CURRENT ACTIVITIES OF THE ASTRO-GEODETIC OBSERVATORY IN JOZEFOSŁAW

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1. INTRODUCTION

Astro-Geodetic Observatory in Józefosław takes part in national and international geodynamic campaigns and scientific projects since 1958, which was the International Geophysical Year. Together with the observation systems the Observatory evaluated itself. We started with latitude observations, passed through Doppler and Transit up to now. Nowadays the Observatory participates in several scientific projects. Since 1991 it is incorporated to IGS, in 2002 tidal observations using the most accurate spring gravimeter started in the frame of ICET, from 2005 investigations on gravity changes using absolute gravimeter began. The Analysis Centre, which is a part of the Observatory, works on advanced GPS data processing, evaluates atmospheric parameters and processes regional observation campaigns. Investigations on PPP successfully started in 2005. Supporting data are collected to calculate environmental influences. This paper is a short overview about researches that are accomplished by the Observatory.

2. ASTRO-GEODETIC OBSERWATORY JÓZEFOSŁAW - OBSERVING SYSTEM

The observing system of the Józefosław Observatory consist of:

- **Satellite observations**
- **Gravity measurements**
- **Meteorological measurements**
- **Ground water, soil moister and rainfalls measurements**

The GNSS Analysis Centre is a integral part of the Observatory.

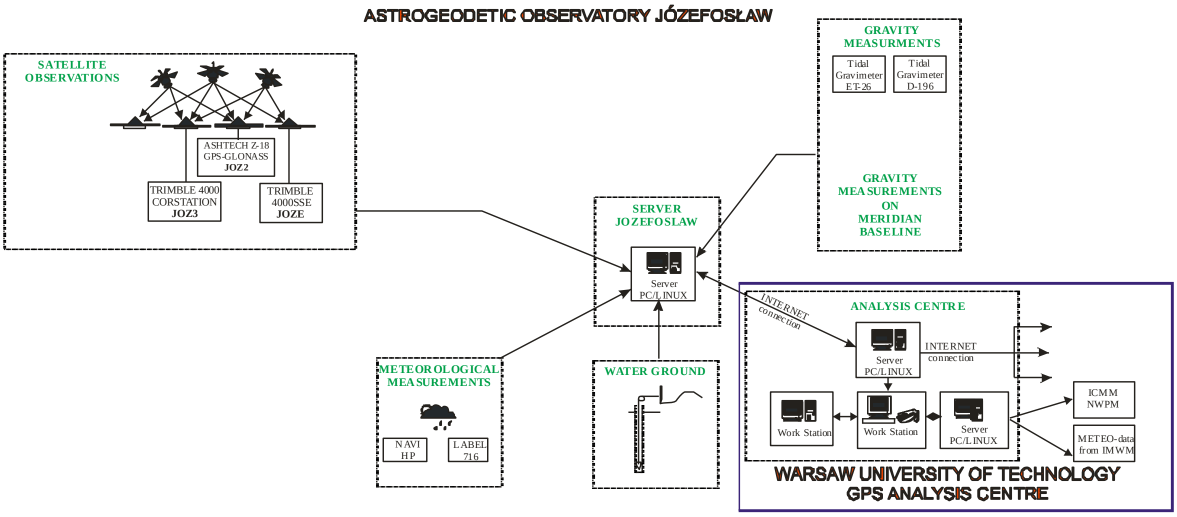

Fig. 1. Astrogeodetic Observatory Józefoław

2.1 SOME RESULTS OF STUDIES ON ACCESSIBILITY AND RELIABILITY OF RTK MEASUREMENTS BY INTERNET

The examples of time delay in RTK measurements using NTRIP technology are shown in the fig.2 and 3.

