

# **Day 11 (Survey 6)**

**Processing Report  
13 February 2018**



# Survey Data

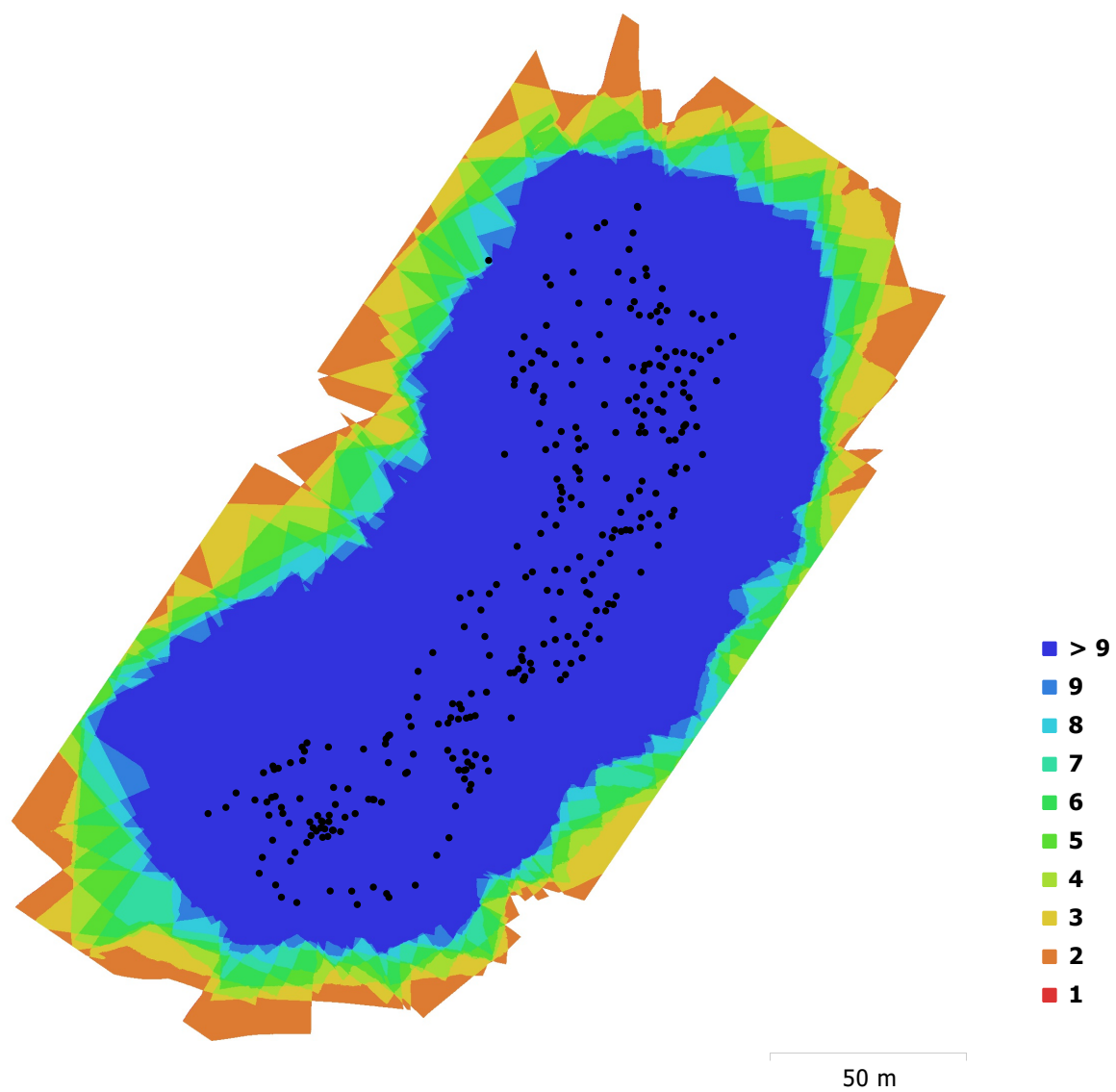


Fig. 1. Camera locations and image overlap.

