

# GPS accuracy part 2: RTK float versus RTK fixed

Kevin W. Hall (*kwhall@ucalgary.ca*), Peter Gagliardi and Don C. Lawton

## ABSTRACT

During the University of Calgary’s 2010 geophysics field school, geophone and source point locations for a 3C-2D seismic line were GPS surveyed by student crews over a period of many days. In the course of the RTK GPS (real time kinematic global positioning system) survey, some geophones were surveyed up to three times, particularly in problem areas on the line. In this case, the problem areas had thick bushes and trees, such that the GPS rover was not able to achieve a good GPS solution due to signal attenuation by the vegetation. Comparisons of the repeated data points show that RTK fixed solutions have the best repeatability (accuracy better than one decimeter). RTK float solutions can be as repeatable as fixed solutions, but can also be out by up to five meters, with no way to tell unless surveying a known point. The authors recommend RTK fixed solutions for surveys with a small station spacing.

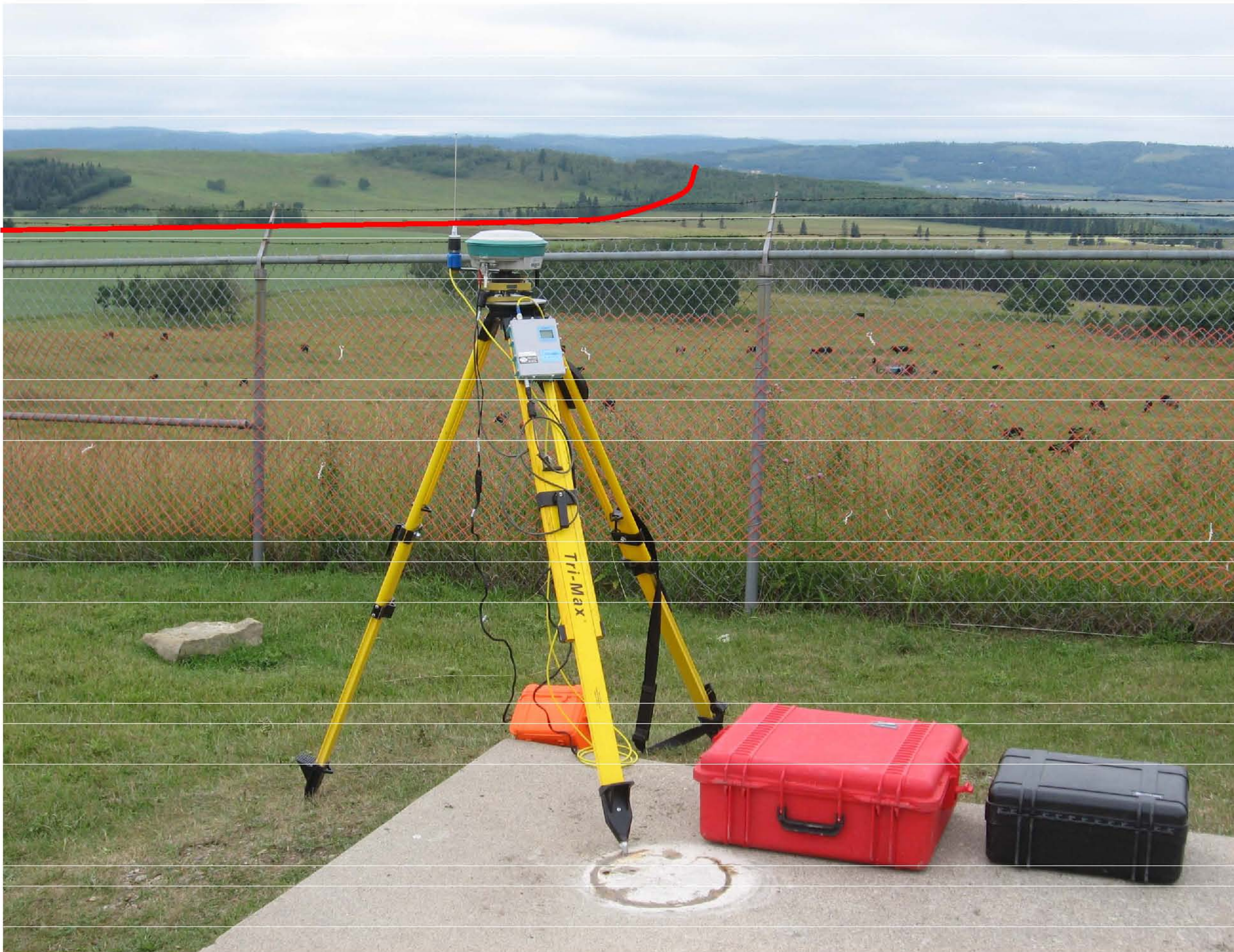


FIG. 1. Typical daily GPS base station setup, looking roughly southwest. The part of the seismic line that is visible in this picture is high-lighted with a red line.

