Report on GNSS Training

Course ID: T151-40

Team No: 03

Team Members:

Tahira Zafar

Susmina Manandhar

Eranga Liyanaathukorala

Walter Valdez

Training held at GIC/AIT, Thailand

6 – 10 JAN 2020

Table of Contents

Table of Contents

Table of Figures

1. Team 3

1.1. Executive Summary

The continuous evolution of mankind in sustaining peaceful life. The search for the technological advancement is becoming the priority for every individual to contribute in this goal of human life. The launching of GNSS technology open new opportunities to search for more applied technologies in the improvement of production and management aspects which serves as a challenge in the coming future due to the increasing demand of food and other basic services. The broad applications of the GNSS will contribute into the fast changing development need for the existing technologies we are using.

The International Committee on Global Navigation Satellite System (ICG), Center for Spatial Information Science, The University of Tokyo (CSIS), and Asian Institute of Technology (AIT) spearheaded the dissemination of the GNSS technology in the world will truly compliment in the equal chances of contributing applied technologies with various uses needed for every country. The conducted rigid training for the GNSS, gives a wider understanding in the different applications of GNSS, setting the correct data collection and downloading and processing collected using different software available (SPP, DGSS and RTK) generated by the organizers.

Every topic in the training course was discussed in details were the participants can grasp the topic. Actual field work was also done during this training to execute the developed hands-on activities and familiar with procedures and proper generation data in the correct format. The files generated were downloaded and processed into graphs and other different forms that will be useful in any applications. The derived outputs were collected for group presentations as a learning outcomes in this training program.

As a concluding remarks, this kind of training is relevant in every aspect of social development for every countries participated in this training course. This technological breakthrough is useful in a wide range of applications. So, every participants are challenge to work on the GNSS application and further continue to study on this topic to be more competent in using GNSS in the different variety of applied field.

1.2. TEAM MEMBERS

Tahira Zafar:

Masters in Environmental Studies from "University of Karachi", Pakistan.
(tahira.16zafar@gmail.com)

Susmina Manandha:

Bachelor's in Geomatics Engineering, Tribhuwan University, Nepal
(manandharsushi@gmail.com)

Eranga Liyanaathukorala:

Master of Science in GIS & RS, University of Peradeniya, Sri Lanka.
(gisehl@yahoo.com)

Walter Valdez:

Faculty member of the Department of Agricultural and Biosystem Engineering at the Bataan Peninsula State University – Abucay Campus in the Philippines.
(terenfe06@gmail.com)

1.3. Introduction

Global Navigation Satellite System (GNSS) refers to a constellation of satellites providing signals from space that transmit positioning and timing data to GNSS receivers. The receivers then use this data to determine location.

GNSS receivers are primarily used in land navigation. Navigation is the process of determining position and direction. However, marine sailing, tourism and recreation are fields where the use of navigation devices is also very common. The average position errors of GNSS receivers decisively influence the ability and accuracy of navigation based on those devices.

As part of the parallel tracking studies, the receiver positions were compared to those of precise GNSS receivers, using corrections from an active geodetic network with an accuracy of higher percentage and minimal error. As a result of the measurement, the accuracy statistics for each of the considered reference points were defined based on approximately real time satellite positions. The several studies conducted indicate that there are significant differences in the accuracy of positioning as performed by the receiver.

There are several advantages of using GNSS raw measurements on smartphones as introduced in this training. Their use can lead to increased GNSS performance, as it opens the door to more advanced GNSS processing techniques that, until now, have been restricted to more professional GNSS receivers due to the higher costing they are offering in the market.

A user's position is estimated using the distance measurements (pseudoranges) between the user's receiver antenna and the position of at least four satellites. Both are determined by the receiver, which evaluates the satellite's signal and navigation message, respectively. This information is required by the PVT solution, which provides the user's position and time anywhere on the globe.

We also trained how to use the different GNSS receivers such as M8T (single signal receiver) and F9P (dual single receiver) for collecting data. This data was convert to RINEX data using RTKLib and then post processing using RTKLib for single signal point processing for RTK which resulted to SPP, DGPS, RTK for usable formats to be used different field of applications.