Number of images:	298	Camera stations:	298
Flying altitude:	42.9 m	Tie points:	1,218,213
Ground resolution:	1.26 cm/pix	Projections:	4,514,338
Coverage area:	0.0324 km <sup>2</sup>	Reprojection error:	1.15 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
Canon PowerShot D30 (5 mm)	4000 x 3000	5 mm	1.55 x 1.55 μm	No

Table 1. Cameras.

# Camera Calibration

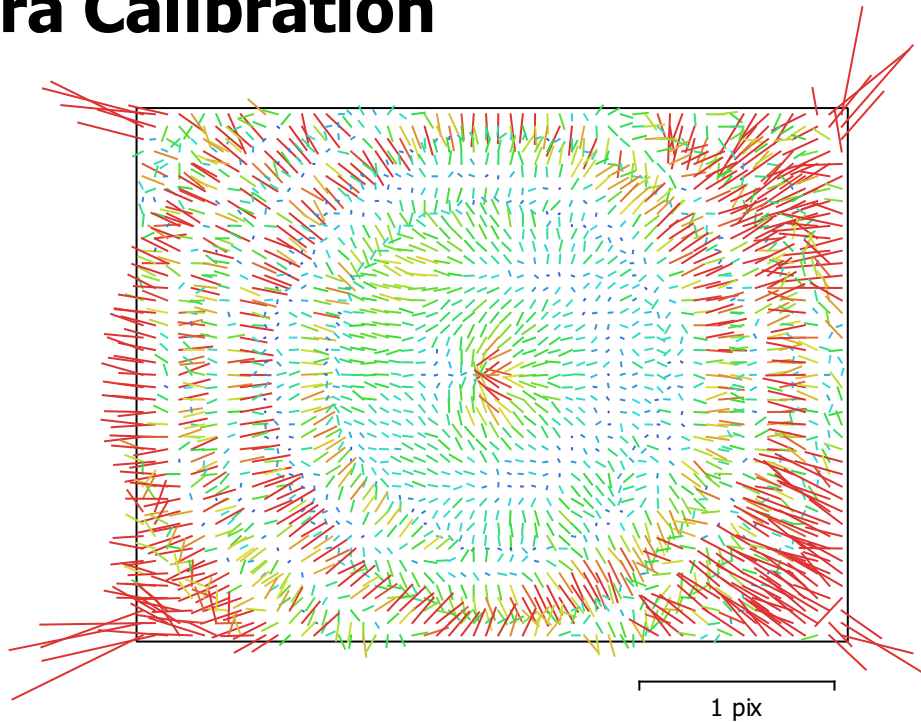


Fig. 2. Image residuals for Canon PowerShot D30 (5 mm).

## Canon PowerShot D30 (5 mm)

298 images

Type  
Frame

Resolution  
**4000 x 3000**

Focal Length  
**5 mm**

Pixel Size  
**1.55 x 1.55  $\mu\text{m}$**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2
<b>F</b>	<b>3280.17</b>	0.052	1.00	-0.41	0.11	-0.33	-0.06	-0.10	0.14	-0.14	0.13	-0.16	0.11
<b>Cx</b>	<b>-18.2098</b>	0.05		1.00	-0.07	0.49	0.03	-0.04	0.01	-0.00	0.00	0.89	-0.08
<b>Cy</b>	<b>-6.95172</b>	0.045			1.00	-0.04	0.34	0.02	-0.01	0.00	-0.00	-0.02	0.93
<b>B1</b>	<b>-0.940386</b>	0.0055				1.00	0.02	-0.01	-0.01	0.00	-0.00	0.26	-0.06
<b>B2</b>	<b>0.398266</b>	0.0052					1.00	0.00	0.00	0.00	-0.00	0.04	0.16
<b>K1</b>	<b>-0.00255726</b>	6.5e-05						1.00	-0.97	0.92	-0.87	-0.05	0.02
<b>K2</b>	<b>0.0179736</b>	0.00048							1.00	-0.99	0.95	0.01	-0.01
<b>K3</b>	<b>-0.137336</b>	0.0014								1.00	-0.99	-0.00	0.01
<b>K4</b>	<b>0.173831</b>	0.0014									1.00	0.00	-0.00
<b>P1</b>	<b>-0.00194867</b>	3.5e-06										1.00	-0.04
<b>P2</b>	<b>-1.86849e-06</b>	3.3e-06											1.00

Table 2. Calibration coefficients and correlation matrix.

