EECE5554 Lab2 Report

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1 Analysis of data from completely open area

The data for the open area was collected at the tennis court near Columbus Ave, where was near the Northeastern University soccer field with no taller buildings nearby, making it an ideal data collection spot.

a. Stationary data

Data quality	Quantity
1	0
2	0
3	0
4	0
5	5396

Table 1 Overview of open area static data quality

From the above data quality statistics we can see that the quality of all stationary data is 5, which can indicate that the quality of stationary GPS data collected using RTK Pair in a sufficiently open spot is excellent. Because all data quality here is 5, we did not pre-process the data before analysis.

The following figure shows the data visualization, Figure 1 demonstrates the specific geographical location of the data we collected, and from Figure 2 all the data can be visualized in 3D space.

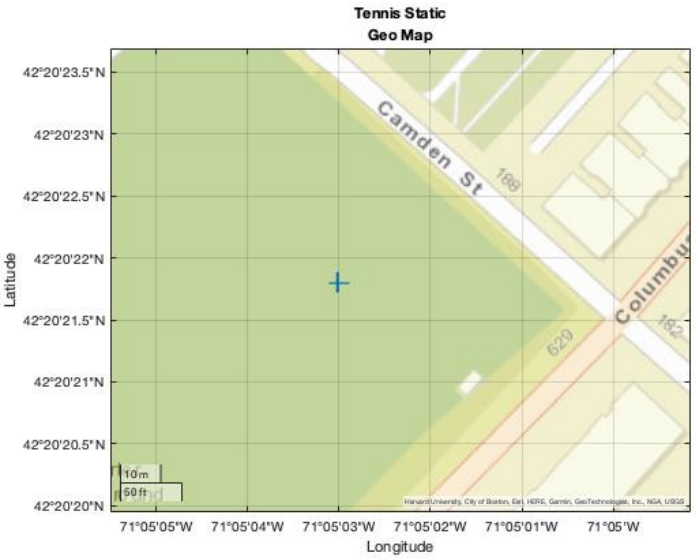

Figure 1 Geographical representation of static data

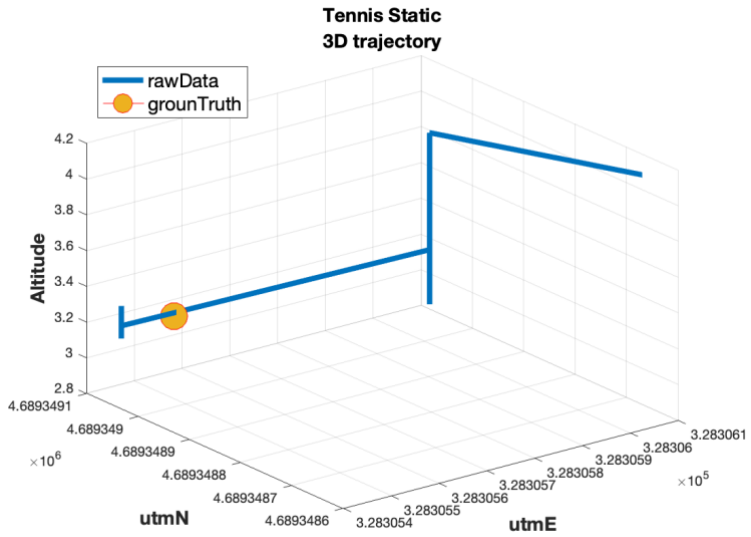

Figure 2 3D trajectory of static data

It is obvious from Figure 2 that the data have different levels of bias both in utm and in altitude, but bias of all axes are within 1m, which is extremely small compared to the stationary data collected in the lab1. We can also clearly see that the distribution of the data error is non-Gaussian from the Figure3 and Figure4.

