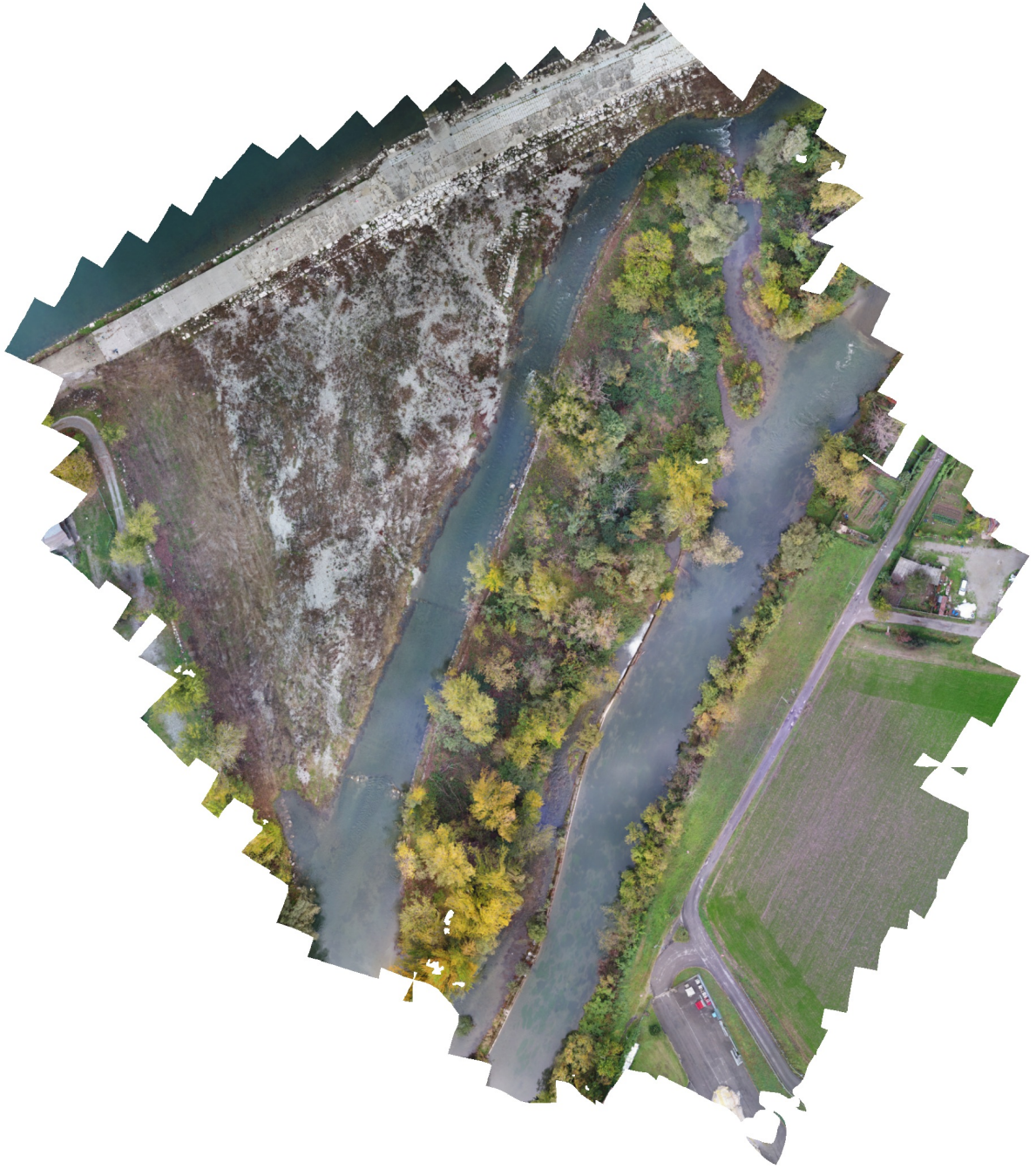


# Agisoft Metashape

Processing Report  
20 December 2022



# Survey Data

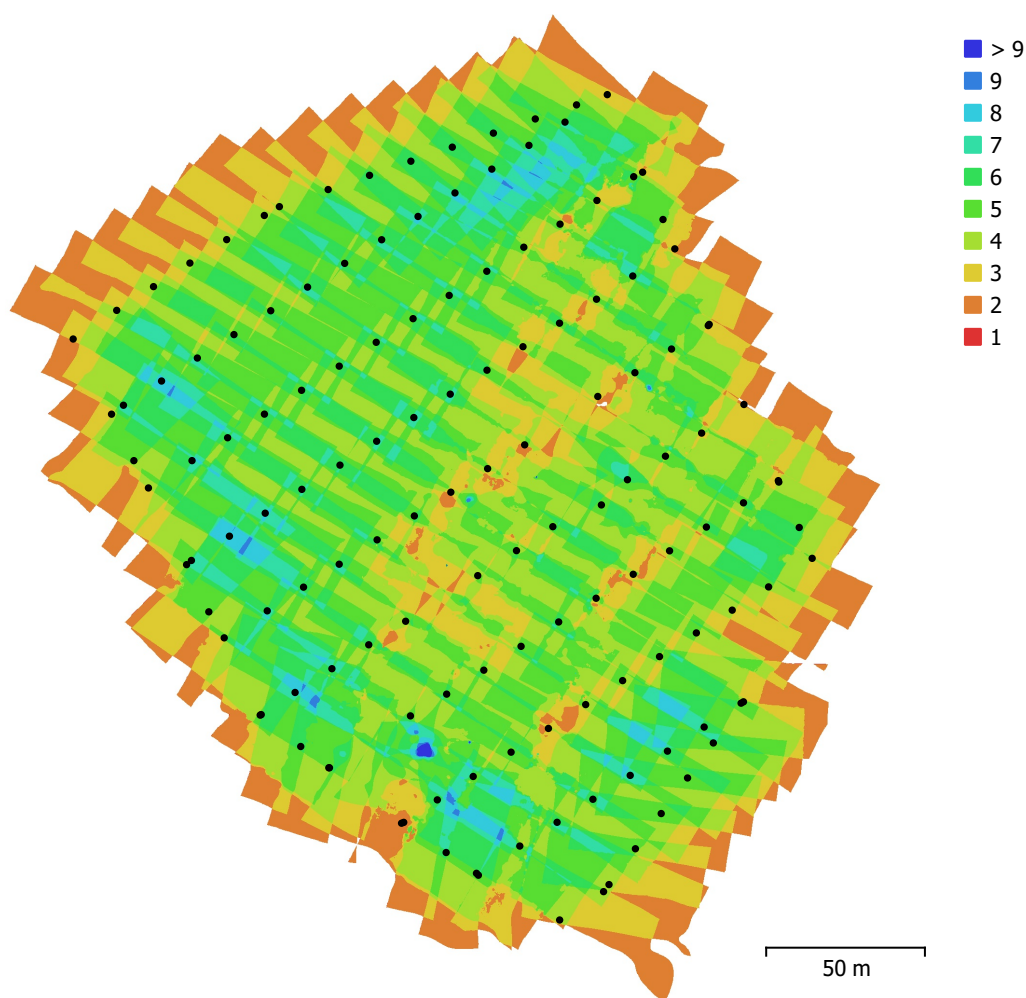


Fig. 1. Camera locations and image overlap.

|                    |                        |                     |           |
|--------------------|------------------------|---------------------|-----------|
| Number of images:  | 141                    | Camera stations:    | 137       |
| Flying altitude:   | 45.7 m                 | Tie points:         | 123,099   |
| Ground resolution: | 9.87 mm/pix            | Projections:        | 360,673   |
| Coverage area:     | 0.0518 km <sup>2</sup> | Reprojection error: | 0.617 pix |

| Camera Model             | Resolution  | Focal Length | Pixel Size     | Precalibrated |
|--------------------------|-------------|--------------|----------------|---------------|
| FC6520, DJI MFT 15mm ... | 5280 x 2970 | 15 mm        | 3.57 x 3.57 μm | Yes           |

Table 1. Cameras.

