

**Important:** Click on the different icons for:

- Help to analyze the results in the Quality Report
- Additional information about the sections

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## Summary i

Project	example_sequoia_msp
Processed	2016-08-23 14:14:39
Camera Model Name(s)	Sequoia_4.0_1280x960 (Green), Sequoia_4.0_1280x960 (Red), Sequoia_4.0_1280x960 (Red edge), Sequoia_4.0_1280x960 (NIR)
Rig name(s)	«Sequoia»
Average Ground Sampling Distance (GSD)	10.62 cm / 4.18 in
Area Covered	0.2264 km <sup>2</sup> / 22.6391 ha / 0.0875 sq. mi. / 55.9715 acres
Time for Initial Processing (without report)	10m:52s

## Quality Check i

<b>Images</b>	median of 10000 keypoints per image	✓
<b>Dataset</b>	704 out of 712 images calibrated (98%), 12 images disabled	✓
<b>Camera Optimization</b>	0.89% relative difference between initial and optimized internal camera parameters	✓
<b>Matching</b>	median of 3632.08 matches per calibrated image	✓
<b>Georeferencing</b>	yes, no 3D GCP	⚠

## Preview i

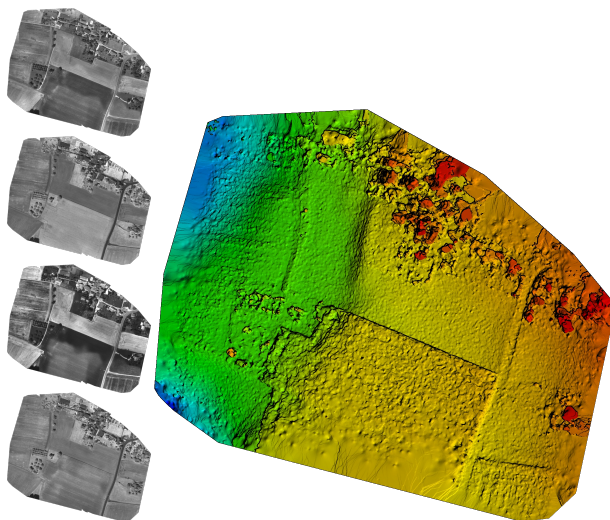


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

## Calibration Details i

Number of Calibrated Images	704 out of 724
Number of Geolocated Images	724 out of 724