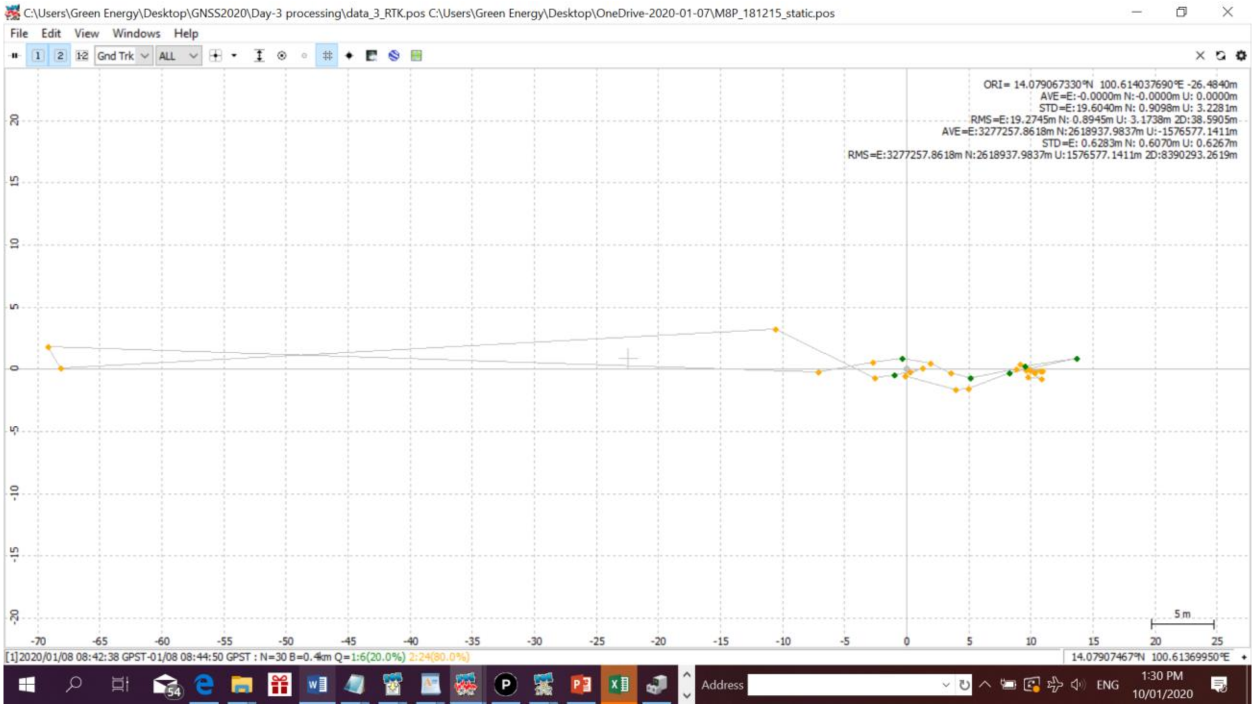


Figure 01: Plot showing data collected by F9P receiver using RTK

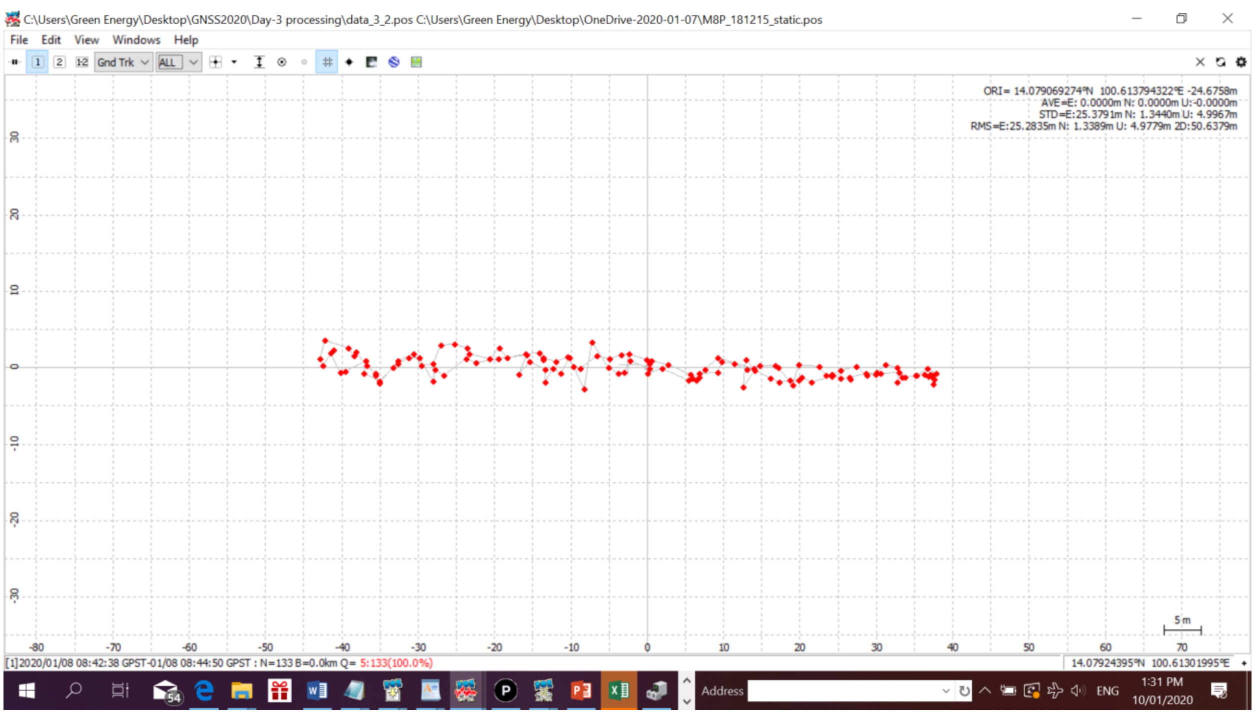


