

# SouthBeach\_20190704

Processing Report  
30 January 2020



# Survey Data

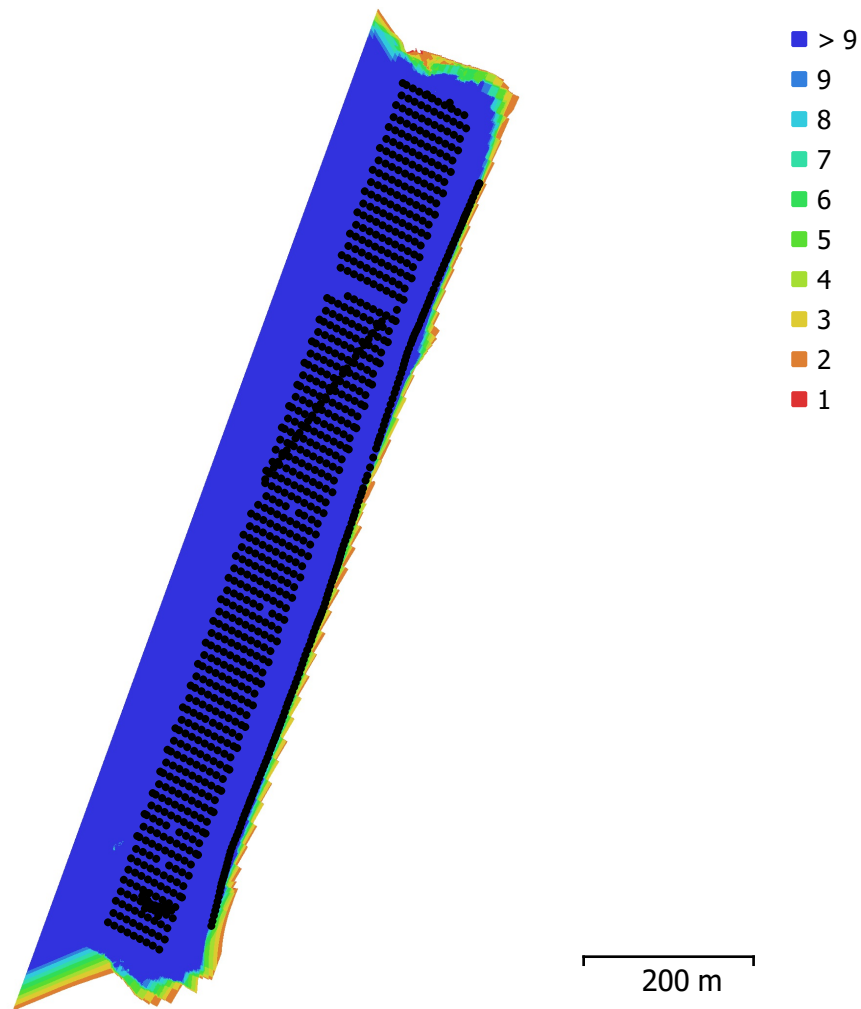


Fig. 1. Camera locations and image overlap.

Number of images:	1,035	Camera stations:	1,035
Flying altitude:	71.9 m	Tie points:	1,561,036
Ground resolution:	1.76 cm/pix	Projections:	5,637,724
Coverage area:	0.224 km <sup>2</sup>	Reprojection error:	0.737 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC6310 (8.8mm)	5472 x 3648	8.8 mm	2.41 x 2.41 $\mu$ m	No
FC6310 (8.8mm)	5464 x 3640	8.8 mm	2.42 x 2.42 $\mu$ m	No

Table 1. Cameras.