## Initial Image Positions i

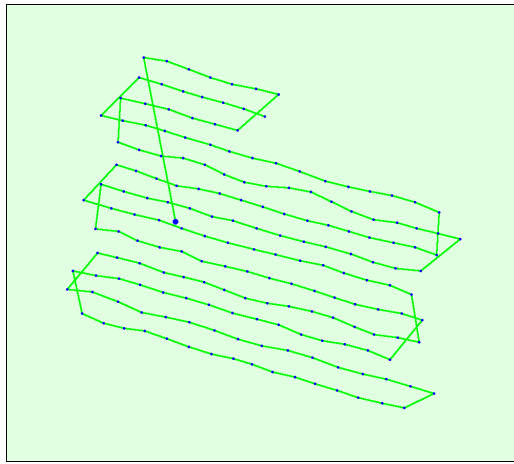
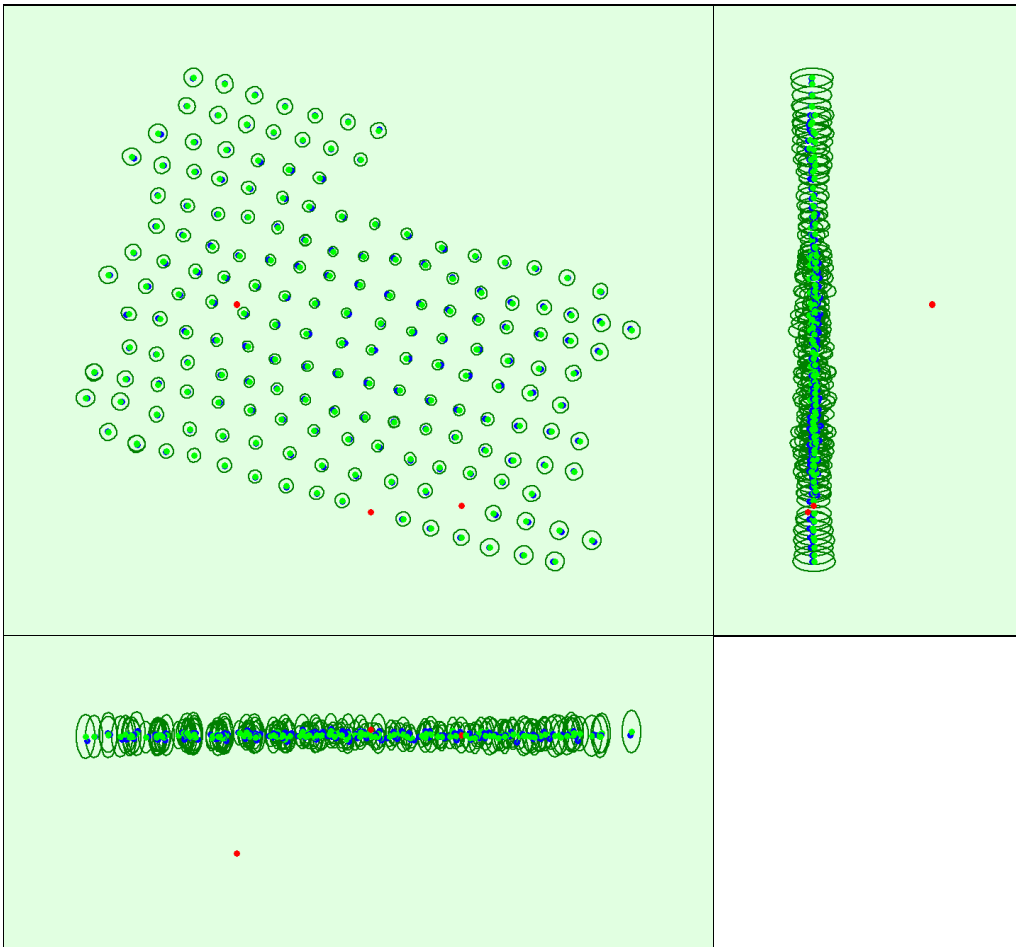


Figure 2: Top view of the initial image position. The green line follows the position of the images in time starting from the large blue dot.

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.

Absolute camera position and orientation uncertainties

	X[m]	Y[m]	Z[m]	Omega [degree]	Phi [degree]	Kappa [degree]
Mean	0.575	0.570	1.262	0.497	0.381	0.176
Sigma	0.097	0.096	0.303	0.023	0.029	0.014

Overlap

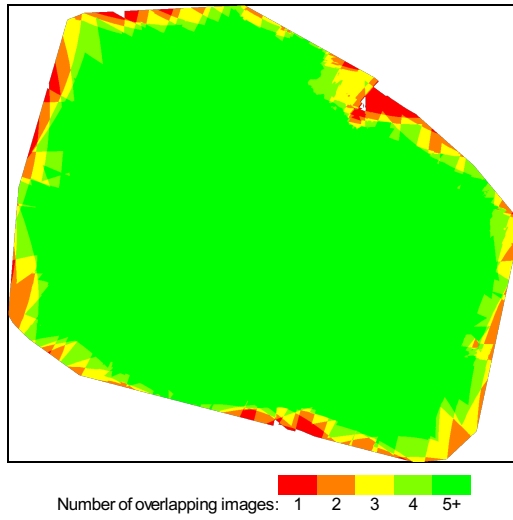


Figure 4: Number of overlapping images computed for each pixel of the orthomosaic. Red and yellow areas indicate low overlap for which poor results may be generated. Green areas indicate an overlap of over 5 images for every pixel. Good quality results will be generated as long as the number of keypoint 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	805427
Number of 3D Points for Bundle Block Adjustment	275142
Mean Reprojection Error [pixels]	0.255