## DISCUSSION

It is clear from Table 1 and Figure 5 that an RTK float solution can be as repeatable as a fixed solution (one decimeter or less), but, it could also be out by up to 5 m. The problem is that we have no way to tell how close a given measurement is to the actual location, without repeating the survey more accurately. As usual, the question that needs to be asked is, how accurate to we need to be? RTK float would likely be good enough for a 100 m station spacing, but not for 1 m or even 10 m station spacing.

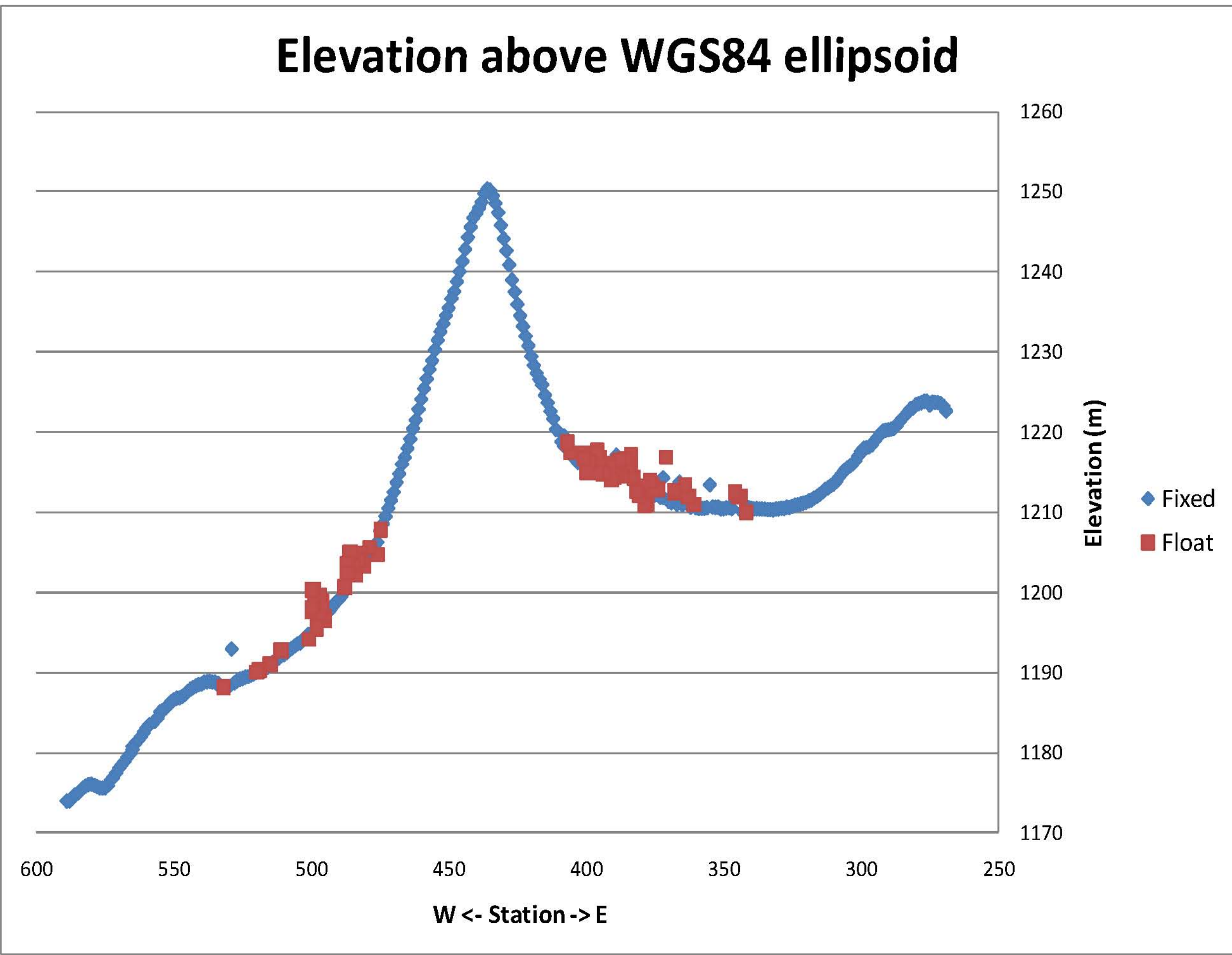


FIG. 2. Elevation profile for western end of the line (west of highway 22).

