ASPRS — THE IMAGING & GEOSPATIAL INFORMATION SOCIETY — MID-SOUTH REGION

Can SfM software be used for the images taken by large frame sensors?
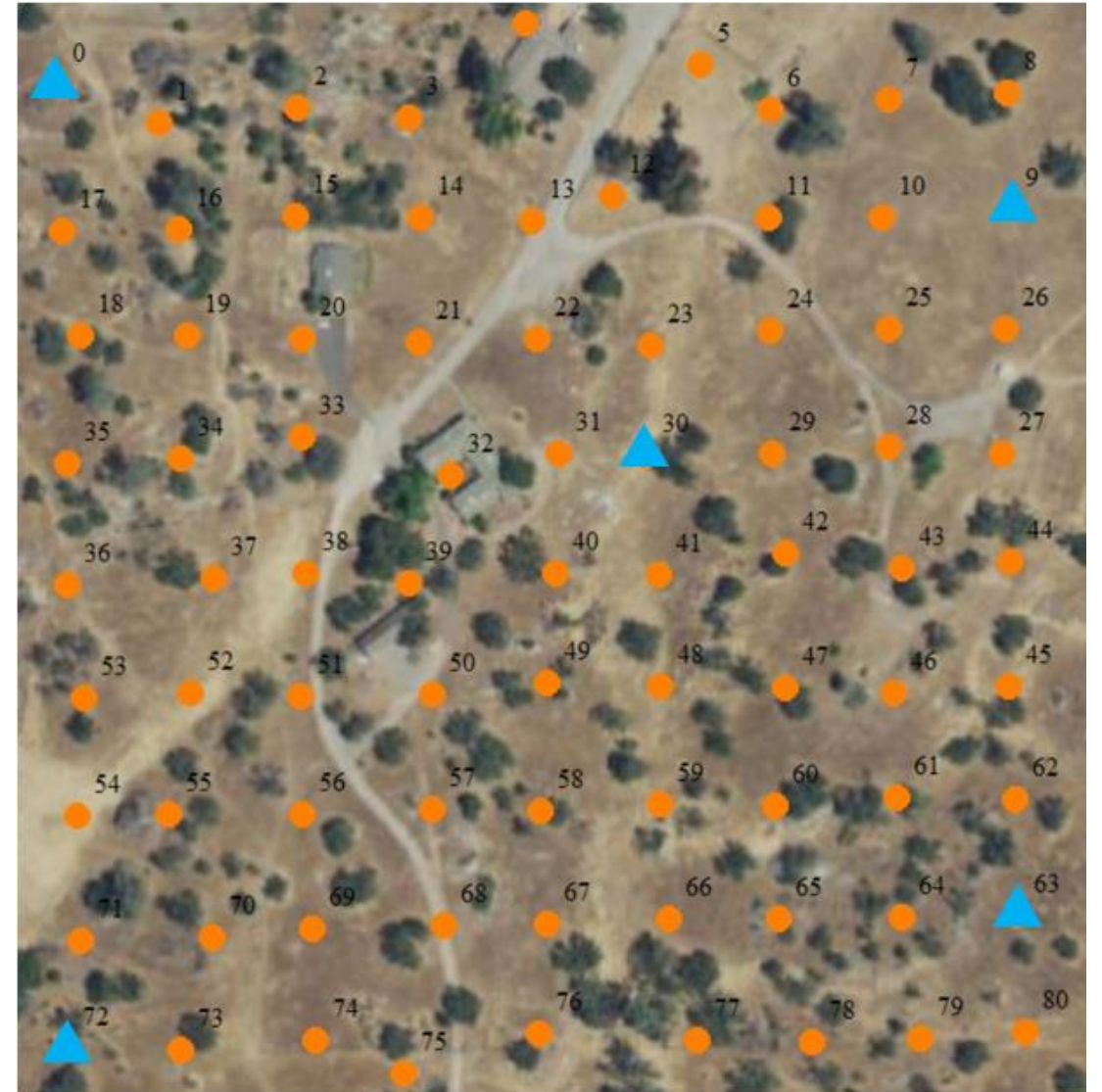
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Test Site and Flight

81 control points laid out in a 9-by-9 grid spaced approximately 40 m apart throughout a 320 m by 320 m area.

The terrain of the area is rolling hills with sparse vegetation, structures and roads.

The control point flight targets were designed to be circular, black and white, and measured about 47 cm in diameter.

These control points were surveyed to 1 cm horizontal and 0.3 cm vertical accuracies, both at one sigma confidence level.

The aircraft platform used was a helicopter at flying height of 270 m above ground level.

The camera model was PhaseOne iXU-RS1000 RGB with a focal length of 51.7 mm and pixel size of 4.6 microns.

Additionally, 70% side/forward overlap is maintained throughout the survey.

Results

With the initial processing 5 points (0, 9, 30, 63 and 72) are used as control points. With the following approach, no control points are used to process the data.

