Emlid Post-Processing Kinematic (PPK) Lab

We have seen that high-accuracy location information is critical for direct georeferencing or for ground control with UAS image analysis. While we typically prefer to have real-time kinematic (RTK) GNSS data where corrections are being applied to our location measures in real time, that isn't always possible or sometimes even desirable. In these situations, we can use a post-processed kinematic (PPK) approach to correct our GNSS data after the fact. This requires that we have a RTK/PPK capable GNSS receiver and either a local base station or access to correction files from a nearby reference station (e.g., a CORS network site). In some cases, PPK can provide more accurate results than RTK because there are no transmission lags between the base and rover to worry about. For this lab we will use a free software app called Emlid Studio to post-process data collected with our Emlid Reach RS GNSS system.

Objectives:

The objectives of this lab are to:

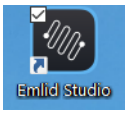
- Understand the PPK process and the use of log files from the rover and base station
- Use Emlid Studio to post-process GNSS data collected by the Emlid rover and local Emlid base station
- Use Emlid Studio to post-process GNSS data collected by the Emlid rover using data from a nearby CORS network site.

Deliverables

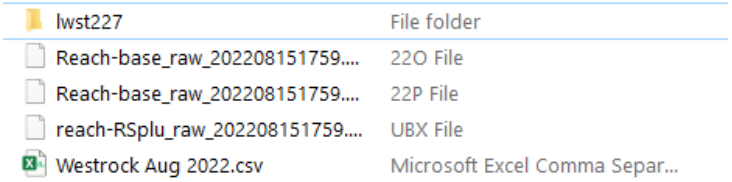
After completing the steps in the lab, answer the questions below and upload screenshots of your historic aerial photo orthomosaic.

Steps

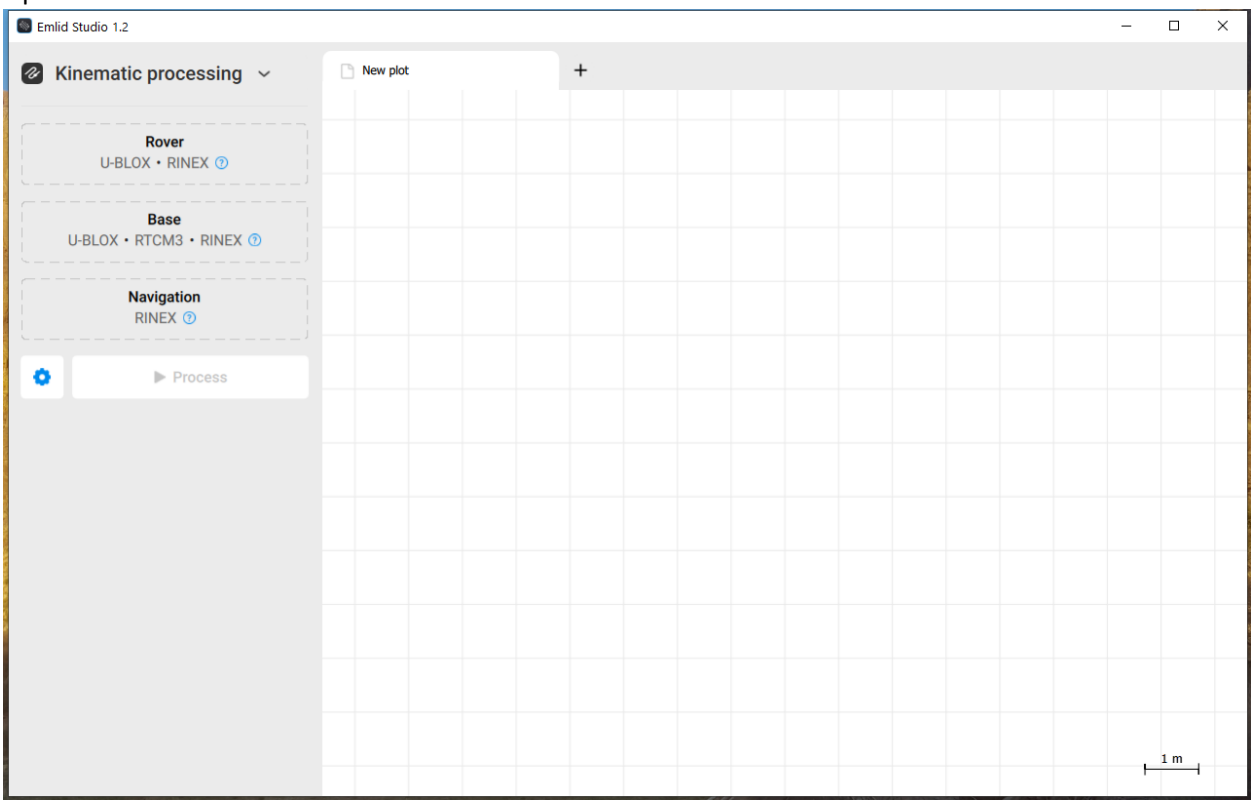
1. Download and install Emlid Studio from https://docs.emlid.com/emlid-studio/#download-emlid-studio



