

Stationary Data Analysis:

- In GPS navigation, estimating the position of the receiver shows a difference in accuracy between latitude and longitude. The latitude has less deviation as compared to the longitude. This can be due to multipath error since the data had been collected inside the university with a lot of buildings around.
- A noticeable trend emerges in the graph (figure 2) which shows deviations from the mean. Initially, there is a significant deviation from the calculated mean position. However, this deviation stabilizes at around the mean position as more data points are collected.

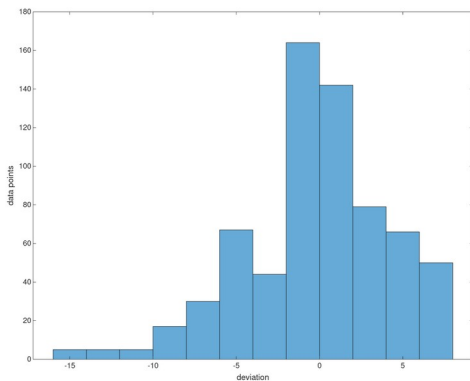


Figure 2: Deviation from mean

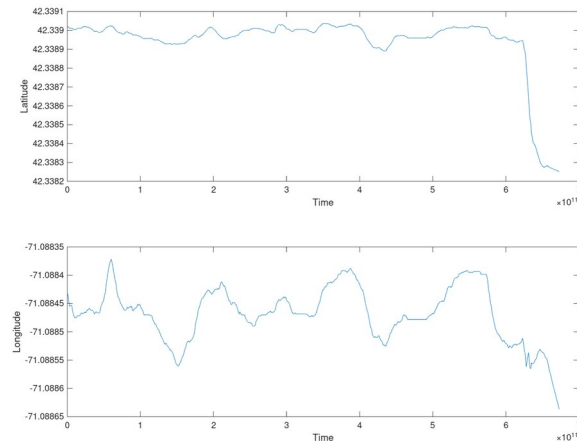


Figure 1: Latitude vs Time, Longitude vs Time

- The **error distribution** for the provided data does not conform to the typical normal or Gaussian distribution pattern. Instead, it stabilizes within the range of the first standard deviation after the initial position estimate.
- In my assessment, bounding the error proves challenging as it depends on a different variables. Factors like the area where the data is collected or a limited number of observable satellites can lead to deviations. It is **difficult to establish rigid bounds** on GPS positioning error.
- **Sources of Error:** Data was collected in an environment with buildings on both sides. External factors such as time of day, weather conditions, and sensor placement could cause variations but I feel that the primary contributor to GPS receiver inaccuracies is the presence of multipath effects.

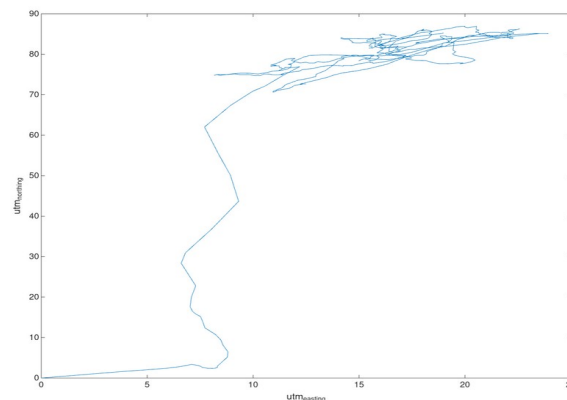


Figure 3: northing vs easting

Moving Data Analysis:

- Upon plotting the data on google maps, it shows the route that I took while collecting the data. The data doesn't seem to have major errors but there could be deviations when the data is minutely analysed.
- The data has very less errors/deviations as compared to the stationary data. This could be because during movement, the number of connected satellites is higher, leading to better precision.
- Mountains, buildings and other things that might obstruct the path between the receiver and the satellite can cause signal noise.

