

Report on GNSS Training

Course ID: T151-40

Team No: 14

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1. TEAM 14

1.1. EXECUTIVE SUMMARY

We participated in GNSS training at AIT/Thailand as the participants from the Geoinformatics Center. As students and young professionals of geospatial domain, our aim was to gain advanced knowledge on GNSS as well as to gain hands on experience. For some, the uses of GNSS were already known whereas some only had basic theoretical knowledge of the GNSS. This five days training course started with the essentials and dived to the advanced topics in GNSS at the end of the course. This training introduced the use of low end receivers to log data and how to post process in software such as RTKlib. It was great that most of the training was focused towards practical and hands on experiments. During the training we got hands on experience to conduct 2 experiments with different GNSS receivers to compare the GNSS processing methods and receiver performances. The first experiment was to collect data in RTK mode for comparison with MADOKA real time PPP. This experiment was led by Dr. Dinesh and Mr. Avinab. Two GNSS antenna were fixed on top of the roof of the vehicle and connected to a single frequency low cost receiver, Dual frequency mid-range receiver and special MADOKA compatible receiver. The data were analyzed to compare the real time positioning performance of RTK compared to real time PPP. The Second experiment was carried out to compare RTK performance of different receivers in an ideal environmental conditions. A low cost receiver, two dual frequency receivers and 1 high end receiver was compared to measure known distance in RTK mode. In a nutshell, GNSS training program was insightful and we look forward to apply these learnings in our future projects.

1.2. TEAM MEMBERS

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1.3. INTRODUCTION

GNSS refers to the constellation of satellites that provide signals from space transmitting position and time data to receivers in the ground where receivers use the data to locate its position. GNSS has the global coverage and data providers include GPS, GLONASS, Beidou, QZSS, Galileo, IRNSS.

The objective of our project is to assess the data obtained from four receivers of different low end and high end receivers. The receivers include M8P, F9P, Swift nav and M2A.

