Lab 1: Single Receiver Static GPS

Introduction

This labs purpose was to set up a Single Receiver Static Global Positioning System (GPS) and collect a series of GPS observations; those observations were collected for 30 minutes, 60 minutes, and also 90 minutes. At the end of the collection, the duration of the observation versus the final precision/accuracy will be gauged by comparing the Precision Point Positioning (PPP) results to a known number, in this case, it would be the Survey Monument.

Precision Point Positioning or PPP as it is also known as is a Static GPS that has traditionally been used by Surveyors as a preferred method of data processing.

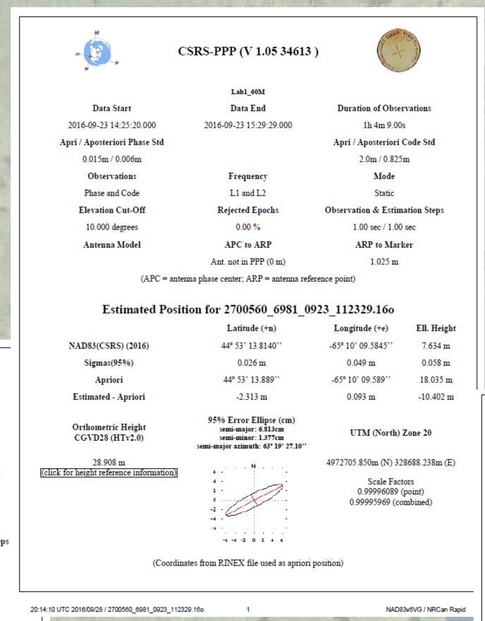
For this lab, a Single-Point Positioning, the way that this method works is it could be a real-time solution that uses a single receiver that measures at least four satellites. This approach is more common outside of the survey industry.

The question that needs to be answered by completing this lab is this: How does the duration of observations affect the overall precision (95% sigmas) of the post-processed coordinates?

Methods

First thing was to set up the unit, making sure that it was level and centered over the monument, within millimeters of the marker. The second thing that happened before starting to collect any observations , there were three separate job files created within the receiver to identify each separate observation periods (those observation periods as stated in the introduction are 30-minutes, 60-minutes, and 90-minutes). Once everything was set up and level, the collect could begin. After the three observations had bee completed, the data was then downloaded and processed. The way that the data was processed was the raw observations were imported into GrafNav, then converted to a GPB format to check the data, next thing was to export the observations into an RINEX format, then take those RINEX files and compress those files into a ZIP folder, next thing was to upload that ZIP file to the Canadian Spatial Reference System (CSRS) Precise Point Positioning (PPP) tool, and then the final step was to download the generated files that were sent to your email by PPP.

The image that you see to the right on the bottom is the first page of the report that was sent by PPP. This report is for the 30-minute observation period.



CSRS-PPP (V 1.05 34613)

Lab1_60M

Data Start	Data End	Duration of Observations
2016-09-23 14:25:20.000	2016-09-23 15:29:29.000	1h 4m 9.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.006m		2.0m / 0.825m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	1.00 sec / 1.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
	Ant. not in PPP (0 m)	1.025 m

(APC = antenna phase center; ARP = antenna reference point)

Estimated Position for 2700560_6981_0923_112329.16o

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (2016)	44° 53' 13.8140''	-65° 10' 09.5845''	7.634 m
Sigmas(95%)	0.026 m	0.049 m	0.058 m
Apriori	44° 53' 13.889''	-65° 10' 09.589''	18.035 m
Estimated - Apriori	-2.313 m	0.093 m	-10.402 m

Orthometric Height CGVD28 (HTv2.0): 28.908 m (click for height reference information)

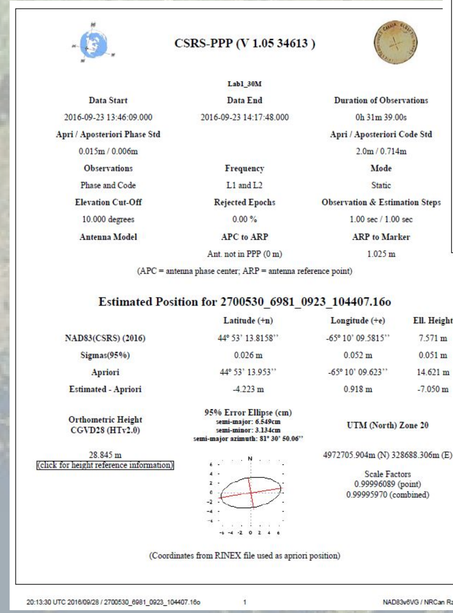
95% Error Ellipse (cm): semi-major: 6.813cm; semi-minor: 1.377cm; semi-major azimuth: 63° 19' 27.10''

UTM (North) Zone 20: 4972705.850m (N) 328688.238m (E)

Scale Factors 0.99996089 (point) 0.99995969 (combined)

(Coordinates from RINEX file used as apriori position)

20:14:10 UTC 2016/09/28 / 2700560_6981_0923_112329.16o 1 NAD83v6VG / NRCan Rapid



CSRS-PPP (V 1.05 34613)

