per calibrated image	
Georeferencing	yes, 68 GCPs (68 3D), mean RMS error = 0.291 US survey foot	

Preview

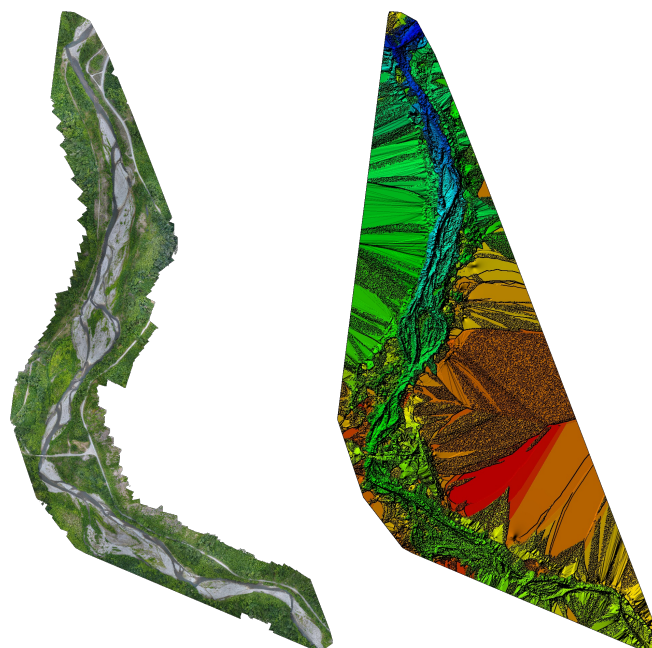


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Calibration Details



Number of Calibrated Images	763 out of 789
Number of Geolocated Images	789 out of 789

