Some Experiences in RTK and DGPS Measurements Using INTERNET and GSM Mobile-phone

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INTRODUCTION

The practical need for GNSS positioning in real time led to the development of a medium for data transmission. The DGPS correction could be transmitted on an area of a few hundred kilometers (test in Polish Solec Kujawski radio station) on log waves.The RTK technique needs a greater flow capacity of the radio lines and shorter distance between the base stations. The RTK data from the base stations could be transmitted in the DARC system by the local stations on UKF channels, but the local stations in Poland are not interested in propagation of RTCM data. The experience in RTK and DGPS measurements using data transmissions by the INTERNET and GSM radio link are presented in this poster.

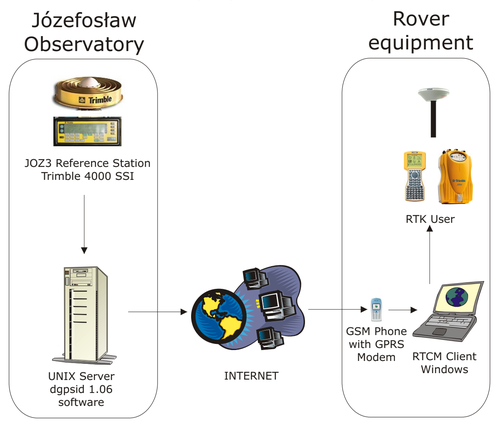
IDEA OF THE PROJECT

Data stream in RTCM 2.1 format, generated by the base receiver Trimble 4000 CORS STATION on JOZ3 reference point, is transmitted from receiver to special Unix server, with dgpsid 1.06 software, witch is permanently connected to the INTERNET. Data on server (IP: 194.29.150.254:8101) are accessible for all INTERNET users.

JOZ3 station is a part of Polish Active Geodetic Control named ASG-PL.

Rover user is equipped with GPRS (General Packet Radio System) Modem in GSM Phone, connected to laptop computer with special RTCM Client software, witch receive RTCM data stream from sever via TCP/IP protocol and transmit it via serial port to rover GPS receiver.

Scheme of needed equipment is presented below.



EQUIPMENT

JOZ2 & JOZ3 reference stations in Józefosław Observatory near Warsaw

Equipment during test measurements

R T K S e t

R T K S e t with usage Trimble Data Controller Software

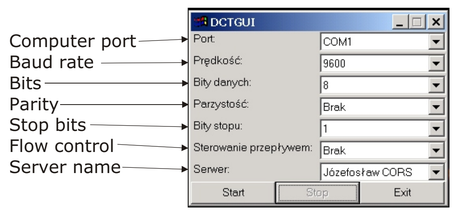
In some test measurements was used the newest Trimble Data Controller software, witch enables reading RTCM data directly from INTERNET, GPRS modem was connected directly to Trimble Data Controller.

D G P S S e t

CLIENT SOFTWARE

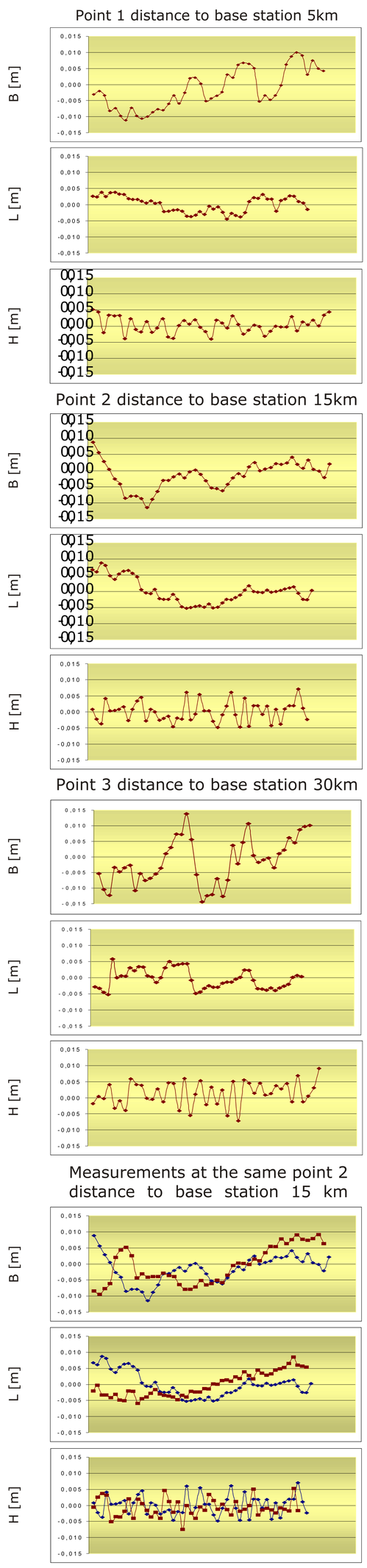
RTCM Client software has been developted, beacause of need stable working and easy to operate client. Nowadays it works in MS Windows, in the future is planned to move it to PDA computers, which are portable and comfortable to use dufing measurements, implement user authorization and billing modules.

Screenshot of client software is presented below.

