Report on GNSS Training

Course ID: T151-40

Team No: 15

Team Members:

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1. TEAM 15

1.1. EXECUTIVE SUMMARY

The aim of the project paper is to study the different accuracy between low cost receiver and high cost receiver. In this case, we, team 15, referenced the baseline data of Trimble NetR9 (high cost receiver) and U-blox M8T (lost cost receiver). And for data processing, we used RTKLIB (2.43 b33 version) which is open source software for standard and precise positioning with GNSS. In terms of the results from data processing, distance errors of XYZ ECEF between NetR9 and M8T are not so clear in SPP positioning mode. However, in DGPS and RTK positioning mode, NetR9's results are found to be more precise and accurate (low errors) than M8T receiver.

1.2. TEAM MEMBERS

The following table describes the name, affiliation and e-mail address of each team member of team-15.

No.	Name	Affiliation	E-mail Address
1.	Mr. Khun Set Thar	Master student (Mahidol University)	khunset.tha@student.mahidol.ac.th
2.	Mr. Wuthiporn Klinhom	Bachelor student (Kasetsart University)	winaofluk@gmail.com
3.	Mr. Teerawat Panchangchaiyasit	Master student (Kasetsart University)	nes35005@gmail.com
4.	Mr. Aung Si Thu Thein	Master student (Asian Institute of Technology)	st120192@ait.asia agsithuforestry@gmail.com

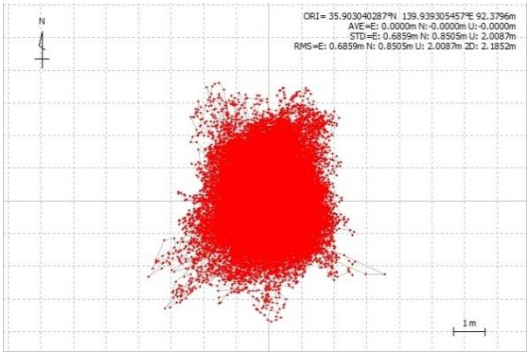
1.3. INTRODUCTION

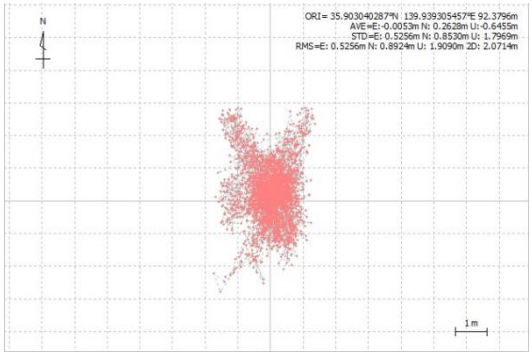
The project is the comparison of accuracy between low-cost receiver and high-cost receiver. With regards, trimble NetR9 receiver is used as former purpose of receiver while U-blox M8T receiver is used for latter one. One U-blox antenna is used to connect with these two different receivers and RTKLIB (version 2.43 b 33) is used to analyze the data collected. Three different types of data processing are used to compare the accuracy which includes SPP (single point positioning) type, DGPS (differential global positioning system) type and RTK (real time kinematic) type.

1.4. SUMMARY

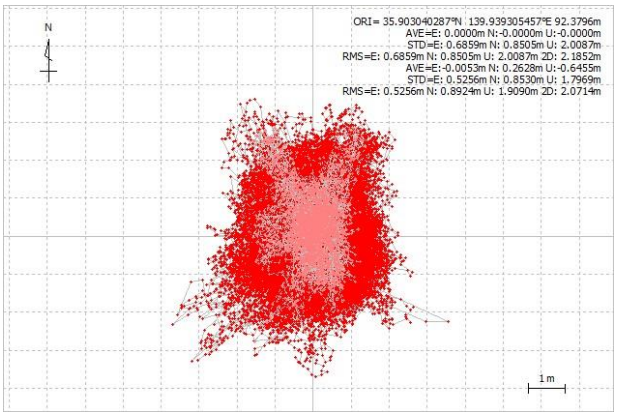
1. SPP Positioning Mode

The following figures describe the accuracy in SPP positioning mode for both M8T and Net9R respectively.





The following figure illustrates the differences of accuracy in SPP positioning mode for both receivers.



With regards to distance error differences between true position and observation position, both receivers don't have too much different accuracy in SPP positioning mode. M8T receiver has -0.6933 m error while NetR9 receiver has -1.2148 m error at x coordinate. Similarly, M8T receiver has 0.5017 m error at y coordinate and 0.6685 m error at z coordinate while NetR9 receiver has 0.9334 m and 0.8342

m respectively. The following table shows the details distance error differences in SPP positioning mode of two different receivers.