### Internal Camera Parameters

#### Sequoia\_4.0\_1280x960 (Green). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: Sequoia\_4.0\_1280x960

	Poly[0]	Poly[1]	Poly[2]	Poly[3]	Poly[4]	c	d	e	f	Principal Point x	Principal Point y
Initial Values	0.000000	1.000000	0.006288	0.118312	0.000000	1553.88	0.00	0.00	1553.88	646.73	481.12
Optimized Values	0.000000	1.000000	0.007231	-0.158824	0.000000	1671.72	0.00	0.00	1671.72	660.59	495.66
Uncertainties (Sigma)			0.001578	0.002948		1.85	0.00	0.00	1.85	0.27	0.35



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, in average, more than 16 ATPs are extracted at this pixel location. Black indicates that, in average, 0 ATP has been extracted at this pixel location. Click on the image to see the average direction and magnitude of the reprojection error for each pixel. Note that the vectors are scaled for better visualization.

### Internal Camera Parameters

#### Sequoia\_4.0\_1280x960 (Red). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: Sequoia\_4.0\_1280x960

	Poly[0]	Poly[1]	Poly[2]	Poly[3]	Poly[4]	c	d	e	f	Principal Point x	Principal Point y
Initial Values	0.000000	1.000000	0.003242	0.123340	0.000000	1565.73	0.00	0.00	1565.73	690.27	494.51
Optimized Values	0.000000	1.000000	0.004454	-0.152819	0.000000	1684.49	0.00	0.00	1684.49	660.93	492.51
Uncertainties (Sigma)			0.006477	0.011370		2.38	0.00	0.00	2.38	1.08	0.93



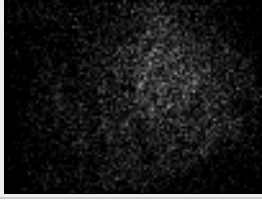
The number of Automatic Tie Points (ATPs) per pixel averaged over all images of the camera model is color coded between black and white. White indicates that, in average, more than 16 ATPs are extracted at this pixel location. Black indicates that, in average, 0 ATP has been extracted at this pixel location. Click on the image to see the average direction and magnitude of the reprojection error for each pixel. Note that the vectors are scaled for better visualization.

### Internal Camera Parameters

#### Sequoia\_4.0\_1280x960 (Red edge). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: Sequoia\_4.0\_1280x960

	Poly[0]	Poly[1]	Poly[2]	Poly[3]	Poly[4]	c	d	e	f	Principal Point x	Principal Point y
Initial Values	0.000000	1.000000	-0.056550	0.256341	0.000000	1566.23	0.00	0.00	1566.23	614.04	465.21
Optimized Values	0.000000	1.000000	0.000768	-0.147310	0.000000	1675.12	0.00	0.00	1675.12	657.43	501.01
Uncertainties (Sigma)			0.007019	0.012310		2.46	0.00	0.00	2.46	1.21	1.09



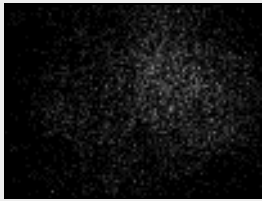
The number of Automatic Tie Points (ATPs) per pixel averaged over all images of the camera model is color coded between black and white. White indicates that, in average, more than 16 ATPs are extracted at this pixel location. Black indicates that, in average, 0 ATP has been extracted at this pixel location. Click on the image to see the average direction and magnitude of the reprojection error for each pixel. Note that the vectors are scaled for better visualization.

