ASEN 5090 Assignment 5

The International GNSS Services (IGS) is a federation of over 200 worldwide agencies that pool resources to generate precise navigation satellite products. You can read about the services and products provided by IGS at their website:

http://igscb.jpl.nasa.gov/ (http://igscb.jpl.nasa.gov/).

Step 1

Go to this map:

http://www.igs.org/network (http://www.igs.org/network)

Find the **IGS station near / in Boulder**. What is this station's four-letter ID? Include this information in your report.

Step 2

We will use the CDDIS FTP archive to obtain our data. Read the instructions here:

http://cddis.nasa.gov/Data_and_Derived_Products/GNSS/daily_30second_data.html (http://cddis.nasa.gov/Data_and_Derived_Products/GNSS/daily_30second_data.html)

We want to download data for **2017-08-21**. Figure out what 3-digit "day of year" this date corresponds to. Include this information in your report.

Step 3

For this project, we will be looking at GNSS observable data from RINEX files. RINEX, which stands for Receiver INdependent EXchange, is a format commonly used to store human-readable GNSS receiver output observables and other GNSS related data. You are looking to read a "dot O" (`.o`) file, which contains receiver observables.

Download an observation data file *for the station* you found in part 1 *and the day* mentioned in part 2. Observation filenames end in `<yy>o`, where `<yy>` is the last two digits of the year. Please use the CDDIS FTP site. Daily records directories start here:

ftp://cddis.gsfc.nasa.gov/gnss/data/daily

The file comes in a compressed format (zipped), and you will need to unzip it before continuing.

Note: these files are somewhat large (around 3 MB), so please ***do not include*** your data file in your project submission.

Step 4

We need to extract the observables from the RINEX files. The project skeletons provide helper functions for parsing RINEX files. If you have software you prefer for parsing RINEX data, feel free to use that instead. Figure out how to use the appropriate functions to parse the RINEX data (read the documentation!).

Note: the file you obtain should end up being a version 2.10 RINEX file. In case you are interested, there is some documentation on this version of RINEX here:

ftp://igs.org/pub/data/format/rinex210.txt

Step 5

With your parsed RINEX data, choose your favorite GPS satellite and use its data to answer the following questions and make the appropriate plots. Don't forget to label your figures appropriately!

- What is the data interval for this file (how long between successive measurement epochs)?
- Plot the L1 pseudorange for your satellite. What is its minimum value? What is its maximum values? Do these values make sense? Explain.
- Plot the L1 and L2 SNR for your satellite on the same plot. Which signal has a higher SNR?
- Plot the L1 and L2 Doppler frequency on the same plot. Which signal has the larger magnitude Doppler frequency? Does this make sense? Explain.
- Compute the Doppler frequency for L1 using the L1 carrier measurement by taking its "derivative" -- i.e. epoch-to-epoch difference (see `diff` function in Python and MATLAB). By what factor do you need to multiply the "diff" of carrier phase to get the correct Doppler frequency. Plot the provided L1 Doppler and your carrier-derived L1 Doppler on the same plot. Are there any discrepancies? If so, describe them -- what are they like and where do they occur in the satellite pass?

Step 6

Include your answers to questions and corresponding plots in a brief report.

Notes

Please upload a `.zip` file to D2L containing your project code and report. Make sure it does not include the RINEX file you downloaded!