

# Tufsodden

Processing Report  
10 March 2021



# Survey Data

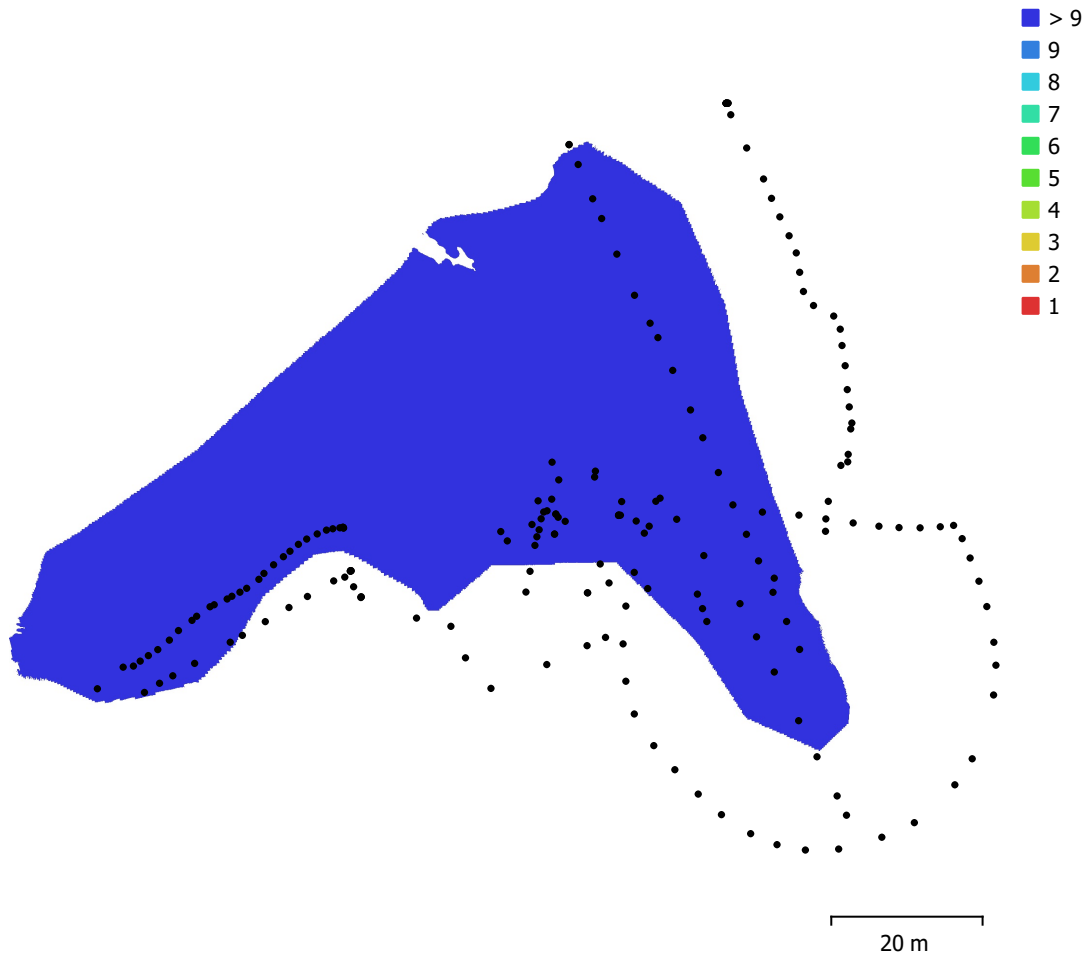


Fig. 1. Camera locations and image overlap.

Number of images:	197	Camera stations:	194
Flying altitude:	28.2 m	Tie points:	186,066
Ground resolution:	7.04 mm/pix	Projections:	608,905
Coverage area:	4e+03 m <sup>2</sup>	Reprojection error:	0.442 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibration
iPhone X, iPhone X back dual camera 4mm f/1.8 (4mm)	4032 x 3024	4 mm	1.23 x 1.23 μm	No
iPhone 7 (4.5mm)	4000 x 3000	4.5 mm	1.62 x 1.62 μm	No

Table 1. Cameras.

