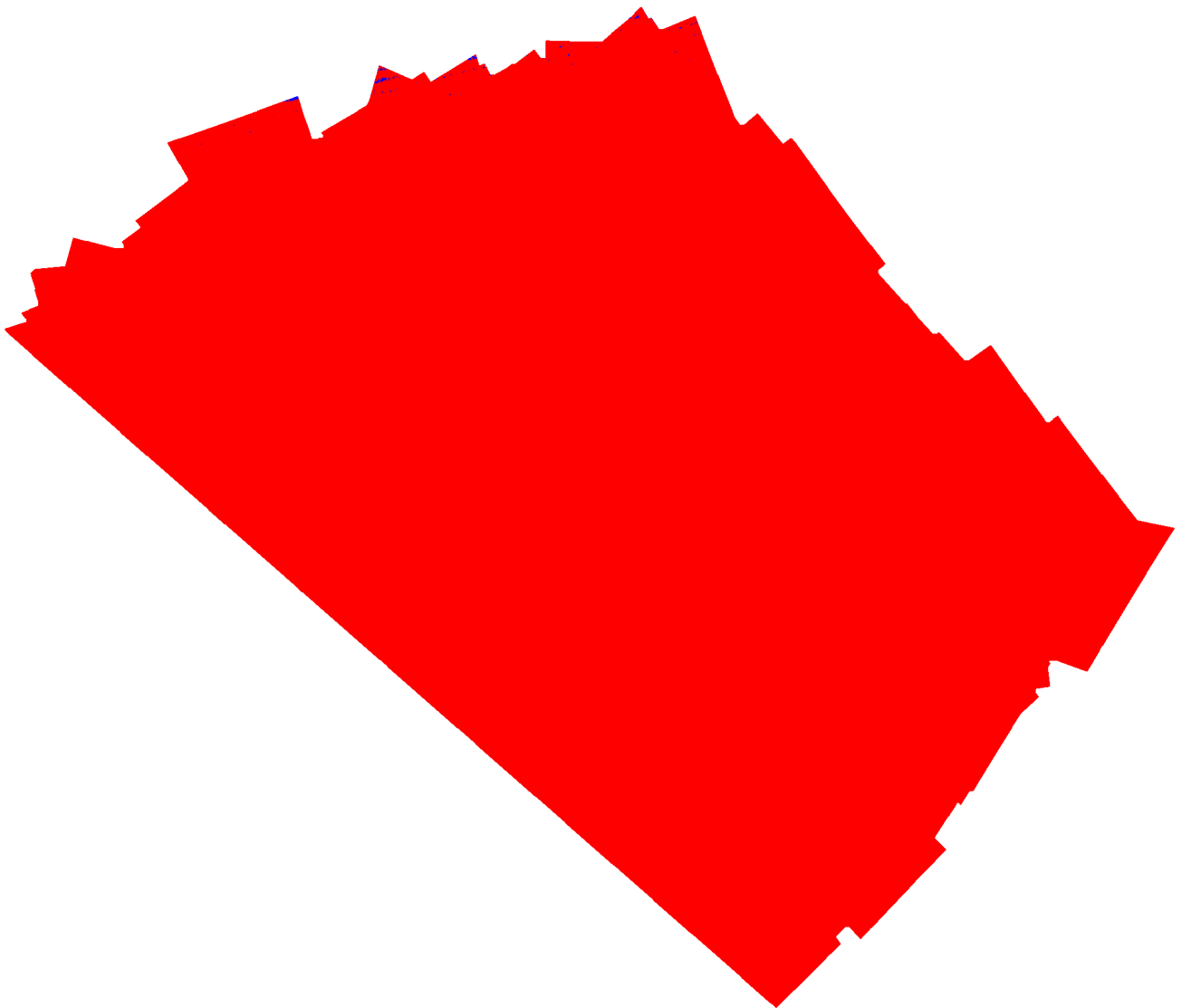


# MSP Report

Processing Report  
15 November 2021