# Camera Calibration

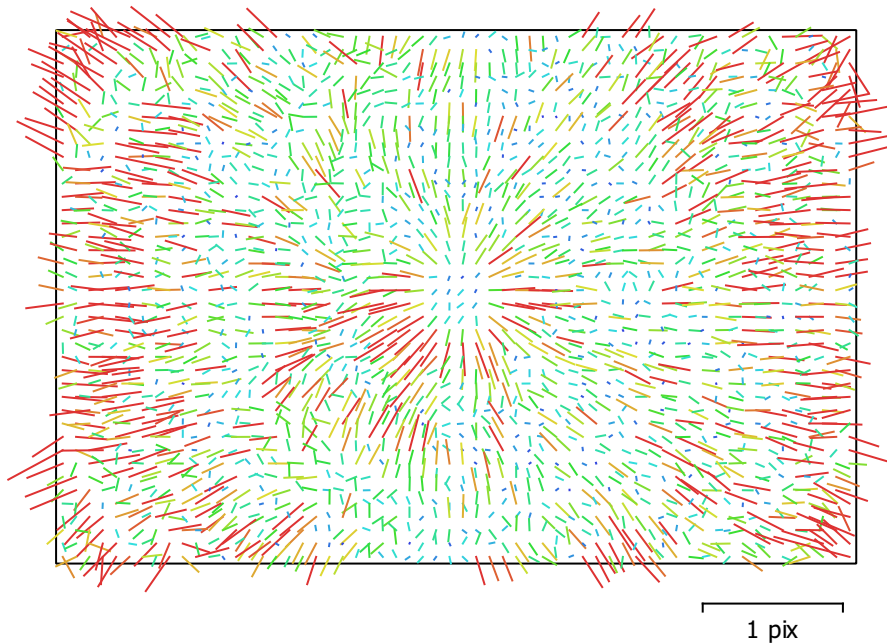


Fig. 2. Image residuals for FC6310 (8.8mm).

## FC6310 (8.8mm)

833 images

Type  
Frame

Resolution  
**5472 x 3648**

Focal Length  
**8.8 mm**

Pixel Size  
**2.41 x 2.41  $\mu$ m**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2	P3	P4
<b>F</b>	<b>3653.63</b>	0.077	1.00	-0.02	-0.13	-0.11	0.12	-0.03	0.01	0.02	-0.04	-0.01	0.02	0.01	-0.01
<b>Cx</b>	<b>-7.35094</b>	0.0091		1.00	-0.12	0.08	-0.03	0.01	-0.01	0.01	-0.01	0.91	-0.07	0.03	-0.03
<b>Cy</b>	<b>36.3205</b>	0.0065			1.00	0.02	0.03	-0.01	0.01	-0.02	0.02	-0.14	0.60	-0.41	0.33
<b>B1</b>	<b>-0.472931</b>	0.0058				1.00	-0.08	0.01	-0.01	0.01	-0.01	0.04	0.00	-0.01	0.01
<b>B2</b>	<b>0.591802</b>	0.0061					1.00	0.00	-0.01	0.01	-0.01	-0.04	-0.02	0.01	-0.00
<b>K1</b>	<b>0.00708785</b>	2.1e-05						1.00	-0.97	0.92	-0.87	0.01	-0.03	0.05	-0.05
<b>K2</b>	<b>-0.0473104</b>	9.9e-05							1.00	-0.99	0.96	-0.01	0.04	-0.06	0.06
<b>K3</b>	<b>0.0908935</b>	0.00019								1.00	-0.99	0.01	-0.04	0.07	-0.07
<b>K4</b>	<b>-0.0554255</b>	0.00012									1.00	-0.02	0.05	-0.07	0.08
<b>P1</b>	<b>3.07066e-07</b>	7.7e-07										1.00	-0.08	0.04	-0.04
<b>P2</b>	<b>0.0020725</b>	1.7e-06											1.00	-0.92	0.82
<b>P3</b>	<b>0.197393</b>	0.0028												1.00	-0.97
<b>P4</b>	<b>-0.138633</b>	0.003													1.00

Table 2. Calibration coefficients and correlation matrix.

# Camera Calibration

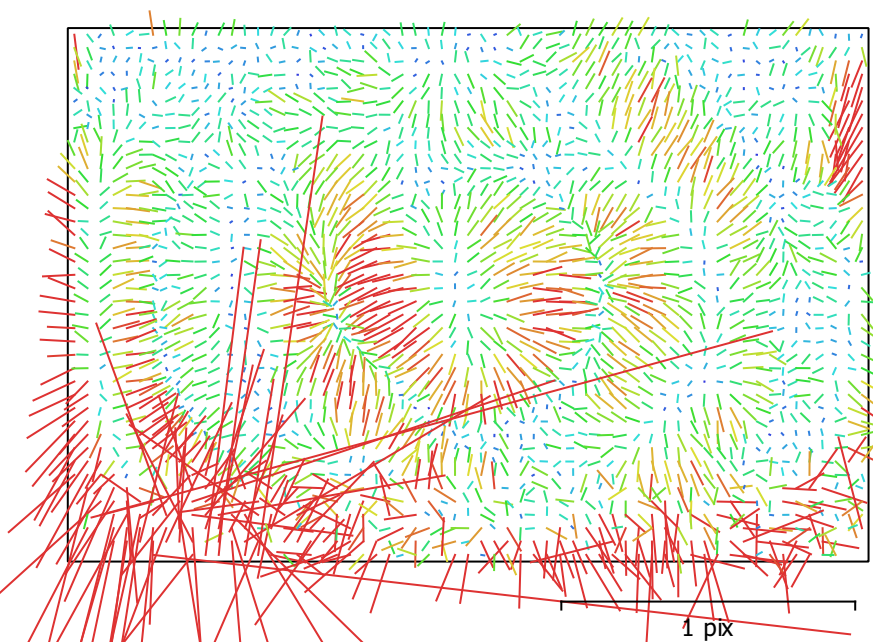


Fig. 3. Image residuals for FC6310 (8.8mm).