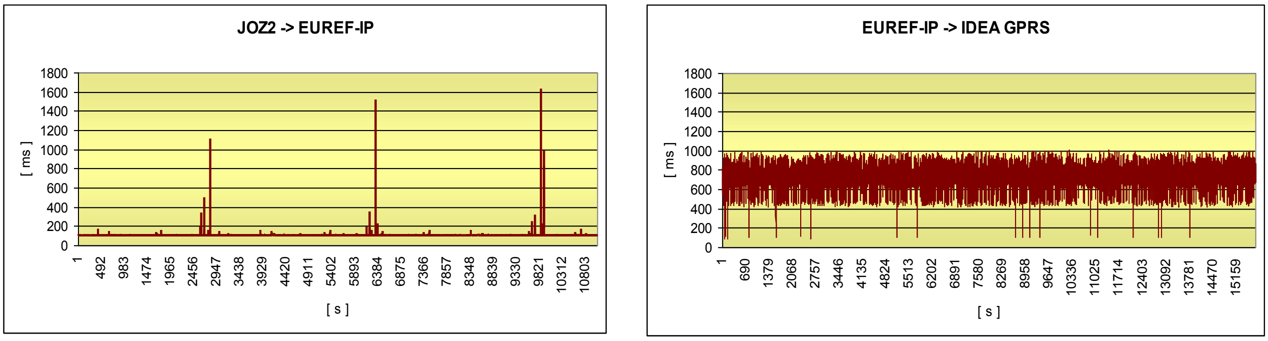

Fig. 2. Time of way of pockets from base station to caster and rover user

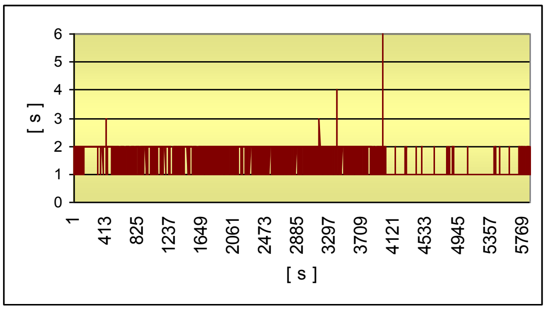

Fig. 3. Correction delay

3. STRUCTURE OF THE GNSS ANALYSIS CENTRE

GNSS Analysis Centre Consist of: WUT EPN Local Analysis Centre, Ionosphere Rapid Analysis Centre, NRT Troposphere Delay Estimation, User Automatic On–Line Service OGPSP and CERGOP Data Processing Centre.