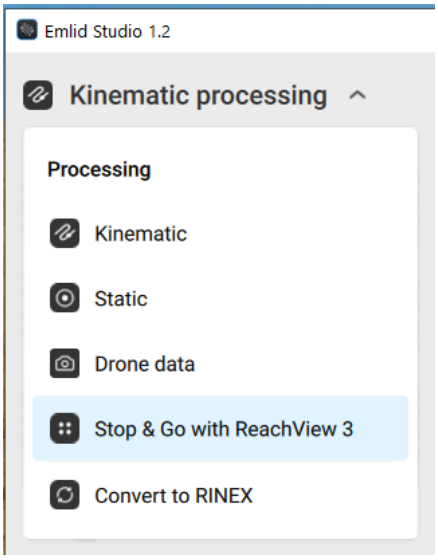
2. Download and unzip the files for this lab from the Canvas assignment page. Make note of which folder you unzipped the files into. The ZIP file will contain the following files. Note that the files starting with **Reach-base_raw…** are log files from the base station. Files starting with reach-**RSplu_raw…** are log files from the rover. The .**csv** file is the survey file that was collected with the rover.



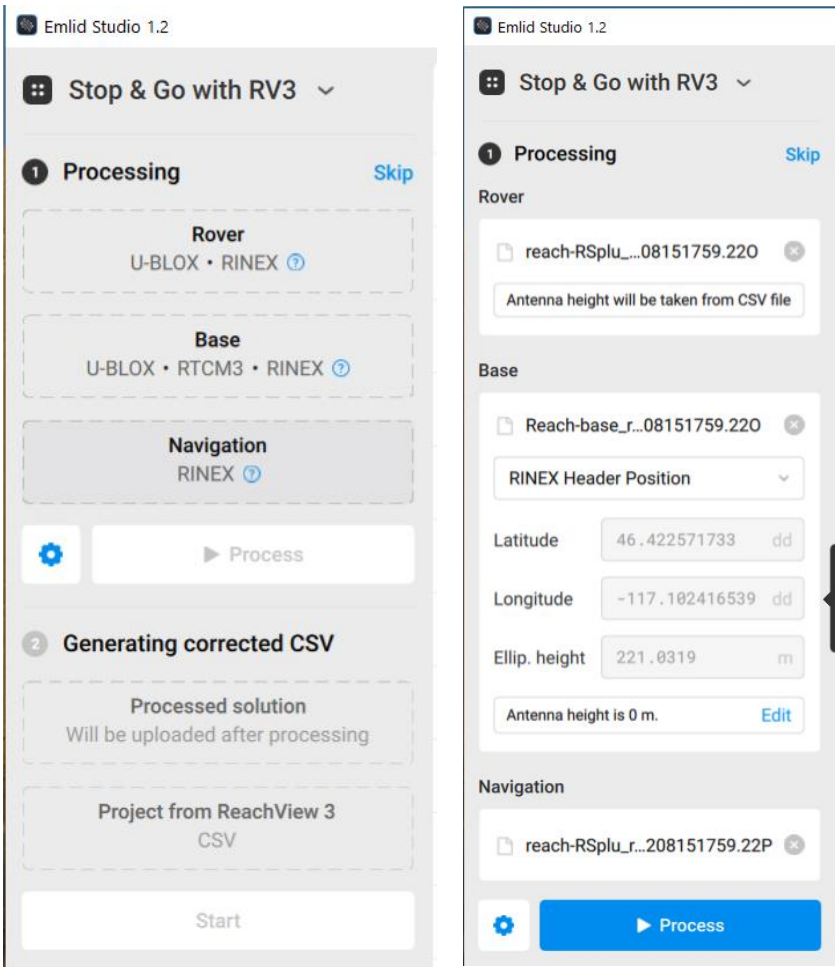
3. Open Emlid Studio



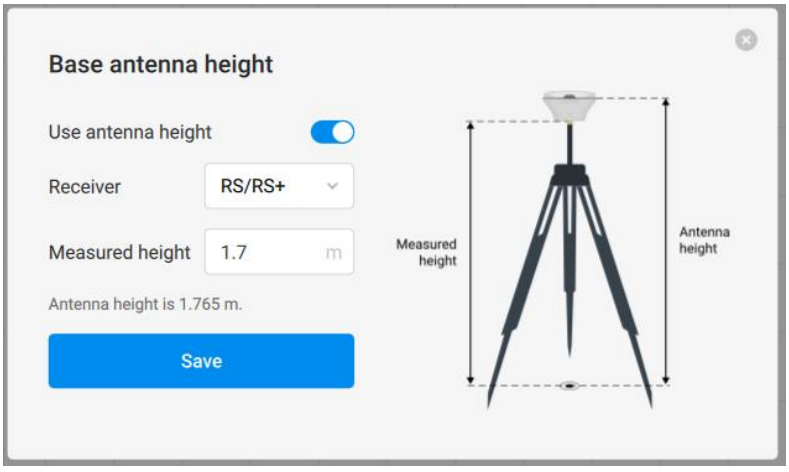
4. Select “Stop & Go with ReachView 3” from the drop down menu.



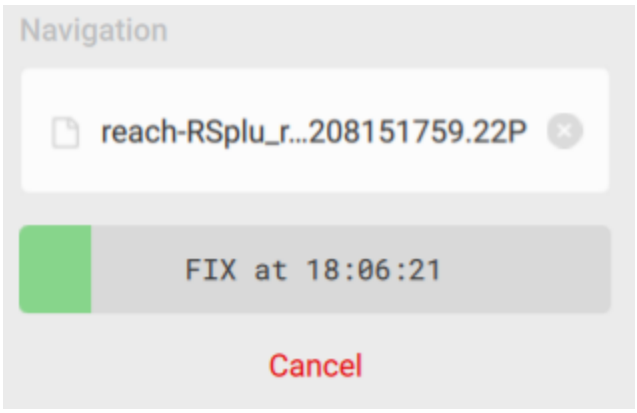
5. Drag-drop the Rover .UBX (track) file and the Base station’s Navigation (.22P) base log (.22O) file onto the boxes on the left side of the Emlid Studio window.