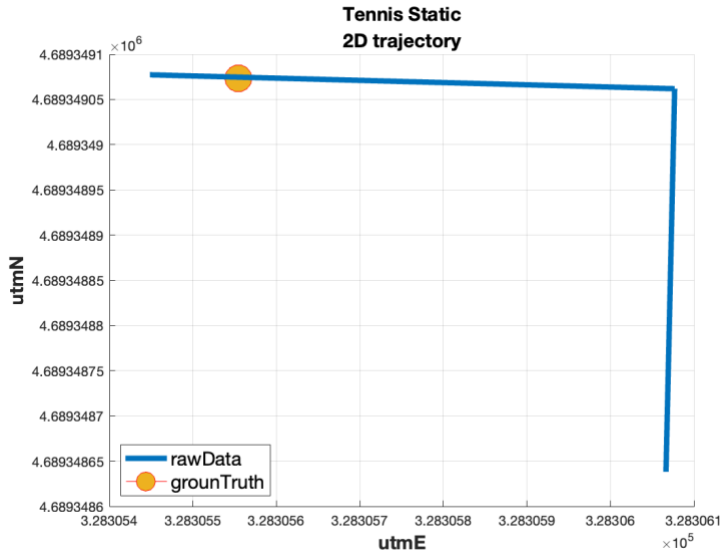

Figure 3 Planar trajectory of data

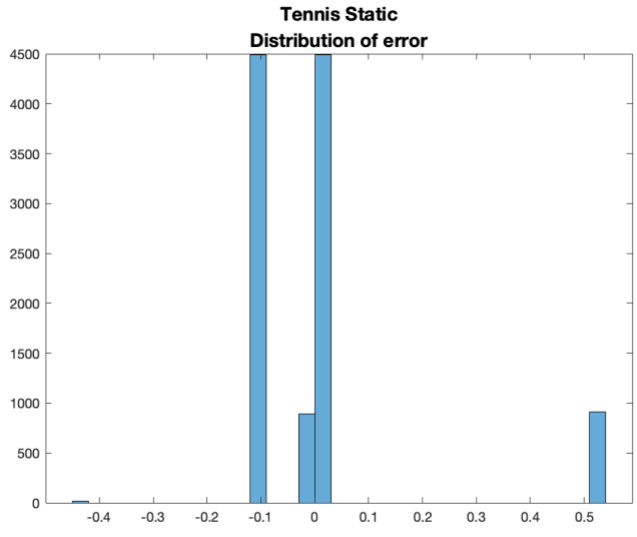

Figure 4 Distribution of error

b. Moving data

Data quality	Quantity
1	0
2	0
3	0
4	3008
5	2411

Table 2 Overview of open area moving data quality

Although the quantity of data with quality 5 is obviously decreased, the overall quality remains good that no data with quality <4.