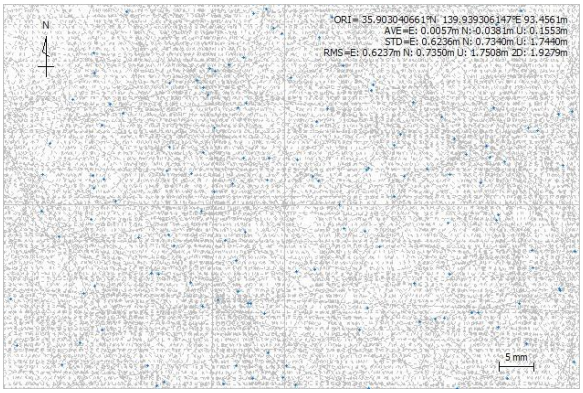
	Types of receivers	ex (m)	ey (m)	ez (m)
SPP	M8T	-0.6933	0.5017	0.6685
	NetR9	-1.2148	0.9334	0.8342

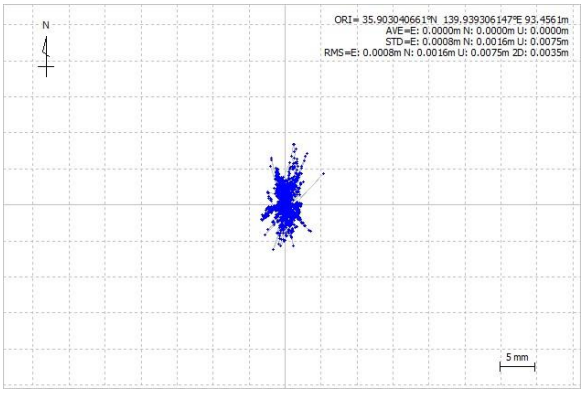
With regards to standard deviation, both receivers don't have too much different standard deviation in SPP positioning mode. The standard deviation for M8T receiver at x coordinate has 0.6859 while NetR9 receiver is 0.5256 m. Similarly, the standard deviation for M8T receiver is 0.8505 at y coordinate and 2.0087 at z coordinate while NetR9 receiver is 0.8530 and 1.7969 respectively. The following table shows the details standard deviation in SPP positioning mode of two different receivers.

	Types of receivers	Std.x	Std.y	Std.z
SPP	M8T	0.6859	0.8505	2.0087
	NetR9	0.5256	0.8530	1.7969

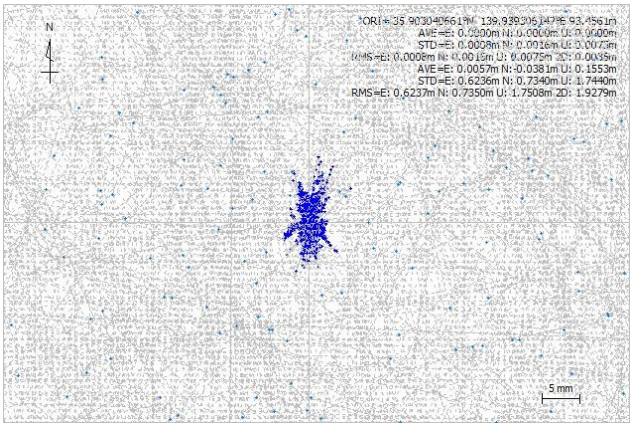
2. DGPS Positioning Mode

The following figures describe the accuracy in DGPS positioning mode for both M8T and Net9R respectively.





The following figure illustrates the differences of accuracy in DGPS positioning mode for both receivers.



With regards to distance error differences between true position and observation position, NetR9 receiver has lower error than M8T receiver in DGPS positioning mode. In details, M8T receiver has 0.1125 m error while NetR9 receiver has -0.0046 m error at x coordinate. Similarly, M8T receiver has -0.0871 m error at y coordinate and -0.0566 m error at z coordinate while NetR9 receiver has 0.0039 m and 0.0036 m respectively. The following table shows the details distance error differences in DGPS positioning mode of two different receivers.