# Ground Control Points

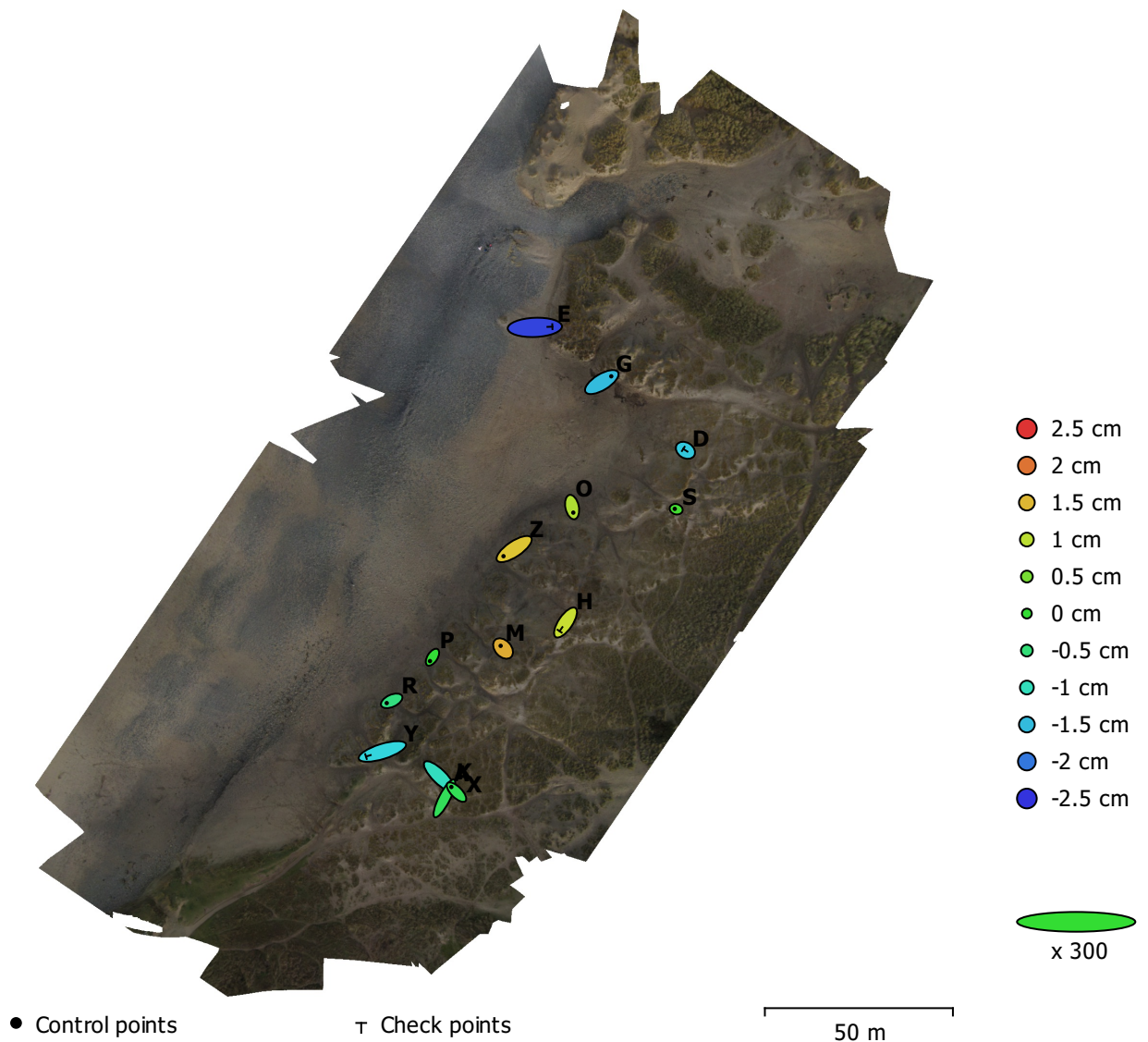


Fig. 3. GCP locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated GCP locations are marked with a dot or crossing.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
10	1.14238	1.19191	0.966502	1.65096	1.91306

Table 3. Control points RMSE.