3.1 WUT EPN LOCAL ANALYSIS CENTRE

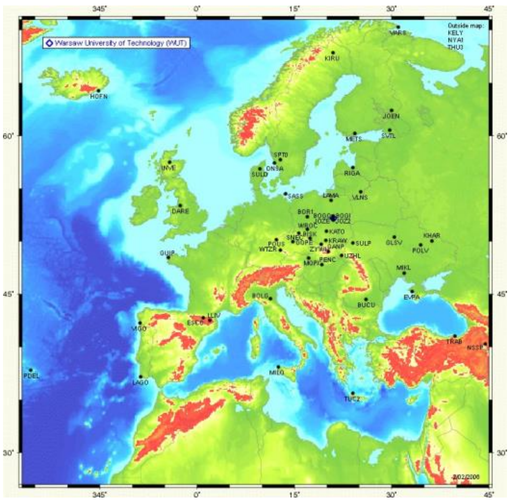

Fig. 4. Map of the EUREF stations processed daily by the WUT EPN LAC

3.2 IONOSPHERE RAPID ANALYSIS CENTRE

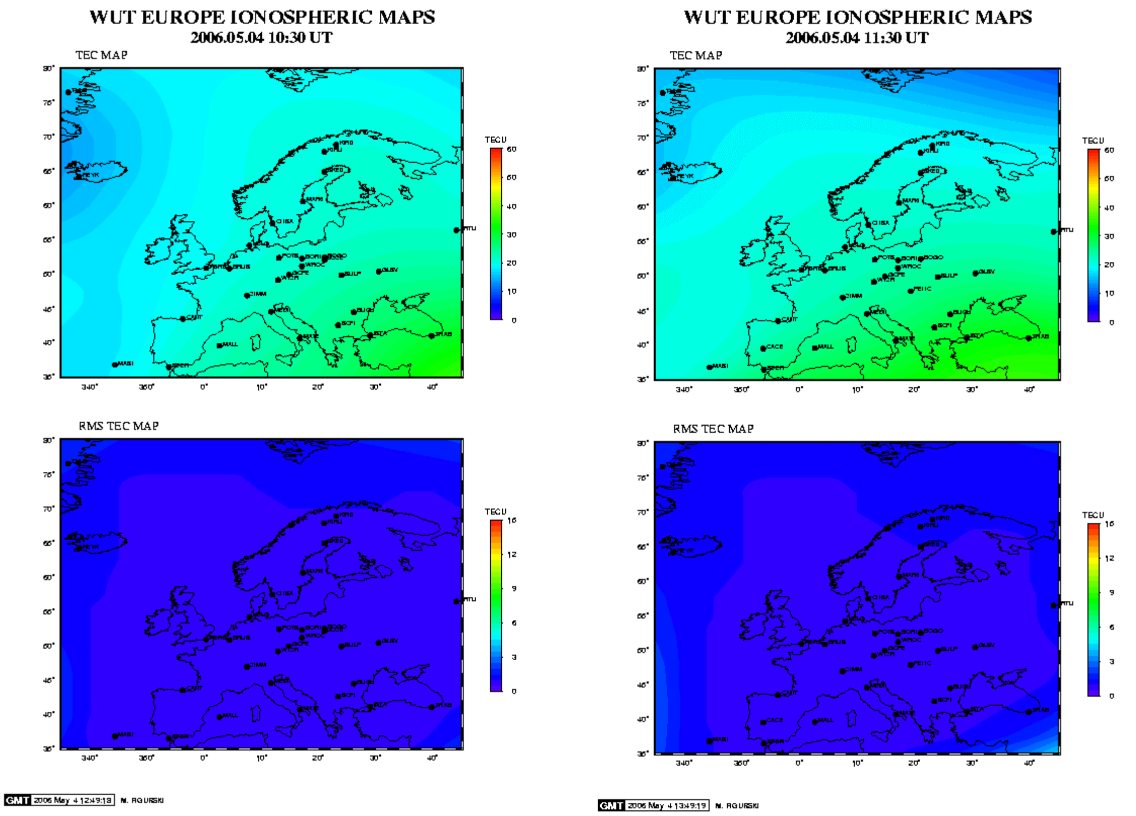

Fig. 5. Maps of the ionosphere processed by the WUT EPEN LAC Regional Rapid Service http://leo.wic.wat.edu.pl/~abwe

3.3. NRT TROPSPHERIC DELAY ESTIMATION

Fully automatic system for Zenith Total Delay (ZTD) estimation in Near Real Time (NRT) has been successfully set up and works for over half a year. The system processes subset of EPN/IGS GPS stations (over 20) in Central Europe.

Test campaign of automated NRT processing which results we present here comprised 22 stations (see map)

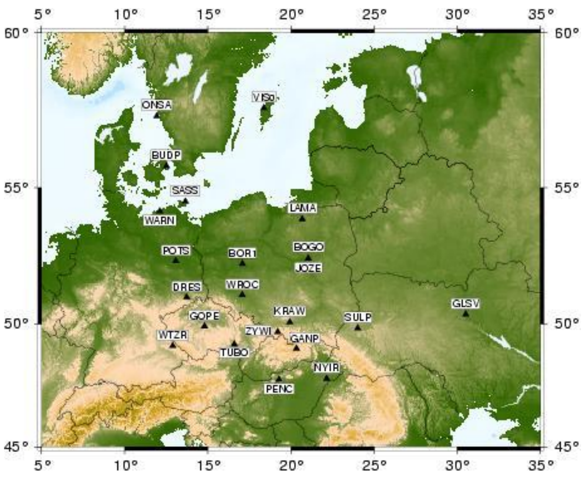

Fig. 6. Map of test NRT campaign stations

Table1 NTR SOLUTION ZTD AND RAPID IGS SOLUTION DIFFERENCES

station	averaged difference (NRT-PW)	averaged absolute difference	No. of poi
BOR 1	1,82	7,42	626
GOPE	5,15	8,52	529
POTS	1,7	7,43	899
WTZR	1,88	7,06	1027
HOFN	-2,05	7,24	55
ONSA	1,62	6,08	541

3.4. USER AUTOMATIC ON–LINE SERVICE OGPSP

The system uses subset of EPN/ IGS GPS stations in Central Europe and is based on Bernese GPS Software version 4.2 (Linux platform) but original panels and BPE are not used. All necessary scripts for preparation input files -I, -F, -N, processing control, data download, error/exception handling etc. have been written in Perl language. System uses EUREF weekly coordinate solutions and IGS cumulative solutions for reference frame realisation. System utilises the most precise IGS orbits which are available at the time of the user data submission (final, rapid, ultra-rapid).