# Camera Calibration

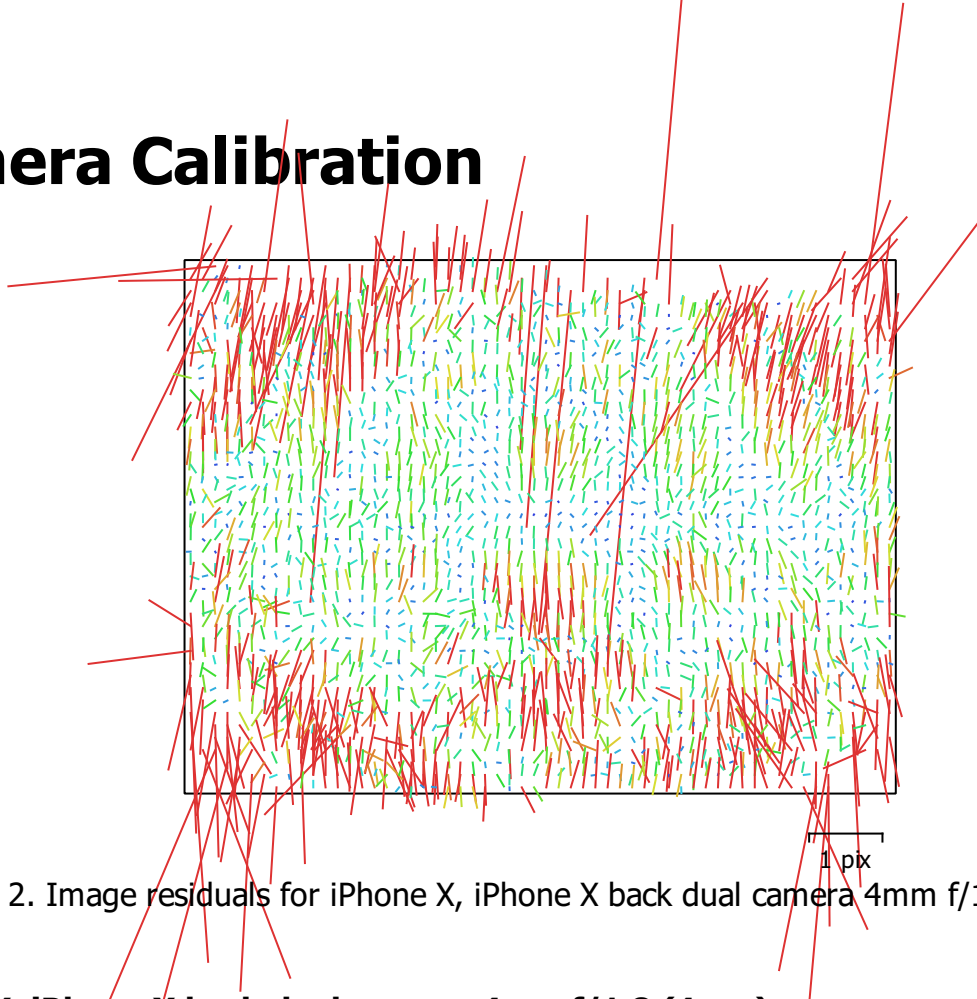


Fig. 2. Image residuals for iPhone X, iPhone X back dual camera 4mm f/1.8 (4mm).