# Survey Data

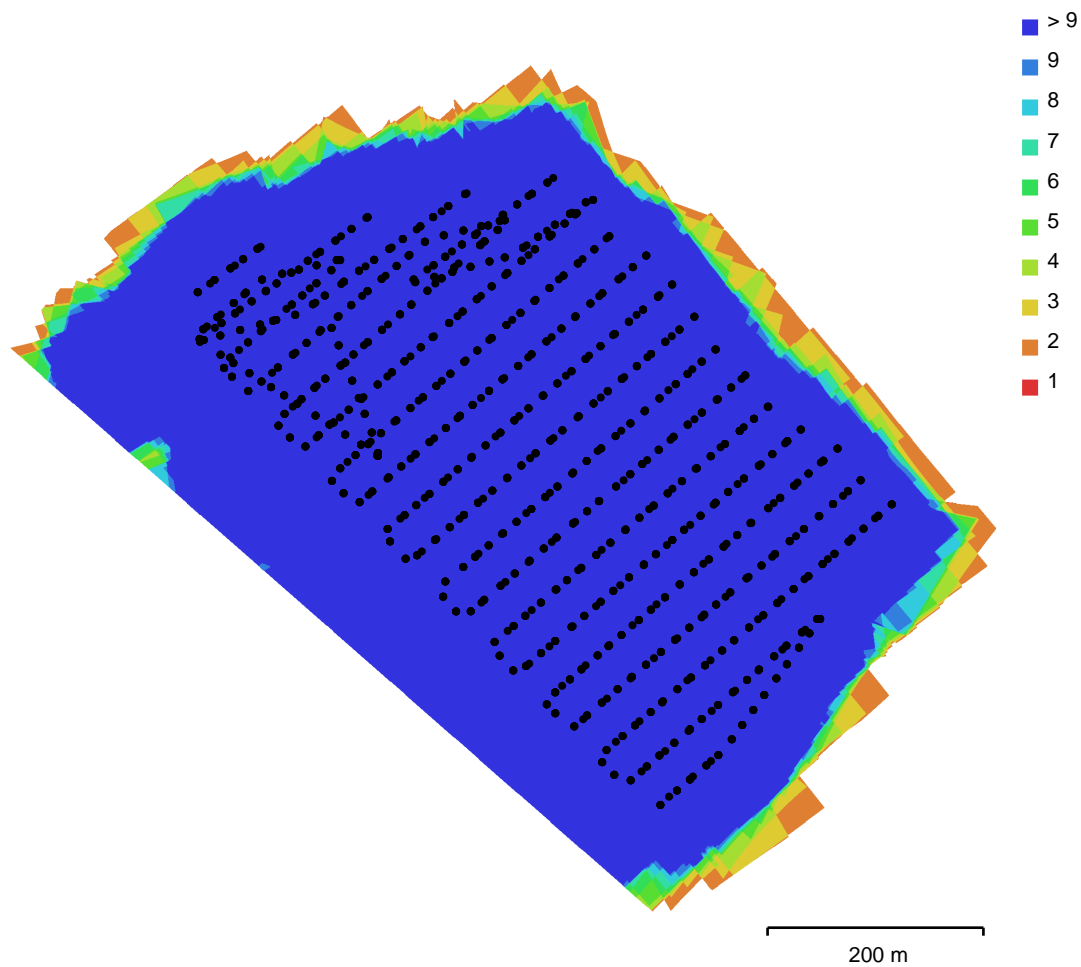


Fig. 1. Camera locations and image overlap.