Figure 02: Plot showing data collected by F9P receiver using SPP

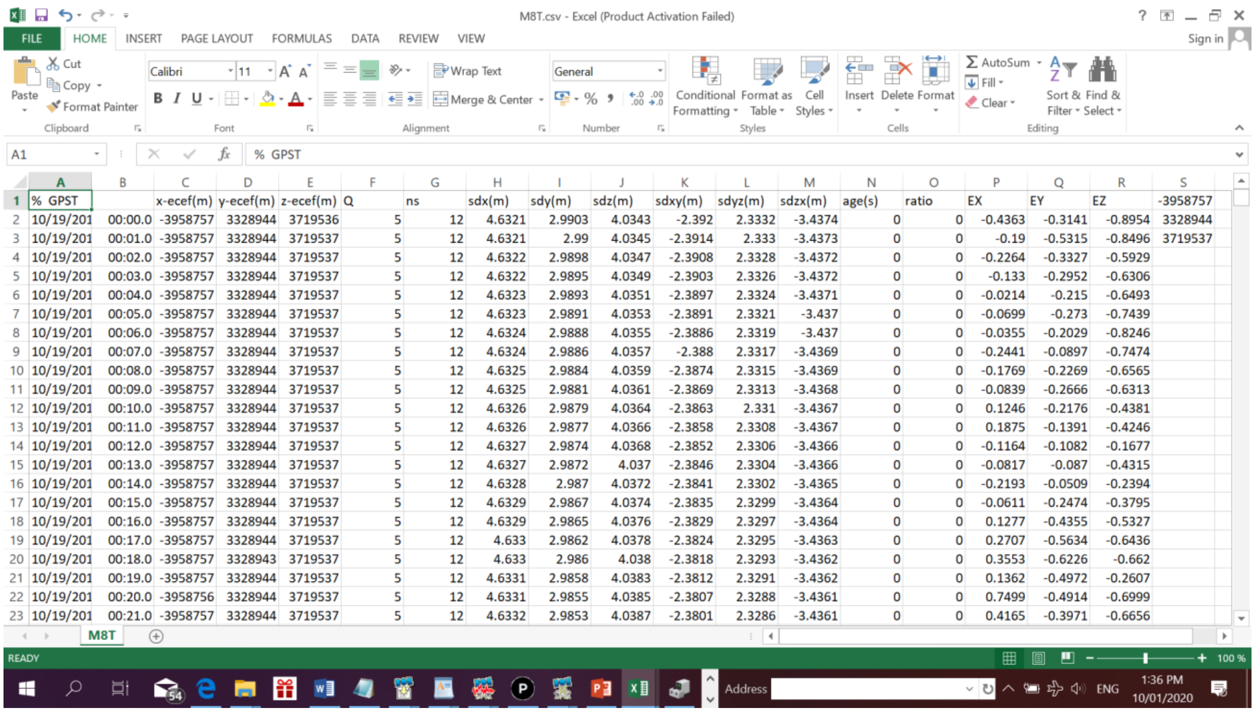


Figure 03: Calculation of error in