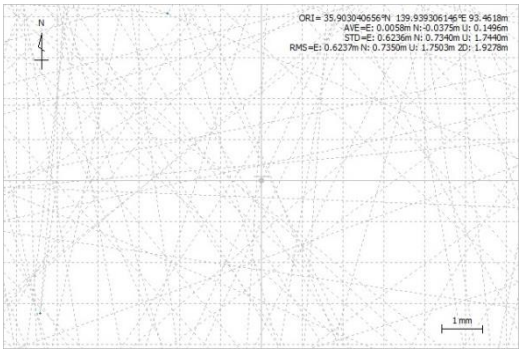
	Types of receivers	**ex (m)**	**ey (m)**	**ez (m)**
DGPS	M8T	0.1125	-0.0871	-0.0566
	NetR9	-0.0046	0.0039	0.0036

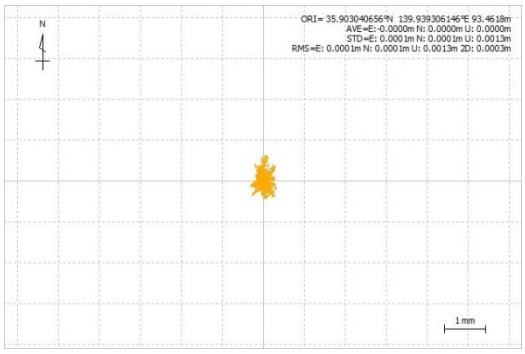
With regards to standard deviation, NetR9 receiver has lower standard deviation than M8T receiver. The standard deviation for M8T receiver at x coordinate has 0.6236 while NetR9 receiver is only 0.0008. Similarly, the standard deviation for M8T receiver is 0.7340 at y coordinate and 1.7440 at z coordinate while NetR9 receiver is 0.0016 and 0.0075 respectively. The following table shows the details standard deviation in DGPS positioning mode of two different receivers.

	Types of receivers	**Std.x**	**Std.y**	**Std.z**
DGPS	M8T	0.6236	0.7340	1.7440
	NetR9	0.0008	0.0016	0.0075

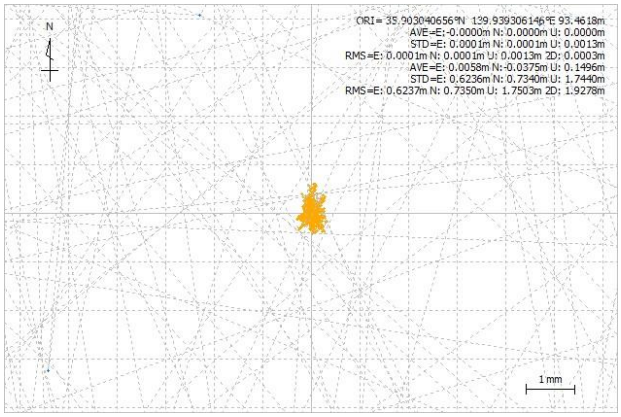
3. RTK Positioning Mode

The following figures describe the accuracy in RTK positioning mode for both M8T and Net9R respectively.





The following figure illustrates the differences of accuracy in RTK positioning mode for both receivers.



With regards to distance error differences between true position and observation position, NetR9 receiver has lower error than M8T receiver in RTK positioning mode. M8T receiver has 0.1106 m error while NetR9 receiver has -0.0008 m error at x coordinate. Similarly, M8T receiver has -0.0864 m error at y coordinate and -0.0561 m error at z coordinate while NetR9 receiver has 0.0006 m and 0.0007 m respectively. The following table shows the details distance error differences in RTK positioning mode of two different receivers.

	Types of receivers	**ex (m)**	**ey (m)**	**ez (m)**
RTK	M8T	0.1106	-0.0864	-0.0561
	NetR9	-0.0008	0.0006	0.0007

With regards to standard deviation, NetR9 receiver has lower standard deviation than M8T receiver in RTK positioning mode. The standard deviation for M8T receiver at x coordinate has 0.6236 while NetR9 receiver is only 0.0001. Similarly, the standard deviation for M8T receiver is 0.7340 at y coordinate and 1.7440 at z coordinate while NetR9 receiver is 0.0001 and 0.0013 respectively. The following table shows the details standard deviation in RTK positioning mode of two different receivers.

	Types of receivers	**Std.x**	**Std.y**	**Std.z**
RTK	M8T	0.6236	0.7340	1.7440
	NetR9	0.0001	0.0001	0.0013

1.5. RECOMMENDATIONS

Generally, high cost receiver generate more accurate data than low cost receiver because of different parameter including (multiple GNSs, multiple frequency, higher numbers of channel, etc.). However, low cost receivers are found to be effective in short baseline survey and open sky situation than high cost receiver. Therefore, choices between low cost and high cost receiver depend on your objectives, your budget and your field experiences etc. because low cost receivers are found to be useful in some situations such as short time and low budget.