? Initial Image Positions

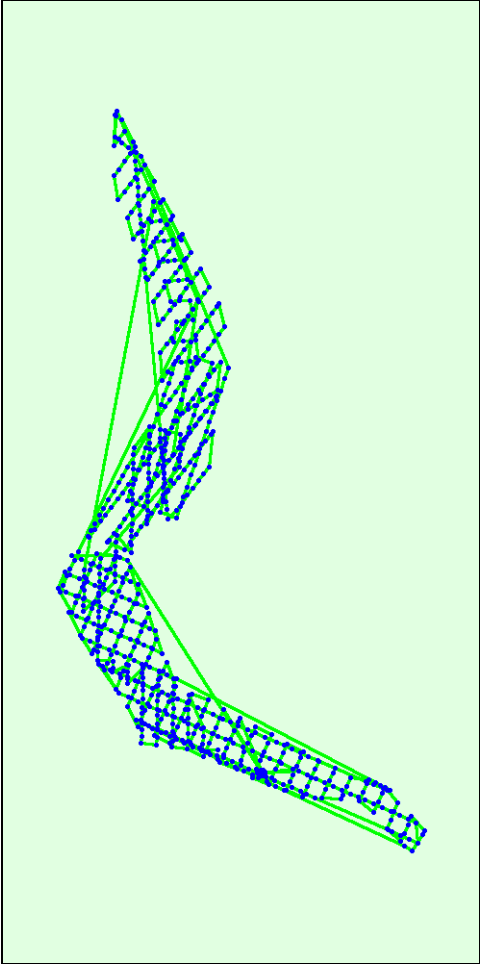
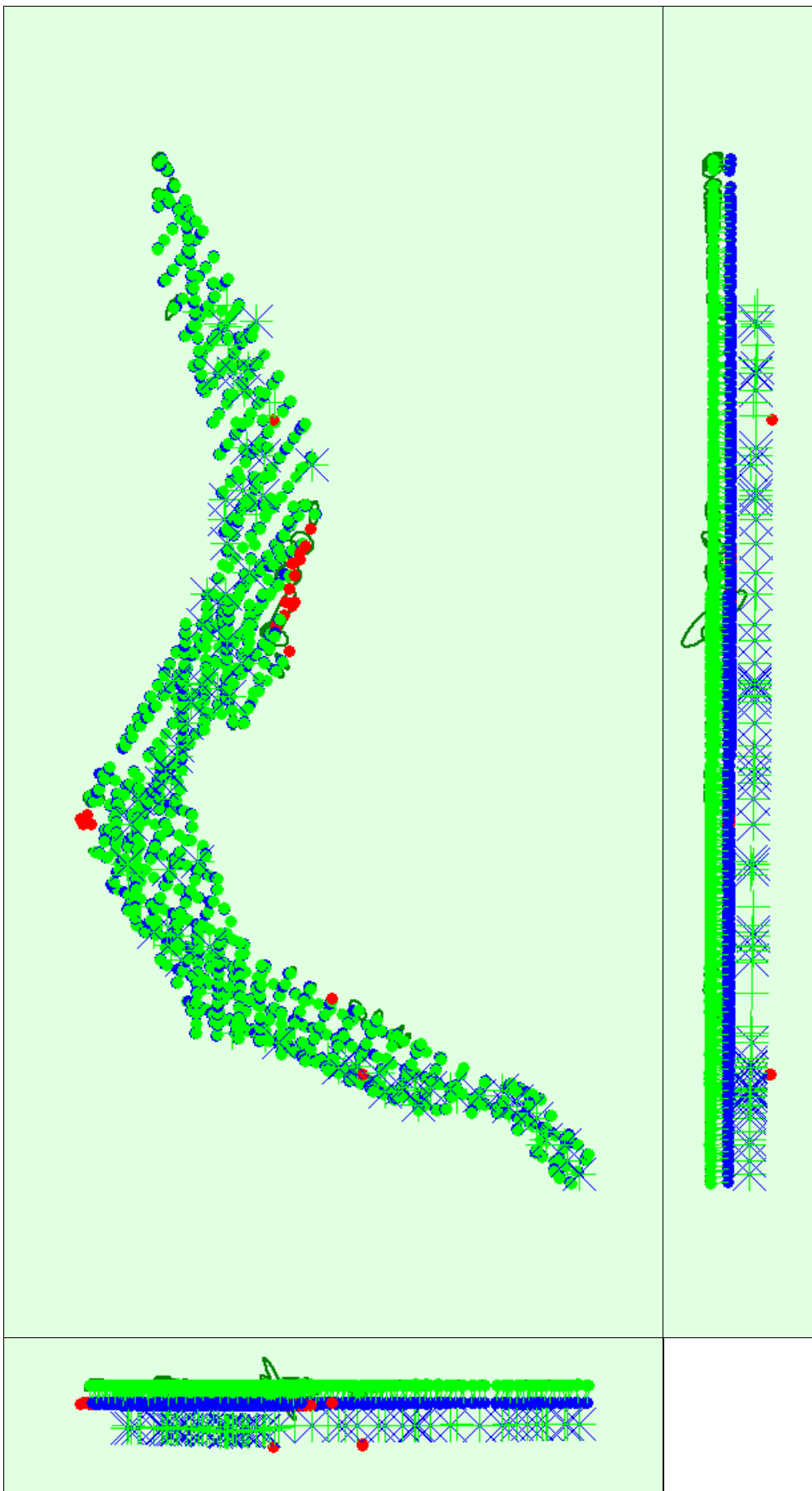


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

? Computed Image/GCPs/Manual Tie Points Positions





Uncertainty ellipses 50x 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.