## iPhone X, iPhone X back dual camera 4mm f/1.8 (4mm)

34 images

Type  
Frame

Resolution  
**4032 x 3024**

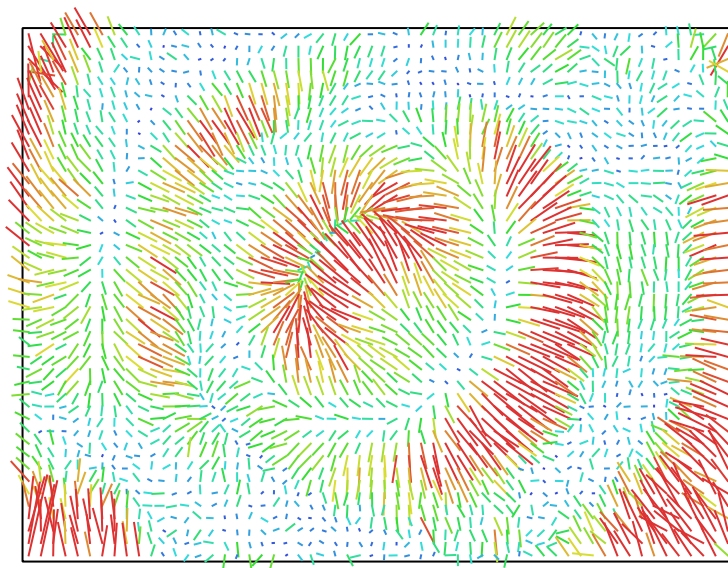
Focal Length  
**4 mm**

Pixel Size  
**1.23 x 1.23  $\mu$ m**

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>3290.86</b>	0.58	1.00	0.14	-0.35	0.31	-0.23	0.30	0.02	0.02
<b>Cx</b>	<b>10.3551</b>	0.49		1.00	0.01	0.15	-0.19	0.22	0.87	-0.04
<b>Cy</b>	<b>-54.2558</b>	0.65			1.00	-0.18	0.16	-0.19	0.10	0.68
<b>K1</b>	<b>0.163988</b>	0.00042				1.00	-0.96	0.91	0.06	-0.03
<b>K2</b>	<b>-0.656961</b>	0.0022					1.00	-0.98	-0.12	0.05
<b>K3</b>	<b>0.920339</b>	0.0038						1.00	0.15	-0.06
<b>P1</b>	<b>-0.00129329</b>	5.5e-05							1.00	-0.01
<b>P2</b>	<b>-0.00110346</b>	4.2e-05								1.00

Table 2. Calibration coefficients and correlation matrix.

# Camera Calibration



1 pix

Fig. 3. Image residuals for FC3170 (4.5mm).

## FC3170 (4.5mm)

163 images

Type  
Frame

Resolution  
**4000 x 3000**

Focal Length  
**4.5 mm**

Pixel Size  
**1.62 x 1.62  $\mu\text{m}$**

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
<b>F</b>	<b>2939.96</b>	0.046	1.00	-0.01	-0.36	-0.20	0.34	-0.35	-0.02	-0.16
<b>Cx</b>	<b>14.6583</b>	0.08		1.00	0.01	0.08	-0.10	0.13	0.97	-0.01
<b>Cy</b>	<b>19.0458</b>	0.061			1.00	0.05	-0.10	0.14	0.00	0.75
<b>K1</b>	<b>-0.0336027</b>	4.8e-05				1.00	-0.95	0.88	0.07	0.06
<b>K2</b>	<b>0.174598</b>	0.00016					1.00	-0.98	-0.10	-0.08
<b>K3</b>	<b>-0.18594</b>	0.00017						1.00	0.13	0.10
<b>P1</b>	<b>6.6417e-05</b>	8.7e-06							1.00	-0.01
<b>P2</b>	<b>-0.000167175</b>	4.5e-06								1.00

Table 3. Calibration coefficients and correlation matrix.