Number of images:	1,883	Camera stations:	1,877
Flying altitude:	136 m	Tie points:	401,220
Ground resolution:	5.62 cm/pix	Projections:	1,628,479
Coverage area:	0.378 km <sup>2</sup>	Reprojection error:	1.32 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC6510 (8.8mm)	5472 x 3648	8.8 mm	2.41 x 2.41 um	No
Altum, Red (7.8mm)	2064 x 1544	7.8 mm	3.45 x 3.45 um	Yes
Altum, Red edge (7.8mm)	2064 x 1544	7.8 mm	3.45 x 3.45 um	Yes
Altum, NIR (7.8mm)	2064 x 1544	7.8 mm	3.45 x 3.45 um	Yes
Altum, LWIR (1.77mm)	160 x 120	1.77 mm	12 x 12 um	Yes

Table 1. Cameras.

# Camera Calibration

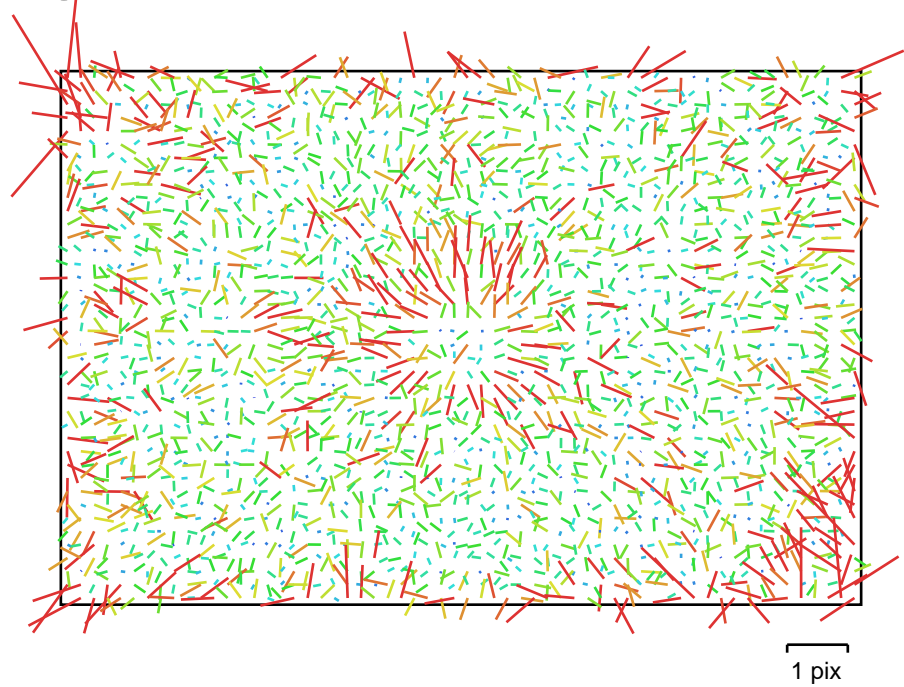


Fig. 2. Image residuals for FC6510 (8.8mm).

## FC6510 (8.8mm)

207 images

Type	Resolution	Focal Length	Pixel Size
Frame	5472 x 3648	8.8 mm	2.41 x 2.41 um
F:	3707.39		
Cx:	-4.18325	B1:	-0.0303123
Cy:	30.5977	B2:	0.279358
K1:	0.00424644	P1:	0.000981907
K2:	-0.0104127	P2:	0.00123337
K3:	0.0119286	P3:	0
K4:	0	P4:	0

