CURRENT ACTIVITIES OF THE ASTRO-GEODETIC OBSERVATORY IN JOZEFOSŁAW

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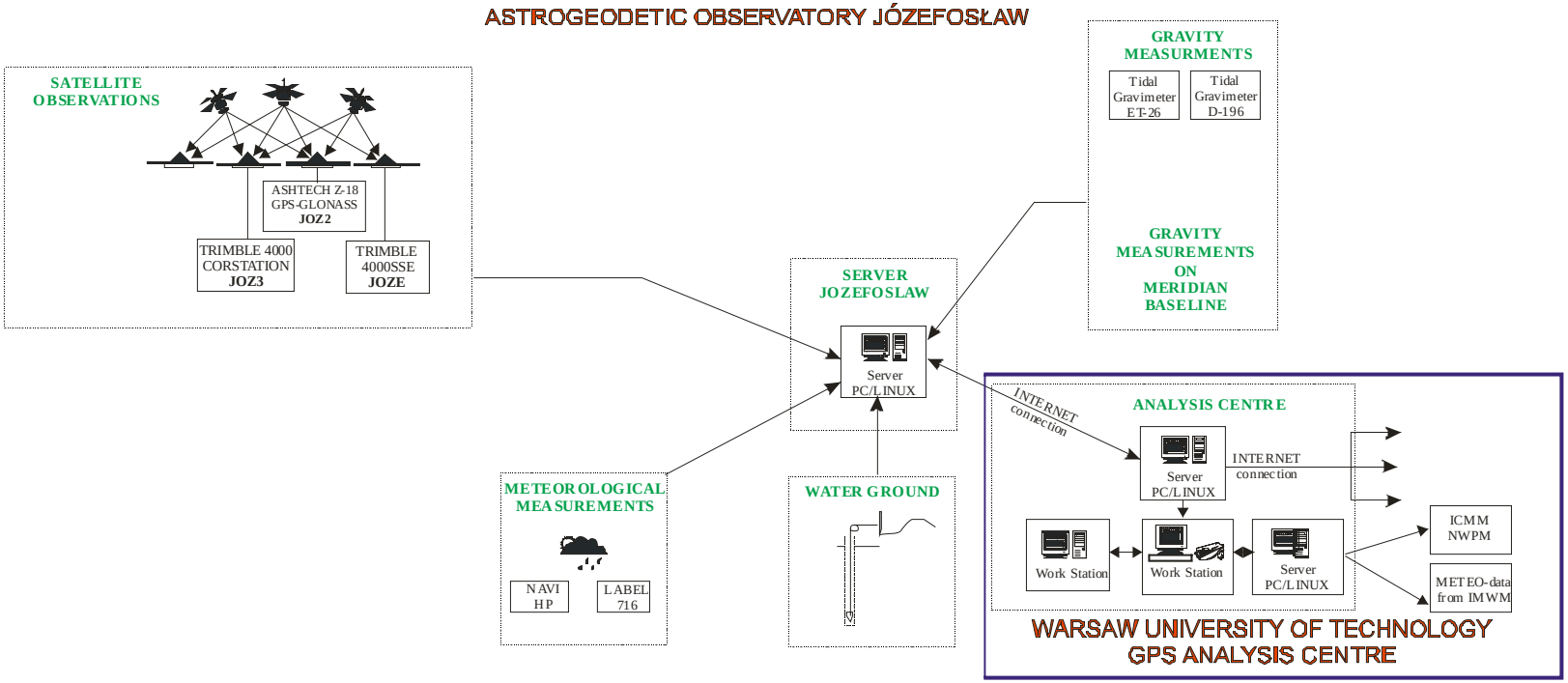
INTRODUCTION

Astro-Geodetic Observatory in Jozefosław 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 to 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 Analyses 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.