# Camera Locations

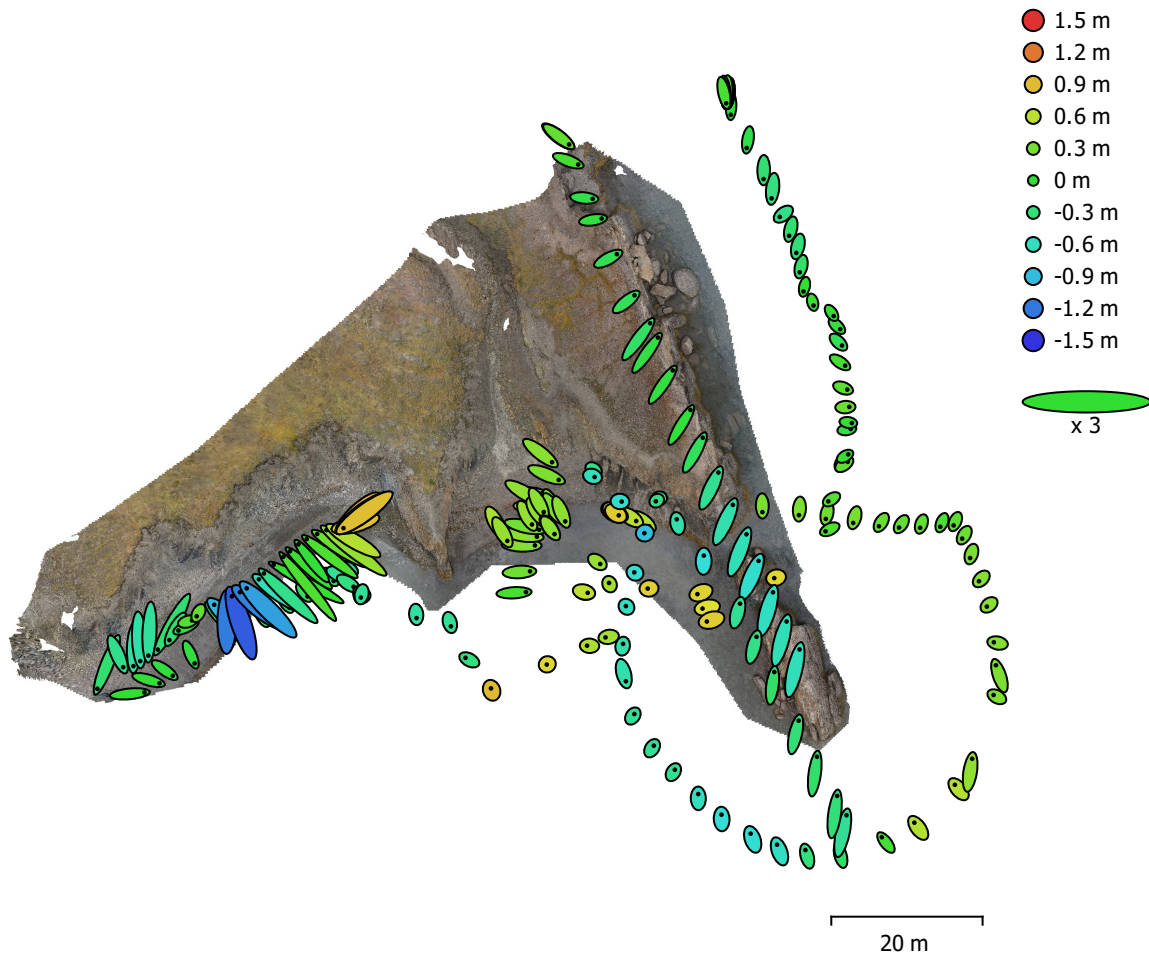


Fig. 4. Camera locations and error estimates.

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)
0.729211	0.859317	0.46238	1.12702	1.21818

Table 4. Average camera location error.  
 X - Longitude, Y - Latitude, Z - Altitude.