Lab1_30M

Data Start	Data End	Duration of Observations
2016-09-23 13:46:09.000	2016-09-23 14:17:48.000	0h 31m 39.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.006m		2.0m / 0.714m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	1.00 sec / 1.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
	Ant. not in PPP (0 m)	1.025 m

(APC = antenna phase center; ARP = antenna reference point)

Estimated Position for 2700530_6981_0923_104407.16o

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (2016)	44° 53' 13.8158''	-65° 10' 09.5815''	7.571 m
Sigmas(95%)	0.026 m	0.052 m	0.051 m
Apriori	44° 53' 13.953''	-65° 10' 09.623''	14.621 m
Estimated - Apriori	-4.223 m	0.918 m	-7.050 m

Orthometric Height CGVD28 (HTv2.0): 28.845 m (click for height reference information)

95% Error Ellipse (cm): semi-major: 6.549cm; semi-minor: 3.334cm; semi-major azimuth: 83° 20' 50.06''

UTM (North) Zone 20: 4972705.904m (N) 328688.306m (E)

Scale Factors 0.99996089 (point) 0.99995970 (combined)

(Coordinates from RINEX file used as apriori position)

20:13:30 UTC 2016/09/28 / 2700530_6981_0923_104407.16o 1 NAD83v6VG / NRCan Rapid

These images are of the first page of the report that was received from PPP.

The image to the left is the first page of the 30 minute collect, the above image is the first page of the 60 minute collect and the final image to the right is the first page of the 90 minute collect that was done on September 23rd, 2016.

Results

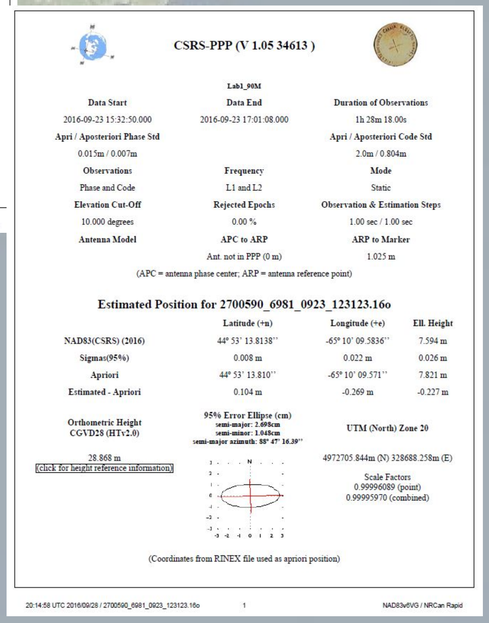
After looking at the results that had been sent back from the Precise Point Positioning there was some small difference in the latitude, longitude, and also the ellipsoidal height has changed somewhat. In the report to the left on the bottom, you can see the latitude and longitude from PPP, but before sending the raw data away for further processing the latitude read as 44 53 13.85443, the longitude read as -65 10 09.59405 , and the ellipsoidal height read as 6.300 meters. The report shows the latitude as 44 53 13.8158, the longitude as -65 10 09.5815 and the ellipsoidal height of 7.571 meters.

Discussion

This lab has made it clear that the longer that you have your unit set up and the longer that you are collecting a specific location the better accuracy you will have.

This work may have some flaws, but with some further collecting on clear days there will be better accuracy.

The above image is an example of what our set up looked like.



CSRS-PPP (V 1.05 34613)

Lab1_90M

Data Start	Data End	Duration of Observations
2016-09-23 15:32:50.000	2016-09-23 17:01:08.000	1h 28m 18.00s
Apri / Aposteriori Phase Std		**Apri / Aposteriori Code Std**
0.015m / 0.007m		2.0m / 0.804m
Observations	**Frequency**	**Mode**
Phase and Code	L1 and L2	Static
Elevation Cut-Off	**Rejected Epochs**	**Observation & Estimation Steps**
10.000 degrees	0.00 %	1.00 sec / 1.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
	Ant. not in PPP (0 m)	1.025 m

(APC = antenna phase center; ARP = antenna reference point)

Estimated Position for 2700590_6981_0923_123123.16o

	Latitude (+n)	Longitude (+e)	Ell. Height
NAD83(CSRS) (2016)	44° 53' 13.8138''	-65° 10' 09.5836''	7.594 m
Sigmas(95%)	0.008 m	0.022 m	0.026 m
Apriori	44° 53' 13.810''	-65° 10' 09.571''	7.821 m
Estimated - Apriori	0.104 m	-0.269 m	-0.227 m

Orthometric Height CGVD28 (HTv2.0): 28.868 m (click for height reference information)

95% Error Ellipse (cm): semi-major: 2.695cm; semi-minor: 1.045cm; semi-major azimuth: 88° 47' 16.39''

UTM (North) Zone 20: 4972705.844m (N) 328688.258m (E)

Scale Factors 0.99996089 (point) 0.99995970 (combined)

(Coordinates from RINEX file used as apriori position)

20:14:58 UTC 2016/09/28 / 2700590_6981_0923_123123.16o 1 NAD83v6VG / NRCan Rapid

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Course: REMT 3010
Date: October 3rd, 2016

The background image is a screen shot from the ArcMap Add Basemap Imagery feature.

The image found under the title is a screen shot taken from Google earth with the 30 minute point being shown .

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