TEST OF THE GPS DUAL-FREQUENCY RECEIVER SEPTENTRIO *POLARX2* AT THE GEODETIC OBSERVATORY PECNÝ

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Abstract

The new GPS dual-frequency receiver *PolaRx2* from SEPTENTRIO company (Leuven, Belgium) has been developed for static GPS NAVSTAR observations at permanent /geodynamical stations. The instrument was bought last year by the Research Institute of Geodesy, Topography and Cartography, Zdiby (CZ) and was completed by the Topcon CR-3 GGD antenna. Results of six month testing with respect to the Ashtech Z-18 receiver are presented to decide if this instrument is useful for geodynamic observations.

1. Introduction

In 2003 the Research Institute of Geodesy, Topography and Cartography bought from the Belgian company SEPTENTRIO the dual frequency receiver *PolaRx2* to set it up at the the newly established permanent GPS station. With regard to the fact that this is a new, inexpensive product enriching the market with commercial GPS receivers, it was necessary to test it before its employing for routine observations. The receiver is delivered without antenna and therefore the customer must choose suitable antenna from the current offer of other producers. For several reasons the antenna *CR3 GGD of Topcon* was chosen in our case and after slight initial technical problems with antenna/receiver connection had been overcome the regular observations started.

2. Experiment

The test was carried out at the Geodetic Observatory Pecný at Ondřejov (Fig. 1). The antenna was fixed to the *metallic barrier* (Fig. 2), which, of course, could slightly influence the experiment, and the receiver *PolaRx2* was placed in the GPS room of the observatory along with the receiver *Ashtech Z18* which served as a standard for testing. *The Ashtech choke-ring GG antenna* has defined the position of the IGS/EPN station GOPE since 1999.

Fig.1 – GOPE station *Fig. 2 – Topcon CR3 GGD antenna on metalic barrier*

The distance between the GOPE reference antenna and the antenna of the tested receiver is 1.1 m, see Fig. 3. The *PolaRx2* receiver was operated in the operational mode with 15 dual-frequency GPS channels and 3 single frequency SBAS channels. Another operational mode is 16 dual-frequency GPS channels. The data was collected on C/A-, P1-, P2-code and L1-, L2-carrier phase and Doppler counts at 1 Hz output rate. The 1 second output was reduced to 30 second output rate. The time of measurements was synchronized with the true GPS time within the range of 1 ms. For collecting *PolaRx2* data we used the RxControl program with our own superstructure for data conversion to RINEX format and data check. A small shortcoming in case of continuous operation of the receiver at any remote permanent station is that the RxControl software does not start logging the measurements to files automatically after the on-site computer starts.

Fig. 3 – Astech choke-ring (GOPE station, left) and Topcon antennas

3. Data Processing

The test was performed during the observation interval from 11th August 2003 until 8th March 2004. The measured data was processed by the software GEOGENIUS (Terrasat/Trimble). The observations in 30 second intervals were concatenated to daily files, the elevation mask adopted for preprocessing was 5 deg. The broadcast orbits were used for computation, but some epochs were processed with precise IGS orbits; no differences were observed. Due to internal oscillator aging the receiver *PolaRx2* inserts 1 ms jump for resetting internal clock every approximately 30 minutes. Therefore, the outputs from the TEQC (Translate Editing Quality Check) protocols are different for each receiver.

4. Results and Conclusions

A time series of the relative position of both antennas – see Figs. 4 a, b, c shows a *seasonal effect* of several mm, which might be, with high probability, caused by a seasonal deformation of the *metallic barrier* to which the Topcon antenna of the tested receiver was attached. However, a comparison with the results of analysis of GOPE coordinates from EPN weekly solutions (fixed to 10 collocation stations) cannot explain this seasonal effect.