The number of match points used by Inpho and Agisoft were the same for the 5 control point and no control point solutions. Inpho used 16,607 and Agisoft used 107,942 match points. As being an SfM software, Agisoft used ~6.5 times more points during the processing.

2D residual vectors are computed and plotted using ESRI ArcMap.

1D residuals are portrayed using contours in GlobalMapper.

Because two processing approaches (5 control points and no control points) are utilized in this study, two 2D residual images are prepared for each software.

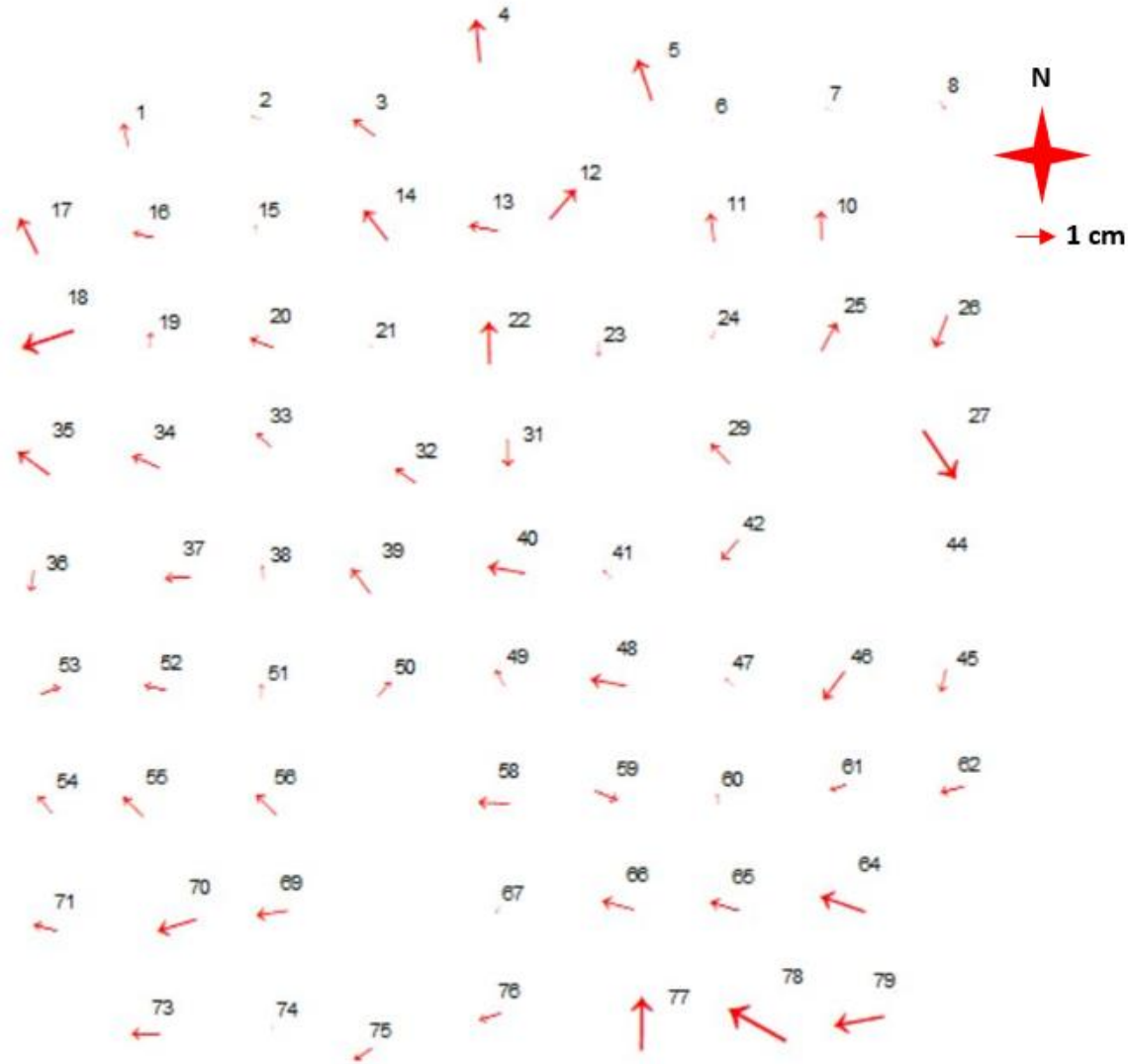# 2D residuals (cm) using Inpho with 5 control points
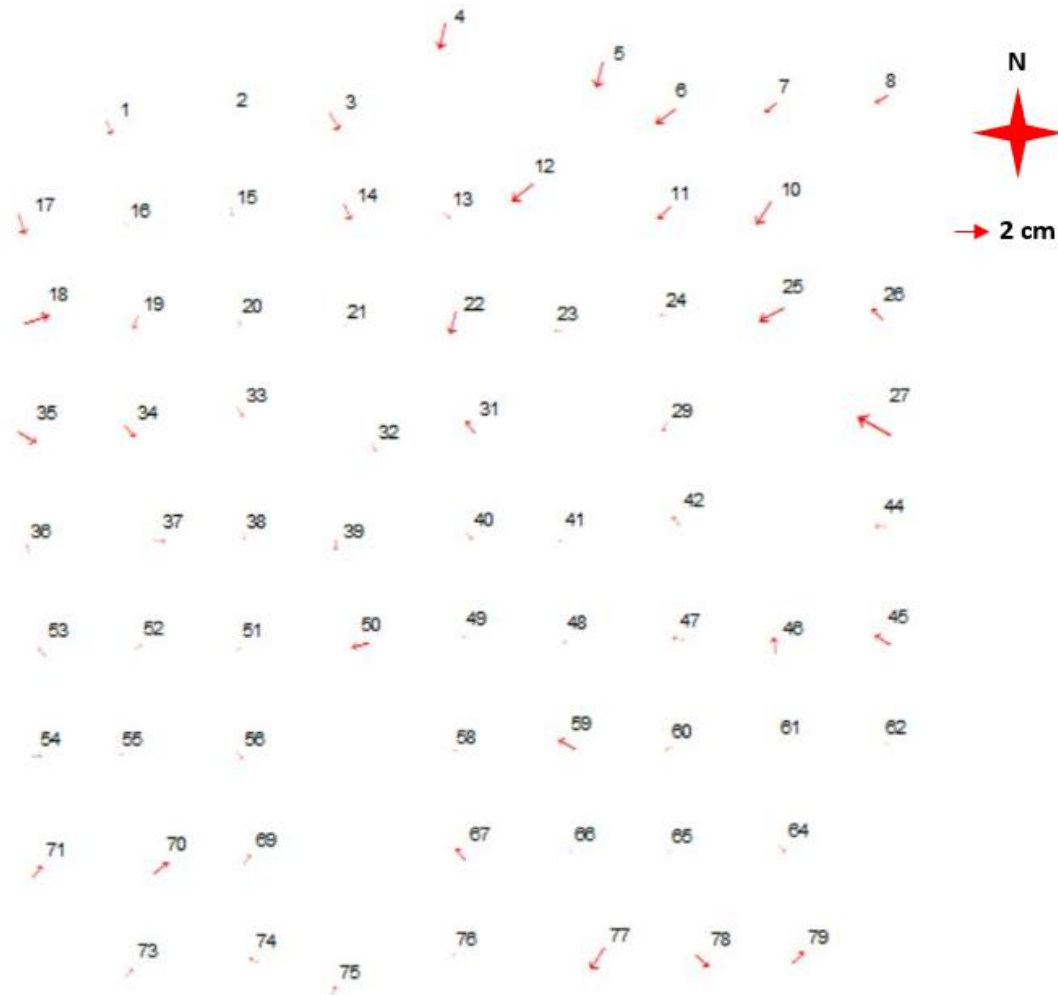
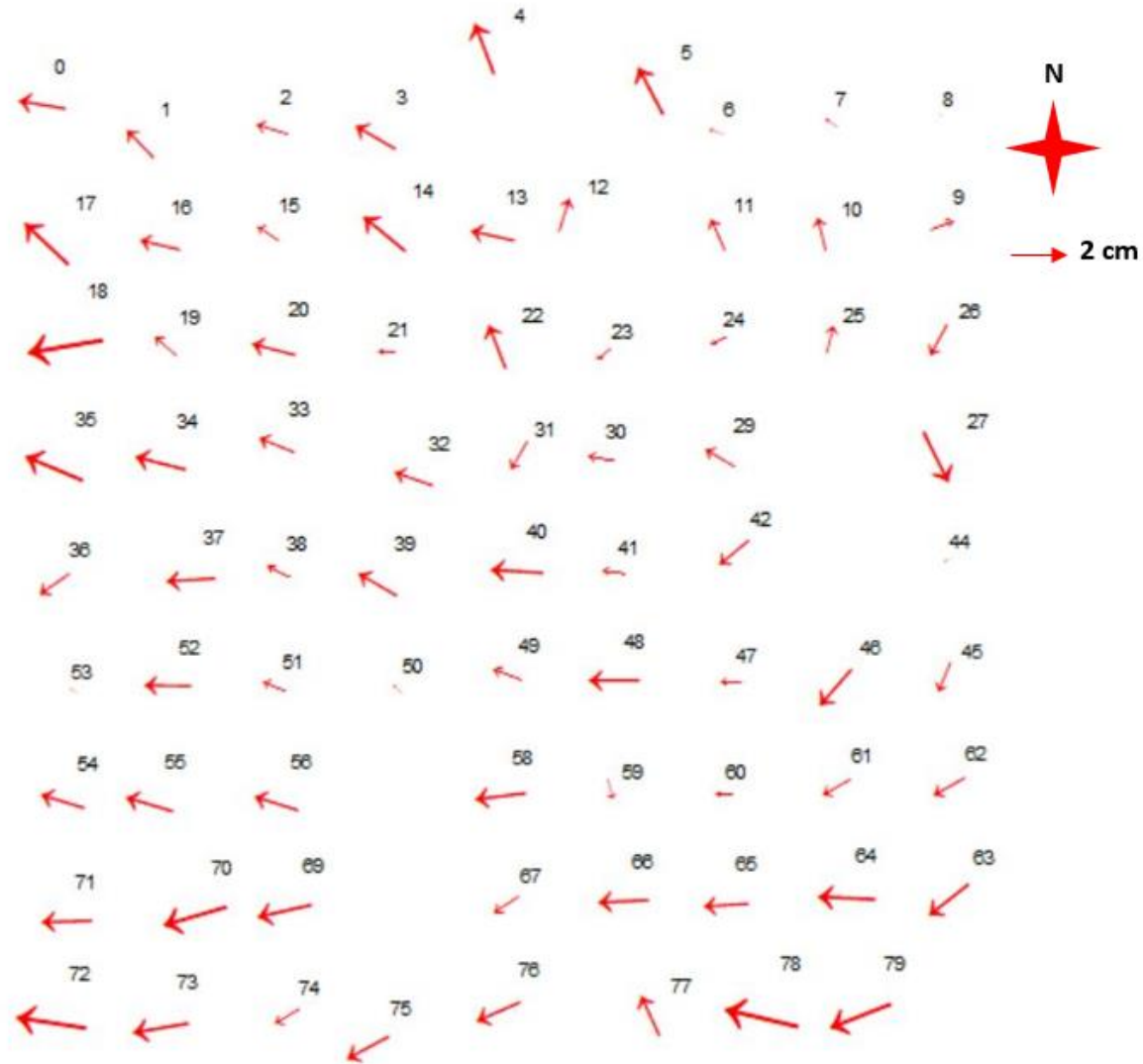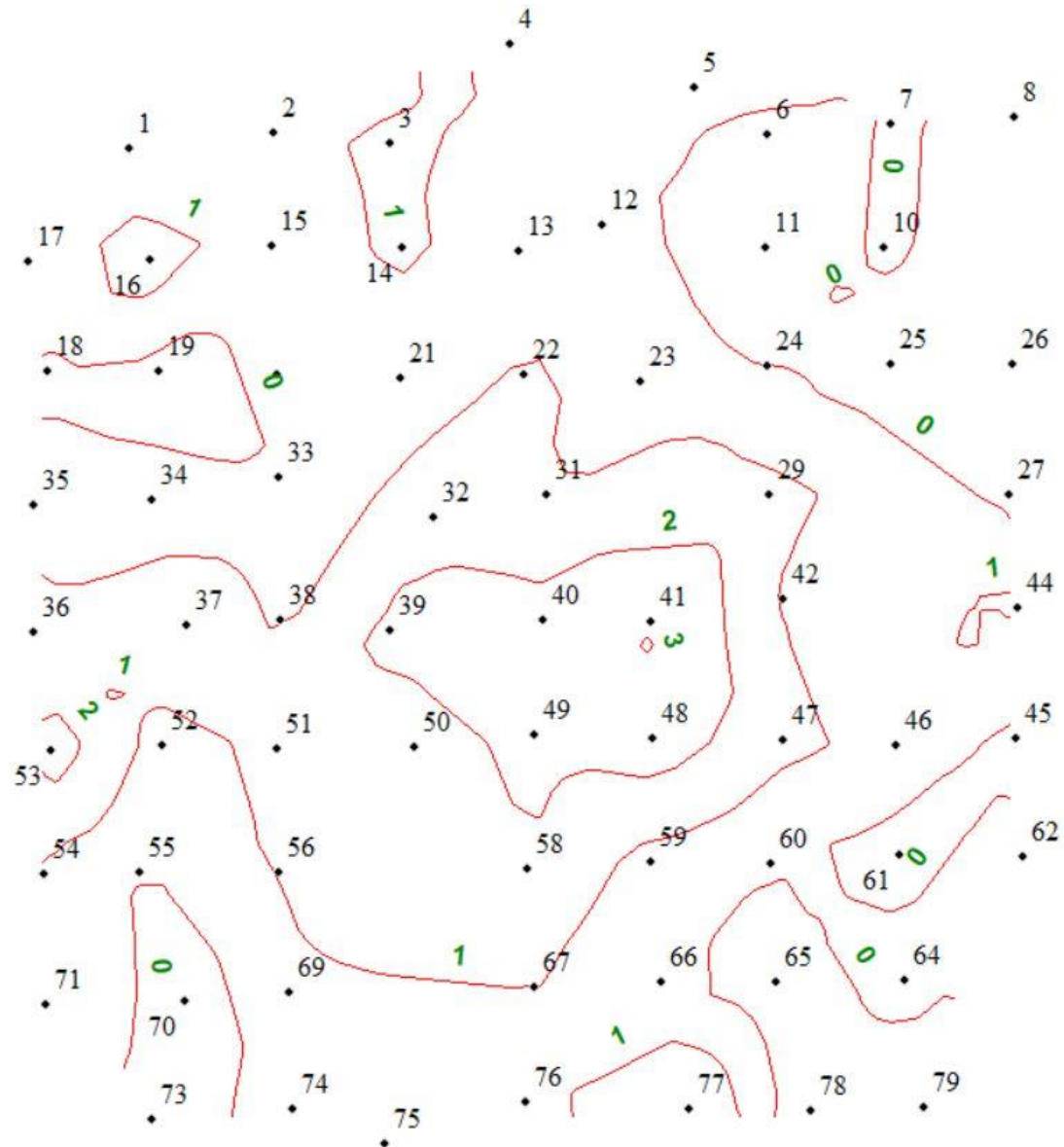# 