data of M8T receiver

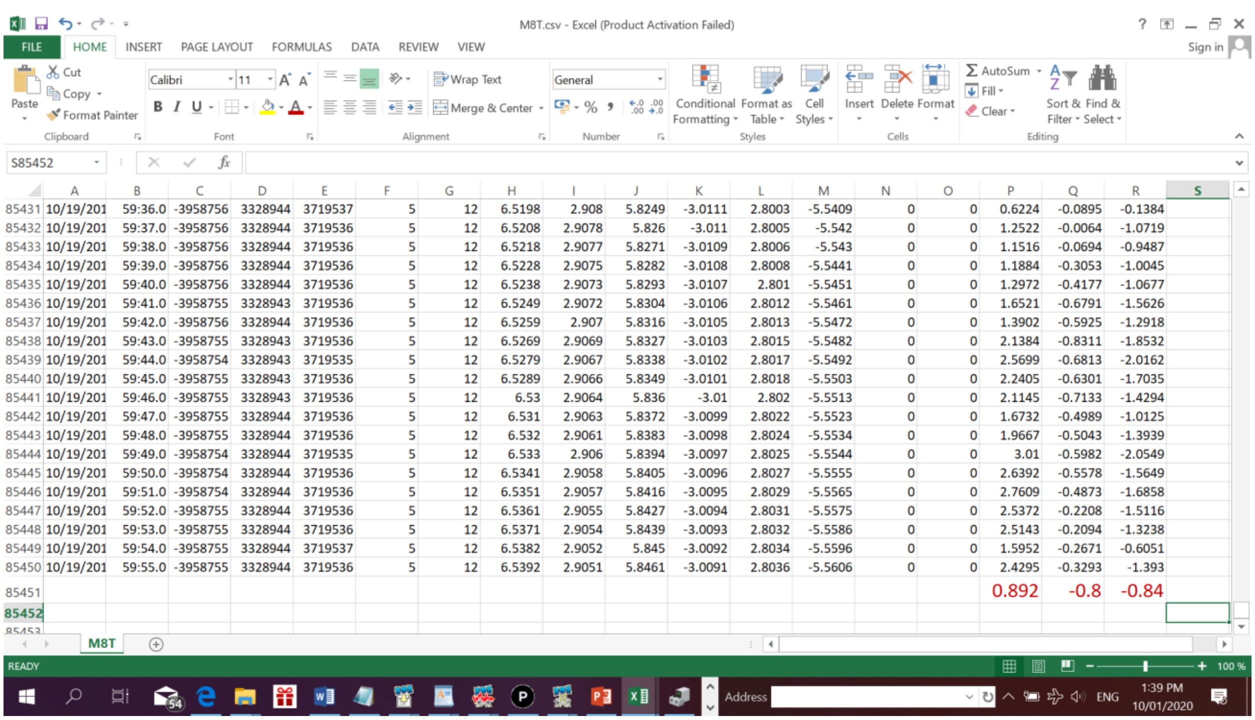
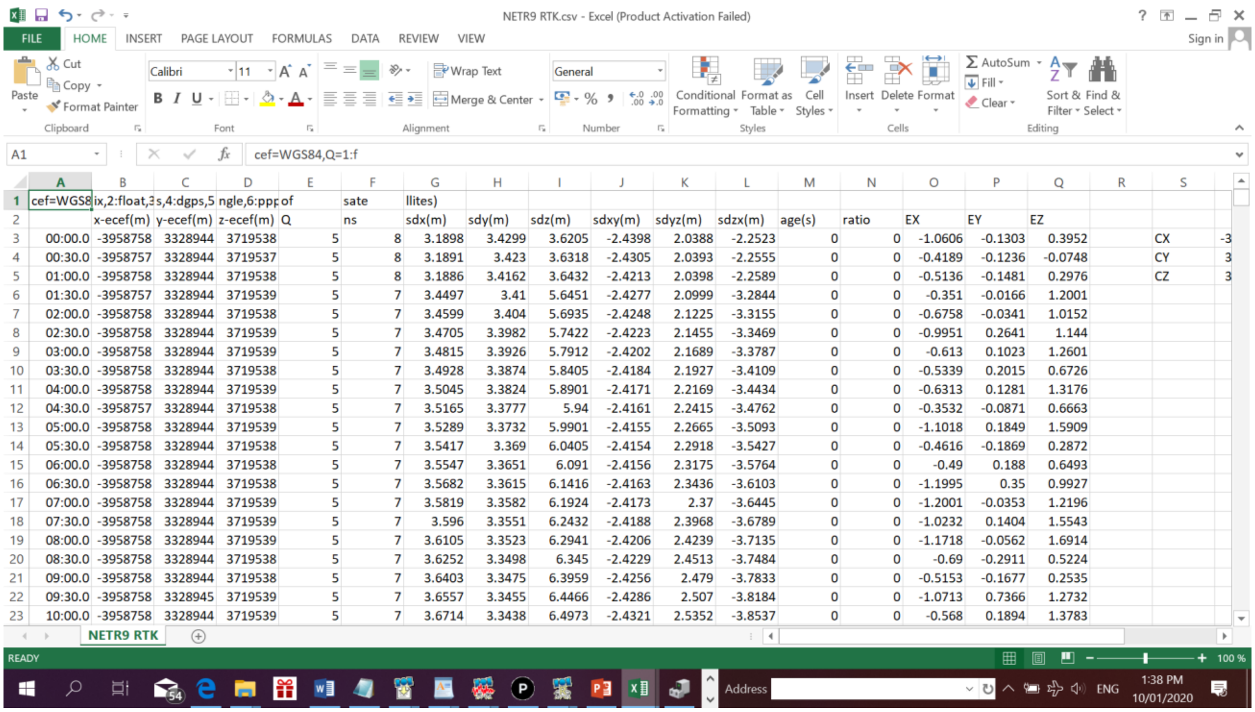
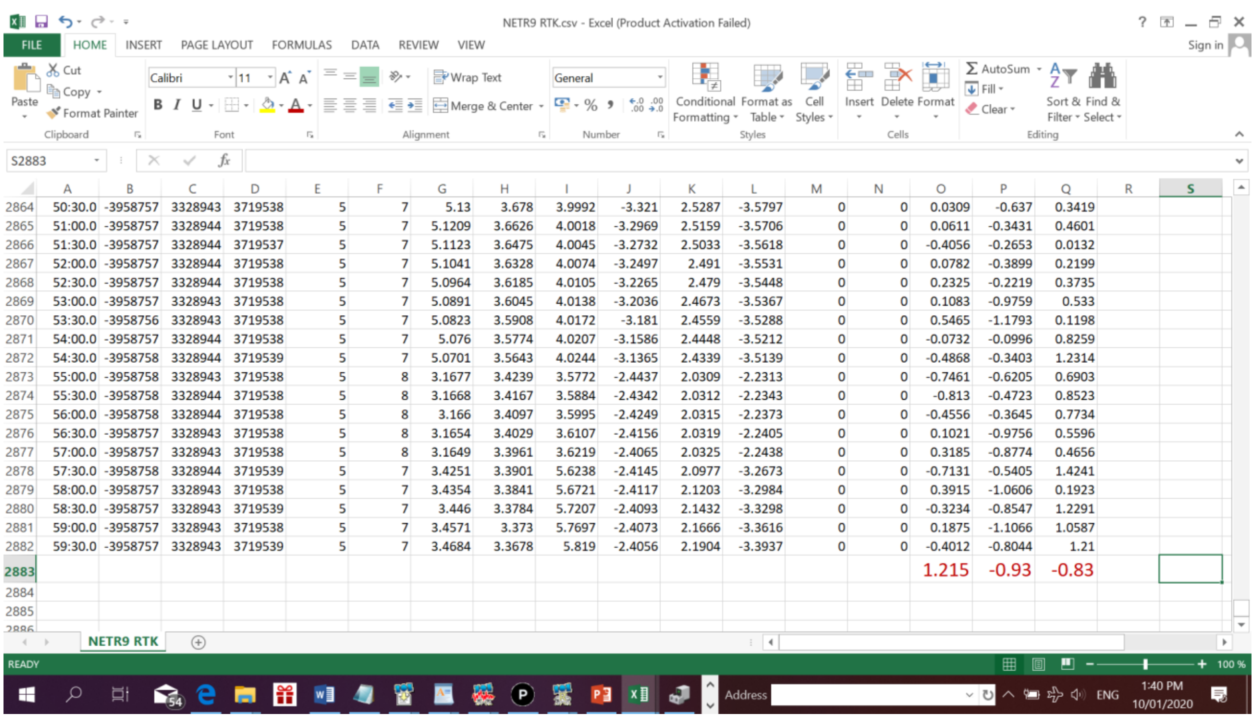


