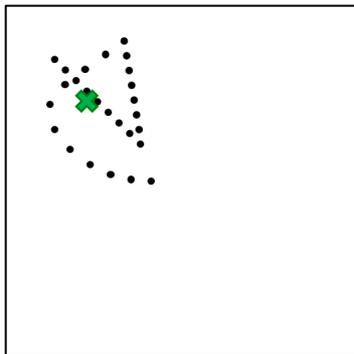


What is... post-processing?

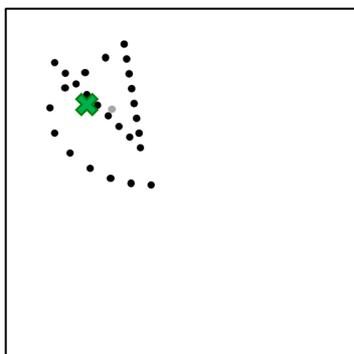
Post-processing is a way to significantly increase the accuracy of your GPS measurements. But how does it work? And what do you need to do it? Here are some interesting facts.



✕ true xy • xy GPS

To increase the accuracy (also see the “What is... accuracy?” document) of GPS point data, researchers have come up with different techniques. Probably the easiest one both to understand and to perform is the **averaging**. Instead of taking just one GPS point (●), you take several points (●●●).

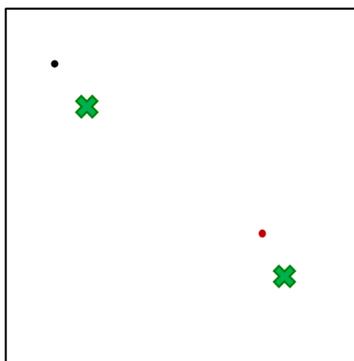
If you do this at different times, the points will be equally distributed. However, if you want to get 20 points to average, most likely you will just start the measurement and wait for 20 seconds, so you get 20 points. This way, even though you stand still, the coordinates you get will ‘walk’ across your screen. This is because they are all measured with about the same, slowly changing satellite constellation. If one satellite disappears from view, this might cause a ‘jump’ in your points.



✕ true xy • xy GPS • xy average

Once you have your 20 points, the averaging is easy. For the x-coordinate, sum up all the x-coordinates of your points and then divide it by 20. Do the same for y, and you have your xy average point (●).

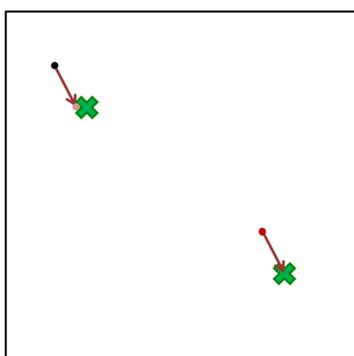
However, since the points you take during 20 seconds are not ‘independent’ from a statistical point of view, averaging can only increase the accuracy to a certain point. Meanwhile, it is a very good method to make sure your point is not among the 0.3% of very bad coordinates.



✕ true xy • xy Rover • xy Base

Another method is what we call **differential GPS** or **DGPS** in short. In order to do that, you need **two GPS receivers** taking coordinates at the same time. One of them is called the **Rover** (●), the other is called the **Reference Station** or **Base Station** (●).

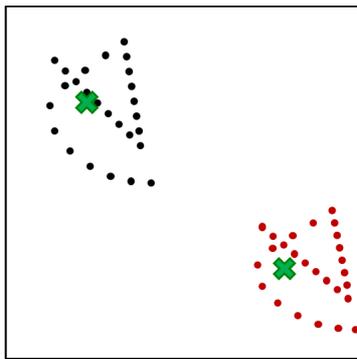
Now you take GPS points with both receivers at the same time. For the Base Station, the true coordinates (✕) are known. This can be achieved in several ways and is usually done by an experienced surveyor.



✕ true xy • xy Rover • xy Base
→ correction • xy corrected

Since the two coordinates (●●), are taken at the **same time**, using the same satellite constellation, having the same atmospheric influences etc., they will most likely have about the same error.

For the GPS point measured at the Base Station, it is very easy to calculate the difference between the measured and the true coordinates ($x_{\text{true}} - x_{\text{measured}} = \Delta x$ correction). Now we can apply the same **correction** (→) to the coordinates of the Rover. The result will not be 100% exact, but much better (higher accuracy) than the uncorrected coordinates.

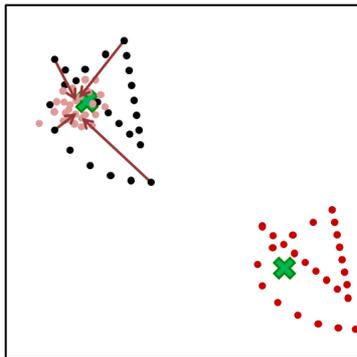


✕ true xy • xy Rover • xy Base

In order to get the best results, usually **averaging and DGPS** are being **combined**. First, a number of points are measured both at the Rover and the Base Station.

For each point, the difference between the measured and the known coordinates at the Base Station is calculated. This correction is applied to the Rover GPS points.

As a result, you get the corrected points (●) at the Rover location.

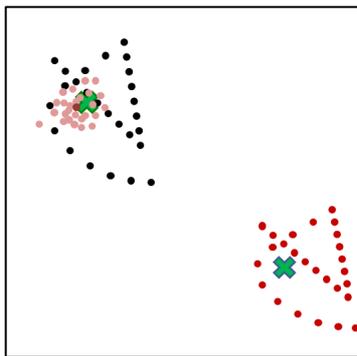


✕ true xy • xy Rover • xy Base
→ correction • xy corrected

After that, you can now calculate the average of the corrected points. The result is a single point (●) with a **high accuracy!**

If the differential correction process is done **after** the data collection, the method is called **post-processing**, which means that first you work on the field, and after (post) that, you do the corrections (processing).

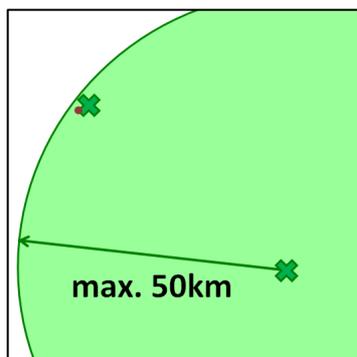
If there is a way to submit the correction data **immediately** (real time) from the Base Station to the Rover, you can get high precision coordinates in the field already. This is called Real Time Kinematic or **RTK** in short. Usually, the corrections are sent from the Base Station to the Rover by some sort of radio transmission.



✕ true xy • xy Rover • xy Base
● xy corrected • xy corr average

Rwanda: If you don't own a Base Station yourself, you can use the one on Telecom House. Its GPS (and Glonass) data can be downloaded from <ftp://igs.ensg.ign.fr/pub/igs/data/> Look for **NURK** (which means National University of Rwanda, Kigali). According to the National Land Centre, more Base Stations all over the country will be erected in the future.

There are **two prerequisites** to use post-processing. 1) Your GPS must be able to record raw data. If you have Trimble GPS devices with ArcPad, you need the **Trimble GPS correct** software. 2) You need software to do the post-processing on your computer. The best way is to use the **Trimble GPS Analyst** extension for ArcGIS (alternatively, you can also use Trimble Pathfinder Office).



✕ true xy ● max. coverage

Important: DGPS (RTK as well as post-processing) relies on the fact that both receivers get the same GPS signals at the same time. If the Rover is too far away from the Base Station, the constellation of the satellites and the signals received are no longer the same. Therefore, the maximum distance for DGPS is **50km** (radius) from the Base Station.



Shown on the left is the coverage of NURK reference station.