2D residuals (cm) using Inpho with no control points
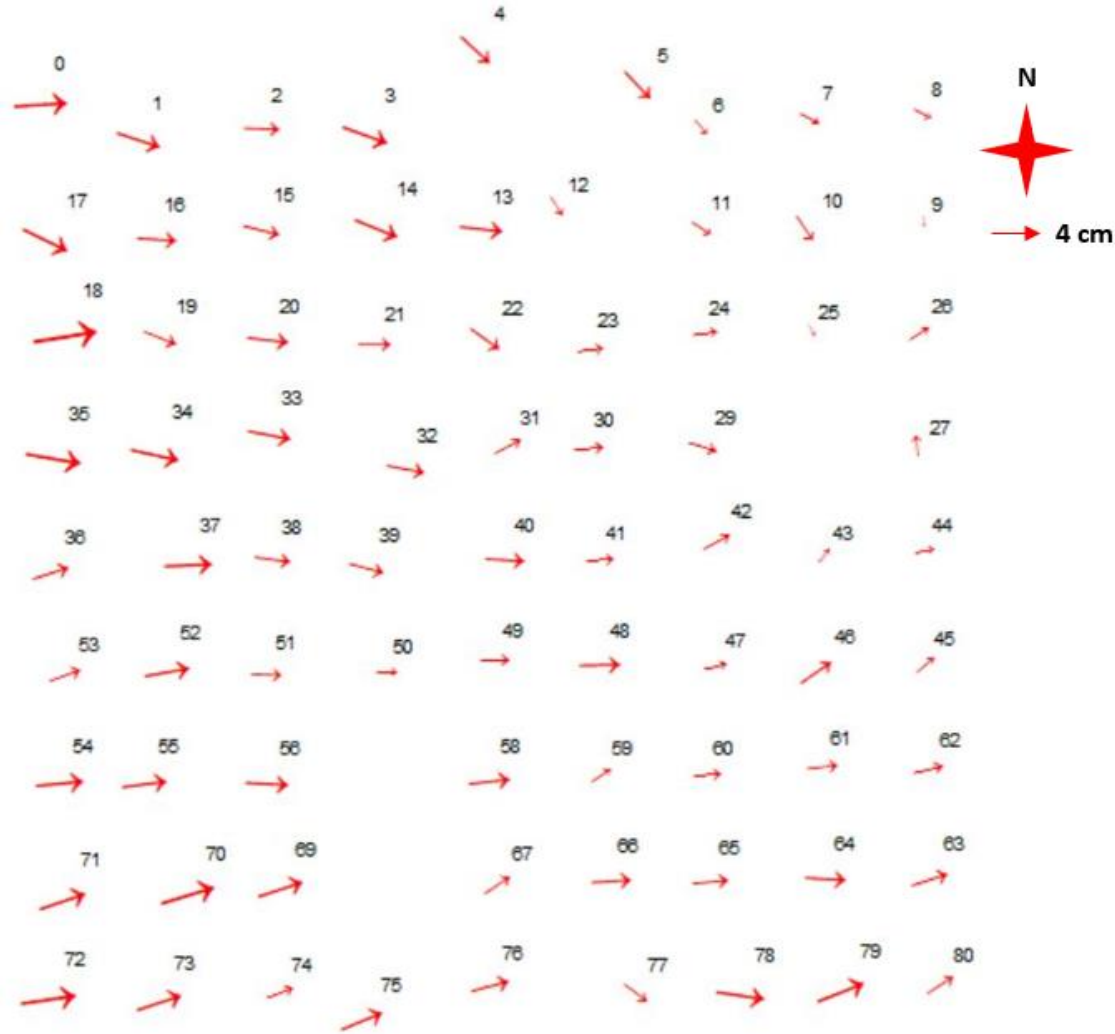
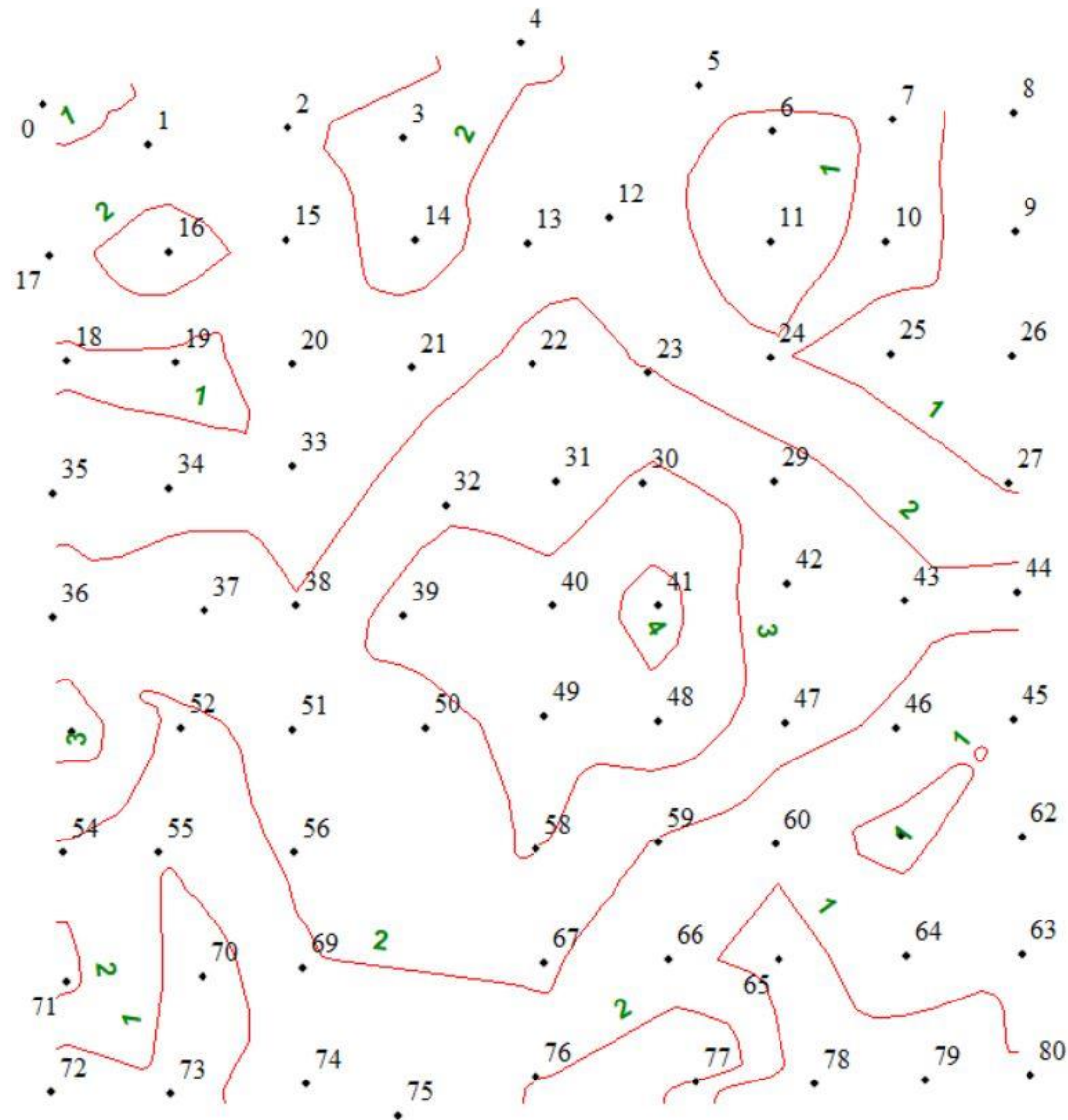# 2D residuals (cm) using Agisoft with 5 control points