Figure 04: Error calculation of data in M8T receiver



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	cef=WGS8	ix,2:float,3	s,4:dgps,5	ngle,6:ppp	of	sate	llites)													
2		x-ecef(m)	y-ecef(m)	z-ecef(m)	Q	ns	sdx(m)	sdy(m)	sdz(m)	sdxy(m)	sdyz(m)	sdzx(m)	age(s)	ratio	EX	EY	EZ			
3	00:00.0	-3958758	3328944	3719538	5	8	3.1898	3.4299	3.6205	-2.4398	2.0388	-2.2523	0	0	-1.0606	-0.1303	0.3952		CX	-3
4	00:30.0	-3958757	3328944	3719537	5	8	3.1891	3.423	3.6318	-2.4305	2.0393	-2.2555	0	0	-0.4189	-0.1236	-0.0748		CY	3
5	01:00.0	-3958758	3328944	3719538	5	8	3.1886	3.4162	3.6432	-2.4213	2.0398	-2.2589	0	0	-0.5136	-0.1481	0.2976		CZ	3
6	01:30.0	-3958757	3328944	3719539	5	7	3.4497	3.41	5.6451	-2.4277	2.0999	-3.2844	0	0	-0.351	-0.0166	1.2001			
7	02:00.0	-3958758	3328944	3719538	5	7	3.4599	3.404	5.6935	-2.4248	2.1225	-3.3155	0	0	-0.6758	-0.0341	1.0152			
8	02:30.0	-3958758	3328944	3719539	5	7	3.4705	3.3982	5.7422	-2.4223	2.1455	-3.3469	0	0	-0.9951	0.2641	1.144			
9	03:00.0	-3958758	3328944	3719539	5	7	3.4815	3.3926	5.7912	-2.4202	2.1689	-3.3787	0	0	-0.613	0.1023	1.2601			
10	03:30.0	-3958758	3328944	3719538	5	7	3.4928	3.3874	5.8405	-2.4184	2.1927	-3.4109	0	0	-0.5339	0.2015	0.6726			
11	04:00.0	-3958758	3328944	3719539	5	7	3.5045	3.3824	5.8901	-2.4171	2.2169	-3.4434	0	0	-0.6313	0.1281	1.3176			
12	04:30.0	-3958757	3328944	3719538	5	7	3.5165	3.3777	5.94	-2.4161	2.2415	-3.4762	0	0	-0.3532	-0.0871	0.6663			
13	05:00.0	-3958758	3328944	3719539	5	7	3.5289	3.3732	5.9901	-2.4155	2.2665	-3.5093	0	0	-1.1018	0.1849	1.5909			
14	05:30.0	-3958758	3328944	3719538	5	7	3.5417	3.369	6.0405	-2.4154	2.2918	-3.5427	0	0	-0.4616	-0.1869	0.2872			
15	06:00.0	-3958758	3328944	3719538	5	7	3.5547	3.3651	6.091	-2.4156	2.3175	-3.5764	0	0	-0.49	0.188	0.6493			
16	06:30.0	-3958758	3328944	3719538	5	7	3.5682	3.3615	6.1416	-2.4163	2.3436	-3.6103	0	0	-1.1995	0.35	0.9927			
17	07:00.0	-3958758	3328944	3719539	5	7	3.5819	3.3582	6.1924	-2.4173	2.37	-3.6445	0	0	-1.2001	-0.0353	1.2196			
18	07:30.0	-3958758	3328944	3719539	5	7	3.596	3.3551	6.2432	-2.4188	2.3968	-3.6789	0	0	-1.0232	0.1404	1.5543			
19	08:00.0	-3958758	3328944	3719539	5	7	3.6105	3.3523	6.2941	-2.4206	2.4239	-3.7135	0	0	-1.1718	-0.0562	1.6914			
20	08:30.0	-3958758	3328944	3719538	5	7	3.6252	3.3498	6.345	-2.4229	2.4513	-3.7484	0	0	-0.69	-0.2911	0.5224			
21	09:00.0	-3958758	3328944	3719538	5	7	3.6403	3.3475	6.3959	-2.4256	2.479	-3.7833	0	0	-0.5153	-0.1677	0.2535			
22	09:30.0	-3958758	3328945	3719539	5	7	3.6557	3.3455	6.4466	-2.4286	2.507	-3.8184	0	0	-1.0713	0.7366	1.2732			
23	10:00.0	-3958758	3328944	3719539	5	7	3.6714	3.3438	6.4973	-2.4321	2.5352	-3.8537	0	0	-0.568	0.1894	1.3783			