**FC6310 (8.8mm)**

202 images

Type  
**Frame**

Resolution  
**5464 x 3640**

Focal Length  
**8.8 mm**

Pixel Size  
**2.42 x 2.42  $\mu$ m**

	Value	Error	F	Cx	Cy	B1	B2	K1	K2	K3	K4	P1	P2	P3	P4
<b>F</b>	<b>3654.69</b>	0.09	1.00	-0.13	-0.05	-0.24	0.20	-0.62	0.23	-0.14	0.10	0.17	0.13	-0.09	0.06
<b>Cx</b>	<b>-10.1684</b>	0.035		1.00	-0.09	0.30	-0.02	0.06	-0.02	0.01	-0.01	-0.16	0.06	0.01	-0.02
<b>Cy</b>	<b>38.1187</b>	0.025			1.00	0.13	0.37	0.03	-0.03	0.03	-0.03	-0.02	-0.61	-0.01	0.04
<b>B1</b>	<b>-0.909686</b>	0.011				1.00	0.14	0.07	-0.04	0.03	-0.02	-0.38	-0.28	0.18	-0.10
<b>B2</b>	<b>0.438569</b>	0.0093					1.00	-0.11	0.02	0.00	-0.01	0.04	-0.26	0.02	-0.01
<b>K1</b>	<b>-0.269362</b>	2.2e-05						1.00	-0.88	0.80	-0.73	-0.05	-0.04	0.03	-0.03
<b>K2</b>	<b>0.124763</b>	6.8e-05							1.00	-0.98	0.94	0.00	0.02	-0.01	0.02
<b>K3</b>	<b>-0.0547844</b>	9.5e-05								1.00	-0.99	0.00	-0.02	0.02	-0.04
<b>K4</b>	<b>0.0117418</b>	4.6e-05									1.00	0.00	0.04	-0.04	0.06
<b>P1</b>	<b>0.000308135</b>	1.8e-06										1.00	0.67	-0.80	0.62
<b>P2</b>	<b>0.000284742</b>	1.7e-06											1.00	-0.69	0.57
<b>P3</b>	<b>0.112557</b>	0.011												1.00	-0.95
<b>P4</b>	<b>0.0255059</b>	0.0084													1.00

Table 3. Calibration coefficients and correlation matrix.

# Ground Control Points



Fig. 4. 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)
9	1.79582	1.22416	2.57807	2.17337	3.37194

Table 4. Control points RMSE.

X - Longitude, Y - Latitude, 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>
1	0.0623639	-0.0239714	0.716613	0.719721	0.185 (53)
3	-1.99199	0.120907	-4.68372	5.09116	0.271 (96)
4	0.238752	-0.149176	-2.26403	2.28147	0.154 (75)
5	-2.76518	2.45898	-1.63811	4.04676	0.117 (69)
6	-0.00370674	0.0103777	0.54417	0.544282	0.170 (77)
7	2.43627	0.376329	-1.95716	3.14761	0.186 (56)
8	-0.564433	0.401642	0.891815	1.12926	0.285 (90)
9	0.868625	-0.110148	-2.72153	2.85891	0.254 (75)
10	-3.21573	-2.66231	4.15081	5.88711	0.293 (44)
<b>Total</b>	<b>1.79582</b>	<b>1.22416</b>	<b>2.57807</b>	<b>3.37194</b>	<b>0.223</b>

Table 5. Control points.  
X - Longitude, Y - Latitude, Z - Altitude.