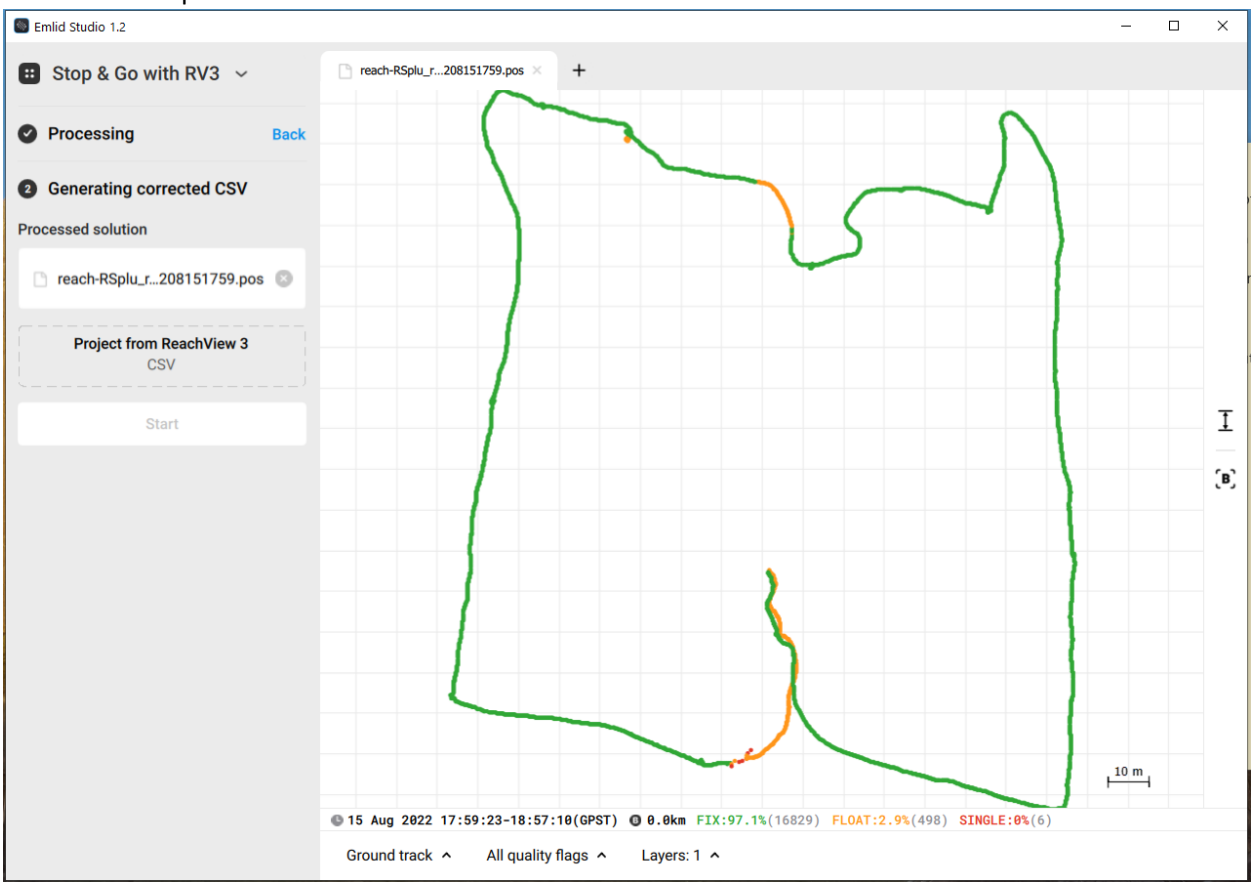
6. Click “Edit” under the Base section to set the height of the base station antenna. Set receiver to “RS/RS+” and Measured Height to 1.7m. Click Save.



7. Click Process to correct the Rover log file using the base station corrections. This may take a few minutes. While it is processing, you can see the status of the individual entries in the log file and how or if they are being corrected. FIX, FLOAT, SINGLE, UNKNOWN.



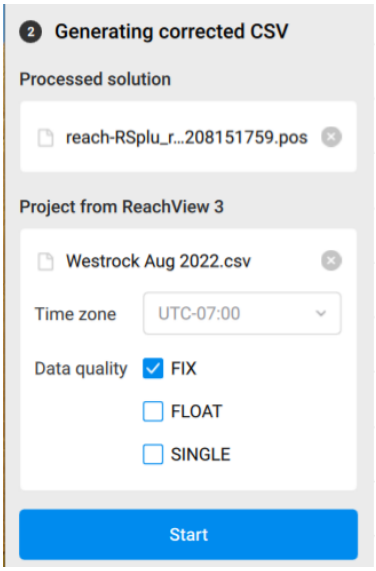
8. When it is finished processing, Emlid Studio will add the results of the post-processing step to the Generating Corrected CSV step. It will also show a map of the rover's path while the log file was being recorded (Zoom in to see individual points). The individual points will be color coded based on their position status.