Figure 05: Error calculation in data for NetR9



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2864	50:30.0	-3958757	3328943	3719538	5	7	5.13	3.678	3.9992	-3.321	2.5287	-3.5797	0	0	0.0309	-0.637	0.3419
2865	51:00.0	-3958757	3328944	3719538	5	7	5.1209	3.6626	4.0018	-3.2969	2.5159	-3.5706	0	0	0.0611	-0.3431	0.4601
2866	51:30.0	-3958757	3328944	3719537	5	7	5.1123	3.6475	4.0045	-3.2732	2.5033	-3.5618	0	0	-0.4056	-0.2653	0.0132
2867	52:00.0	-3958757	3328944	3719538	5	7	5.1041	3.6328	4.0074	-3.2497	2.491	-3.5531	0	0	0.0782	-0.3899	0.2199
2868	52:30.0	-3958757	3328944	3719538	5	7	5.0964	3.6185	4.0105	-3.2265	2.479	-3.5448	0	0	0.2325	-0.2219	0.3735
2869	53:00.0	-3958757	3328943	3719538	5	7	5.0891	3.6045	4.0138	-3.2036	2.4673	-3.5367	0	0	0.1083	-0.9759	0.533
2870	53:30.0	-3958756	3328943	3719538	5	7	5.0823	3.5908	4.0172	-3.181	2.4559	-3.5288	0	0	0.5465	-1.1793	0.1198
2871	54:00.0	-3958757	3328944	3719538	5	7	5.076	3.5774	4.0207	-3.1586	2.4448	-3.5212	0	0	-0.0732	-0.0996	0.8259
2872	54:30.0	-3958758	3328944	3719539	5	7	5.0701	3.5643	4.0244	-3.1365	2.4339	-3.5139	0	0	-0.4868	-0.3403	1.2314
2873	55:00.0	-3958758	3328943	3719538	5	8	3.1677	3.4239	3.5772	-2.4437	2.0309	-2.2313	0	0	-0.7461	-0.6205	0.6903
2874	55:30.0	-3958758	3328944	3719538	5	8	3.1668	3.4167	3.5884	-2.4342	2.0312	-2.2343	0	0	-0.813	-0.4723	0.8523
2875	56:00.0	-3958758	3328944	3719538	5	8	3.166	3.4097	3.5995	-2.4249	2.0315	-2.2373	0	0	-0.4556	-0.3645	0.7734
2876	56:30.0	-3958757	3328943	3719538	5	8	3.1654	3.4029	3.6107	-2.4156	2.0319	-2.2405	0	0	0.1021	-0.9756	0.5596
2877	57:00.0	-3958757	3328943	3719538	5	8	3.1649	3.3961	3.6219	-2.4065	2.0325	-2.2438	0	0	0.3185	-0.8774	0.4656
2878	57:30.0	-3958758	3328944	3719539	5	7	3.4251	3.3901	5.6238	-2.4145	2.0977	-3.2673	0	0	-0.7131	-0.5405	1.4241
2879	58:00.0	-3958757	3328943	3719538	5	7	3.4354	3.3841	5.6721	-2.4117	2.1203	-3.2984	0	0	0.3915	-1.0606	0.1923
2880	58:30.0	-3958757	3328943	3719539	5	7	3.446	3.3784	5.7207	-2.4093	2.1432	-3.3298	0	0	-0.3234	-0.8547	1.2291
2881	59:00.0	-3958757	3328943	3719538	5	7	3.4571	3.373	5.7697	-2.4073	2.1666	-3.3616	0	0	0.1875	-1.1066	1.0587
2882	59:30.0	-3958757	3328943	3719539	5	7	3.4684	3.3678	5.819	-2.4056	2.1904	-3.3937	0	0	-0.4012	-0.8044	1.21
2883															1.215	-0.93	-0.83