# Digital Elevation Model

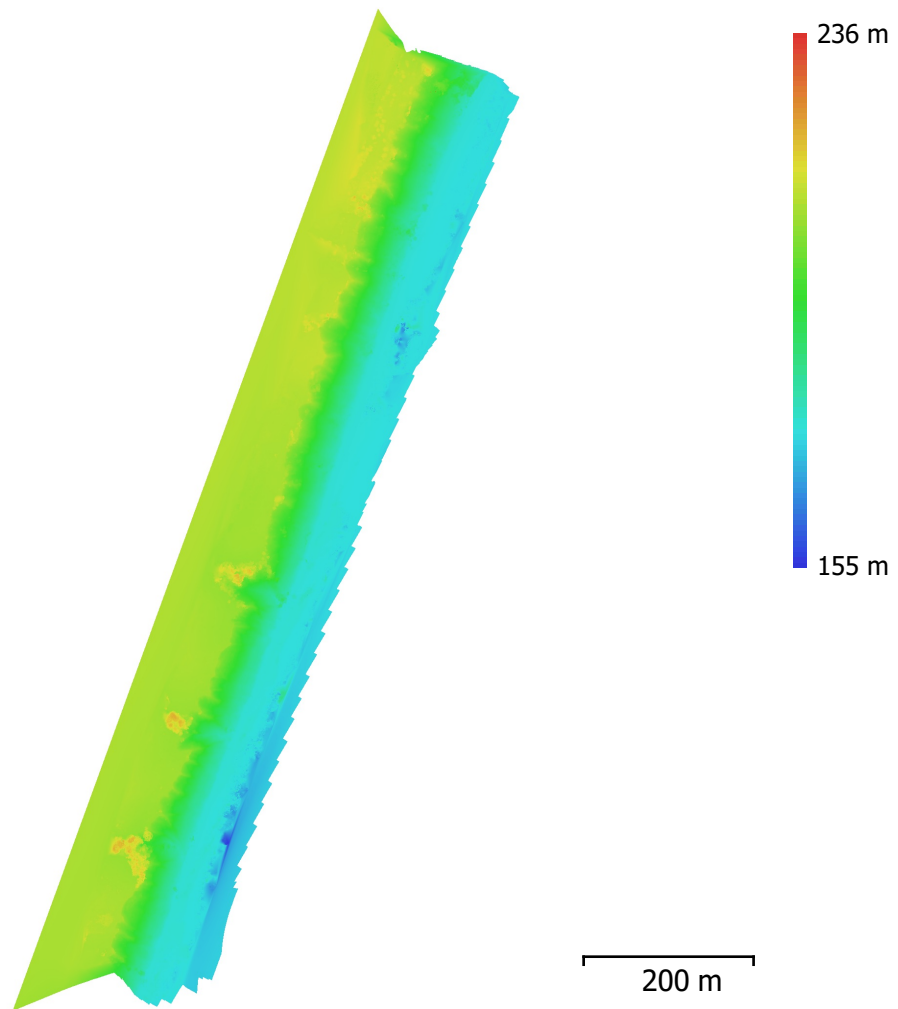


Fig. 5. Reconstructed digital elevation model.

Resolution: 3.52 cm/pix  
Point density: 809 points/m<sup>2</sup>

# Processing Parameters

## General

Cameras	1035
Aligned cameras	1035
Markers	9
Coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	1,561,036 of 1,673,532
RMS reprojection error	0.16368 (0.737032 pix)
Max reprojection error	6.67942 (49.6015 pix)
Mean key point size	3.24967 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	4.10663

## Alignment parameters

Accuracy	High
Generic preselection	Yes
Reference preselection	Yes
Key point limit	40,000
Tie point limit	10,000
Adaptive camera model fitting	No
Matching time	6 hours 0 minutes
Alignment time	29 minutes 43 seconds

## Optimization parameters

Parameters	f, b1, b2, cx, cy, k1-k4, p1-p4
Adaptive camera model fitting	No
Optimization time	1 minutes 20 seconds

## Depth Maps

Count	1035
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## Reconstruction parameters

Quality	High
Filtering mode	Aggressive
Processing time	18 hours 59 minutes

## Dense Point Cloud

Points	186,464,457
Point colors	3 bands, uint8

## Reconstruction parameters

Quality	High
Depth filtering	Aggressive
Depth maps generation time	18 hours 59 minutes
Dense cloud generation time	1 days 9 hours

## Model

Faces	37,117,301
Vertices	18,566,176
Vertex colors	3 bands, uint8

## Reconstruction parameters

Surface type	Height field
Source data	Dense
Interpolation	Enabled
Quality	High
Depth filtering	Aggressive
Face count	37,292,891
Processing time	18 minutes 0 seconds

## Orthomosaic

Size	34,559 x 66,768
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Coordinate system	WGS 84 / UTM zone 16N (EPSG::32616)
Colors	3 bands, uint8
<b>Reconstruction parameters</b>	
Blending mode	Mosaic
Surface	Mesh
Enable hole filling	Yes
Processing time	1 hours 13 minutes
<b>Software</b>	
Version	1.4.3 build 6529
Platform	Windows 64