	X[US survey foot]	Y[US survey foot]	Z[US survey foot]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.433	0.455	0.774	0.060	0.051	0.021
Sigma	0.283	0.354	0.276	0.048	0.035	0.019

 Overlap

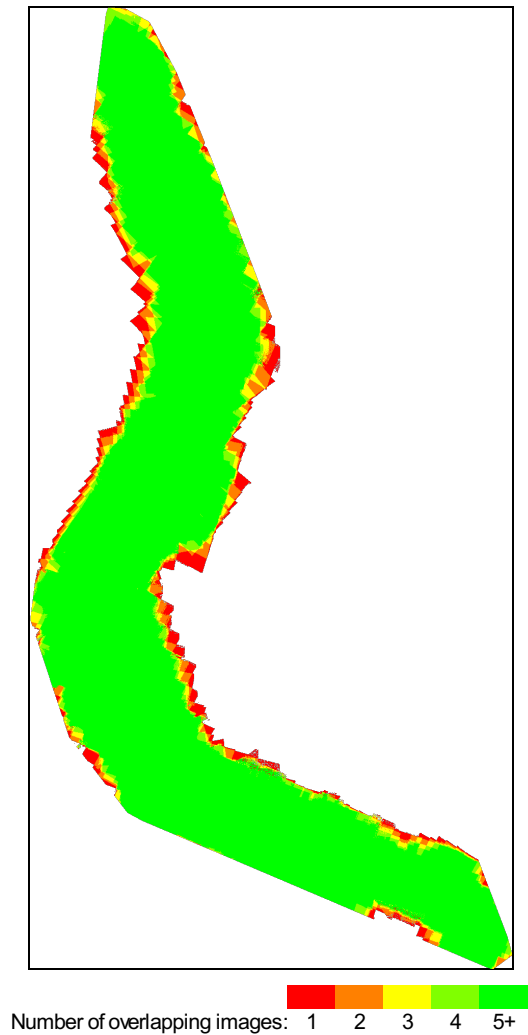


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	3729696
Number of 3D Points for Bundle Block Adjustment	1085303
Mean Reprojection Error [pixels]	0.216

 Internal Camera Parameters

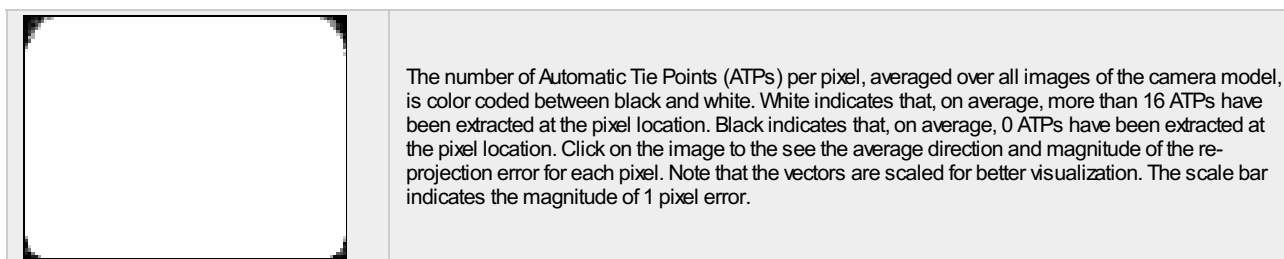
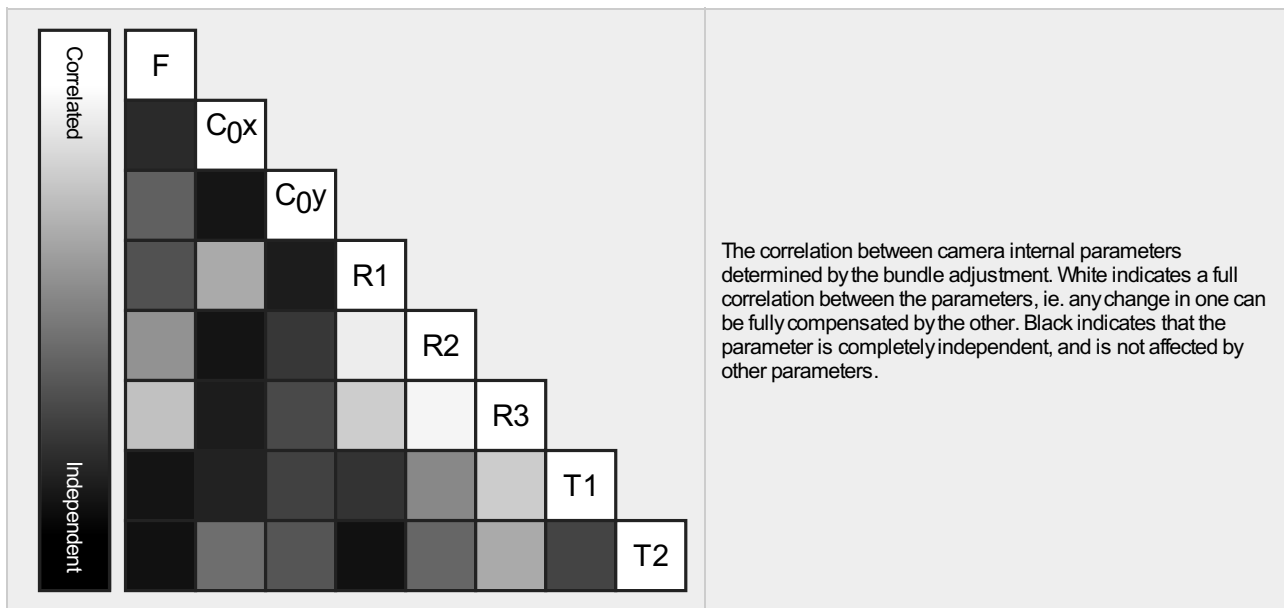
 **FC330_3.6_4000x3000 (RGB). Sensor Dimensions: 6.317 [mm] x 4.738 [mm]**