Figure 06: Error calculation in data for NetR9

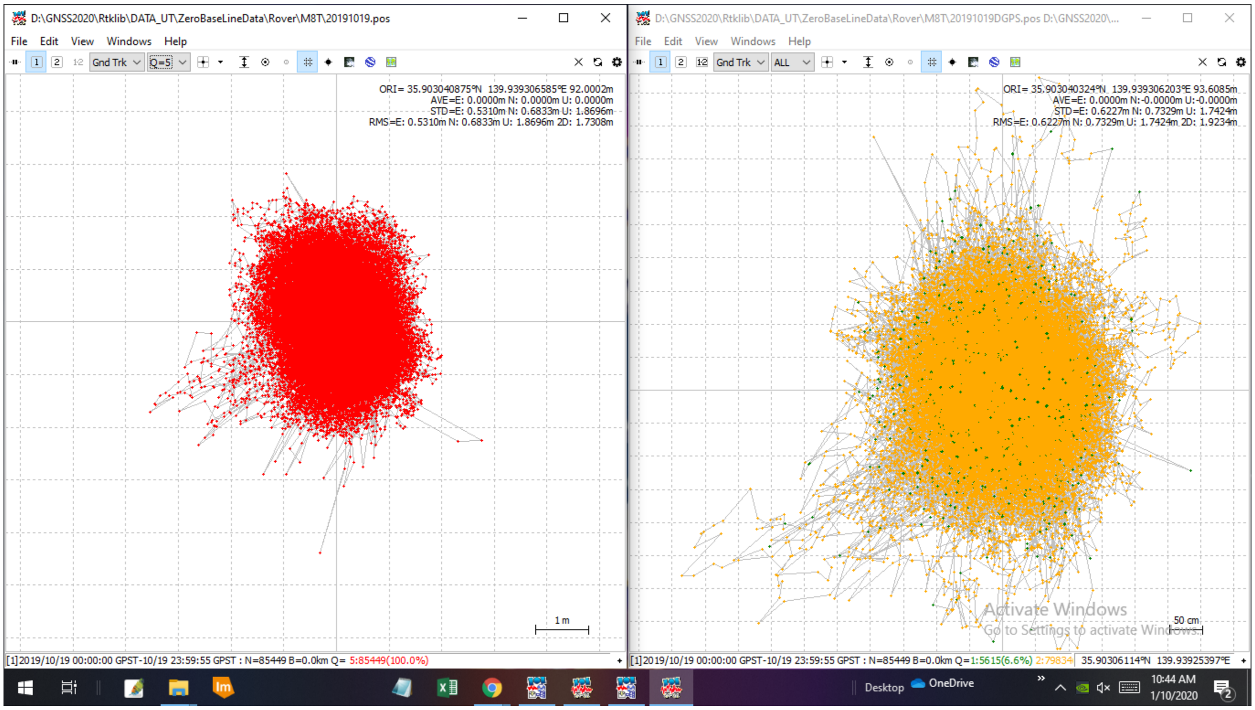


Figure 07: Comparison of the output performing SPP and DGPS

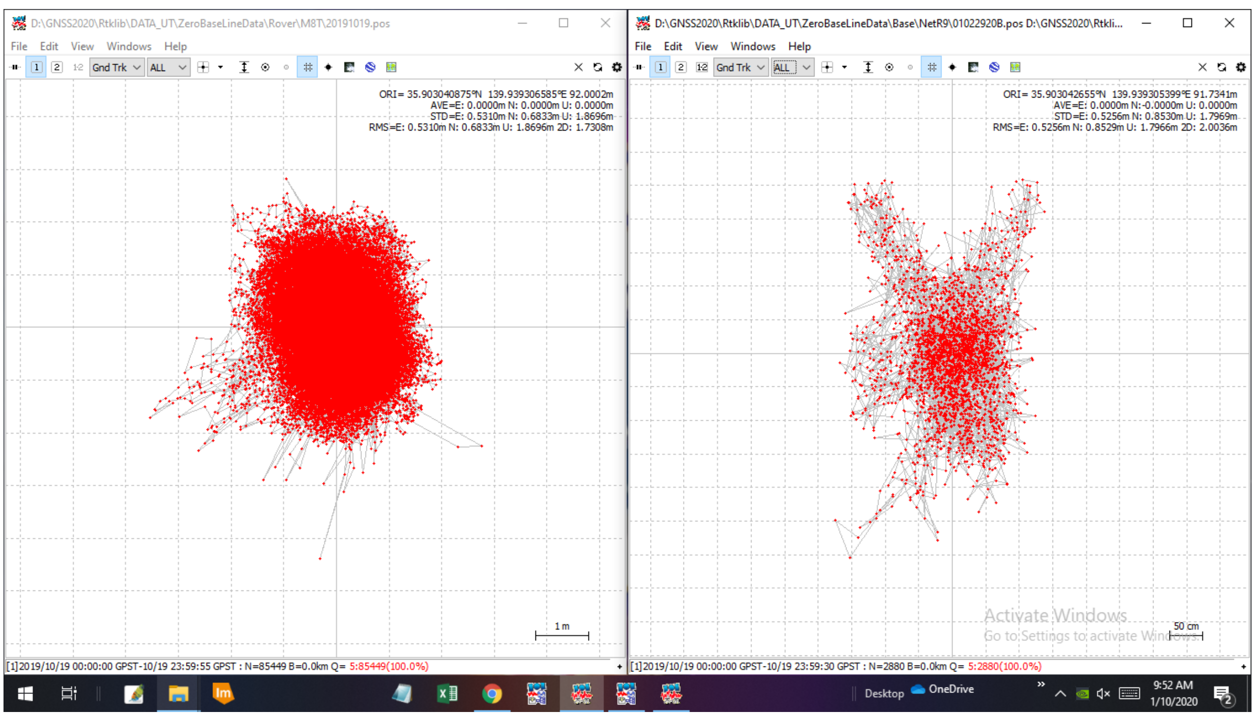


Figure 08: Comparison of output using SPP and RTK

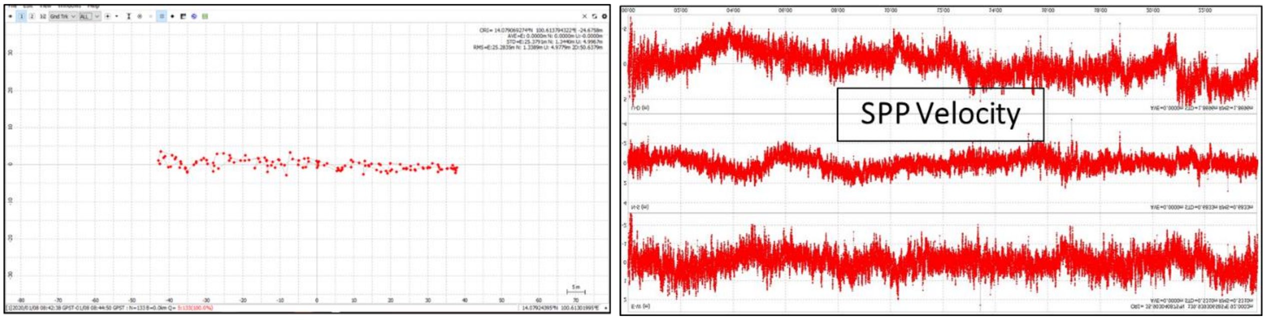


Figure 09: Velocity plot of SPP

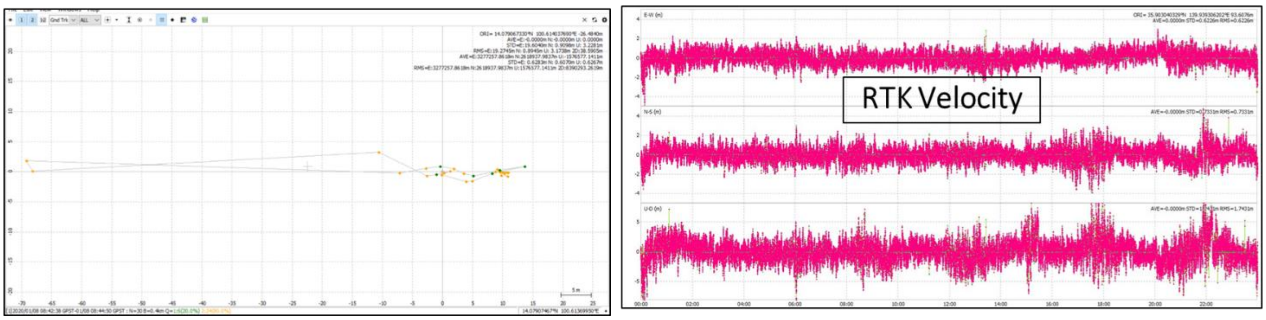


Figure 10: Velocity plot of RTK

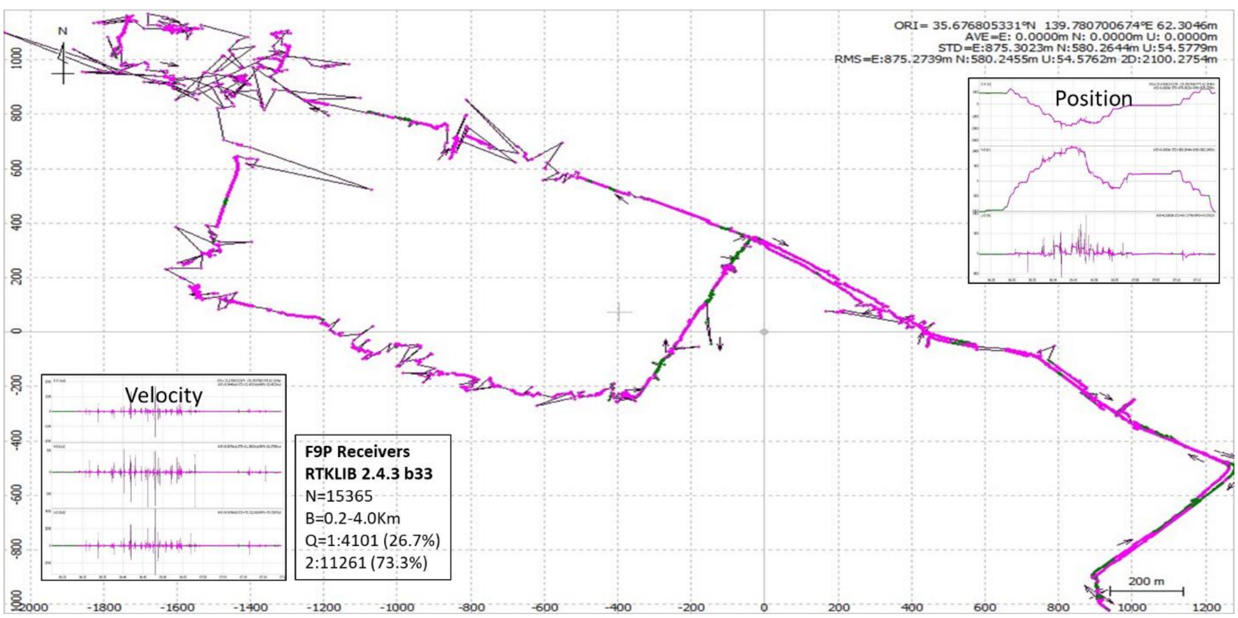


Figure 11: Plot of kinematic data using F9P