# Camera Calibration

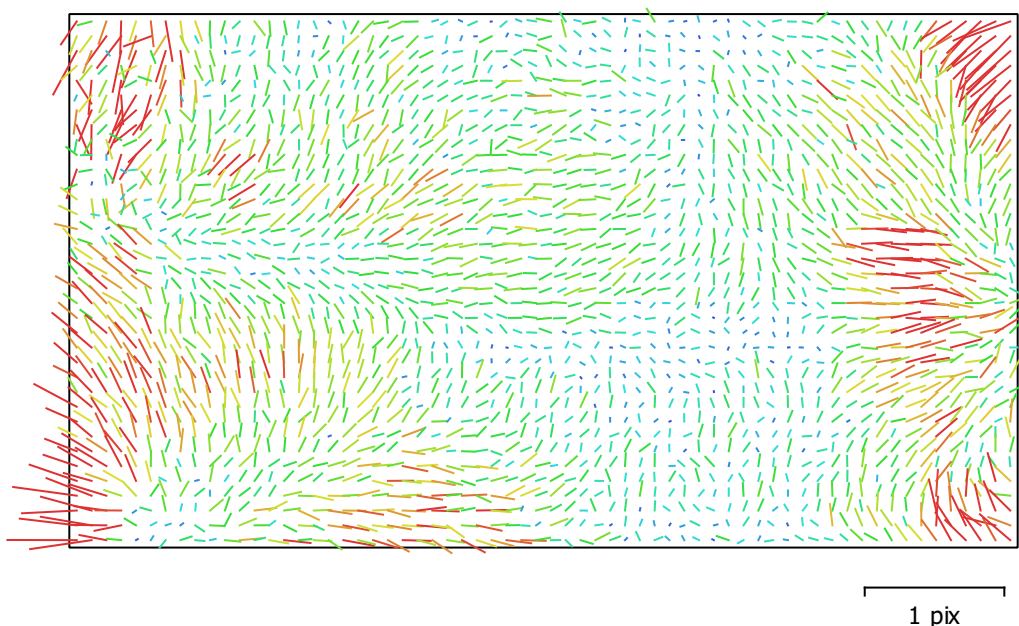


Fig. 2. Image residuals for FC6520, DJI MFT 15mm F1.7 ASPH (15mm).

## FC6520, DJI MFT 15mm F1.7 ASPH (15mm)

141 images, precalibrated

| Type  | Resolution  | Focal Length | Pixel Size     |
|-------|-------------|--------------|----------------|
| Frame | 5280 x 2970 | 15 mm        | 3.57 x 3.57 μm |
| F:    | 4550.57     |              |                |
| Cx:   | 40.7968     | B1:          | -14.1409       |
| Cy:   | -10.4168    | B2:          | -0.065175      |
| K1:   | -0.221097   | P1:          | -2.71648e-05   |
| K2:   | 0.110361    | P2:          | -9.60296e-05   |
| K3:   | -0.0112893  | P3:          | 0              |
| K4:   | 0           | P4:          | 0              |