### Internal Camera Parameters

#### Sequoia\_4.0\_1280x960 (NIR). Sensor Dimensions: 4.800 [mm] x 3.600 [mm]

EXIF ID: Sequoia\_4.0\_1280x960

	Poly[0]	Poly[1]	Poly[2]	Poly[3]	Poly[4]	c	d	e	f	Principal Point x	Principal Point y
Initial Values	0.000000	1.000000	0.010450	0.114805	0.000000	1558.55	0.00	0.00	1558.55	656.07	477.95
Optimized Values	0.000000	1.000000	-0.001018	-0.140605	0.000000	1679.05	0.00	0.00	1679.05	667.86	495.63
Uncertainties (Sigma)			0.008580	0.015170		2.73	0.00	0.00	2.73	1.46	1.39



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, in average, more than 16 ATPs are extracted at this pixel location. Black indicates that, in average, 0 ATP has been extracted at this pixel location. Click on the image to see the average direction and magnitude of the reprojection error for each pixel. Note that the vectors are scaled for better visualization.

### Camera Rig «Sequoia» Relatives. Images: 724

	Transl X[m]	Transl Y[m]	Transl Z[m]	Rot X[degree]	Rot Y[degree]	Rot Z[degree]
Sequoia_4.0_1280x960 (Green)	Reference Camera					
Sequoia_4.0_1280x960 (Red)						
Initial Values	0.000	-0.015	0.000	0.000	0.000	0.000
Optimized values	0.000	-0.015	0.000	-0.289	-0.325	-0.046
Uncertainties (sigma)				0.051	0.061	0.006
Sequoia_4.0_1280x960 (Red edge)						
Initial Values	0.015	0.000	0.000	0.000	0.000	0.000
Optimized values	0.015	0.000	0.000	-0.095	-0.331	-0.149
Uncertainties (sigma)				0.060	0.068	0.007
Sequoia_4.0_1280x960 (NIR)						
Initial Values	0.015	-0.015	0.000	0.000	0.000	0.000
Optimized values	0.015	-0.015	0.000	-0.160	-0.399	-0.127
Uncertainties (sigma)				0.077	0.082	0.008

### 2D Keypoints Table

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	3632
Min	10000	421
Max	10000	6275
Mean	10000	3502

#### 2D Keypoints Table for Camera Sequoia\_4.0\_1280x960 (Green)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	4096
Min	10000	736
Max	10000	6275
Mean	10000	3945

#### 2D Keypoints Table for Camera Sequoia\_4.0\_1280x960 (Red)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	2174
Min	10000	421

Max	10000	4494
Mean	10000	2319

### 2D Keypoints Table for Camera Sequoia\_4.0\_1280x960 (Red edge)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	2128
Min	10000	727
Max	10000	3505
Mean	10000	2092

### 2D Keypoints Table for Camera Sequoia\_4.0\_1280x960 (NIR)

	Number of 2D Keypoints per Image	Number of Matched 2D Keypoints per Image
Median	10000	1888
Min	10000	597
Max	10000	2592
Mean	10000	1758

### Median / 75% / Maximal Number of Matches Between Camera Models

	Sequoia_4.0_1... (Green)	Sequoia_4.0_128... (Red)	Sequoia_4... (Red edge)	Sequoia_4.0_128...(NIR)
Sequoia_4.0_1280x960 (Green)	64 / 310 / 3557	26 / 106 / 1540	8 / 27 / 895	5 / 14 / 791
Sequoia_4.0_1280x960 (Red)		90 / 1083 / 3205	5 / 11 / 756	3 / 12 / 759
Sequoia_4.0_1280x960 (Red edge)			142 / 1042 / 3299	12 / 68 / 1063
Sequoia_4.0_1280x960 (NIR)				240 / 1255 / 2367

### 3D Points from 2D Keypoint Matches

	Number of 3D Points Observed
In 2 Images	174951
In 3 Images	46298
In 4 Images	21855
In 5 Images	11226
In 6 Images	6789
In 7 Images	4194
In 8 Images	2841
In 9 Images	2016
In 10 Images	1384
In 11 Images	970
In 12 Images	693
In 13 Images	591
In 14 Images	400
In 15 Images	259
In 16 Images	210
In 17 Images	157
In 18 Images	97
In 19 Images	77
In 20 Images	43
In 21 Images	39
In 22 Images	21
In 23 Images	14
In 24 Images	9
In 25 Images	5
In 26 Images	1
In 27 Images	1
In 28 Images	1