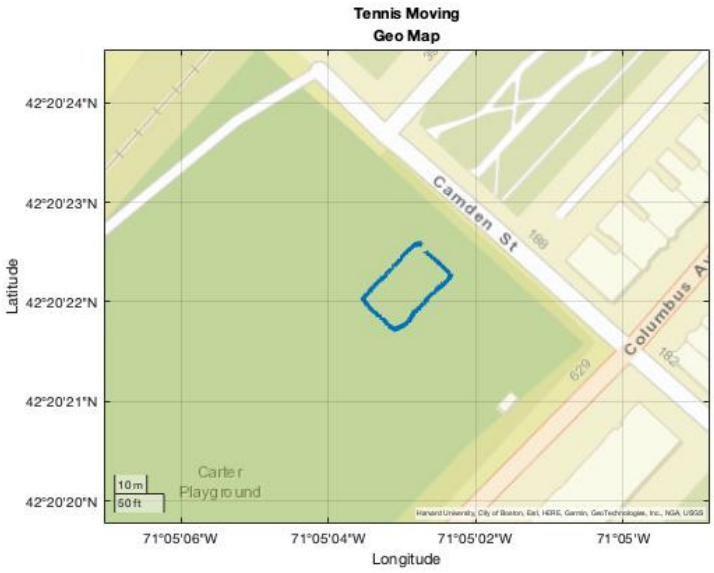

Figure 5 Geographical representation of moving data

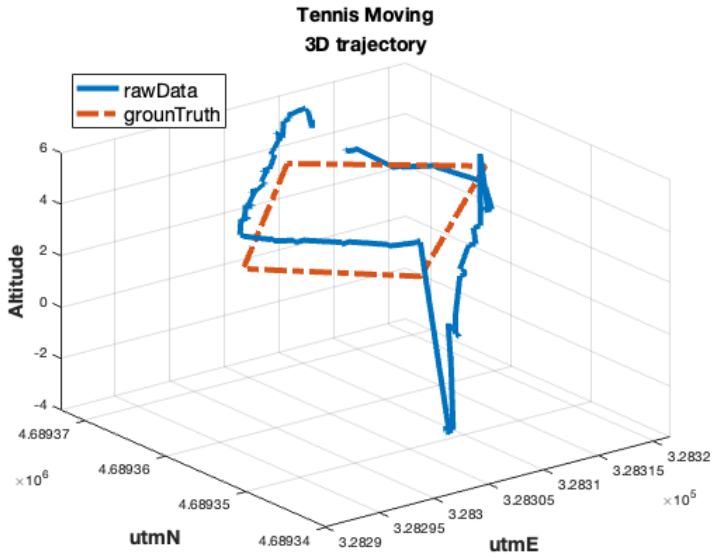

Figure 6 3D trajectory of moving data

As shown in Figure 5, compared with the moving data collected by Lab1, the accuracy of moving data collected by using RTS Pair is greatly improved, and it is almost the same as our movement trajectory. However, the altitude data which could be seen in Figure5 was still unstable. Large offsets still existed after excluding low quality data which indicated that the distribution of altitude data error is non-Gaussian.