The choice of the IGS/EPN stations can be performed in 3 ways:

- **system automatically will choose 3 nearest stations,**
- **user will specify 1 to 4 stations,**
- **system automatically will choose 3 optimal stations evenly distributed around the user station (in testing)**

Communication with the user is arranged via webpage (below) for observation file upload and e-mail to send the results back

Fig. 7. OGPSP service - main webpage http://ogpsp.gik.pw.edu.pl

We are going to implement PPP method into our Internet based service for automated GPS data processing. First results are shown in the fig. 8.

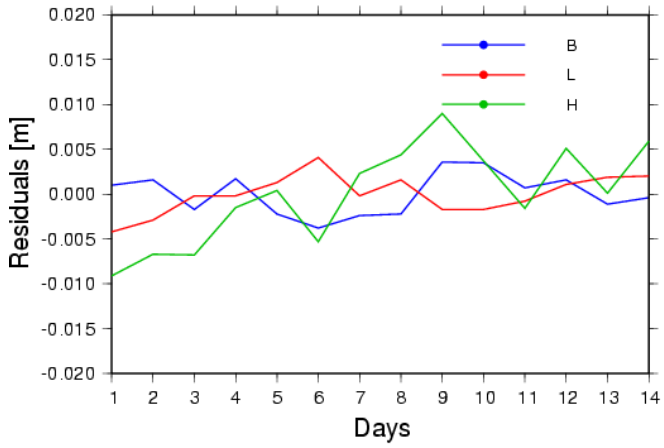

Fig. 8. Test results of PPP data processing

3.5. CERGOP DATA PROCESSING CENTRE

In this part of GNSS Analysis Centre CERGOP GPS campaign are processed. Map of CERGOP stations are presented in the fig. 9. The results are used to the strain analysis. Principal strain directions are shown in the fig. 10.

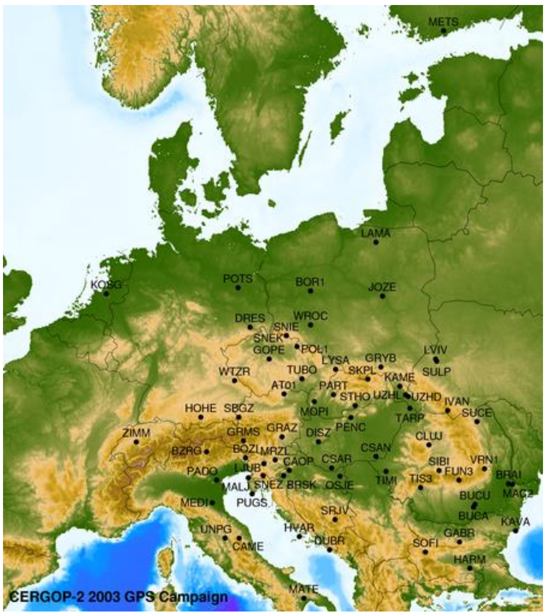

Fig. 9. Map of the CERGOP2'2003 stations

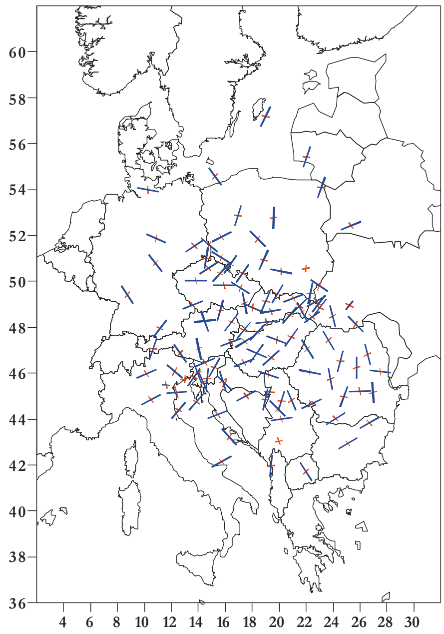

Fig. 10. Principal directions of the strain

4. GRAVITY TIDES MEASUREMENTS

Tidal laboratory and results of tidal measurements are shown in the fig. 11 and 12.