The two anomalous points in the Fixed-Fixed data (blue; Figures 2, 4 and 6) may be explained by the observation that one group of students was holding the range-pole up as high as they could to try and get a fixed solution, then quickly dropping the range pole to the ground beside a geophone and collecting a data point before the unit flipped to RTK float. It is possible that survey points were accidentally acquired while the pole was in the air.

## ACKNOWLEDGEMENTS

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## REFERENCES

Kevin W. Hall, K.W., Cooper, J.K., and Lawton, D.C., 2008, GPS accuracy: Hand-held versus RTK: CREWES Research Report, **20**.

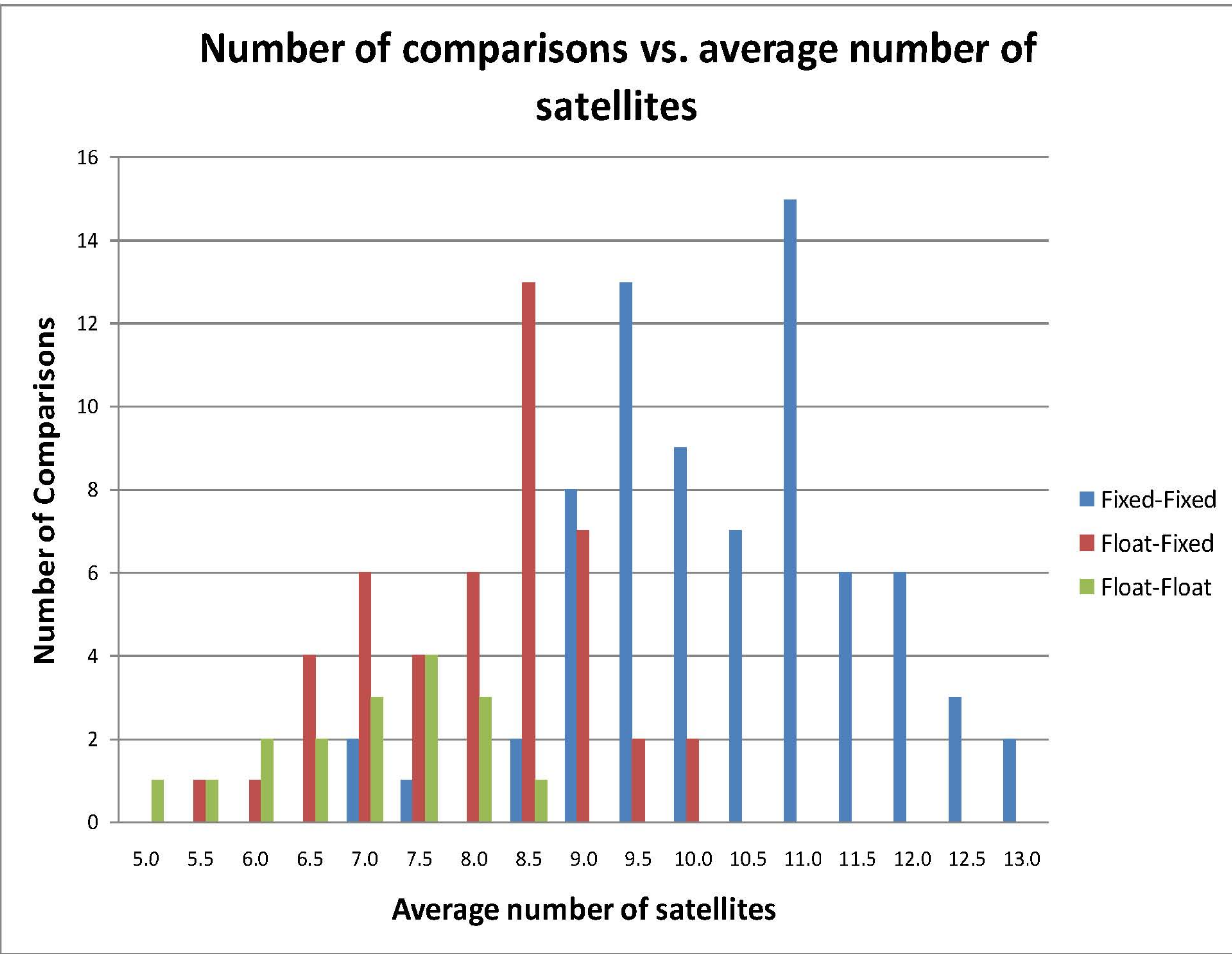


FIG. 3. Number of comparisons versus average number of satellites.

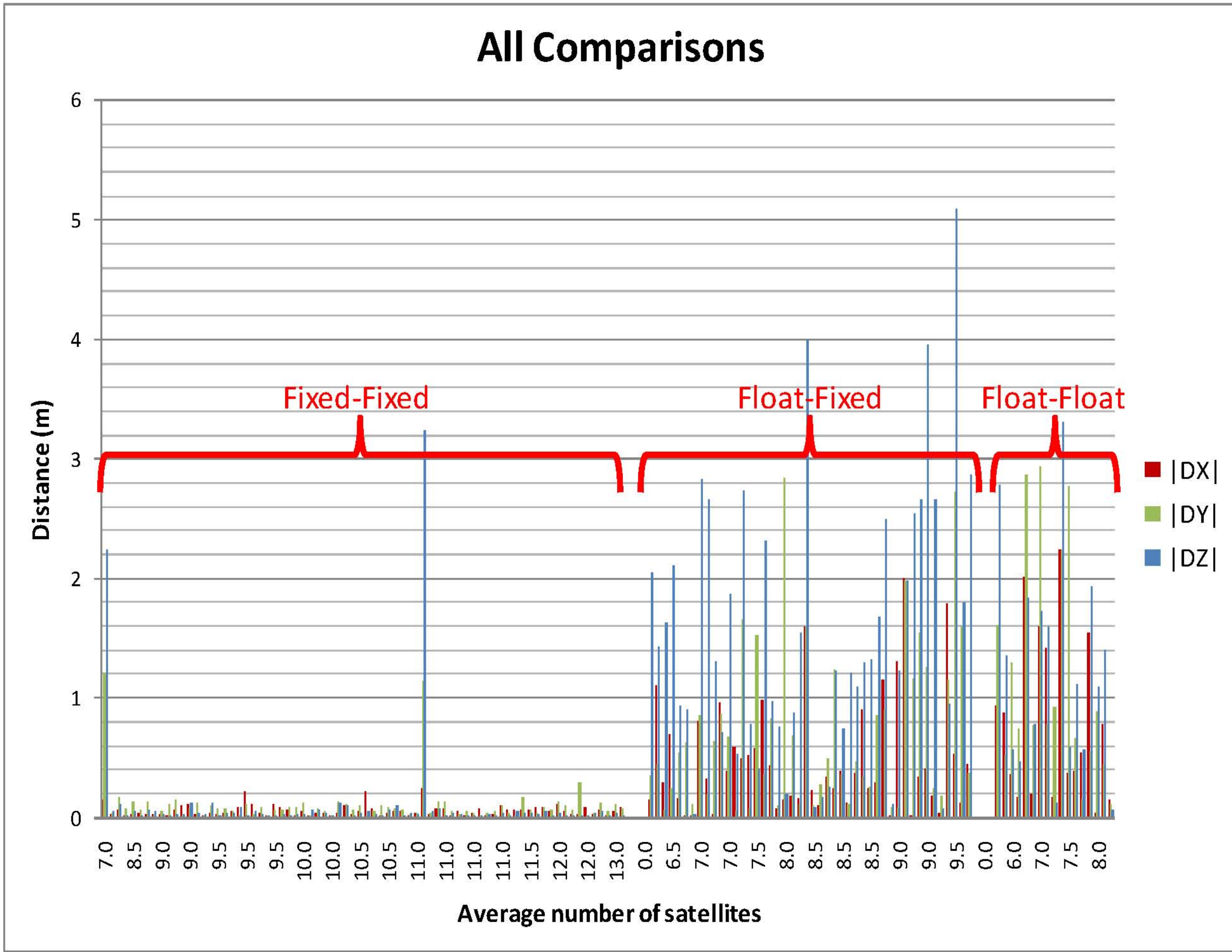


FIG. 4. All results.