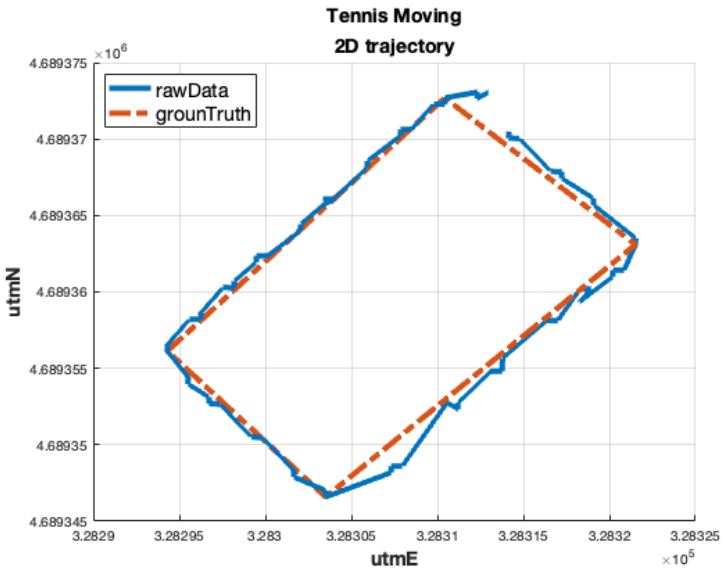

Figure 7 Planar trajectory of moving data

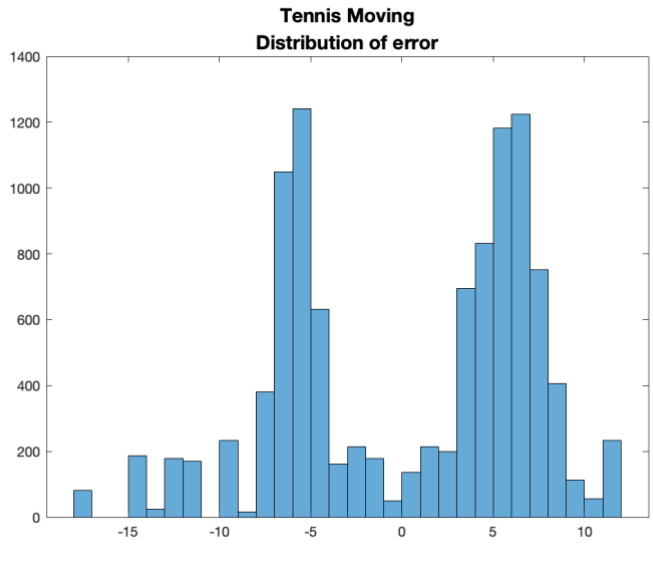

Figure 8 Distribution of error

From the analysis of the data in Figure 7 and Figure 8, it is easy to notice that the movement data error distribution is multimodal distribution causing by the rectangle shape of data which means that the error distribution will be Gaussian-distribution if doing analysis of four parts separately.

2 *Analysis of data with partial occlusion and reflections*

The data for the open area was collected outside of ISEC, Columbus Ave, where have some taller buildings nearby, making it a data collection spot with partial occlusion and reflections.

a. Stationary data

Data quality	Quantity
1	209
2	0
3	0
4	512
5	4363

Slight increase in low quality data obtained from moving collection compared to stationary collection, possibly due to occasional

disconnection of the transmitter during moving. In order to reduce the impact of low-quality data on the analysis results, data which quality below 4 were removed.

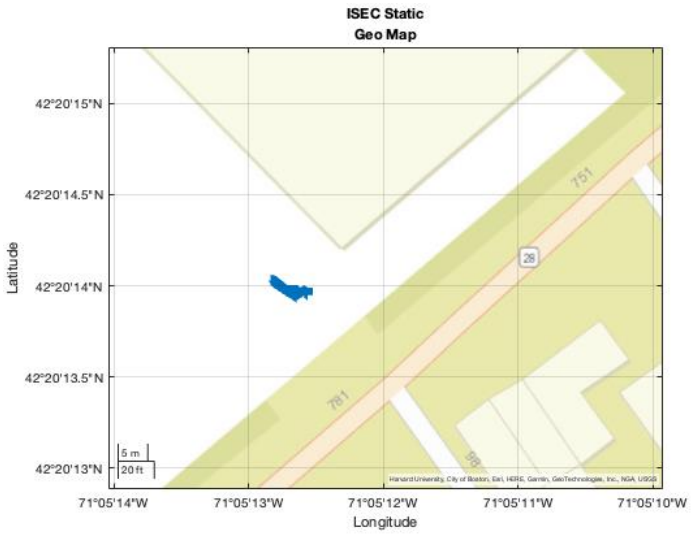

Figure 9 Geographical representation of static data

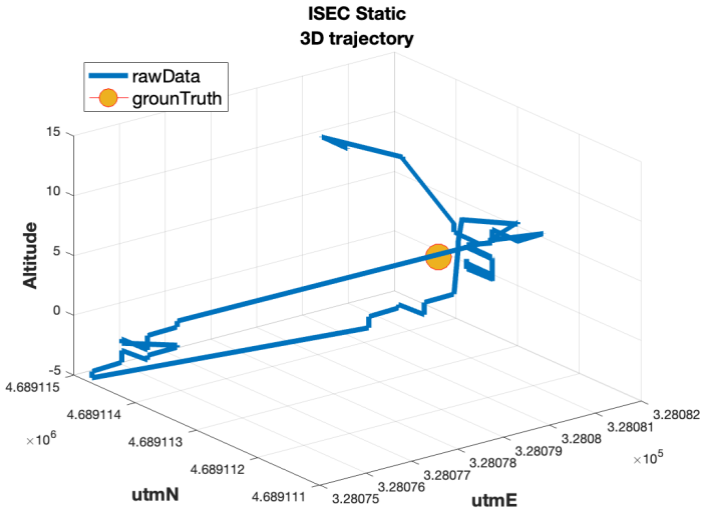

Figure 10 3D trajectory of static data

The data here still have different levels of offsets in utm and altitude, however, the bias of utm is much larger the that of altitude which might cause by occlusions and reflections.