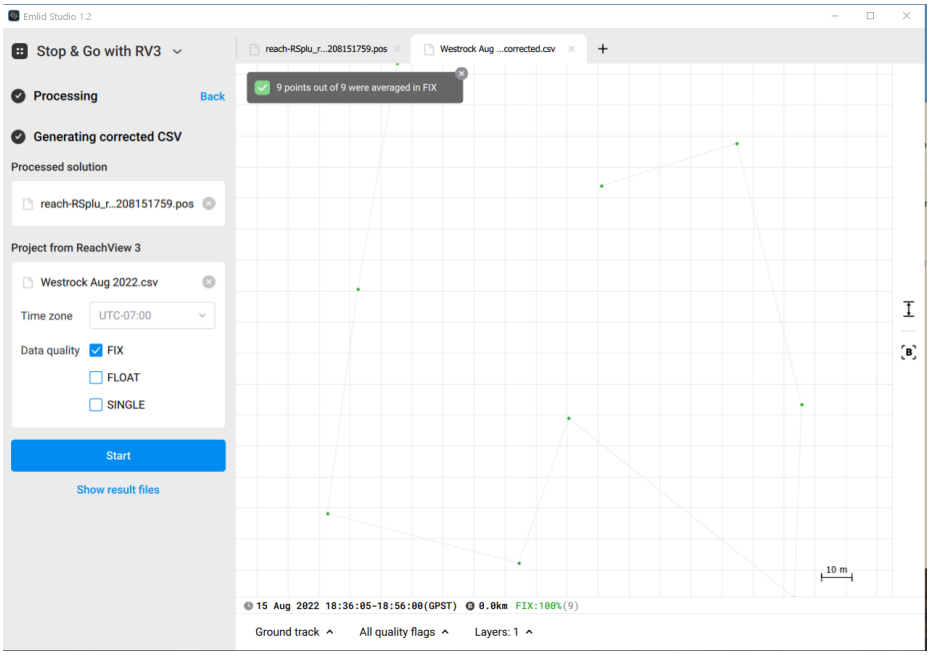
9. Drag/drop the CSV file from ReachView3 onto the Emlid Studio window. This CSV file contains the ground control points that were collected at the site. The GCPs were recorded using point averaging – i.e., all GPS readings for 30 seconds were averaged to calculate the estimated location for the GCP. The CSV file contains precise information on