# Camera Calibration

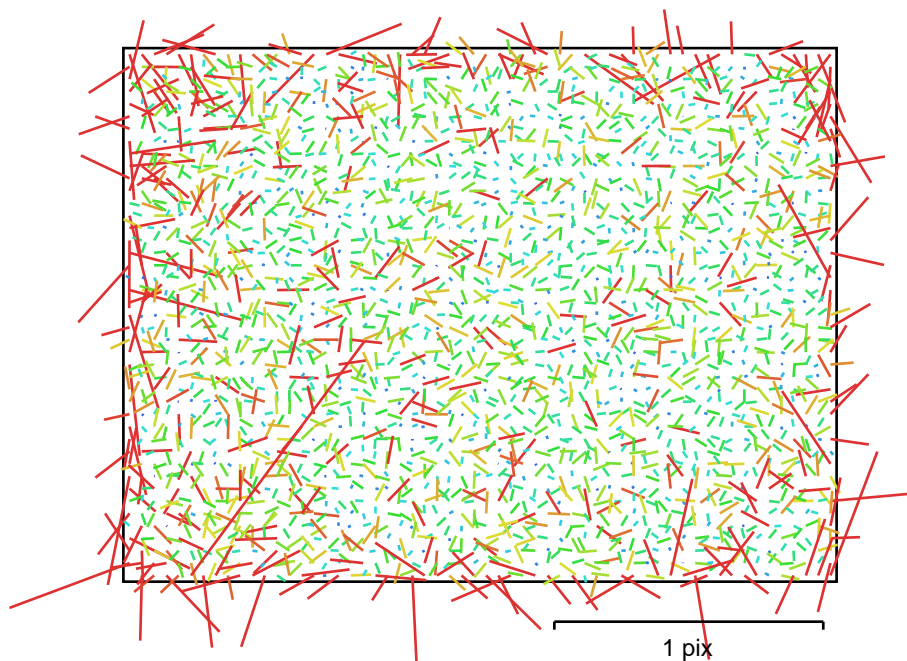


Fig. 3. Image residuals for Altum, Red (7.8mm).

## Altum, Red (7.8mm)

419 images, precalibrated

Type	Resolution	Focal Length	Pixel Size
Frame	2064 x 1544	7.8 mm	3.45 x 3.45 um
F:	2283.82		
Cx:	10.769	B1:	-0.634601
Cy:	14.6761	B2:	-0.112047
K1:	-0.136111	P1:	3.03301e-05
K2:	0.171394	P2:	-6.64077e-05
K3:	-0.0560102	P3:	0
K4:	0	P4:	0

# Camera Calibration

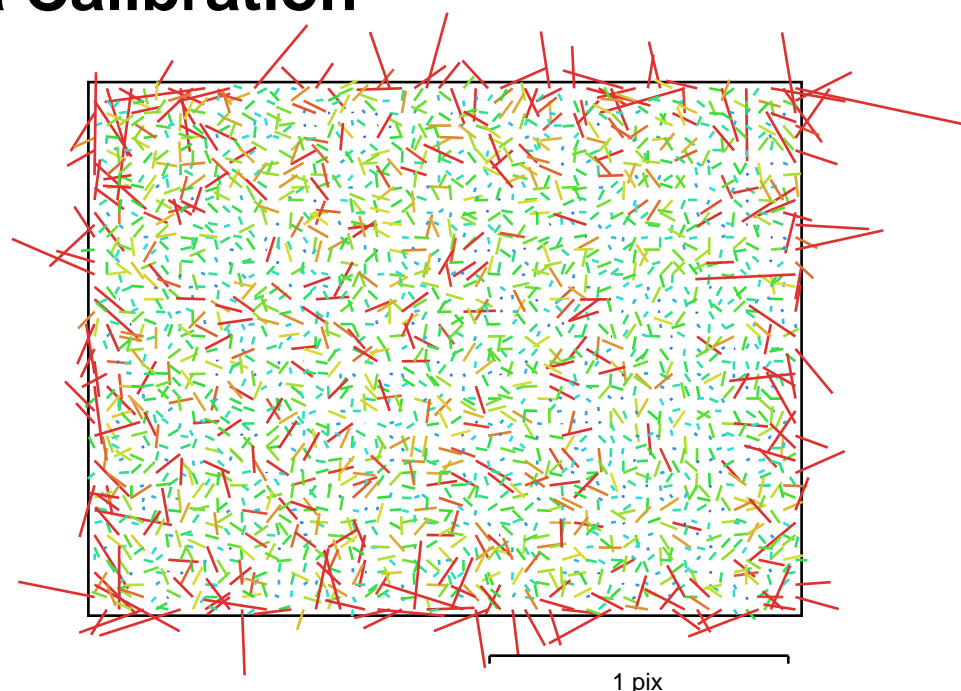


Fig. 4. Image residuals for Altum, Red edge (7.8mm).

