

H24VSP Project 3

INTRODUCTION TO PPP USING DL5

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NGI

1. Introduction
2. Veripos Services
3. Live demo
4. Practical work

Introduction

Aim of the Project is to compare difference between Network RTK and PPP technique in:

- convergence time;
- precision - estimated and actual after convergence;
- accuracy after convergence.

We will be using:

- Leica GS10;
- maritime Veripos LD5 receiver with AsterRx chipset¹.

¹For short introductory video see <http://bit.ly/VeriposLD5>.

Veripos Services

Veripos offer hardware (receivers) in combination with following services²:

- **Veripos Standard** with single frequency DGPS and 1-2 metre accuracy.
- **Legacy Veripos Standard Plus** with dual-frequency DGPS for low latitude areas and 1-2 metre accuracy.
- **Veripos Standard²** with single frequency combined GPS and GLONASS DGPS.

- **Veripos Ultra/APEX** using global orbit, clock correction and dual-frequency GPS/GLONASS observations for dm level accuracy.

Corrections are transmitted via Inmarsat geostationary satellites - 25E, 98W, 143.5E, AORE, AORW, IOR, POR³. All coordinates provided are in ITRF2008.

²Also check <http://www.veripos.com/services.html> and for video <http://bit.ly/VeriposServices>.

³<http://www.veripos.com/global-coverage.html>

- Provides RTCM Type 1⁴, 3⁵ messages.
- Normal accuracy: 1-2m.
- Typical latency: 4 seconds⁶.
- Single difference (DGPS) using GPS C/A code

⁴DGPS corrections.

⁵GPS reference station parameters.

⁶Typical correction update interval is 15 seconds.

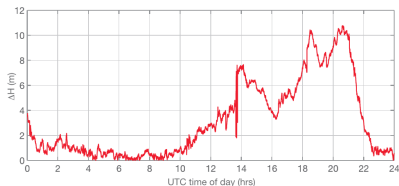
Standard Plus is intended to support DGPS positioning for lower latitudes and combat ionospheric activity.

- Provides RTCM Type 1, 3, 15⁷ messages.
- Normal accuracy: 1-2m.
- Typical latency: 4 seconds.
- Single difference (DGPS) using GPS C/A and P code

Note that this is legacy service, according to <http://www.veripos.com/services.html>.

⁷Ground transmitter parameters including ionospheric delay information

Veripos standard



Veripos standard plus

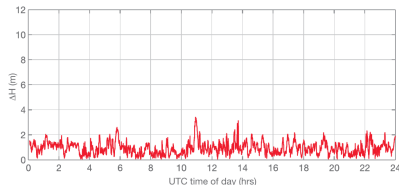


Figure 1: *Solutions at a monitor site in Malongo [Veripos]*

- Provides RTCM Type 1, 3, 31⁸, 32⁹ messages.
- Normal accuracy: 1-2m.
- Typical latency: 4 seconds.
- Single difference (DGPS) using GPS and GLONASS C/A code¹⁰

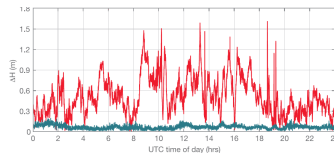
⁸DGPS GLONASS corrections.

⁹GPS GLONASS reference station parameters.

¹⁰It is possible to use GLONASS only with this service as well.

- Orbit and clock corrections in JPL GDGPS format.
- Normal accuracy: 0.1m planar.
- Typical latency: 2 seconds with 30 s update rate.
- Precise Point Positioning (PPP) using C/A and P code and L1/L2 carrier phase for GPS.

Horizontal accuracy



Vertical accuracy

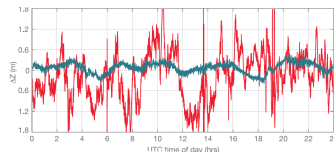
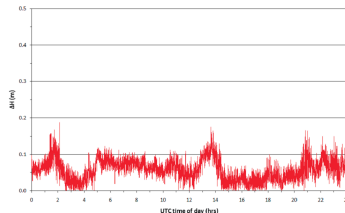


Figure 2: *Standard and Ultra solutions at a monitor site in Singapore.*

- Orbit and clock corrections in Veripos OCDS format.
- Normal accuracy: 0.1m planar.
- Typical latency: 2 seconds with 30 s update rate.
- Precise Point Positioning (PPP) using C/A and P code and L1/L2 carrier phase for GPS and GLONASS.

Apex horizontal accuracy



Apex vertical accuracy

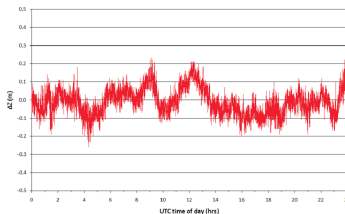


Figure 3: *Veripos Apex solution at a monitor site in Aberdeen.*

Live demo

Practical work

- LD5 will be restarted at 12:00 in order to converge properly.
- You will start collecting RTK data after 14:00.
- You will download Veripos NMEA strings for Ultra and Apex² alongside data from GS10.
- Make sure that Veripos NMEA file has been splitted into \$GPGGA and \$GPGST before leaving.

Point	Frame	Lat[deg]	Long[deg]	EllHt[m]	Notes
NGB5	ETRF97	52 57 07.05318	01 11 01.44897 W	91.2065	at point
NGB5	ETRF97	52 57 07.05318	01 11 01.44897 W	91.3865	at ARP ^a
NGB5	ETRF97	52 57 07.05318	01 11 01.44897 W	91.4280	at antenna PCO ^b
NGB5	ITRF2008	52 57 7.070524	01 11 1.427085 W	91.480	at antenna PCO ^c
NGB5	ITRF2008	5257.1178421	00111.0237848 W	91.480	at antenna PCO ^d

Table 1: *Coordinates of NGB5*

^aAntenna height = 0.18m.

^bAntenna offset for ionosphere free solution is $2.545L_1 - 1.545L_2$ so
 $2.545 * 55.3 - 1.545 * 64.2 = 41.5mm$.

^cConverted from ETRF97 to ITRF2008 at epoch 2015-12-04.

^dConverted to DDMM.MMMMMMMM to be compatible with NEMEA GGA string.

In Verpos provides two types of NMEA strings \$GPGGA and \$GPGST. \$GPGGA will behave differently in PPP mode with QA flag always 2 or 5. To obtain any information about solution we need to examine last flag before CRC(*).

Example

\$GPGGA,183324.00,5257.1178371,N,001111.0236798,W,5,17,0.7,42.76,M,49.01,M,30.5,0268*54.

Values for the flag indicate:

0268 *ULTRA*²

0281 *APEX*²

0068 *ULTRA*

0081 *APEX*

1006 *Standard*²

Example

*\$GPGST,140545.00,3.81,0.02,0.01,81.00,0.02,0.01,0.02*57.*

Cell	Notes
0	Message ID \$GPGST
1	UTC of position fix ^a
2	RMS value of the pseudorange or carrier phase (RTK/PPP) residuals
3	Error ellipse semi-major axis 1 sigma error, in meters
4	Error ellipse semi-minor axis 1 sigma error, in meters
5	Error ellipse orientation, degrees from true north
6	Latitude 1 sigma error, in meters
7	Longitude 1 sigma error, in meters
8	Height 1 sigma error, in meters
9	The checksum data, always begins with *

^aNotice 17s offset to GPS time.

Questions?