	Count	dx  (m)	dy  (m)	dz  (m)
MIN, Fixed-Fixed	74	0.0	0.0	0.0
MIN, Fixed-Fixed (edited)	72	0.0	0.0	0.0
MIN, Float-Fixed	46	0.0	0.0	0.0
MIN, Float-Float	17	0.0	0.1	0.1
MAX, Fixed-Fixed	74	0.2	1.2	3.2
MAX, Fixed-Fixed (edited)	72	0.2	0.3	0.1
MAX, Float-Fixed	46	2.0	2.8	5.1
MAX, Float-Float	17	2.2	2.9	3.3
MEDIAN, Fixed-Fixed	74	0.0	0.1	0.0
MEDIAN, Fixed-Fixed (edited)	72	0.0	0.1	0.0
MEDIAN, Float-Fixed	46	0.3	0.5	1.3
MEDIAN, Float-Float	17	0.5	0.8	1.1
MEAN, Fixed-Fixed	74	0.1	0.1	0.1
MEAN, Fixed-Fixed (edited)	72	0.1	0.1	0.0
MEAN, Float-Fixed	46	0.5	0.7	1.5
MEAN, Float-Float	17	0.8	1.2	1.3
STDDEV, Fixed-Fixed	74	0.0	0.2	0.4
STDDEV, Fixed-Fixed (edited)	72	0.0	0.0	0.0
STDDEV, Float-Fixed	46	0.5	0.7	1.1
STDDEV, Float-Float	17	0.7	0.9	0.9

Table 1. Statistics summary.