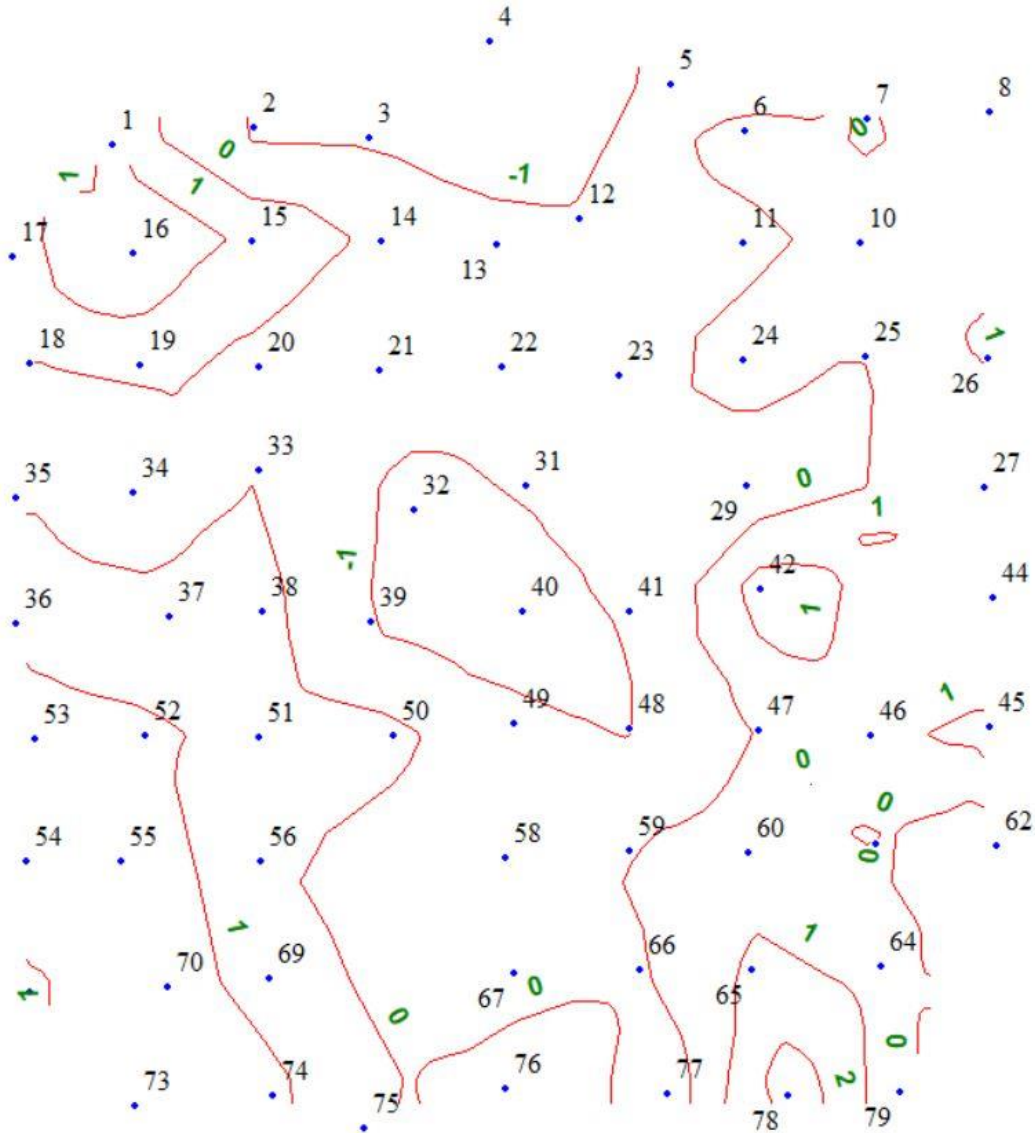# 2D residuals (cm) using Agisoft with no control points