EXIF ID: FC330_3.6_4000x3000

	Focal Length	Principal Point x	Principal Point y	R1	R2	R3	T1	T2
Initial Values	2285.722 [pixel] 3.610 [mm]	2000.006 [pixel] 3.159 [mm]	1500.003 [pixel] 2.369 [mm]	-0.001	-0.002	0.000	-0.001	-0.001
Optimized Values	2371.530 [pixel] 3.746 [mm]	2001.827 [pixel] 3.162 [mm]	1575.584 [pixel] 2.488 [mm]	-0.035	0.088	-0.068	0.001	-0.001

Uncertainties (Sigma)	4.061 [pixel] 0.006 [mm]	0.341 [pixel] 0.001 [mm]	0.517 [pixel] 0.001 [mm]	0.000	0.001	0.001	0.000	0.000
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2D Keypoints Table



	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	41737	4810
Mn	29860	36
Max	68432	12932
Mean	42669	4888

3D Points from 2D Keypoint Matches



	Number of 3D Points Observed
In 2 Images	652243
In 3 Images	171353
In 4 Images	83830
In 5 Images	48471
In 6 Images	30860
In 7 Images	20920
In 8 Images	15048
In 9 Images	11178
In 10 Images	8805
In 11 Images	7057
In 12 Images	5685
In 13 Images	4771
In 14 Images	3866
In 15 Images	3268
In 16 Images	2708
In 17 Images	2317
In 18 Images	1944
In 19 Images	1745
In 20 Images	1369

In 21 Images	1218
In 22 Images	1014
In 23 Images	906
In 24 Images	740
In 25 Images	598
In 26 Images	533
In 27 Images	469
In 28 Images	441
In 29 Images	381
In 30 Images	311
In 31 Images	282
In 32 Images	208
In 33 Images	179
In 34 Images	125
In 35 Images	97
In 36 Images	83
In 37 Images	63
In 38 Images	65
In 39 Images	47
In 40 Images	38
In 41 Images	30
In 42 Images	19
In 43 Images	12
In 44 Images	6

