Studies on accessibility and reliability of RTK measurements by Internet

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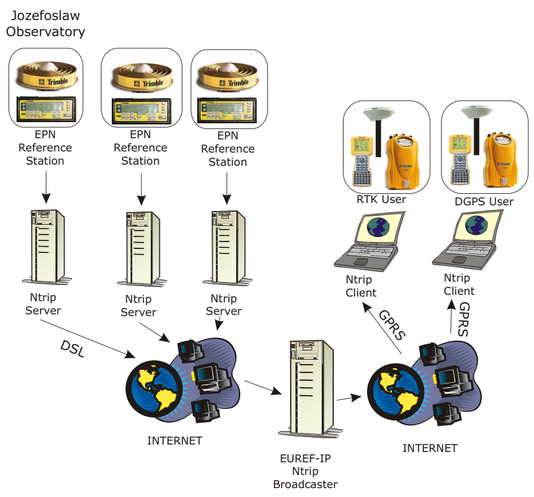
INTRODUCTION

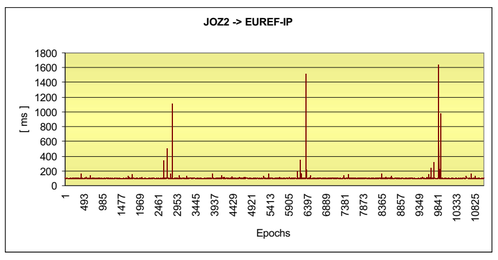
Accessibility and reliability Real time kinematic (RTK) positioning with usage data transmition by the internet and GPRS radio link are presented in this poster. During test measurements two systems were used, first one was EUREF-IP and second one was system designed by ARMIKRO Company with cooperation of Institute of Geodesy and Geodetic Astronomy of Warsaw University of Technology.

EXPERIMENTAL MEASUREMENTS

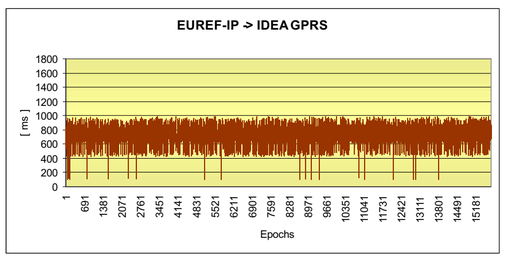
First experiment was performed to measure capacity of the Internet connection of rover user. On charts below there is presented time of way of packets from rover user to reference station. For this experiment ping test was used. In EUREF-IP system way of data stream consist from two segments, from reference station to broadcaster and from broadcaster to rover user. In IGGA technology there is direct connection between rover user and reference station.



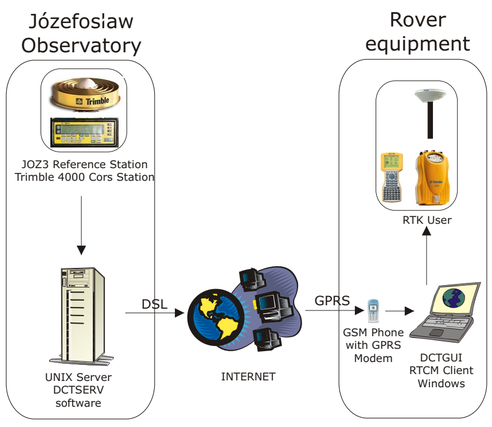
EUREF-IP Pilot project



EUREF-IP System time of way of packets form JOZ2 base station to EUREF-IP broadcaster



EUREF-IP System time of way of packets form EUREF-IP broadcaster to rover user with GPRS Internet connection



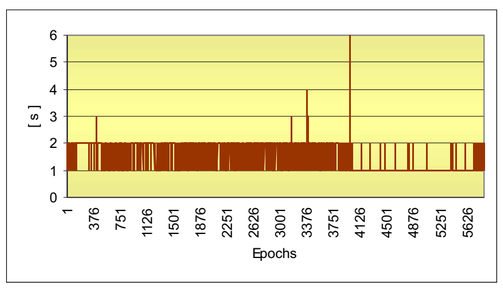
IGGA-ARMIKRO Technology

IGGA System time of way of packets form JOZ3base station to to rover user with GPRS Internet connection

System	Way	Average time of packets way	Packet loss
EUREF-IP	JOZE-> EUREF-IP	100 ms	1%
	EUREF-IP-> GPRS	705 ms	6%
		805 ms	**7%**
IGGA-ARMIKRO	JOZE-> GPRS	**686 ms**	**5%**

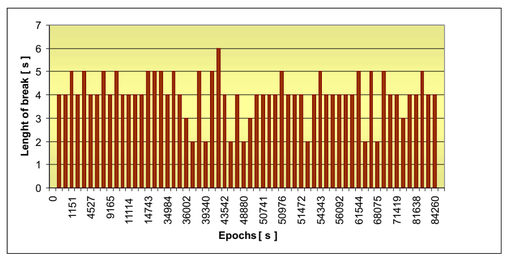
Delays in data transfer by computer network doesn't depend on distances, main influence has GPRS transmition.

Second experiment was performed to measure time delay of correction in IGGA system, for this test data stream in NMEA GGK format form rover RTK receiver was recorded. In this test as a rover Trimble 4700 receiver was used. Time of correction delay is presented on the chart below.