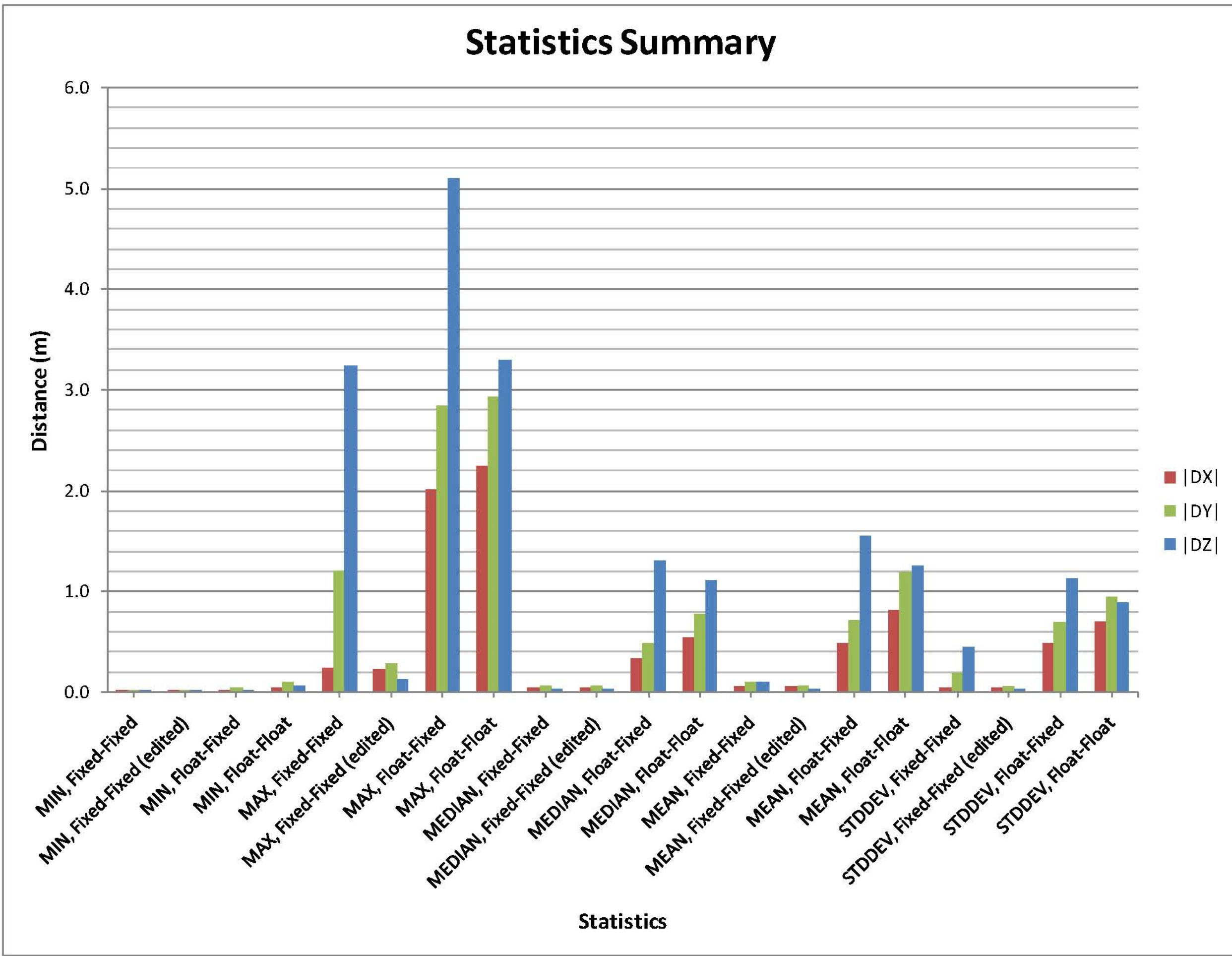


FIG. 5. Statistics summary.