2D Keypoint Matches



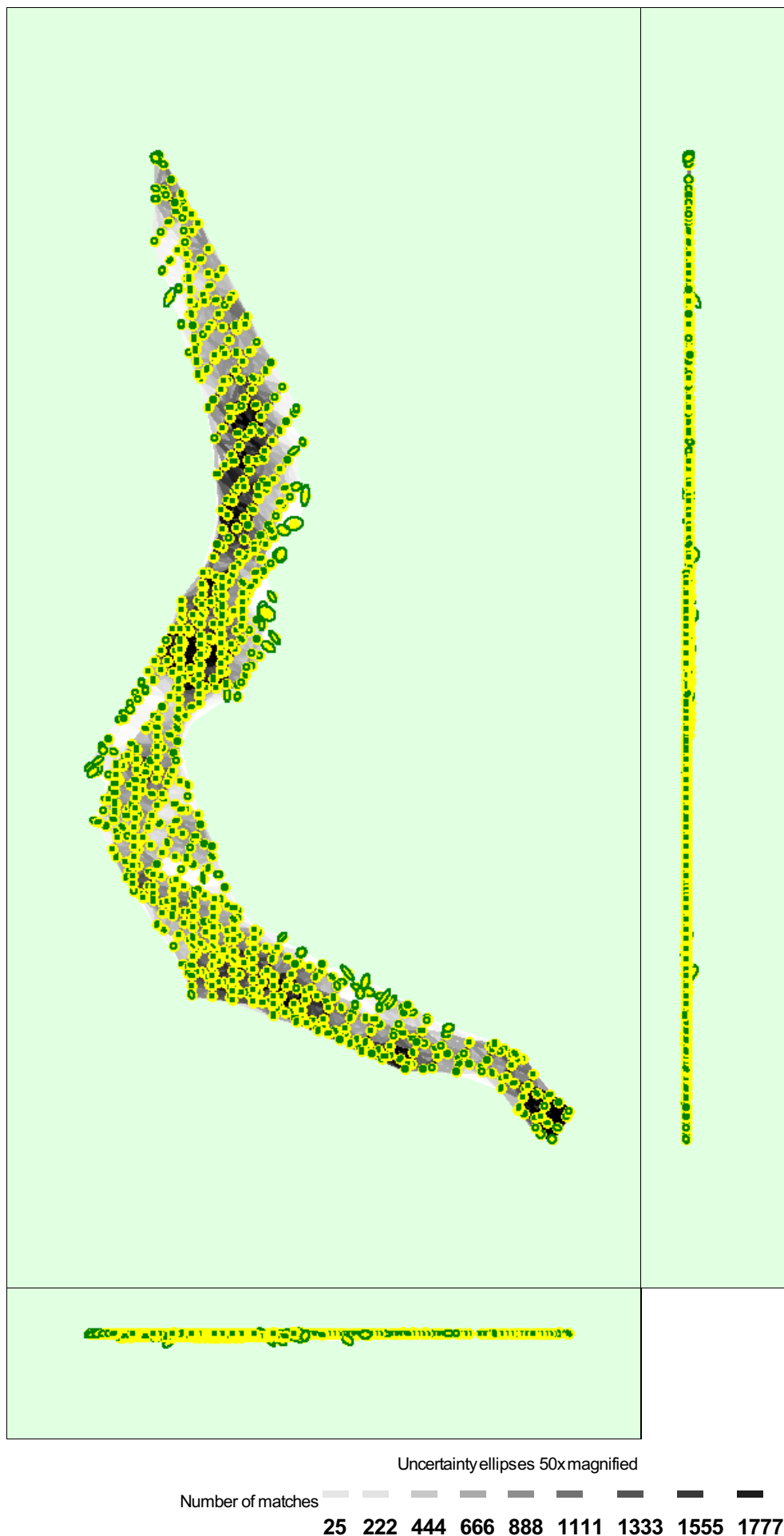


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty of the bundle block adjustment result.