Fixed parameters: All



# Ground Control Points

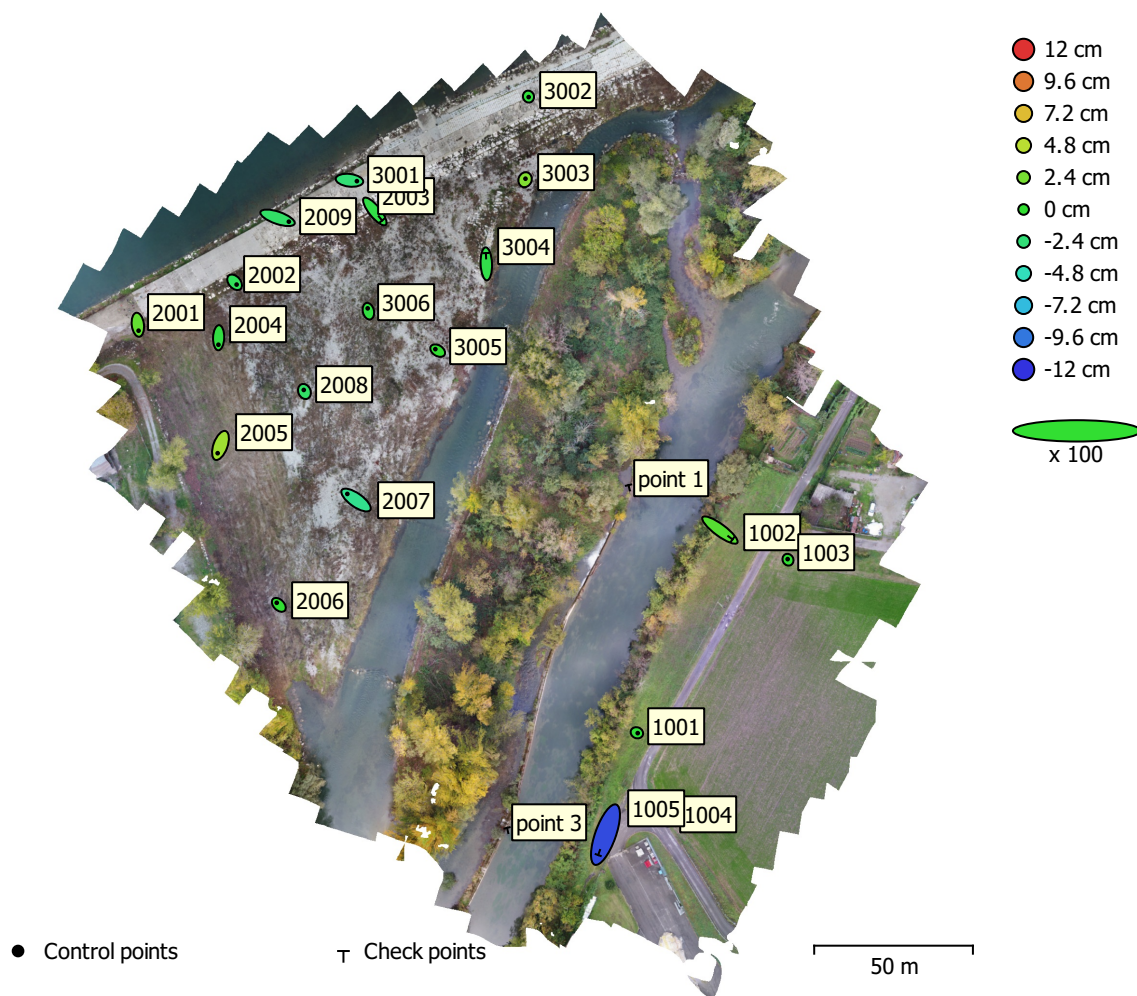


Fig. 3. GCP locations and error estimates.

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) |
|-------|--------------|--------------|--------------|---------------|------------|
| 16    | 2.65266      | 2.34362      | 1.75848      | 3.53966       | 3.9524     |

Table 2. 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     | 5.14516      | 8.34139      | 5.63709      | 9.80058       | 11.3061    |

Table 3. 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> |
|--------------|---------------------|---------------------|---------------------|-------------------|--------------------|
| 1001         | 0.526163            | -0.227046           | -0.27687            | 0.636439          | 1.428 (4)          |
| 1003         | -0.20964            | 0.382777            | -0.0578846          | 0.440248          | 0.987 (6)          |
| 1004         | -0.510318           | -0.0630006          | 0.21299             | 0.55656           | 0.323 (4)          |
| 2001         | 0.460504            | -3.7439             | 1.71669             | 4.14438           | 1.873 (4)          |
| 2002         | 1.26243             | -1.4308             | -1.35107            | 2.33802           | 3.292 (4)          |
| 2004         | -0.141802           | -4.40982            | -0.558582           | 4.44732           | 1.676 (6)          |
| 2005         | -1.78454            | -4.89116            | 3.78233             | 6.43537           | 3.334 (5)          |
| 2006         | -1.31939            | 1.30867             | -0.00908453         | 1.85835           | 2.480 (4)          |
| 2007         | -5.47852            | 3.85921             | -3.16128            | 7.40954           | 1.821 (6)          |
| 2008         | -0.419128           | 0.956167            | -1.81811            | 2.09653           | 0.407 (5)          |
| 2009         | 7.12312             | -2.43313            | -1.80295            | 7.74013           | 2.720 (3)          |
| 3001         | 4.68071             | -0.555894           | -2.29011            | 5.24048           | 2.111 (4)          |
| 3002         | 0.109133            | -0.303096           | -0.40979            | 0.521253          | 4.161 (3)          |
| 3003         | 0.24458             | 0.619825            | 2.77974             | 2.85849           | 3.251 (6)          |
| 3005         | -1.46888            | 0.924497            | 0.0198171           | 1.73571           | 5.489 (5)          |
| 3006         | -0.431895           | 1.7789              | -0.520141           | 1.90304           | 0.509 (5)          |
| <b>Total</b> | <b>2.65266</b>      | <b>2.34362</b>      | <b>1.75848</b>      | <b>3.9524</b>     | <b>2.591</b>       |

Table 4. 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> |
|--------------|---------------------|---------------------|---------------------|-------------------|--------------------|
| 1002         | 7.96456             | -5.87652            | 1.23789             | 9.97497           | 0.418 (4)          |
| 1005         | -4.59551            | -12.8498            | -11.1513            | 17.6235           | 0.625 (5)          |
| 2003         | 4.61231             | -5.698              | -0.71871            | 7.36595           | 0.801 (6)          |
| 3004         | -0.253757           | 6.7968              | -0.840814           | 6.85331           | 0.597 (6)          |
| point 1      |                     |                     |                     |                   | 0.049 (4)          |
| point 3      |                     |                     |                     |                   | 1.027 (6)          |
| <b>Total</b> | <b>5.14516</b>      | <b>8.34139</b>      | <b>5.63709</b>      | <b>11.3061</b>    | <b>0.642</b>       |