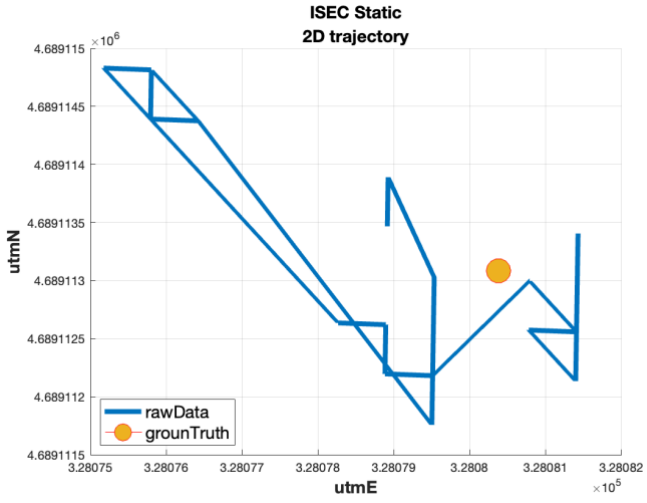

Figure 11 Planar trajectory of data

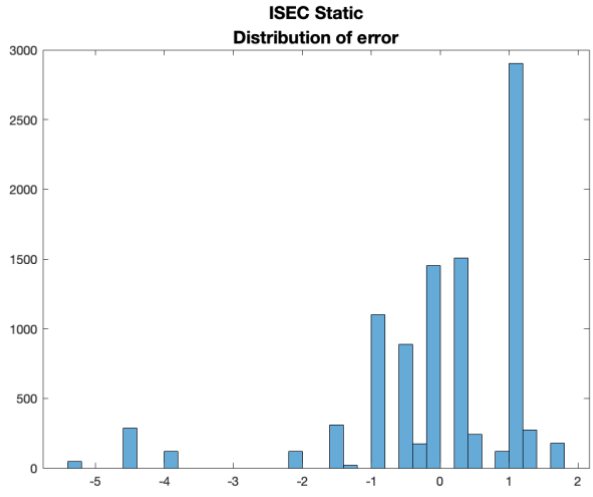

Figure 12 Distribution of error

Compared with stationary data in open area, the data behind isec is full of noices and offsets, the error distribution is obviously non-Gaussian.

b. Moving data

Data quality	Quantity
1	238
2	0
3	0
4	302
5	3395

The overall data quality remains in same level as stationary data quality, data with quality 5 was slightly increased.