? Relative camera position and orientation uncertainties



	X [US survey foot]	Y [US survey foot]	Z [US survey foot]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.417	0.421	0.336	0.063	0.055	0.024
Sigma	0.185	0.211	0.171	0.032	0.026	0.013

? Manual Tie Points



MTP Name	Projection Error [pixel]	Verified/Marked
mtp122	0.633	24 / 24
mtp123	0.645	24 / 24
mtp124	0.559	24 / 24
mtp125	0.752	18 / 18
mtp126	0.947	13 / 13
mtp127	1.108	7 / 7
mtp128	0.751	6 / 6
mtp129	0.677	23 / 23
mtp130	0.798	14 / 14
mtp131	0.433	10 / 10
mtp132	0.740	25 / 25
mtp133	0.920	9 / 9
mtp134	0.951	30 / 30
mtp135	0.638	31 / 31
mtp136	0.769	35 / 35
mtp137	0.798	38 / 38
mtp138	0.630	36 / 36
mtp139	1.514	14 / 14
mtp140	0.998	10 / 10
mtp141	0.695	10 / 10
mtp142	0.632	4 / 4
mtp143	0.516	32 / 32
mtp144	0.722	33 / 33
mtp145	0.891	22 / 22

Projection errors for manual tie points. The last column counts the number of images where the manual tie point has been automatically verified vs. manually marked.

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
103 (3D)	0.020 / 0.020	0.034	0.009	-0.828	0.611	4 / 4
105 (3D)	0.020 / 0.020	0.239	0.246	-0.432	0.704	32 / 32
106 (3D)	0.020 / 0.020	-0.193	0.060	-0.197	0.415	5 / 5
108 (3D)	0.020 / 0.020	-0.029	-0.081	0.248	0.688	10 / 10
116 (3D)	0.020 / 0.020	0.007	-0.007	-0.292	0.626	8 / 8
126 (3D)	0.020 / 0.020	-0.014	0.005	-0.011	0.493	8 / 8
127 (3D)	0.020 / 0.020	0.124	-0.020	0.421	0.822	6 / 6
128 (3D)	0.020 / 0.020	0.178	-0.004	0.114	0.661	22 / 22
129 (3D)	0.020 / 0.020	0.051	0.051	-0.126	0.740	15 / 15
132 (3D)	0.020 / 0.020	-0.050	0.130	0.007	0.668	8 / 14
136 (3D)	0.020 / 0.020	0.222	0.160	0.243	0.655	11 / 11
137 (3D)	0.020 / 0.020	-0.187	-0.095	0.162	0.548	17 / 17