X - Easting, Y - Northing, Z - Altitude.

Count	X error (cm)	Y error (cm)	Z error (cm)	XY error (cm)	Total (cm)
4	2.1998	0.901373	1.62794	2.37731	2.88128

Table 4. Check points RMSE.

X - Easting, Y - Northing, Z - Altitude.

<b>Label</b>	<b>X error (cm)</b>	<b>Y error (cm)</b>	<b>Z error (cm)</b>	<b>Total (cm)</b>	<b>Image (pix)</b>
A	1.71783	-1.69026	-1.03774	2.62389	1.014 (25)
G	1.67708	1.02382	-1.52479	2.48713	0.918 (49)
K	1.27052	2.46023	-0.304412	2.78561	1.104 (23)
M	-0.430292	0.471066	1.61898	1.74016	1.249 (30)
O	0.212763	-0.988092	0.901675	1.35448	0.958 (44)
P	-0.441874	-0.681316	-0.0429745	0.813198	0.957 (40)
R	-0.878742	-0.399331	-0.573623	1.12281	0.803 (29)
S	-0.252691	0.0699665	0.109829	0.284272	0.974 (34)
X	-0.909347	0.907262	-0.268237	1.31225	1.068 (23)
Z	-1.89315	-1.26434	1.41339	2.6796	0.816 (33)
<b>Total</b>	<b>1.14238</b>	<b>1.19191</b>	<b>0.966502</b>	<b>1.91306</b>	<b>0.982</b>

Table 5. Control points.  
X - Easting, Y - Northing, Z - Altitude.

<b>Label</b>	<b>X error (cm)</b>	<b>Y error (cm)</b>	<b>Z error (cm)</b>	<b>Total (cm)</b>	<b>Image (pix)</b>
D	-0.385398	0.243911	-1.41884	1.49035	0.936 (48)
E	3.10685	0.127864	-2.37568	3.91315	0.914 (37)
H	-1.04566	-1.53513	1.08229	2.14974	0.830 (39)
Y	-2.90895	-0.904114	-1.33131	3.32443	1.063 (46)
<b>Total</b>	<b>2.1998</b>	<b>0.901373</b>	<b>1.62794</b>	<b>2.88128</b>	<b>0.945</b>

Table 6. Check points.  
X - Easting, Y - Northing, Z - Altitude.