when that averaging started and stopped that Emlid Studio will use to select the corrected points from the rover log to

average to improve the estimate of the GCP location.

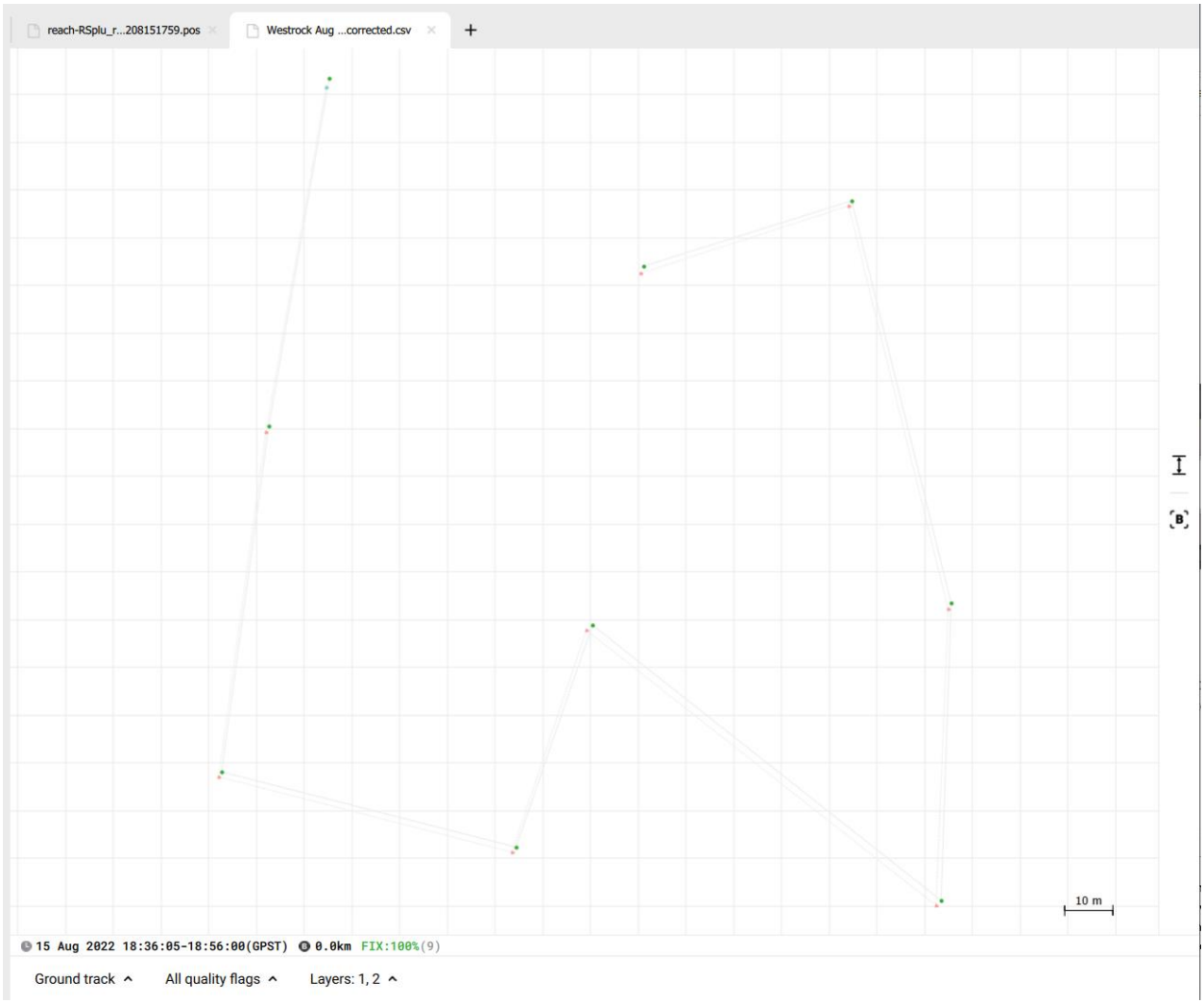
Uncheck “FLOAT” and SINGLE from the data quality options (we want only highest quality FIX points to be used in the averaging. Then click Start to correct the GCP points.