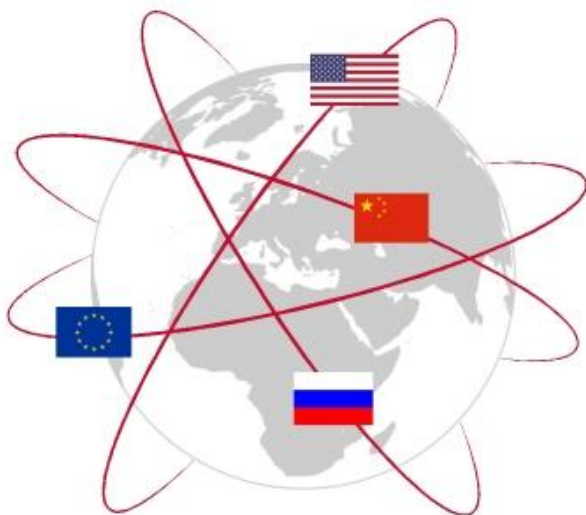


Figure 1: GNSS schematic drawing with service provider countries

1.4. SUMMARY

Single point positioning of M8T low cost receiver

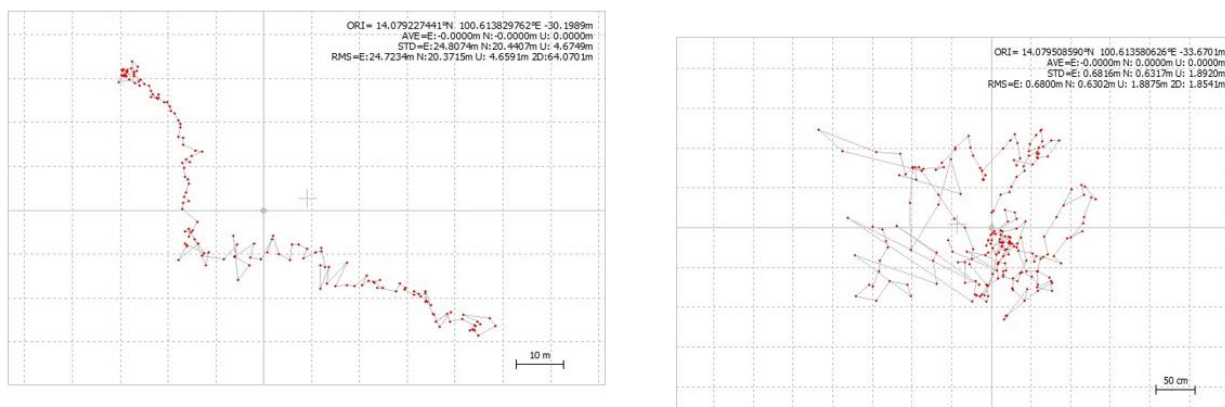


Figure 2: Results of M8T dynamic data (left) and static data (right)

Low cost receivers can be used when required conditions are met along with the good quality antenna.

Single Point Positioning Comparison of M8T and F9

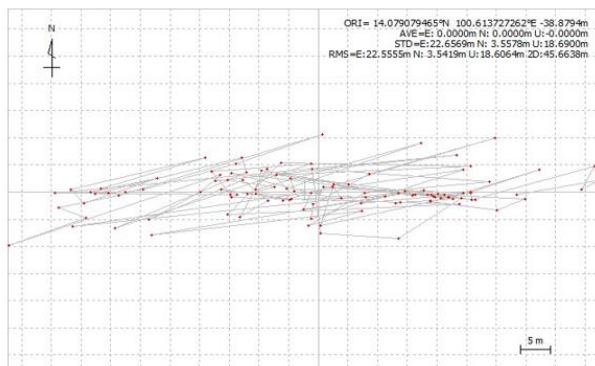


Fig: M8T (SPP)

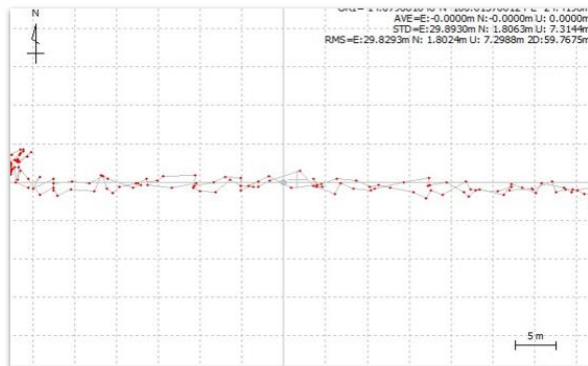
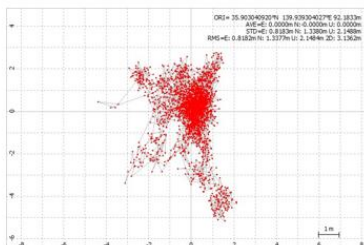


Fig: F9 (SPP)

Figure 3: Comparing results of single and dual frequency receivers for dynamic data

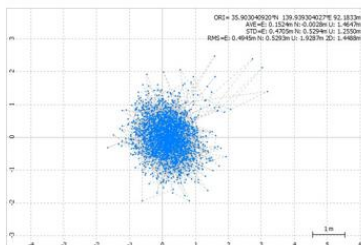
Points were collected by walking a transect line. Dynamic data were collected with a single and dual frequency receiver and came to a conclusion that dual frequency receiver provides better data in comparison to single frequency data.

Zero Baseline Test for M8T



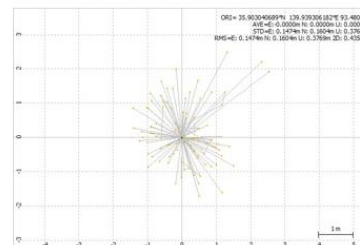
Accuracy in SPP

X	Y	Z
-0.929657202	0.531779548	0.726747918



Accuracy in DGPS

X	Y	Z
-0.07768854	0.11618718	0.129911627



Accuracy in PPK

X	Y	Z
-0.038146075	0.024143547	0.053605958

Figure 4: Accuracy assessment of different process modes

PPK has the highest accuracy among other processing modes.

Kinematic GNSS performance comparison of Different Receivers

Table 1 shows the comparison of different receivers. Receivers range from low end to high end survey grade receivers.