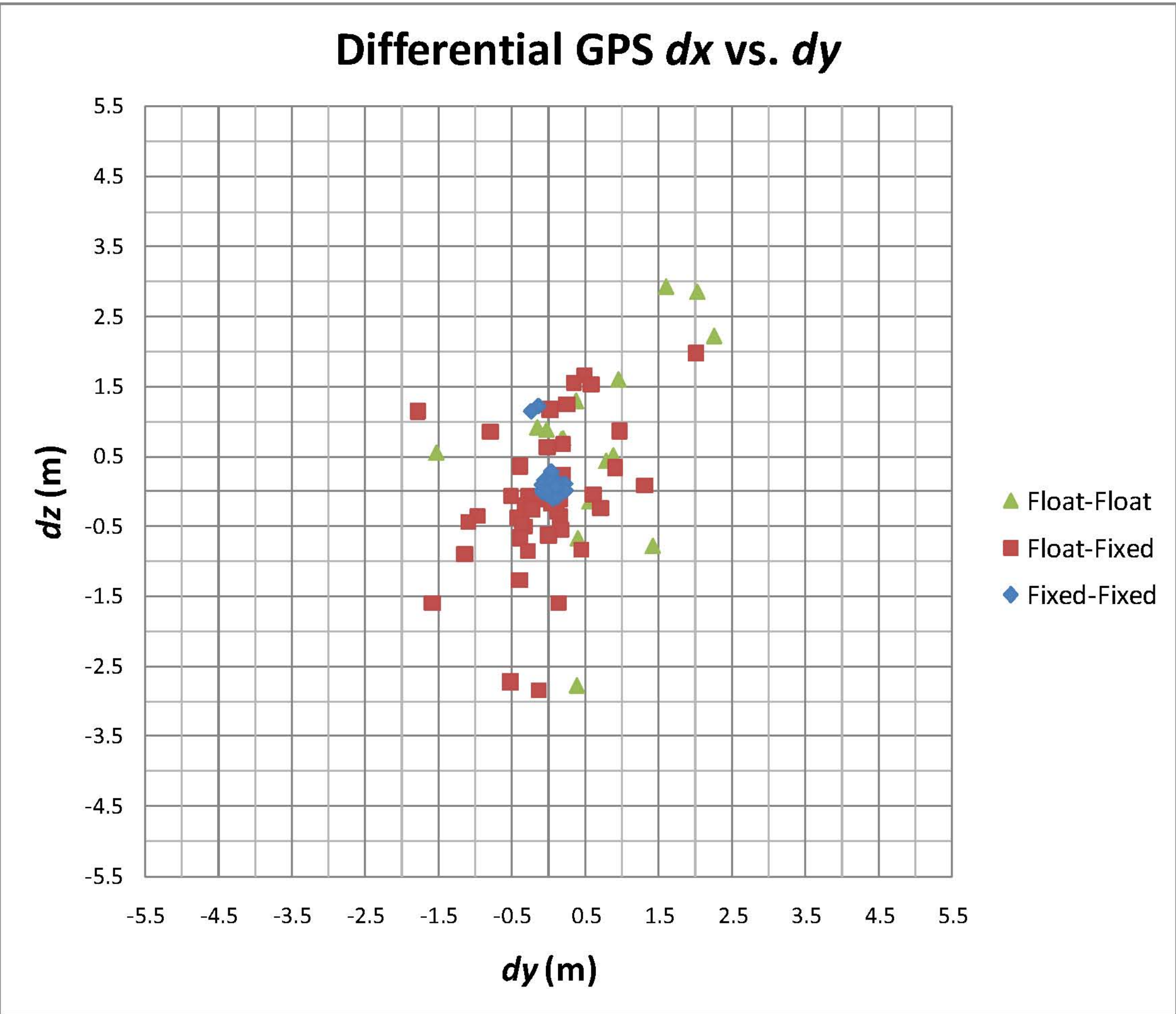


FIG. 6a) Crossplot:  $dx$  vs.  $dy$ .

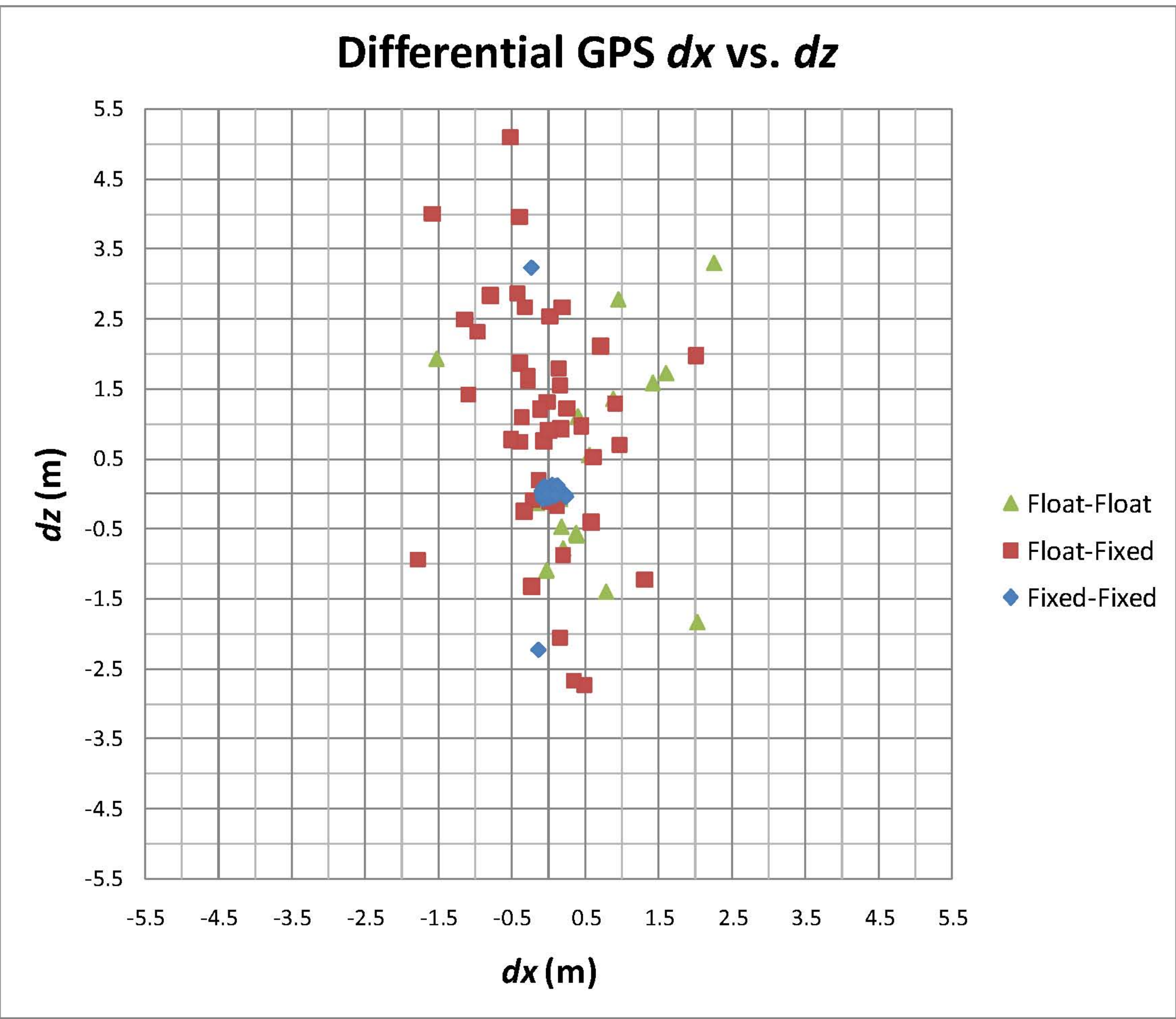


FIG. 6b) Crossplot:  $dx$  vs.  $dz$ .