10. Emlid Studio will save the corrected GCP file in the same directory as the base and rover files are stored in. It will also show a map of the corrected GCP locations.



11. You can add the uncorrected points to the map in Emlid Studio to see how much the points were shifted during the PPK correction process. At the bottom of the window, click the up-arrow next to Layer 1. Choose Add Layer 2. Navigate to the folder where the original/uncorrected CSV file is located. Select it and click Open. The corrected points will show in green and the uncorrected points will show in orange.



12. Repeat the process using the log files collected from the CORS station in Lewiston, ID. You can download the file directly from the CORS network site using the info below or use the files contained in the **lwst227** folder in the lab's ZIP file.
    a. https://geodesy.noaa.gov/UFCORS/
    b. Station LWST
    c. Get date/time/duration from Emlid Studio
    d. Sampling Rate: as is
    e. All Signals: Check GPS and GLO+GAL+BEI
    f. Leave optional files unchecked
    g. Save file and unzip it.
13. Replace base station files with LWST CORS files
    a. Leave rover file as is (do not change, we want to correct the rover log file with the CORS data instead of our base station)
    b. Use the .o file for the Base file
    c. Use the .n file for the Navigation file
    d. Click Process to correct the rover's track log.

e. Compare the CORS-corrected rover log map to the Emlid-corrected rover map. Notice a larger amount of FLOAT points.
f. Once completed, reprocess the CSV file. Need to check FLOAT or it will drop one of the points.
g. Add the EMLID-corrected GCP file to the CORS-corrected GCP map. Notice how they are different. Estimate how far apart the points are.

Lab Questions to Answer

Please answer the following questions and where appropriate provide justification for your answers. 10 points each.

1. Approximately how far did the post-processing move GCP points in the survey file when correcting with the local Emlid base station data (hint: you can load the CSV files into ArcGIS or QGIS and display the points there to get better distance measurements)? Were these differences consistent?

2. How did the correction of the GCP points differ between using the local Emlid base station and the nearby CORS reference station? What might have caused these differences?

3. What proportion of the points in the rover track log were FIX, FLOAT, and SINGLE for both the correction using the local base station and the CORS reference station? What might that suggest for whether to use a local or a CORS network station?