ASEN 5090 HW 6 (Position Accuracy) Due Wed 2-Nov-2016 at 17:00

- *Submission as a "report" to D2L dropbox assignment06 by 17:00 2-Nov-2016*

Objectives

- Explore characteristics and accuracy of GPS for point (stand-alone) positioning.
- Review data plotting and calculation of error statistics.

Static Positioning Accuracy

In this homework we will look more closely at the positioning accuracy/precision of the GPS receivers by analyzing position solutions recorded from a stationary receiver over a 24 hour period.

An example data set is provided that was computed using observations at 30 second intervals from one of the IGS Sites. The data file (GPS_solutions2.mat) has a variable named "data" which has 5 columns, with the following definitions:

1. time of week (seconds)
2. X – WGS-84 coordinate (m)
3. Y – WGS-84 coordinate (m)
4. Z – WGS-84 coordinate (m)
5. number of satellites used in the solution

You will notice that despite the fact that the antenna was fixed, the position solutions over the course of the day are not constant. The deviations of these solutions are the errors that we will consider.

Work to Perform

1) Compute and submit the mean X, Y, Z position, and subtract this from each of the recorded values to find the deviations dX, dY, and dZ. Compute the latitude, longitude, and height of the mean position.
2) Convert the deviations in WGS-84 to ENU deviations.
3) Plot the East, North, and height deviations versus time on separate graphs. (You can use subplots.) Describe any interesting or unusual features in your results. See if you can determine what causes them. (You might want to look at column 5...)
4) Make a scatter plot of the North error vs East error in meters. When you make the plot be sure that the grid is square – i.e. 1m on the y-axis should be the same length as 1m on the x-axis. Describe any interesting or unusual features in your results.
5) Compute and submit the standard deviations of the N, E, and height errors in meters;

6) For the East-North errors, find a) the error covariance matrix; b) the semimajor and semiminor axes of the error ellipse; and c) the 50% CEP.
7) Plot the 1-σ horizontal error ellipse and 50% CEP on your scatter plot.

Make sure all the values you submit as your final answers are given with the correct number of significant figures.