138 (3D)	0.020/ 0.020	0.026	0.114	0.069	0.841	4 / 4
143 (3D)	0.020/ 0.020	-0.239	0.373	-0.420	1.046	4 / 4
146 (3D)	0.020/ 0.020	-0.554	0.434	-1.437	0.619	30 / 30
147 (3D)	0.020/ 0.020	-0.944	-0.080	-0.578	0.711	27 / 27
148 (3D)	0.020/ 0.020	-0.157	-0.155	0.104	0.627	42 / 42
149 (3D)	0.020/ 0.020	0.244	0.094	0.188	0.585	35 / 35
150 (3D)	0.020/ 0.020	0.180	-0.011	-0.262	0.752	30 / 30
151 (3D)	0.020/ 0.020	-0.233	-0.141	-0.151	0.400	3 / 3
156 (3D)	0.020/ 0.020	-0.345	0.134	-0.287	0.604	6 / 6
157 (3D)	0.020/ 0.020	0.201	-0.232	-1.664	0.460	4 / 4
159 (3D)	0.020/ 0.020	0.580	-0.561	-0.051	0.762	25 / 25
161 (3D)	0.020/ 0.020	-0.007	-0.136	0.088	0.508	20 / 20
162 (3D)	0.020/ 0.020	-0.067	0.147	-0.513	0.389	6 / 6
163 (3D)	0.020/ 0.020	0.257	-0.117	0.725	1.022	5 / 5
165 (3D)	0.020/ 0.020	-0.111	-0.003	-0.502	0.695	4 / 4
167 (3D)	0.020/ 0.020	0.195	-0.012	0.241	0.690	6 / 6
169 (3D)	0.020/ 0.020	0.021	0.050	-0.269	0.565	22 / 22
170 (3D)	0.020/ 0.020	-0.190	-0.149	0.122	0.541	18 / 18
171 (3D)	0.020/ 0.020	0.194	-0.073	-0.047	0.817	12 / 12
172 (3D)	0.020/ 0.020	-0.000	0.122	-0.051	0.664	22 / 22
174 (3D)	0.020/ 0.020	0.138	-0.131	-0.267	0.816	20 / 20
175 (3D)	0.020/ 0.020	-0.008	-0.046	-0.349	0.403	6 / 6
176 (3D)	0.020/ 0.020	-0.036	-0.473	-1.223	0.801	5 / 5
183 (3D)	0.020/ 0.020	-0.112	-0.140	0.278	0.527	7 / 7
185 (3D)	0.020/ 0.020	-0.049	0.041	0.061	1.088	27 / 27
186 (3D)	0.020/ 0.020	0.080	-0.051	-0.080	0.773	37 / 37
187 (3D)	0.020/ 0.020	0.287	-0.631	0.152	0.753	26 / 26
188 (3D)	0.020/ 0.020	-0.035	-0.226	-0.138	0.731	31 / 31
189 (3D)	0.020/ 0.020	-0.070	0.168	0.214	0.540	29 / 29
190 (3D)	0.020/ 0.020	0.046	0.076	-0.164	0.668	29 / 29
191 (3D)	0.020/ 0.020	0.005	-0.223	-0.651	0.672	4 / 4
192 (3D)	0.020/ 0.020	-0.241	-0.037	-0.417	0.460	5 / 5
193 (3D)	0.020/ 0.020	0.117	-0.032	0.308	0.658	19 / 19
194 (3D)	0.020/ 0.020	0.012	0.124	-0.037	0.878	21 / 21
195 (3D)	0.020/ 0.020	-0.173	0.008	-0.085	1.072	9 / 9
300 (3D)	0.020/ 0.020	-0.109	-0.031	0.840	0.110	2 / 2
301 (3D)	0.020/ 0.020	-0.047	-0.028	0.155	0.615	14 / 14
302 (3D)	0.020/ 0.020	0.113	0.134	-0.321	1.197	10 / 10
303 (3D)	0.020/ 0.020	0.110	-0.041	0.181	1.701	15 / 15
304 (3D)	0.020/ 0.020	-0.097	-0.048	0.058	0.675	18 / 18
305 (3D)	0.020/ 0.020	0.228	0.127	0.007	0.855	14 / 14
306 (3D)	0.020/ 0.020	-0.048	-0.143	-0.439	0.322	5 / 5
307 (3D)	0.020/ 0.020	-0.335	0.010	-0.021	0.518	7 / 7
308 (3D)	0.020/ 0.020	0.113	0.005	-0.179	0.946	10 / 10
310 (3D)	0.020/ 0.020	-0.120	0.132	-0.079	0.797	7 / 7
311 (3D)	0.020/ 0.020	0.116	-0.052	0.444	1.105	14 / 14
312 (3D)	0.020/ 0.020	-0.140	-0.064	-0.274	1.001	11 / 11
313 (3D)	0.020/ 0.020	0.144	-0.104	0.262	0.744	15 / 15
314 (3D)	0.020/ 0.020	-0.025	-0.053	-0.937	0.828	19 / 19
315 (3D)	0.020/ 0.020	0.015	0.209	-0.075	0.807	12 / 12
316 (3D)	0.020/ 0.020	-0.049	-0.090	0.217	0.607	10 / 10
317 (3D)	0.020/ 0.020	0.157	0.079	0.086	0.974	10 / 10
318 (3D)	0.020/ 0.020	-0.090	-0.237	-0.057	0.903	10 / 10
319 (3D)	0.020/ 0.020	-0.192	0.119	0.143	0.820	16 / 16
320 (3D)	0.020/ 0.020	0.262	-0.042	-0.117	1.034	10 / 10
321 (3D)	0.020/ 0.020	0.630	-0.537	-1.741	5.076	4 / 4
Mean [US survey foot]		0.000407	-0.029077	-0.141640		