## Altum, Red edge (7.8mm)

419 images, precalibrated

Type	Resolution	Focal Length	Pixel Size
Frame	2064 x 1544	7.8 mm	3.45 x 3.45 um
F:	2288.77		
Cx:	35.6135	B1:	-0.147616
Cy:	26.7635	B2:	0.0122043
K1:	-0.136031	P1:	0.000158087
K2:	0.170403	P2:	5.23268e-05
K3:	-0.0562821	P3:	0
K4:	0	P4:	0

# Camera Calibration

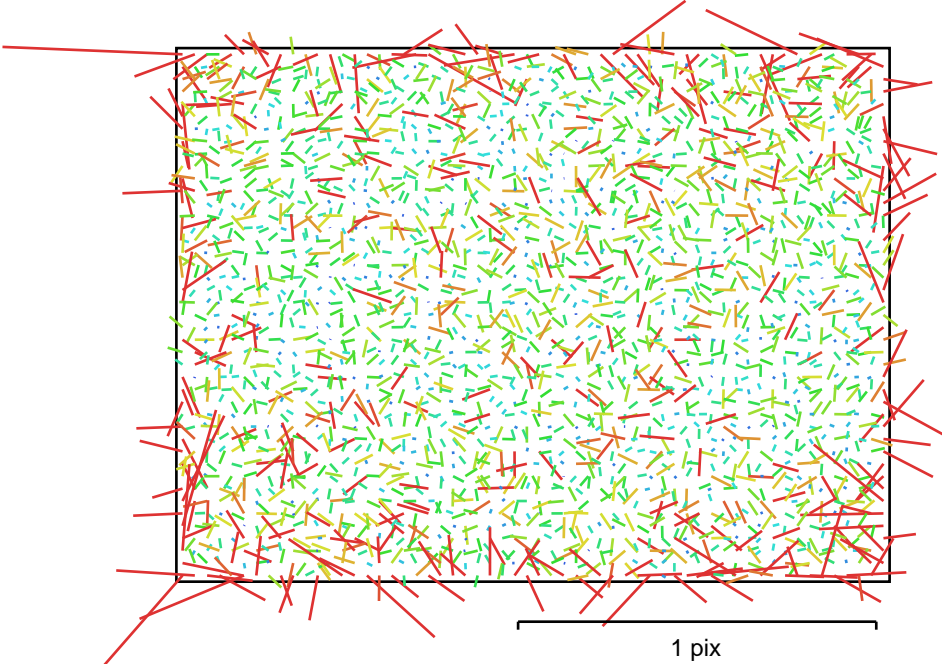


Fig. 5. Image residuals for Altum, NIR (7.8mm).

**Altum, NIR (7.8mm)**  
419 images, precalibrated

Type	Resolution	Focal Length	Pixel Size
Frame	2064 x 1544	7.8 mm	3.45 x 3.45 um
F:	2298.8		
Cx:	22.2155	B1:	-0.216892
Cy:	14.24	B2:	0.157799
K1:	-0.137535	P1:	0.000394143
K2:	0.172502	P2:	1.116e-05
K3:	-0.0616346	P3:	0
K4:	0	P4:	0