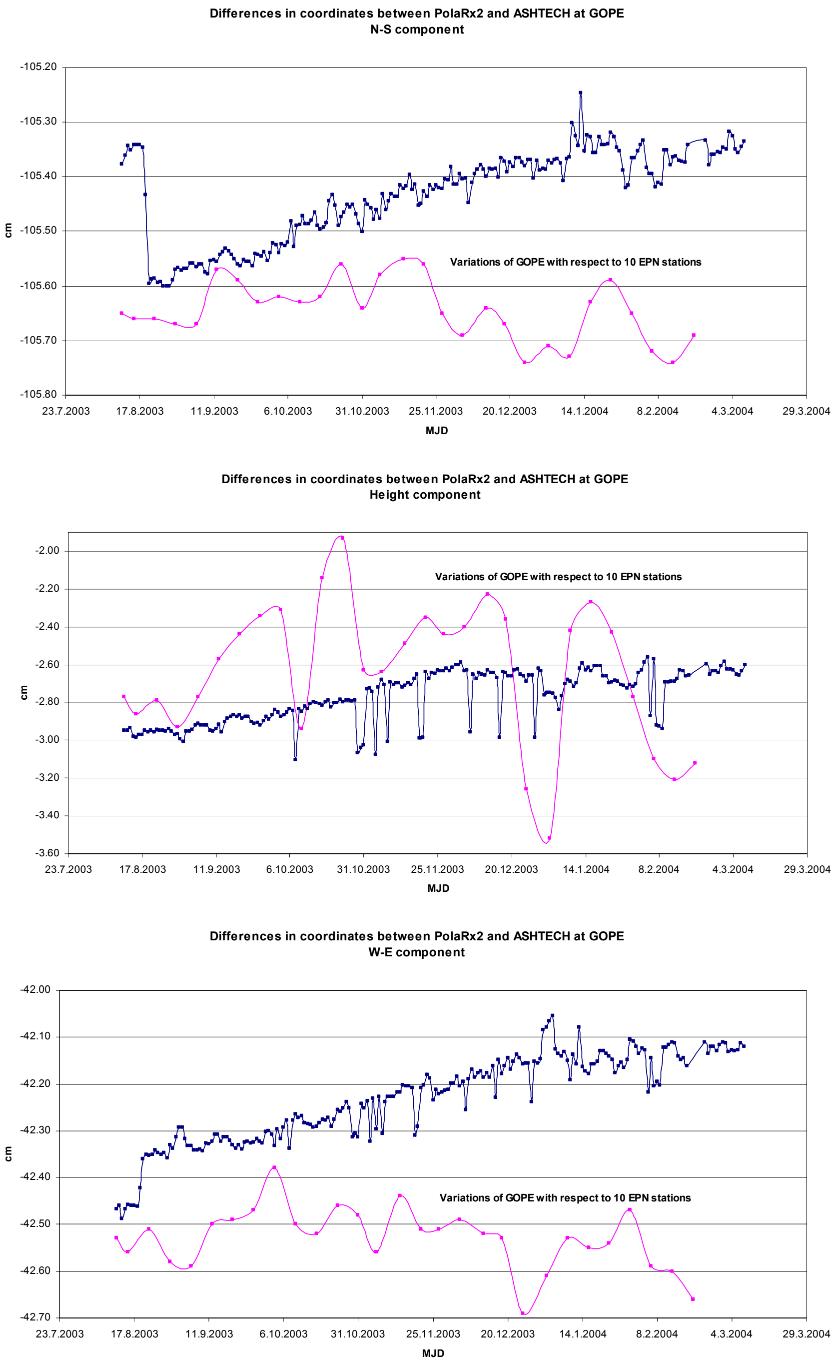

Fig. 4 a, b, c

Jump at the begining of the series is caused by mechanical deformation of the barrier and can be omitted. To compare the functionality of both receivers different parameters from TEQC (Translate Editing Quality Check) files produced everyday for each receiver can be used. In Fig. 5 the number of satellites with received signals is shown for each individual day. For the GPS NAVSTAR satellites the number is almost the same; the tested version of the *PolaRx2* receiver does not receive the GLONASS signals.

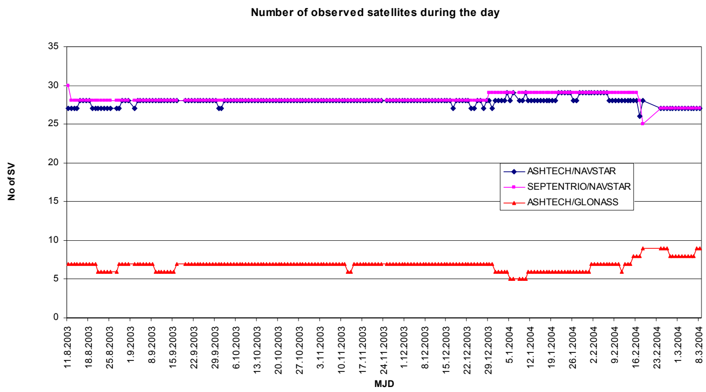

Fig. 5

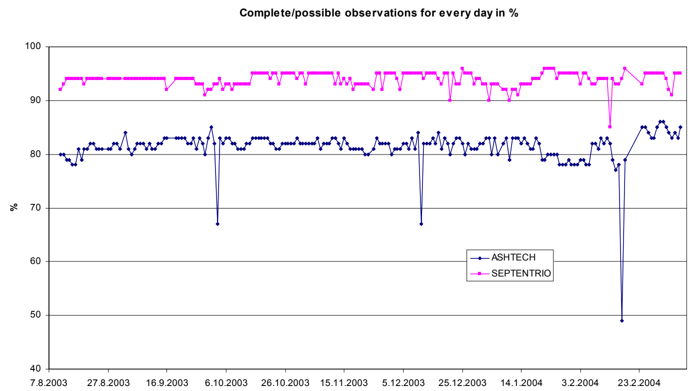

Fig. 6

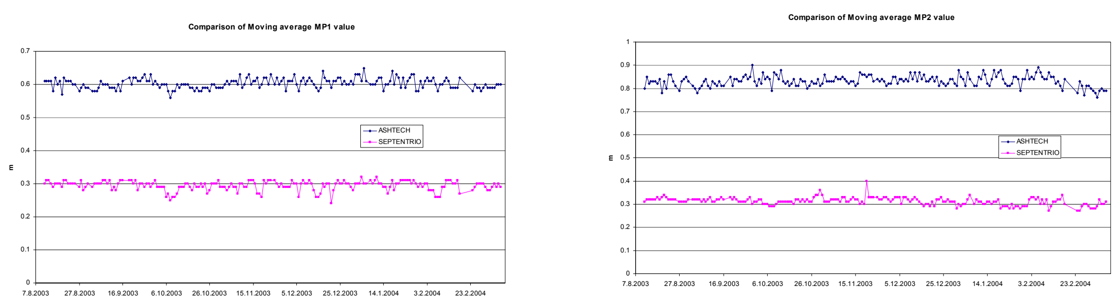

Fig. 7 – mean value of multipath

The ratio of received versus possible total observation volume per day in percent is slightly better for the receiver *PolaRx2,* and so is the multipath comparison on both frequencies, see Fig. 7. Of course the multipath in case of the *Ashtech* receiver could be mitigated by more than one half but it would lead to complications in post-processing within the network of permanent stations.

An evaluation of the results of more than half a year observations on a „very short baseline“ shows that the receiver *PolaRx2* in combination with the *TOPCON antenna* gives results which can satisfy even the highest demands made on GPS observations by geodynamic research.

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