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

# Digital Elevation Model

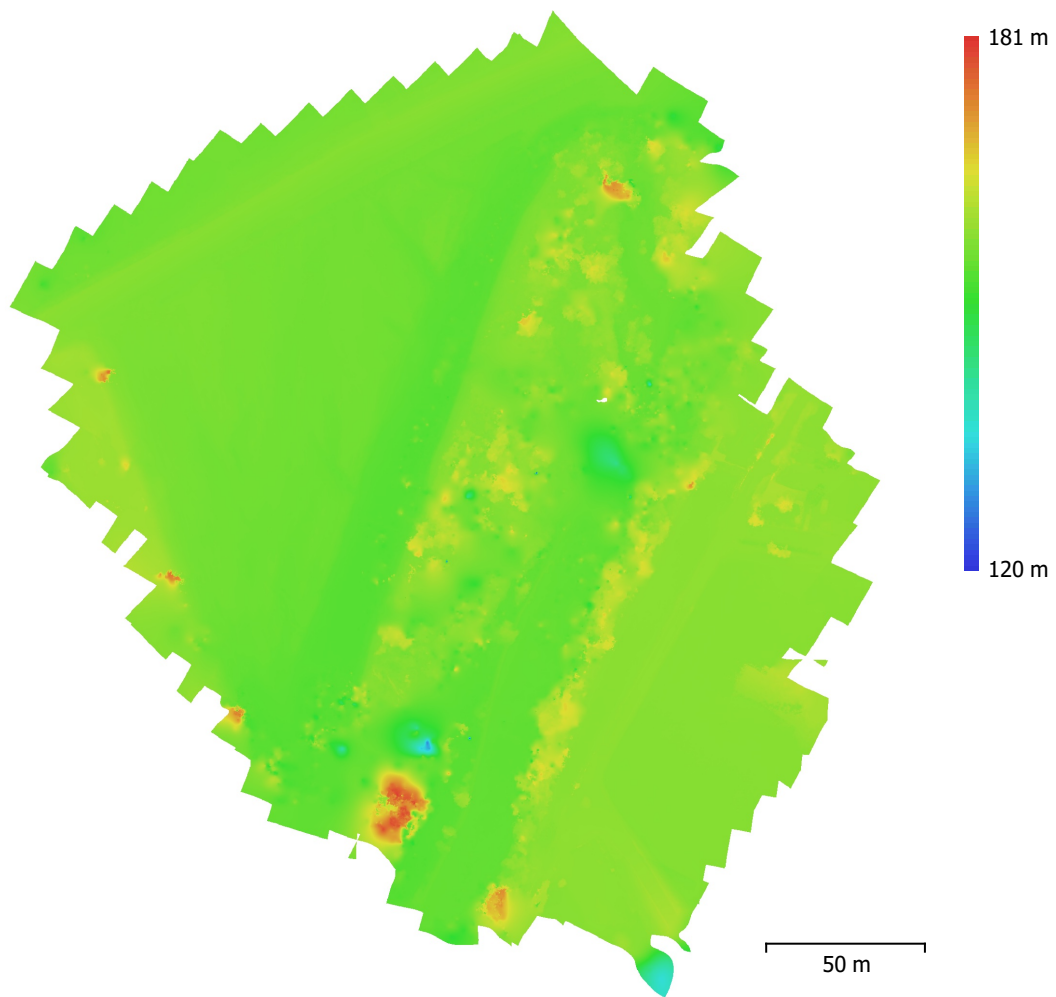


Fig. 4. Reconstructed digital elevation model.