### 2D Keypoint Matches

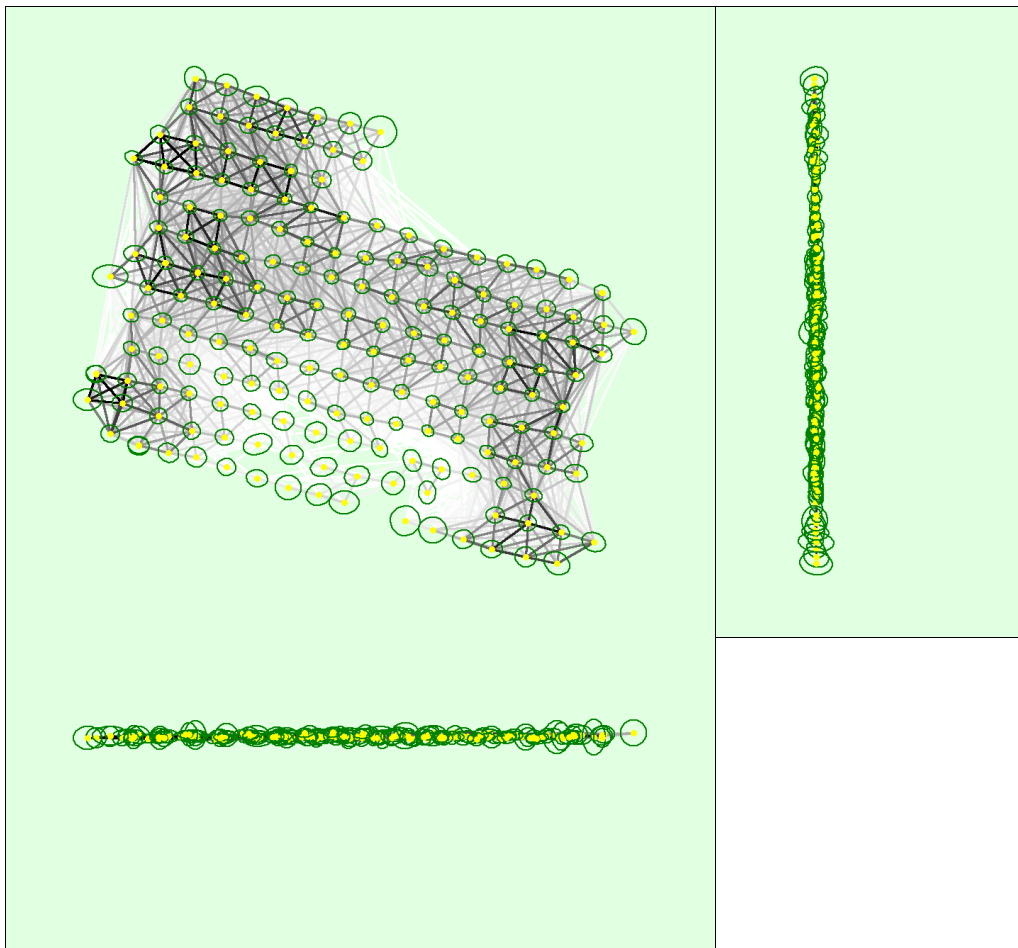


Figure 5: Computed image positions with links between matched images. The darkness of the links indicates the number of matched 2D keypoints between the images. Bright links indicate weak links and require manual tie points or more images. Dark green ellipses indicate the relative camera position uncertainty 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	0.148	0.130	0.109	0.088	0.104	0.035
Sigma	0.034	0.030	0.039	0.027	0.031	0.011

