Lab 2 - Satellite and User Positioning

Due: 2/26/2024

Part I: Static Class Data

Download the static data from the website. This data includes two Novatel receivers outputs and an IF data file all from the same antenna. We will only need one of the Novatel data sets (RCVR_S1) for this assignment.

a) Using the ephemeris, determine the SV positions as a function of GPS time. You can check your calculation using initial satellite positions provided. Provide a sky plot of the SV positions over the period of the data collection
b) Using the pseudoranges and SV positions, calculate the GPS position. You can check your calculations using the initial GPS position provided.
c) Convert the ECEF positions to LLA and plot in Google Earth, Google Maps, or GPS visualizer. Where was the data taken and how much error/wander does there appear to be over the static data set?
d) Convert the ECEF positions from the Novatel to ENU (use Toomers Corner as the reference location). Plot the E,N,U positions vs. time and characterize their errors. Compare this to the DOP.
e) Calculate and plot the velocity in ENU coordinates. What measurement did you use for velocity? What is the accuracy in each axis?

Part II: Class Dynamic Data

Download the dynamic data from the website. This data includes Septentrio data from 3 separate antennas and an IF data file for one of the antennas on a moving platform. We will only be using data from one of the Septentrio antennas for this assignment (and only the L1 data*). Note this data was taken at approximately the same time as the static data set (i.e. same ephemeris).

a) Using the L1 pseudoranges and SV positions, calculate the GPS positions for the dynamic data set. We have provide the first solution for you to verify your answer. What is your expected position error?
b) Convert the ECEF positions LLA and plot in Google Earth, Google Maps, or GPS visualizer (where was the data taken and what was happening)?
c) Calculate the moving platform's velocity. Plot the Speed and Course vs. time.
d) Plot the clock bias and clock drift vs. time

% Note: to grab just the L1 pseudoranges you can use:
>>psr=RCVR_S1.measurements.L1.psr;

Part III (Optional/Bonus): Geocaching Data

This optional part correlates with the results of the first lab (Lab 1 - Geocaching).

a) ***Get Ephemerides Online***. Using the RINEX files described in class, determine the navigation message file that will contain the appropriate parameters to calculate the satellite positions. Describe the parts of the filename that indicate this is the correct file. You may also be able to get the ephemeris from other websites in a more direct form.

b) ***Sky View Plot***. In terms of GPS week and seconds of week, when are the positions to be calculated? Generate the polar sky plot shown in Lab 1 – Geocaching and compare to the Sky Plot from Lab 1.