Fig. 11. Tidal Observatory

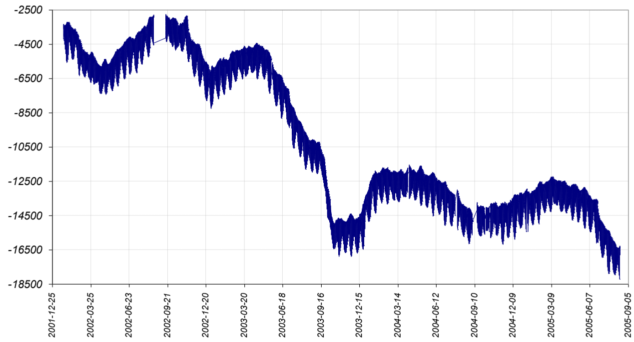

Fig. 12. Tidal observations

Values of amplitude factor and phase shift obtained from data analysis performed by LaCoste & Romberg ET26 gravitymeter in the period 2002-2006 ar shown in the fig. 13 and 14.

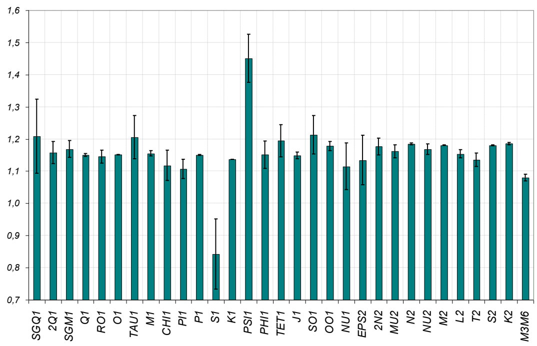

Fig. 13. Amplitude factor

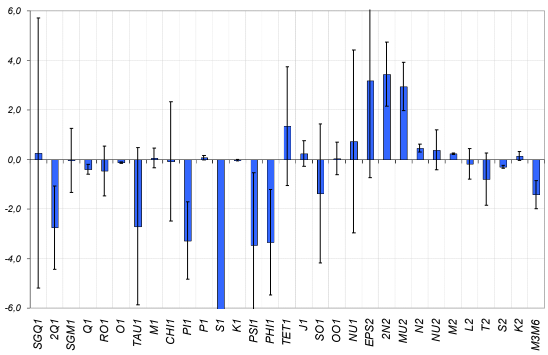

Fig. 14. Phase shift [°]

5. ABSOLUTE GRAVITY MEASUREMENTS

The results of absolute gravity measurements using FG-5 230 are shown above.

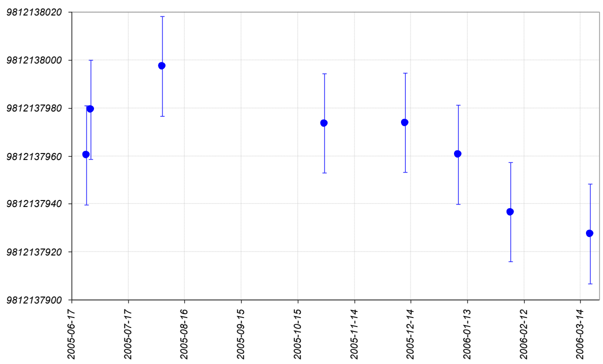

Fig. 15. Absolute gravitymeter FG5 **Fig. 16. Results of absolute gravity measurements**

6. SUPPORTING OBSERVATIONS:

Supporting observations includided:

- **ambient pressure, temperature and humidity;**
- **soil moisture;**
- **rainfalls;**
- **ground water table;**
- **snow coverage.**

The examples of it influences to gravity [nm/s^2] are shown in the figure below.