The setup for kinematic GNSS performance include an antenna which was connected to the splitter. Splitter then gives the signals to various receivers. The base data from TRIMBLE NetR9 was set up so that it can correct in real time. The setup is shown the figure below.

Table 1: Specifications of various receivers

Receiver Specifications



	M8T	M8P	Septentrio m2a	SwiftNav Piksi
Price	*	**	****	***
Number of Channels	72	72	448	
Signals	L1, B1, E1	L1, B1	L1, L2, E1, E5b, B1, B2	L1, L2, G1, G2, B1, B2, E1, E5b
Power Consumption			1.1 W	2.9 W

Kinematic GNSS performance comparison of Different Receivers - Setup

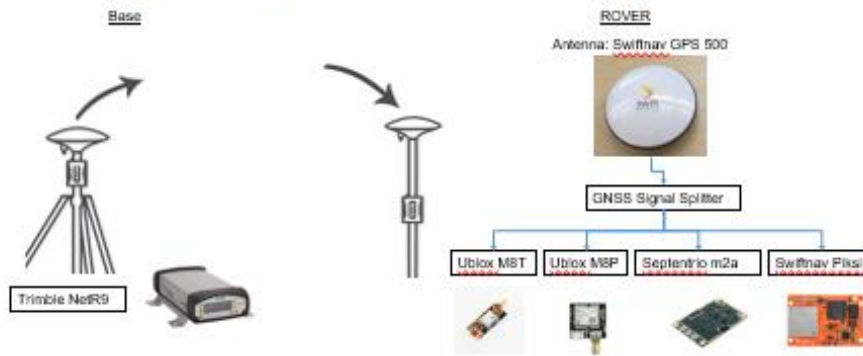


Figure 5: Instrument setup for kinematic GNSS performance comparison of different receivers

A transect line of 12 m was walked for this experiment in AIT compound. The results of fixed solution is shown in figure 6 and the fixed rates are compared in Table 2.

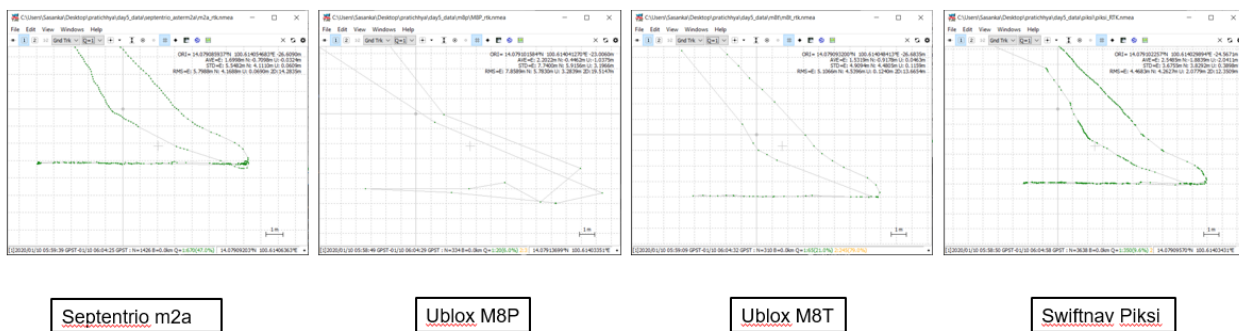


Figure 6: Results from different receivers for the fixed solution

Table 2: Results comparing fixed rates and measured distances from different receivers

	Septentrio M2A	Ublox M8P	Ublox M8T	Swiftnav Piksi
Fix Rate	47%	6%	21%	9.6%
Measured Distance (Fixed Solutions)	12m	–	11.8m	12.2m
Bands Used	L1,L2	L1	L1	L1,L2

M2A receiver gave accurate results in our experiment.

1.5. RECOMMENDATIONS

Following are the recommendations:

1. It would be better if we had compared the data from the exact same location.
2. The data of the transect walk could be interfered by the tree canopy and water near the sampling place. This should be avoided as much as possible.
3. During different data augmentation especially RTK, the internet connections should be stable.