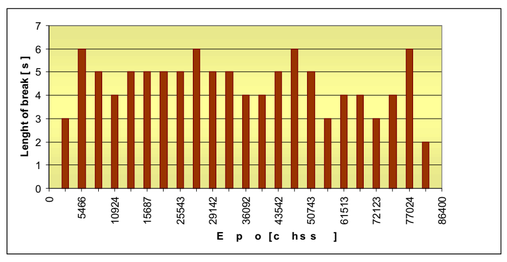


Correction delay

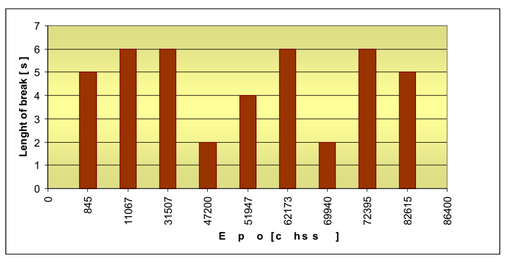
Third experiment was performed to test accessibility of RTCM stream though the Internet for RTK measurements. For this test 3 day experiment was performed . RTK positions from rover receiver were recorded every second in this test. In this experiment as rover Trimble 4700 receiver was used and IGGA RTCM data stream dissemination system. Positions were recorded with 1Hz frequency.



Breaks during 1st day friday



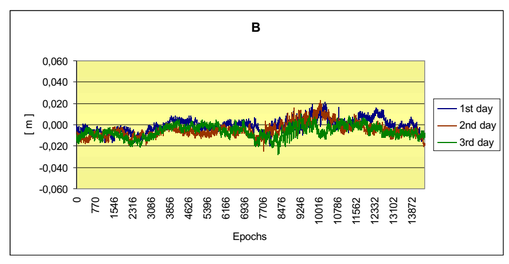
Breaks during 2nd day saturday



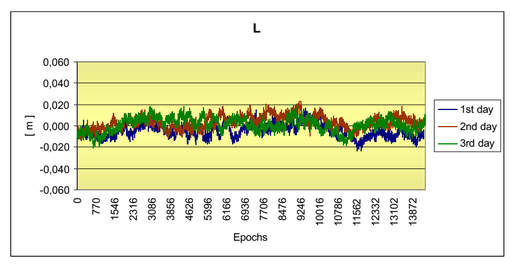
Breaks during 3rd day sunday

Day	Qty. of breaks	Total time without correction	Average lenght of break	Correction accessibility
1 – Friday	62	241 s	3,9 s	99,72 %
2 – Saturday	24	104 s	4,3 s	99,88 %
3 – Sunday	10	42 s	4,2 s	99,95 %
Average	32	129 s	4,1 s	99,85 %

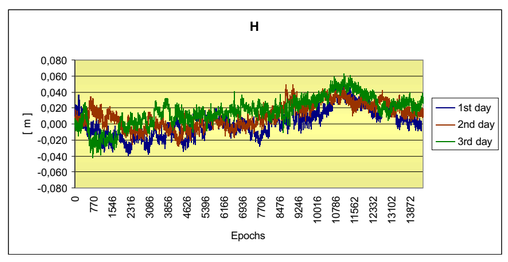
Breaks with out receiving corrections are very short, maximum break was 6 secounds and depend mostly on the load of Internet network. Differences of RTK positions in 3 day experiment are shown on charts below.



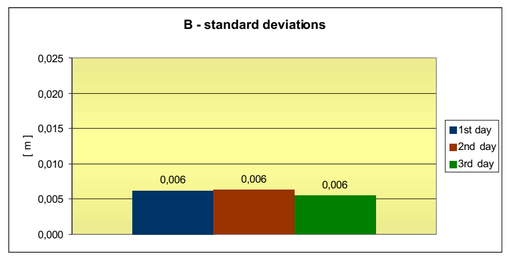
Differences of longitude in 3 day experiment

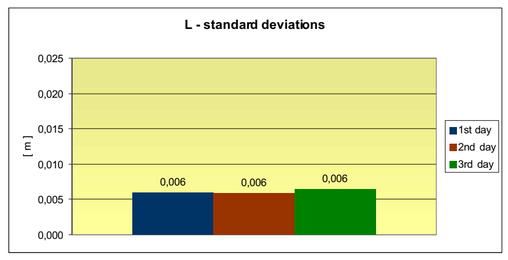


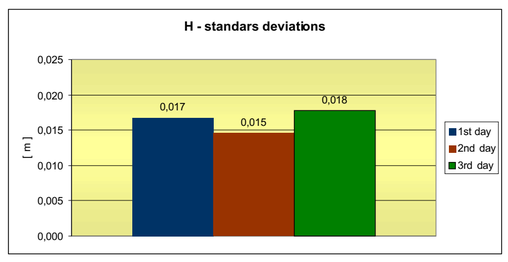
Differences of latitude in 3 day experiment



Differences of height in 3 day experiment







CONCLUSIONS

RTK measurements with usage RTCM data streams via the Internet are accessitable (accessitability 99,85%), breaks without correction are very short (4s). Correction delay in both presented systems is very short and on the same level (2s). This technique ensures accuracy and accessability high enough for majority of survey,geodesy, precise navigation, engineering and agriculture works.

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