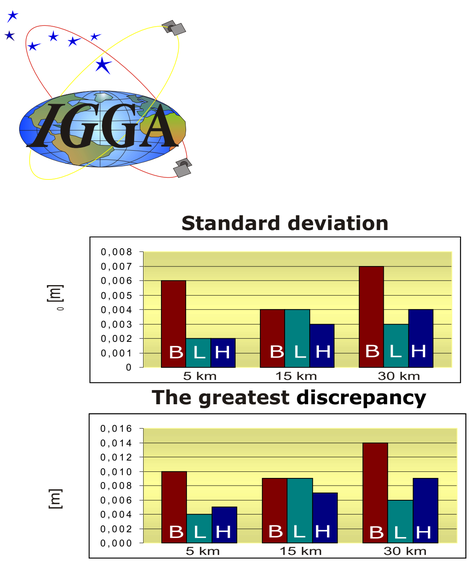


EXPERIMENTAL MEASUREMENTS

Experimental measurements were done on three test points 5 km, 15 km and 30 km from JOZ3 base station. Position of points was fixed when the accuracy was better then ± 1,5 mm in horizon and ± 2,0 mm in high. On every test point were saved 50 positions in RTK FIX mode. Accuracy of measurements is presented in charts below.



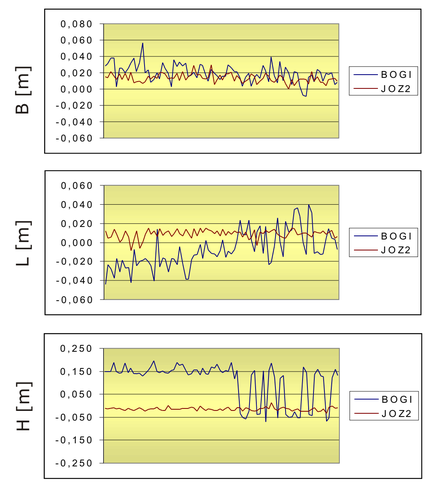
The EUREF 2004 Symposium of the IAG Subcommission for Europe (EUREF) 2-5 June 2004 Bratislava, Slovakia



PARTICIPATION IN EUREF-IP

The IAG Subcommision for Europe - EUREF decided in June 2002 to set up and maintain a real-time GNSS infrastructure on the Internet using stations of its European GPS/GLONASS Permanent Network - EPN. Although today's primary objective is to disseminate RTCM corrections over the Internet for precise differential positioning and navigation. The service that EUREF established, called "EUREF-IP" (IP for Internet Protocol), is based on a dissemination standard, called "Networked Transport of RTCM via the Internet Protocol" (Ntrip). Ntrip is a generic, stateless application-level protocol based on the Hypertext Transfer Protocol HTTP Version 1.1 . It is designed to disseminate differential correction data (e.g. in the RTCM-104 format), or other kinds of GNSS streaming data, to stationary or mobile users over the INTERNET. Ntrip is implemented in three system software components: NtripClients, NtripServers and NtripCasters. The NtripCaster is the actual HTTP server program whereas NtripClient and NtripServer are acting as HTTP clients. Potential to support mass usage; disseminating hundreds of streams simultaneously for up to a thousand users possible when applying modified Internet Radio broadcasting software. Considering security needs; stream providers and users don't necessarily get into contact, streams are usually not blocked by firewalls or proxyservers protecting the Local Area Networks , which enables streaming over any mobile IP network owing to the use of TCP/IP. The EUREF-IP service is based on a number of GPS permanent stations of EUREF's EPN. One of them is JOZ2 station, equipped with GPS/GLONASS Asthech Z-18 receiver. JOZ2 station transmit RTCM-104 v. 2.2 data. The goal of the pilot project is to evaluate and stimulate the use of the Ntrip technology. All data are sent to a EUREF Broadcaster from where they can be received by authorised users. EUREF-IP is currently a trial service. Data are available for test and evaluation purposes only. All real-time positioning is done by transmitting RTCM-format messages or proprietary binary messages. Available RTCM message types are 1, 2, 3, 6, 9, 16,18/19,20/21, and 22. GNSS data streams from the EUREF-IP network are available in real-time through EUREF-IP's Broadcaster, current Internet address and port is "213.20.169.236:80". The available Internet bandwidth is limited to handle a maximum of 1000 users simultaneously. Note that any provider must guarantee up to 10 kbits/sec Internet bandwidth per provided stream in order to allow a continuous uninterrupted service. Feel free to download Ntrip server software for Windows and Linux reading from a Serial Port or TCP/IP port. To receive EUREF-IP data streams, the user needs a user-ID and a client password. Authorization can be provided for a single stream, for a group of streams or for all available streams. Data is available for demonstration and evaluation purposes only. For receiving data streams in real time you may use the GNSS Internet Radio under Ms Windows, Linux, Ms Windows CE operating system and Palm OS system.

Measurements at the same point with usage different EUREF-IP base stations BOGI (50 km) and JOZ2 (10 km)



CONCLUSIONS

Using INTERNET and GSM mobile phones as a medium to transport data streams for DGPS and RTK measurements has advantages such as:

- simple access to data from base station.
- multi-access, limited only by the link capacity,
- no need to build special radio stations for data distribution,
- easy and cheap user's equipment,
- fast measurments that ensures accuracy high enough for the majority of geodetic works,
- bigger range then VHF radio modems.