# Camera Calibration

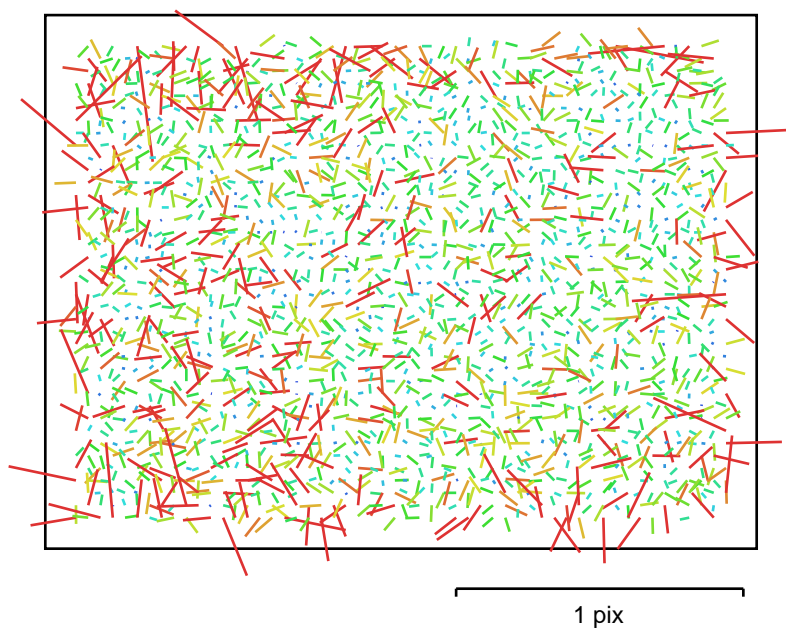


Fig. 6. Image residuals for Altum, LWIR (1.77mm).

## Altum, LWIR (1.77mm)

419 images, precalibrated

Type	Resolution	Focal Length	Pixel Size
Frame	160 x 120	1.77 mm	12 x 12 um
F:	161.554		
Cx:	-0.784532	B1:	0.0438435
Cy:	-1.92464	B2:	-0.122387
K1:	-0.339848	P1:	-0.00051901
K2:	0.24148	P2:	-0.000347779
K3:	-0.127748	P3:	0
K4:	0	P4:	0



# Camera Locations



Fig. 7. Camera locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.  
Estimated camera locations are marked with a black dot.

X error (m)	Y error (m)	Z error (m)	XY error (m)	Total error (m)
1.32703	1.42505	8.83049	1.94725	9.04264

Table 2. Average camera location error.  
X - Longitude, Y - Latitude, Z - Altitude.