# Digital Elevation Model

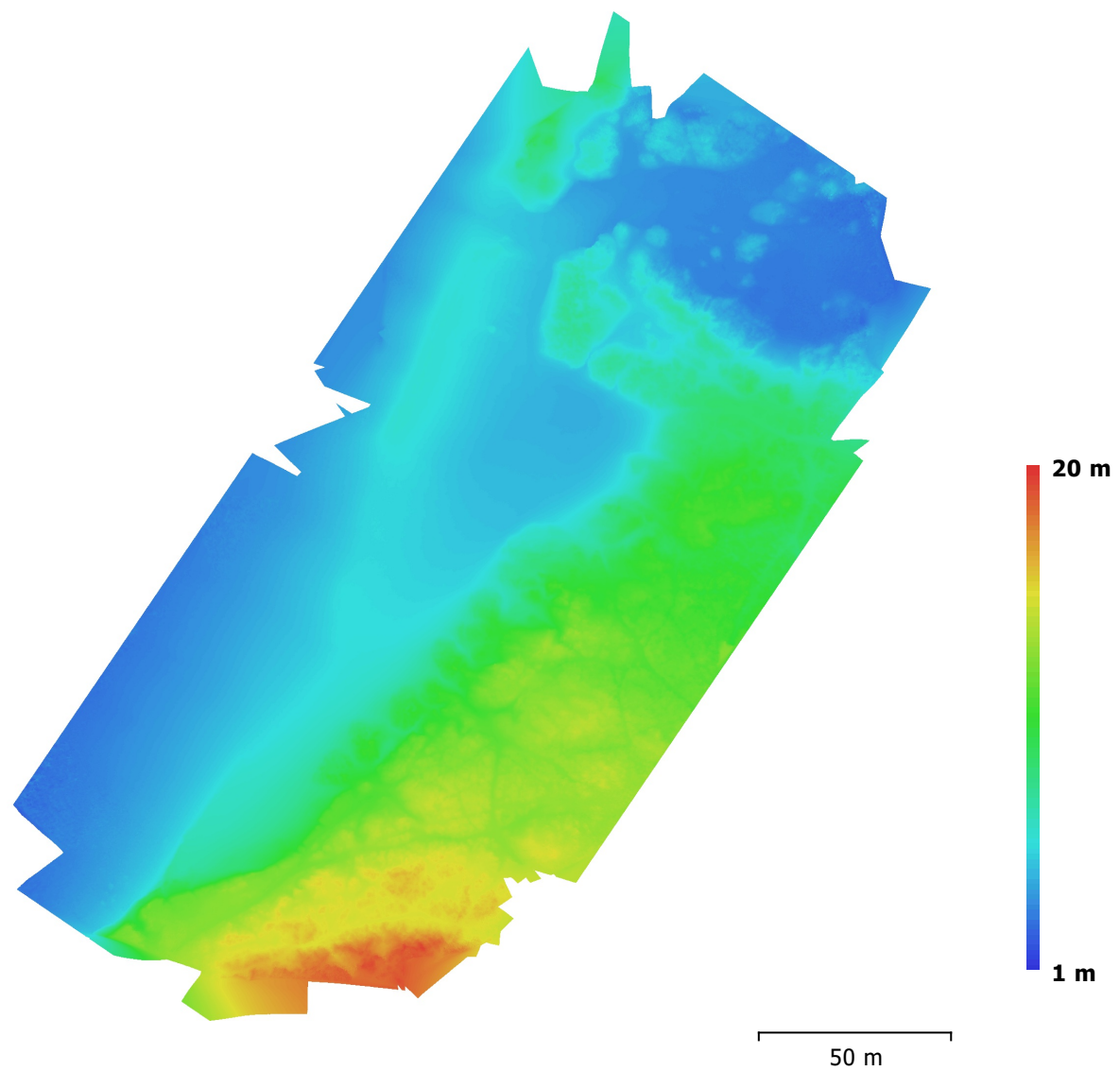


Fig. 4. Reconstructed digital elevation model.

Resolution: 2.52 cm/pix  
Point density: 15.7 points/cm<sup>2</sup>

# Processing Parameters

## General

Cameras	298
Aligned cameras	298
Markers	14
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	1,218,213 of 1,301,800
RMS reprojection error	0.21012 (1.14538 pix)
Max reprojection error	0.759971 (59.6604 pix)
Mean key point size	4.94085 pix
Effective overlap	4.16971

### Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Yes
Key point limit	100,000
Tie point limit	0
Adaptive camera model fitting	Yes
Matching time	2 hours 7 minutes
Alignment time	11 minutes 50 seconds

### Optimization parameters

Parameters	f, b1, b2, cx, cy, k1-k4, p1, p2
Fit rolling shutter	No
Optimization time	31 seconds

## Dense Point Cloud

Points	52,596,413
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### Reconstruction parameters

Quality	High
Depth filtering	Aggressive
Depth maps generation time	13 hours 58 minutes
Dense cloud generation time	4 hours 16 minutes

## Model

Faces	3,485,896
Vertices	1,745,198

### Reconstruction parameters

Surface type	Height field
Source data	Dense
Interpolation	Enabled
Quality	High
Depth filtering	Aggressive
Face count	3,506,419
Processing time	2 minutes 43 seconds

## Orthomosaic

Size	18,942 x 20,811
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Channels	3, uint8

### Reconstruction parameters

Blending mode	Mosaic
Surface	Mesh
Enable color correction	No
Enable hole filling	Yes
Processing time	30 minutes 57 seconds

## Software

Version	1.3.2 build 4205
Platform	Windows 64