Resolution: 1.97 cm/pix  
Point density: 0.257 points/cm<sup>2</sup>

# Processing Parameters

## General

|                 |     |
|-----------------|-----|
| Cameras         | 141 |
| Aligned cameras | 137 |
| Markers         | 23  |

## Shapes

|                   |                                     |
|-------------------|-------------------------------------|
| LineString        | 1                                   |
| Polygon           | 4                                   |
| Coordinate system | WGS 84 / UTM zone 32N (EPSG::32632) |
| Rotation angles   | Yaw, Pitch, Roll                    |

## Point Cloud

|                                |                         |
|--------------------------------|-------------------------|
| Points                         | 123,099 of 145,439      |
| RMS reprojection error         | 0.183887 (0.616536 pix) |
| Max reprojection error         | 0.750945 (27.0389 pix)  |
| Mean key point size            | 2.9932 pix              |
| Point colors                   | 3 bands, uint8          |
| Key points                     | No                      |
| Average tie point multiplicity | 2.93979                 |

## Alignment parameters

|                               |                      |
|-------------------------------|----------------------|
| Accuracy                      | High                 |
| Generic preselection          | Yes                  |
| Reference preselection        | No                   |
| Key point limit               | 40,000               |
| Key point limit per Mpx       | 1,000                |
| Tie point limit               | 4,000                |
| Exclude stationary tie points | Yes                  |
| Guided image matching         | No                   |
| Adaptive camera model fitting | No                   |
| Matching time                 | 2 minutes 45 seconds |
| Matching memory usage         | 406.27 MB            |
| Alignment time                | 31 seconds           |
| Alignment memory usage        | 42.68 MB             |

## Optimization parameters

|                               |                     |
|-------------------------------|---------------------|
| Adaptive camera model fitting | No                  |
| Optimization time             | 0 seconds           |
| Date created                  | 2022:12:20 10:38:42 |
| Software version              | 1.8.4.14856         |
| File size                     | 9.78 MB             |

## Depth Maps

|       |     |
|-------|-----|
| Count | 134 |
|-------|-----|

## Depth maps generation parameters

|                  |                       |
|------------------|-----------------------|
| Quality          | High                  |
| Filtering mode   | Mild                  |
| Max neighbors    | 16                    |
| Processing time  | 16 minutes 36 seconds |
| Memory usage     | 2.27 GB               |
| Date created     | 2022:12:20 11:35:12   |
| Software version | 1.8.4.14856           |
| File size        | 510.30 MB             |

## Dense Point Cloud

|        |             |
|--------|-------------|
| Points | 106,409,493 |
|--------|-------------|

|  |  |
|--|--|
| Point colors                             | 3 bands, uint8                           |
| <b>Depth maps generation parameters</b>  |  |
| Quality                                  | High                                     |
| Filtering mode                           | Mild                                     |
| Max neighbors                            | 16                                       |
| Processing time                          | 16 minutes 36 seconds                    |
| Memory usage                             | 2.27 GB                                  |
| <b>Dense cloud generation parameters</b> |  |
| Processing time                          | 4 minutes 59 seconds                     |
| Memory usage                             | 4.83 GB                                  |
| Date created                             | 2022:12:20 11:40:11                      |
| Software version                         | 1.8.4.14856                              |
| File size                                | 1.50 GB                                  |
| <b>DEM</b>                               |  |
| Size                                     | 25,086 x 26,224                          |
| Coordinate system                        | WGS 84 / UTM zone 32N (EPSG::32632)      |
| <b>Reconstruction parameters</b>         |  |
| Source data                              | Dense cloud                              |
| Interpolation                            | Enabled                                  |
| Processing time                          | 1 minutes 38 seconds                     |
| Memory usage                             | 311.32 MB                                |
| Date created                             | 2022:12:20 13:45:53                      |
| Software version                         | 1.8.4.14856                              |
| File size                                | 499.51 MB                                |
| <b>Orthomosaic</b>                       |  |
| Size                                     | 27,402 x 31,078                          |
| Coordinate system                        | WGS 84 / UTM zone 32N (EPSG::32632)      |
| Colors                                   | 3 bands, uint8                           |
| <b>Reconstruction parameters</b>         |  |
| Blending mode                            | Mosaic                                   |
| Surface                                  | DEM                                      |
| Enable hole filling                      | Yes                                      |
| Enable ghosting filter                   | No                                       |
| Processing time                          | 4 minutes 5 seconds                      |
| Memory usage                             | 1.43 GB                                  |
| Date created                             | 2022:12:20 13:57:19                      |
| Software version                         | 1.8.4.14856                              |
| File size                                | 3.19 GB                                  |
| <b>System</b>                            |  |
| Software name                            | Agisoft Metashape Professional           |
| Software version                         | 1.8.4 build 14856                        |
| OS                                       | Windows 64 bit                           |
| RAM                                      | 15.78 GB                                 |
| CPU                                      | Intel(R) Core(TM) i7-10700 CPU @ 2.90GHz |
| GPU(s)                                   | Quadro P1000                             |