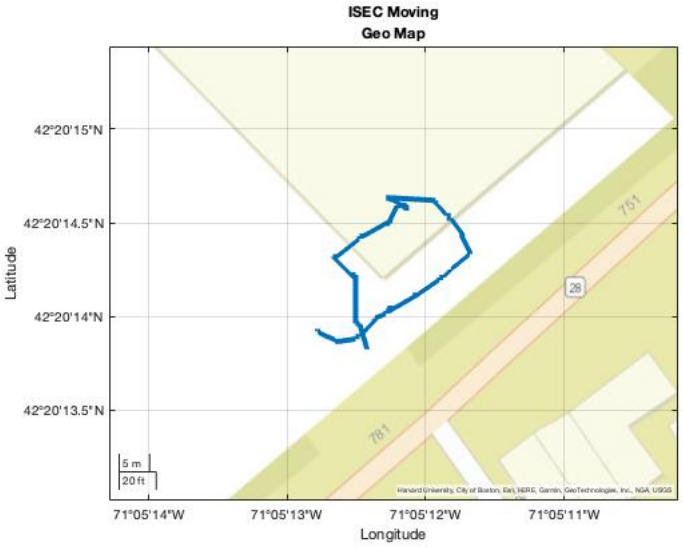

Figure 13 Geographical representation of moving data

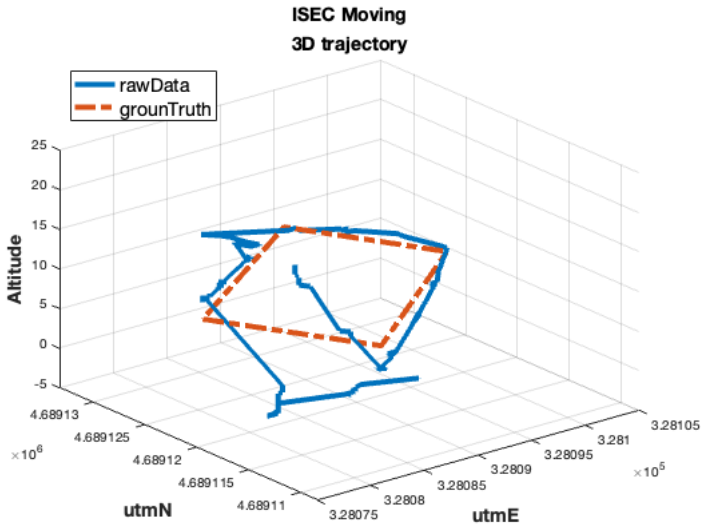

Figure 14 3D trajectory of moving data

Compared to the open area moving data, the data here have a much larger error on the utm and still have a large offset on the altitude, which could be easily notice in Figure14.

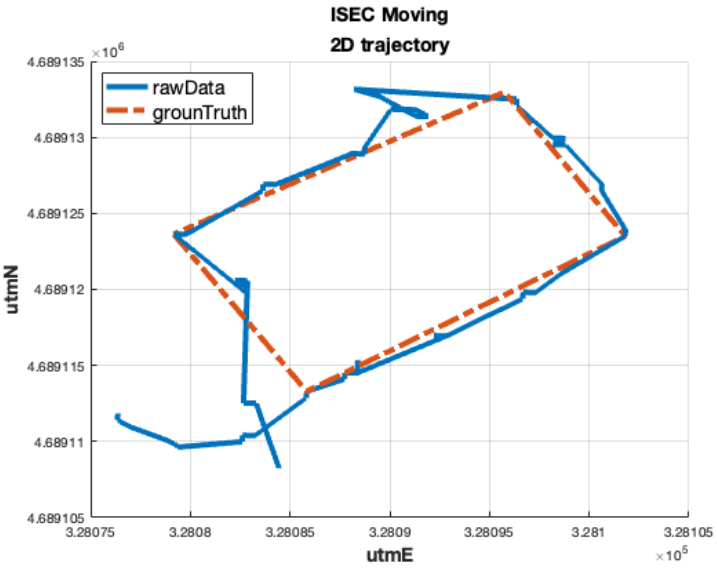

Figure 15 Planar trajectory of data

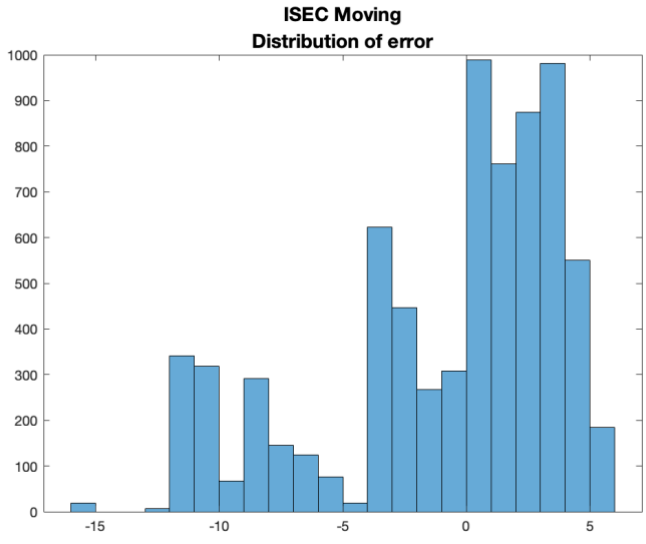

Figure 16 Distribution of error

Data in Figure 15 and Figure 16 shows that offsets on utmN and utmE are increased, and random noise appears sometime. However, the error distribution is non-Gaussian.