# Digital Elevation Model

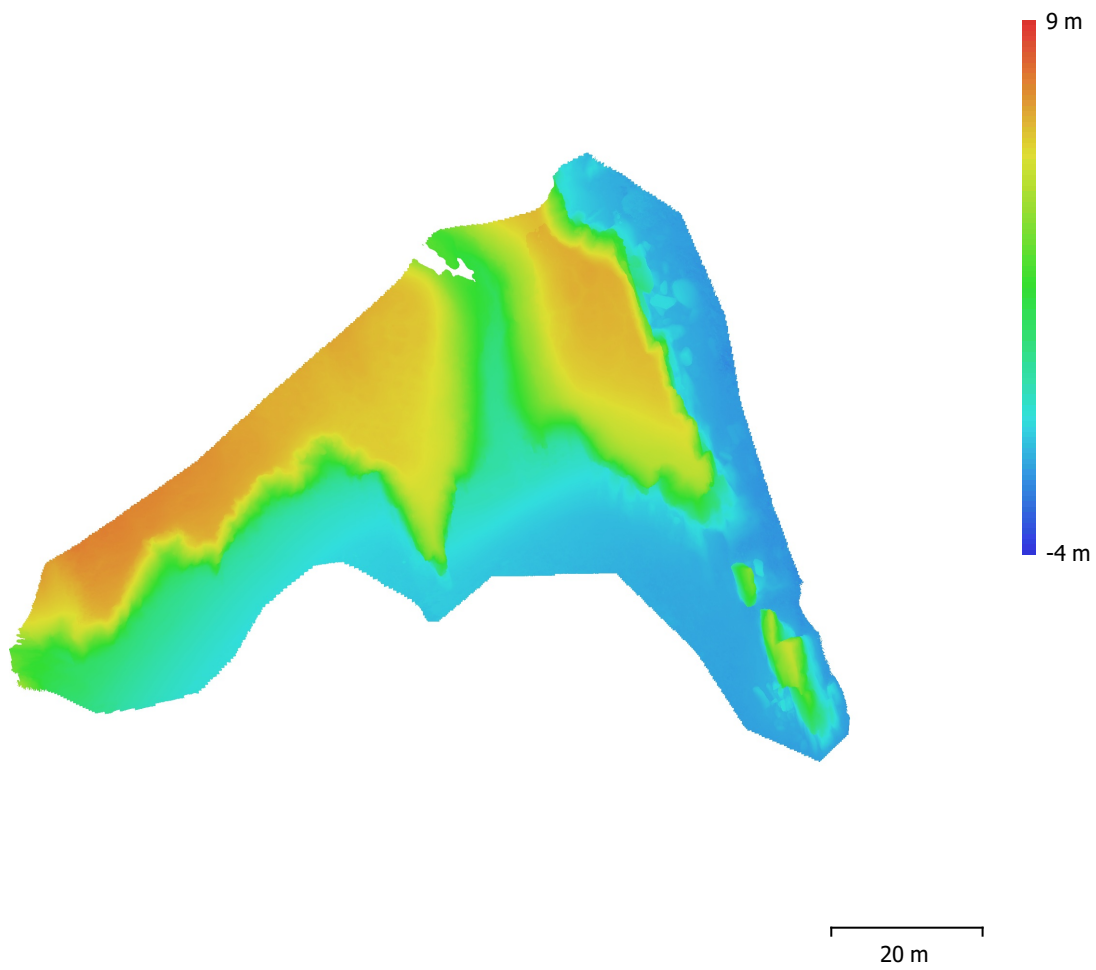


Fig. 5. Reconstructed digital elevation model.

Resolution: 7.04 mm/pix  
Point density: 2.02 points/cm<sup>2</sup>

# Processing Parameters

## General

Cameras	197
Aligned cameras	194
Coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	186,066 of 212,764
RMS reprojection error	0.284395 (0.442277 pix)
Max reprojection error	0.861829 (13.613 pix)
Mean key point size	1.56031 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	3.31598

## Alignment parameters

Accuracy	Highest
Generic preselection	Yes
Reference preselection	Source
Key point limit	40,000
Tie point limit	4,000
Guided image matching	No
Adaptive camera model fitting	No
Matching time	1 minutes 40 seconds
Matching memory usage	374.13 MB
Alignment time	1 minutes 19 seconds
Alignment memory usage	113.78 MB
Software version	1.6.3.10732
File size	15.66 MB

## Depth Maps

Count	192
<b>Depth maps generation parameters</b>	
Quality	Ultra High
Filtering mode	Mild
Processing time	22 minutes 12 seconds
Memory usage	4.43 GB
Software version	1.6.3.10732
File size	1.82 GB

## Dense Point Cloud

Points	231,997,888
Point colors	3 bands, uint8
<b>Depth maps generation parameters</b>	
Quality	Ultra High
Filtering mode	Mild
Processing time	22 minutes 12 seconds
Memory usage	4.43 GB
<b>Dense cloud generation parameters</b>	
Processing time	1 hours 39 minutes
Memory usage	22.14 GB
Software version	1.6.3.10732
File size	3.02 GB

## Model

Faces	1,499,999
Vertices	761,381
Vertex colors	3 bands, uint8
Texture	8,192 x 8,192, 4 bands, uint8
<b>Depth maps generation parameters</b>	
Quality	Ultra High
Filtering mode	Mild
Processing time	22 minutes 12 seconds
Memory usage	4.43 GB
<b>Reconstruction parameters</b>	
Surface type	Arbitrary
Source data	Dense cloud
Interpolation	Enabled
Strict volumetric masks	No
Processing time	1 hours 54 minutes
Memory usage	119.10 GB
<b>Texturing parameters</b>	
Mapping mode	Generic
Blending mode	Mosaic
Texture size	8,192
Enable hole filling	Yes
Enable ghosting filter	Yes
UV mapping time	11 minutes 43 seconds
Blending time	1 minutes 17 seconds
Software version	1.6.3.10732
File size	177.09 MB
<b>Tiled Model</b>	
Texture	3 bands, uint8
<b>Depth maps generation parameters</b>	
Quality	Ultra High
Filtering mode	Mild
Processing time	22 minutes 12 seconds
Memory usage	4.43 GB
<b>Reconstruction parameters</b>	
Source data	Dense cloud
Tile size	256
Face count	Medium
Enable ghosting filter	No
Processing time	3 hours 13 minutes
Memory usage	48.28 GB
Software version	1.7.1.11797
File size	430.22 MB
<b>System</b>	
Software name	Agisoft Metashape Professional
Software version	1.7.1 build 11797
OS	Windows 64 bit
RAM	127.78 GB
CPU	Intel(R) Core(TM) i9-9900K CPU @ 3.60GHz
GPU(s)	GeForce RTX 2080