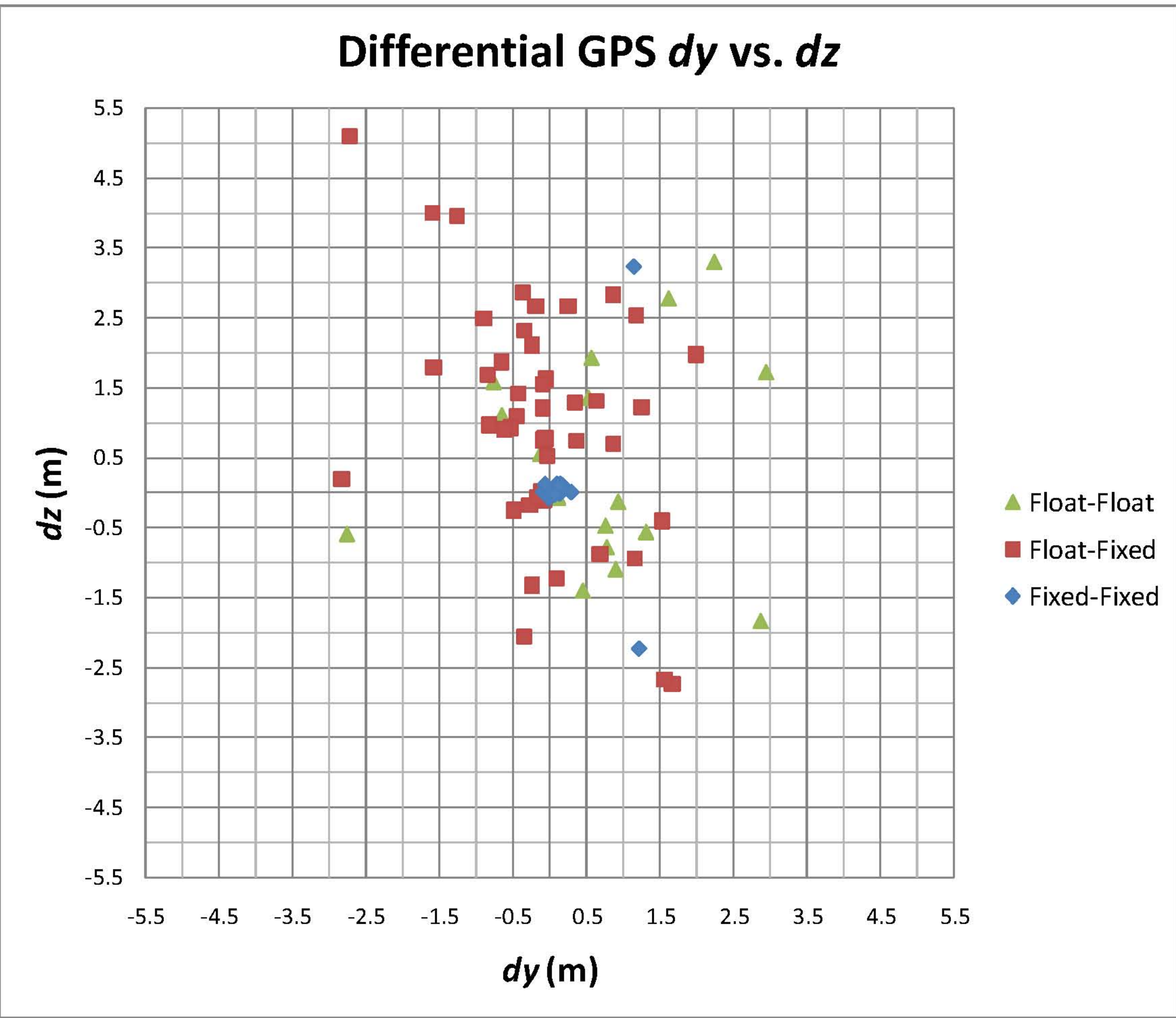


FIG. 6c) Crossplot:  $dy$  vs.  $dz$ .