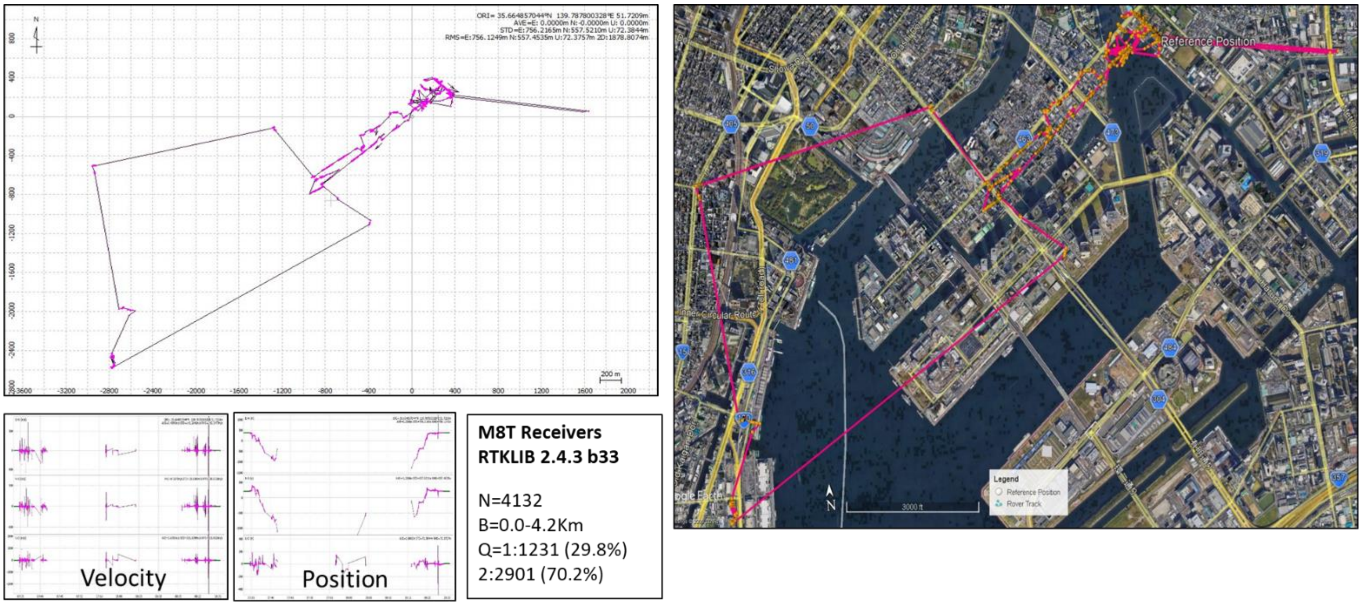


Figure 12: Kinematic data using Google Earth

Figure 13: Generated graph and data using RTKDroid

1.4. RECOMMENDATIONS

Based on this training course the following recommendations were derived:

a. The prepared training course was compact,
b. The training should focus in the hands-on application, and
c. The data results analysis should be discuss further and explain well, and give examples in the real life applications.