## Geolocation Details

### Absolute Geolocation Variance

Min Error [m]	Max Error [m]	Geolocation Error X[%]	Geolocation Error Y[%]	Geolocation Error Z[%]
-	-7.76	0.00	0.00	0.00
-7.76	-6.21	0.00	0.00	0.00
-6.21	-4.66	0.00	0.00	2.84
-4.66	-3.10	0.00	0.00	7.95
-3.10	-1.55	19.32	1.14	14.20
-1.55	0.00	28.98	53.98	21.59
0.00	1.55	34.38	44.89	31.25
1.55	3.10	17.33	0.00	21.02
3.10	4.66	0.00	0.00	1.14
4.66	6.21	0.00	0.00	0.00
6.21	7.76	0.00	0.00	0.00
7.76	-	0.00	0.00	0.00
<b>Mean [m]</b>		0.024388	-0.027389	-0.176779
<b>Sigma [m]</b>		1.435855	0.674600	2.096218
<b>RMS Error [m]</b>		1.436063	0.675155	2.103659

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]	93.75	100.00	97.73
[-2.00, 2.00]	100.00	100.00	100.00
[-3.00, 3.00]	100.00	100.00	100.00
<b>Mean of Geolocation Accuracy [m]</b>	2.430326	2.430326	4.513710
<b>Sigma of Geolocation Accuracy [m]</b>	0.102694	0.102694	0.371599

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

Geolocation Orientational Variance	RMS [degree]
Omega	8.295
Phi	9.501
Kappa	123.471

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) i7-3630QM CPU @ 2.40GHz RAM: 16GB GPU: Intel(R) HD Graphics 4000 (Driver: 10.18.10.3282), NVDIA GeForce GT 650M (Driver: 10.18.13.5362), RDPDD Chained DD (Driver: unknown), RDP Encoder Mirror Driver (Driver: unknown), RDP Reflector DisplayDriver (Driver: unknown)
Operating System	Windows 7 Professional, 64-bit

### Coordinate Systems

Image Coordinate System	WGS84 (egm96)
Output Coordinate System	WGS84 / UTMzone 32N (egm96)

### Processing Options

Detected Template	No Template Available
Keypoints Image Scale	Full, Image Scale: 2
Advanced: Matching Image Pairs	Aerial Grid or Corridor
Advanced: Matching Strategy	Use Geometrically Verified Matching: yes
Advanced: Keypoint Extraction	Targeted Number of Keypoints: Custom, Number of Keypoints: 10000
Advanced: Calibration	Calibration Method: Alternative Internal Parameters Optimization: All External Parameters Optimization: All Rematch: Custom, yes
Rig «Sequoia» processing	optimize relative rotation using a subset of secondary cameras

## Point Cloud Densification details

### Processing Options

Image Scale	multiscale, 1/2 (Half image size, Default)
Point Density	Low (Fast)
Minimum Number of Matches	3
3D Textured Mesh Generation	no
Advanced: Matching Window Size	7x7 pixels
Advanced: Image Groups	Green, NIR, Red, Red edge
Advanced: Use Processing Area	yes
Advanced: Use Annotations	yes
Advanced: Limit Camera Depth Automatically	no
Time for Point Cloud Densification	02m:06s

### Results

Number of Generated Tiles	1
Number of 3D Densified Points	348875
Average Density (per m <sup>3</sup> )	1.09

# DSM, Orthomosaic and Index Details



## Processing Options



DSM and Orthomosaic Resolution	1 x GSD (10.6 [cm/pixel])
DSM Filters	Noise Filtering: yes Surface Smoothing: yes, Type: Sharp
Orthomosaic	Generated: yes Merge Tiles: yes GeoTIFF Without Transparency: no Google Maps Tiles and KML: no
Index Calculator: Radiometric Calibration	Generated: yes
Index Calculator: Reflectance Map	Generated: yes Resolution: 1 x GSD (10.6 [cm/pixel]) Merge Tiles: no
Index Calculator: Indices	ndvi
Index Calculator: Index Values	Polygon Shapefile [cm/grid]: 400
Time for Orthomosaic Generation	07m:45s
Time for Reflectance Map Generation	10m:07s
Time for Index Map Generation	26s