Sigma [US survey foot]		0.224296	0.183407	0.466417		
RMS Error [US survey foot]		0.224296	0.185698	0.487449		

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 v.s. manually marked.

 Absolute Geolocation Variance



Mn Error [US survey foot]	Max Error [US survey foot]	Geolocation Error X[%]	Geolocation Error Y[%]	Geolocation Error Z [%]
-	-49.21	0.00	0.00	0.00
-49.21	-39.37	0.00	0.26	0.00
-39.37	-29.53	0.26	1.05	0.00
-29.53	-19.69	4.19	6.55	0.00
-19.69	-9.84	9.83	15.33	2.10
-9.84	0.00	25.95	27.65	55.44
0.00	9.84	48.89	25.29	39.06
9.84	19.69	9.31	17.17	2.36
19.69	29.53	1.44	5.50	0.52
29.53	39.37	0.13	1.05	0.13
39.37	49.21	0.00	0.00	0.26
49.21	-	0.00	0.13	0.13
Mean [US survey foot]		-8.423014	-0.573641	-168.126324
Sigma [US survey foot]		9.388294	13.410896	7.031278
RMS Error [US survey foot]		12.612979	13.423159	168.273289

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]	-8.423014	-0.573641	-168.126324

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]	91.74	76.93	99.48
[-2.00, 2.00]	99.87	98.69	99.87
[-3.00, 3.00]	100.00	99.87	100.00
Mean of Geolocation Accuracy [US survey foot]		16.404167	32.808333
Sigma of Geolocation Accuracy [US survey foot]		0.000001	0.000003

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

Geolocation Orientational Variance	RMS [degree]
Omega	0.529
Phi	0.991
Kappa	8.589

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) i7-8700 CPU @ 3.20GHz RAM: 32GB GPU: NVIDIA GeForce GT 730 (Driver: 25.21.14.1917), Intel(R) UHD Graphics 630 (Driver: 25.20.100.6617)
Operating System	Windows 10 Pro, 64-bit

Coordinate Systems



Image Coordinate System	WGS 84 (EGM96 Geoid)
Ground Control Point (GCP) Coordinate System	WGS 84 / UTM zone 10N (EGM96 Geoid)
Output Coordinate System	NAD83 / Washington South (ftUS) (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: no
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Automatic
Advanced: Calibration	Calibration Method: Standard 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	Optimal
Minimum Number of Matches	3
3D Textured Mesh Generation	yes
3D Textured Mesh Settings:	Resolution: Medium Resolution (default) Color Balancing: no
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	01h:38m:28s
Time for Point Cloud Classification	08m:18s
Time for 3D Textured Mesh Generation	10m:32s

Results



Number of Generated Tiles	3
Number of 3D Densified Points	45508725
Average Density (per US survey foot ³)	0.64

DSM, Orthomosaic and Index Details



Processing Options



DSM and Orthomosaic Resolution	1 x GSD (5.19 [cm/pixel])
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DSMFilters	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
Contour Lines Generation	Generated: yes Contour Base [US survey foot]: 0 Elevation Interval [US survey foot]: 2 Resolution [cm]: 100 Minimum Line Size [vertices]: 20
Time for DSMGeneration	39m:30s
Time for Orthomosaic Generation	01h:45m:15s
Time for DTMGeneration	00s
Time for Contour Lines Generation	01m:46s
Time for Reflectance Map Generation	00s
Time for Index Map Generation	00s