Assessing Image Accuracy using GNSS

This exercise involves collecting and evaluating data we'll be using in our semester-long project. We'll be collecting much of our data from aerial images. Here we'll evaluate a 2017, leaf-off drone image collected over the St. Paul Campus. The image may be found in the class L drive, in the Campusimages folder.

Our broad workflow is:

- identify a set of 10 or more features which can be precisely identified to within an inch or so (e.g., sidewalk/curb corners, stable paint marks, small pipes), visible on the aerial image, and for which collect GNSS points can be collected
- extract the "test" x and y coordinates from the image
- visit those points in the field and collect GNSS data using Trimble hardware
- download and differentially correct those data using Trimble software (Pathfinder Office, or PFO)
- Convert corrected data to ArcGIS compatible formats, and extract "true" x and y coordinates for our points
- Calculate the image coordinate error using an NSSDA spreadsheet

Find and familiarize yourself with the 2017 leaf-off image. It is surprising how much detail you can see, and many suitable test features are visible on your image. Select features that are well distributed across your study area, are not under trees or right next to buildings, and for which you can safely collect data.

Create a geodatabase/feature layer, digitize the point locations in the NAD83(CORS96) UTM zone 15 coordinates we'll be using throughout this course, and extract the x and y values for each point.

Use the provided GNSS equipment to visit and collect data for each of your points. Use carrier phase collection, and collect until the predicted accuracy stabilizes, generally in the 5 to 20 cm range if you have it set on horizontal positional prediction. This should take from 30 seconds to several minutes for each point.

When collecting the GPS data, try to maintain carrier lock. This means you should close the feature, but not the file, between points, and carefully walk with the pole/tripod upright and above your head from one point to the next. It helps if you don't pass under any obstructions, e.g., narrow gaps between buildings, under dense canopy. The expected accuracy shown in Terrasync may spike to a larger number for a bit, but if you maintain lock on most of the satellites, it will decline quickly and you may be able to collect for only a few minutes at each point.

Use the Pathfinder Office software in the lab to differentially correct and export the data, then extract the x and y coordinates for this GNSS "truth."

Complete the NSSDA spreadsheet.

*When finished, turn in the NSSDA spreadsheet (as an .xls or .xlsx), the GPS files (.cors and .ssf) and the points (as a geodatabase or zipped shapefiles) for your test points layer.*

Some helpful notes:
For this exercise, you want to GPS features that are very distinct on the images, e.g., sharp corners at sidewalk intersections, the base of very distinct poles where you can clearly identify the ground surface, or the corners of rectangular concrete pads in grassy fields (see the image for three examples).

These points are too close together, you would want them well-distributed throughout your area, but they are examples of the kind of points we'd like to identify.

It would be prudent to select one or two extra points on images while in the lab, because a point in the field might not suit. They might not be easily identifiable, or have changed since the image was created. Visit your points in the field to ensure you can find them, or that the sidewalk hasn't been rebuilt, or the pole moved.

You may have to collect GPS data for a bit longer at your first point, up to 10 minutes with the high-resolution GPS. It is good practice to collect your first point twice, once until you get carrier lock, then closing that point, and then a second in which you capture a point over the same first location. The initial data aren't as good as the GNSS equipment collects, and if you average that in to your final estimate of point location, you get a slightly poorer answer. By collecting twice at the first point, while maintaining lock, you get better results. As noted before, you may reduce the time at the second or third points if you can maintain carrier lock.

You may find you need to "offset" if you use power poles, e.g., stand a meter south or east of the pole so that your GPS can "see" sufficient satellites. If so, you need to measure the angle and distance to the pole, and adjust your corrected coordinates accordingly, as described in the resources provided on the main web page.

*Create maps of your project areas with one of the image as a background, show your test point layers, and an appropriate legend, title, and other map elements. Turn this in on Moodle on the specified due date*.

*Zip/compress your ssf and cors files for the field points, and turn those in via Moodle.*

*Also remember to turn in your NSSDA spreadsheet*