# Digital Elevation Model

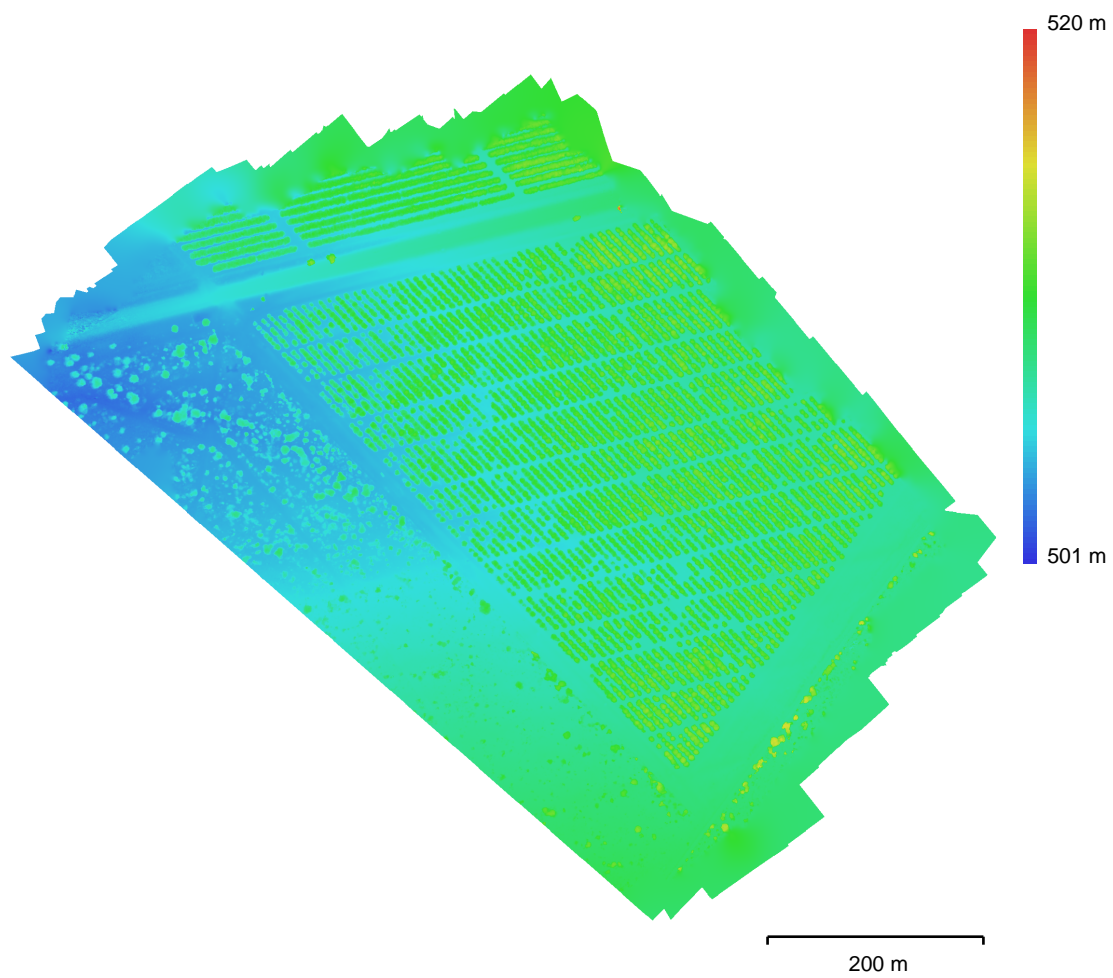


Fig. 8. Reconstructed digital elevation model.

Resolution: 5.62 cm/pix  
Point density: 316 points/m<sup>2</sup>

# Processing Parameters

## General

Cameras	1883
Aligned cameras	1877
Coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	401,220 of 485,430
RMS reprojection error	0.125317 (1.3161 pix)
Max reprojection error	0.439711 (60.6294 pix)
Mean key point size	7.83708 pix
Point colors	%n bands, uint8
Key points	1.34 GB
Average tie point multiplicity	5.72685

## Alignment parameters

Accuracy	Low
Generic preselection	No
Reference preselection	Yes
Key point limit	40,000
Tie point limit	2,000
Adaptive camera model fitting	No
Matching time	%n minutes %n seconds
Alignment time	%n minutes %n seconds

## Optimization parameters

Parameters	f, b1, b2, cx, cy, k1-k3, p1, p2
Adaptive camera model fitting	No
Optimization time	%n minutes %n seconds
Software version	1.5.2.7838

## Dense Point Cloud

Points	169,345,289
Point colors	None

## Depth maps generation parameters

Quality	Ultra High
Filtering mode	Aggressive
Processing time	%n hours %n minutes

## Dense cloud generation parameters

Processing time	%n minutes %n seconds
Software version	1.5.2.7838

## Model

Faces	11,179,721
Vertices	5,593,557
Vertex colors	%n bands, uint8

## Depth maps generation parameters

Quality	Ultra High
Filtering mode	Aggressive
Processing time	%n hours %n minutes

## Reconstruction parameters

Surface type	Height field
Source data	Dense cloud
Interpolation	Enabled
Strict volumetric masks	No
Processing time	%n minutes %n seconds

**General**

Software version 1.5.2.7838

**DEM**

Size 17,702 x 17,161

Coordinate system WGS 84 (EPSG::4326)

**Reconstruction parameters**

Source data Dense cloud

Interpolation Enabled

Processing time %n minutes %n seconds

Software version 1.5.2.7838

**Orthomosaic**

Size 16,258 x 13,946

Coordinate system WGS 84 (EPSG::4326)

Colors %n bands, uint16

**Reconstruction parameters**

Blending mode Average

Surface Mesh

Enable hole filling Yes

Processing time %n minutes %n seconds

Software version 1.5.2.7838

**Raster Transform**

Expression B1

**Software**

Version 1.5.2 build 7838

Platform Linux 64