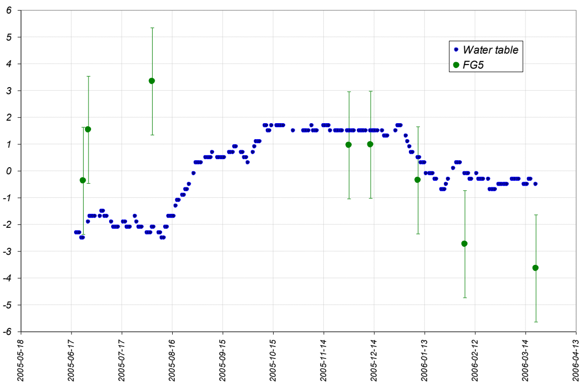

Fig. 17. Influence of ground water changes

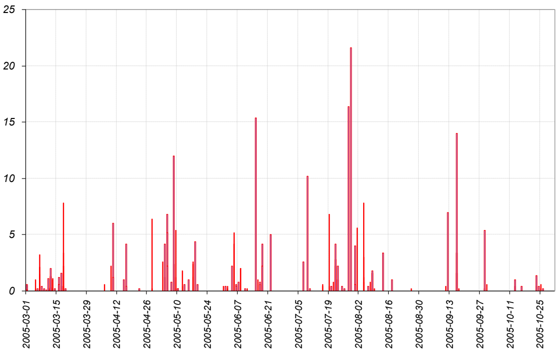

Fig. 18. Rainfalls measurements

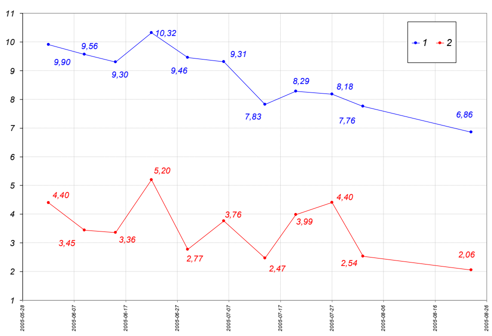

Fig. 19. Soil moister

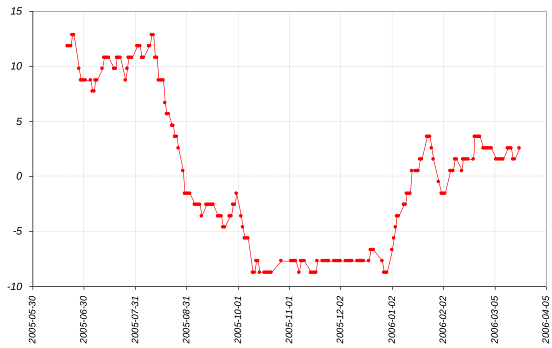

Fig. 20. Influence of waterlevel changes

Results of calibration ET-26 to FG 230 are shown in the fig. 21.

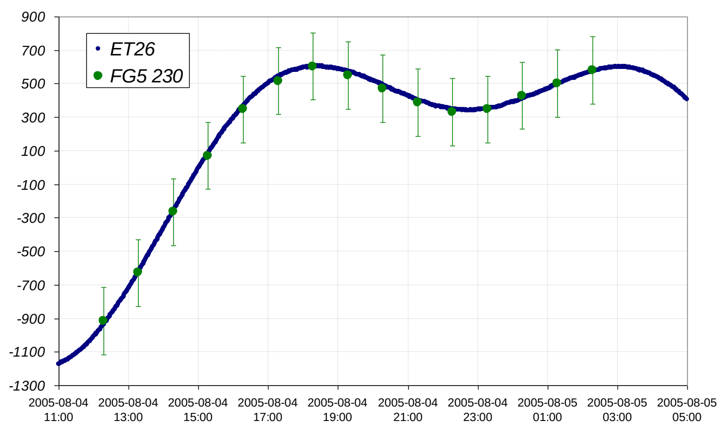

Fig. 21. Calibration

7. CLOSING REMARKS

Scientific research in the future will be concentrated on the following topics:

- **Improvement of GNSS observation and data processing according EPN standards;**
- **Studies on deformations of the Earth surface and its influence to station position and gravity;**
- **Determination of the secular variations of the gravity;**
- **Studies on the Earth tide using two gravity meters;**
- **NRT data processing looking for its implementation to numerical models for weather prediction;**
- **Evaluation on-line automatic service for GPS data processing OGPSP;**
- **Development of GPS PPP technology for geophysics, geodesy and navigation;**
- **Studies on improvement RTK GNSS technology using IP technology;**
- **Real time GNSS data processing.**

8. ACNOWLEGEMENTS

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