1D residuals (cm) using Inpho with 5 control points

1D residuals (cm) using Inpho with no control points

1D residuals (cm) using Agisoft with 5 control points

1D residuals (cm) using Agisoft with no control points
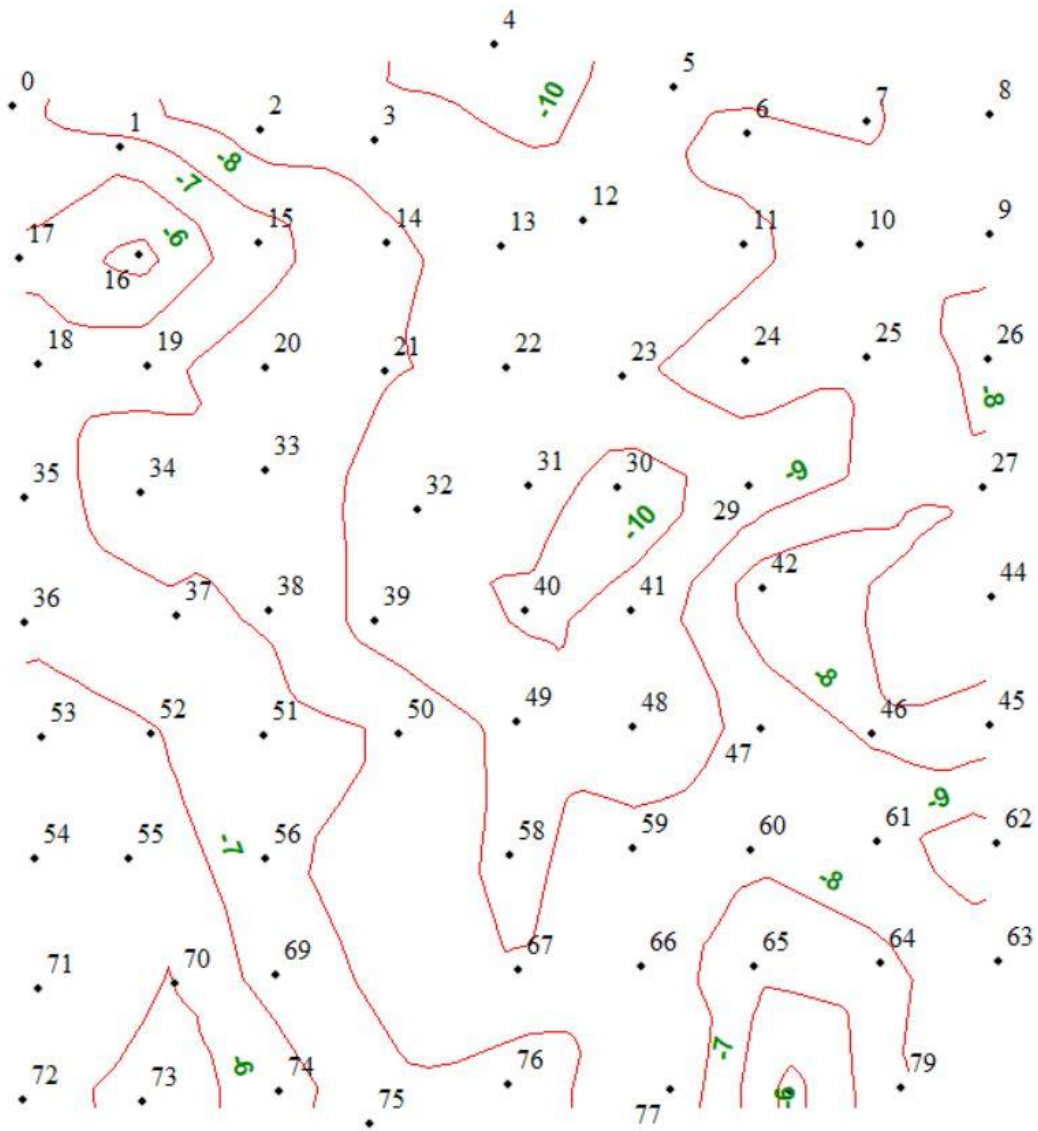
In terms of 2D residuals, the magnitude of the residuals is not the same in each case, and as can be seen in 1D images, residual elevations vary for each case as well.

Thus, to further analyze the results; RMS, Standard Deviation, Mean, Minimum, Maximum and Range

- ✓ RMS
- ✓ Standard Deviation
- ✓ Mean
- ✓ Minimum
- ✓ Maximum
- ✓ Range

statistics are computed for both software for the two processing approaches employed.

		Inpho			Agisoft		
		X	Y	Z	X	Y	Z
	RMS	1.0	1.0	1.1	0.9	0.8	1.0
	Std Dev	1.0	1.0	0.9	0.7	0.8	1.0
5 control	Mean	-0.2	-0.3	0.7	-0.6	0.3	0.2
	Min	-3.0	-2.4	-1.1	-2.4	-2.0	-1.9
	Max	2.3	1.7	3.2	1.3	2.3	2.7
	Range	5.3	4.1	4.3	3.7	4.3	4.6
	RMS	3.1	1.1	2.0	1.6	0.9	8.3
	Std Dev	1.1	1.1	1.0	0.9	0.9	1.2
No control	Mean	2.9	0.0	1.8	-1.3	0.2	-8.2
	Min	-0.2	-2.4	0.0	-3.3	-2.2	-10.6
	Max	5.5	1.9	4.4	1.1	2.2	-5.6
	Range	5.7	4.3	4.4	4.4	4.3	5.0

Conclusions

In terms of 2D residuals, for both Inpho and Agisoft, when no control point is used for the processing, magnitude of the residuals is greater than the magnitude of the residuals when 5 control points are used.

If we compare Agisoft results against Inpho results, some variations are apparent from case to case, although mostly the magnitude of the residuals are close to each other.

In terms of 1D residuals, for both software when no control point is used for the processing, variation in contours is much greater than the variations when 5 control points are used.

If we compare Agisoft results against Inpho results, residual elevations vary from case to case (i.e., contour lines do not look the same).

Overall, when 5 control points are used to process the data, RMS and standard deviations for both Inpho and Agisoft are around 1 cm, which is within the ground control accuracy.

When no control points are used to process the data, RMS and standard deviations for both Inpho and Agisoft exceeded the ground control accuracy. This is especially the case with Agisoft Z coordinate results. Thus, when no control point is used, Agisoft produced unsatisfactory results.

THANK YOU
FOR YOUR
ATTENTION