OBSERVING SYSTEM

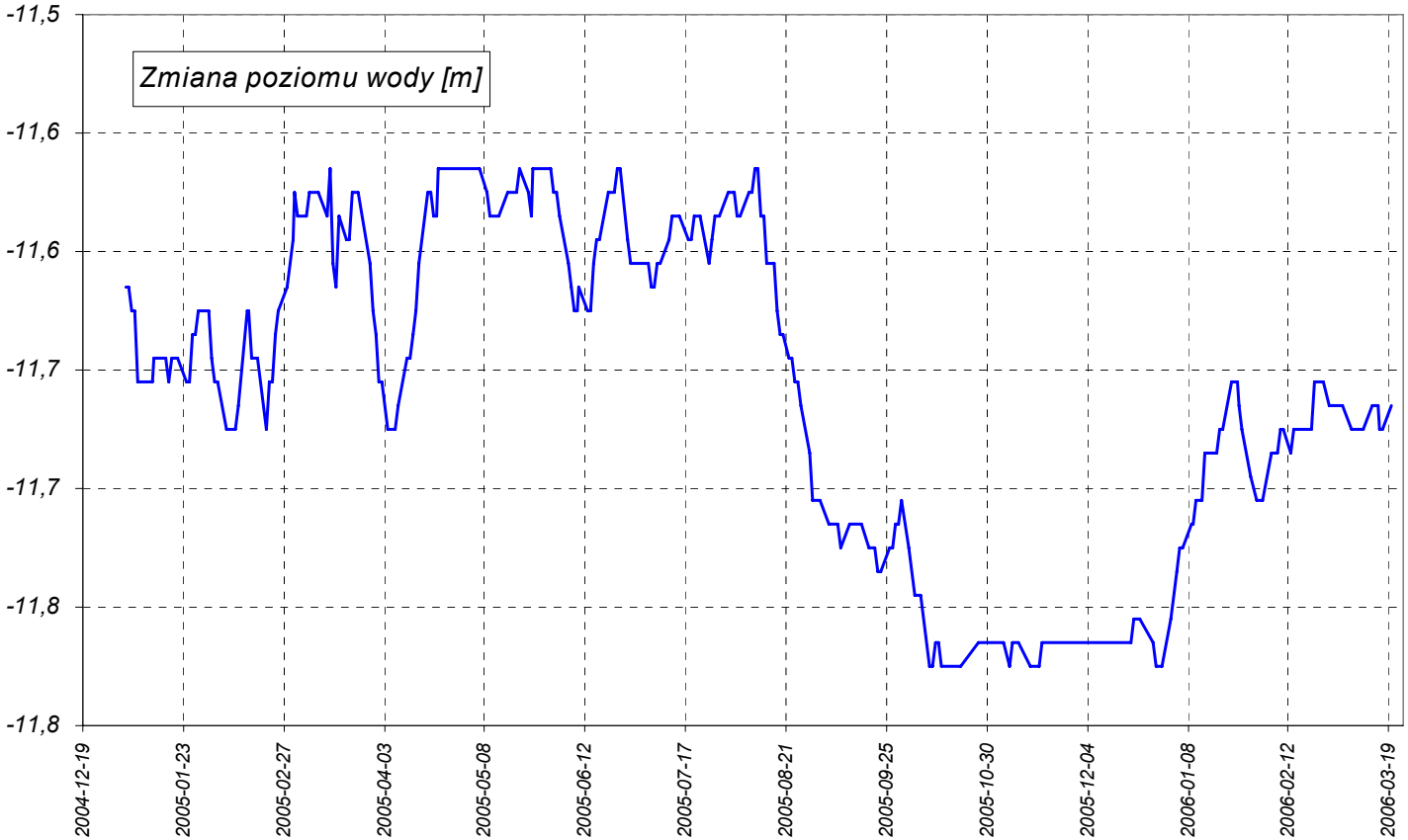


OBSERVING SYSTEM

GNSS receiver working in the Observatory:

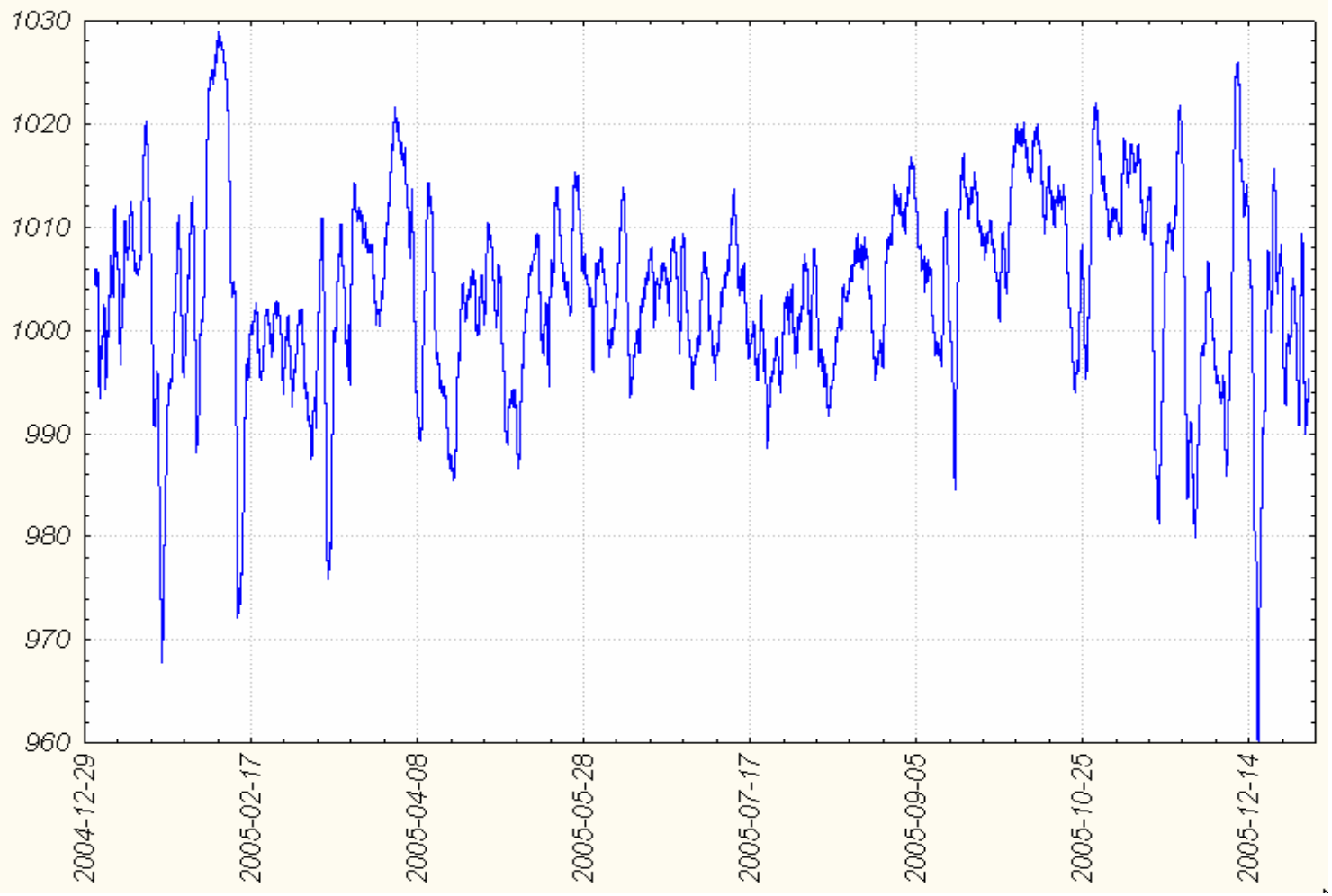
- TRIMBLE 4000SSE (GPS) in IGS/EUREF, since 1993 (JOZE);
- Ashtech Z-18 (GPS/GLONASS) in IGS/IGLOS/ since 2000 (JOZ2) also IGS IP and EUREF IP;
- TRIMBLE 4000 CorStation in ASG PL network, also EUREF IP.

OBSERVING SYSTEM



Ground water changes

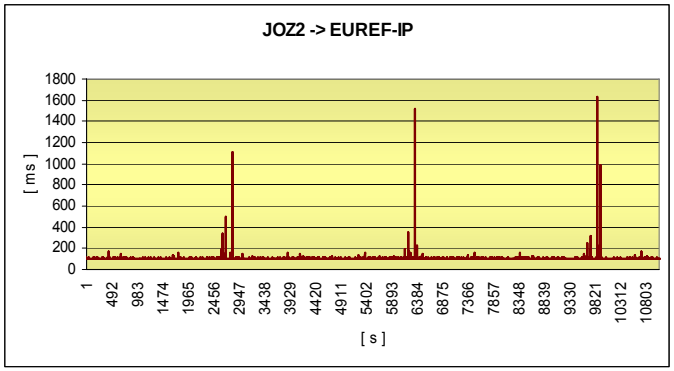
OBSERVING SYSTEM

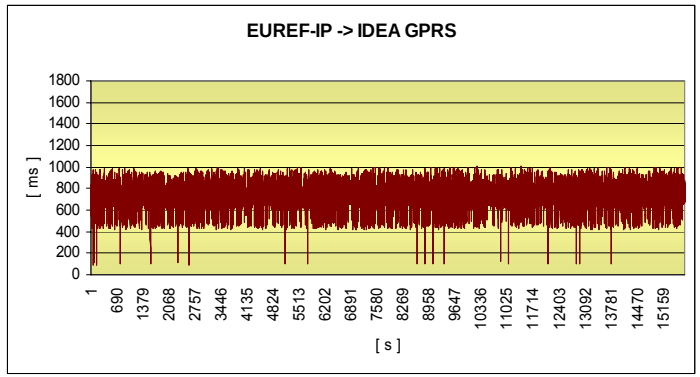


Pressure [hPa]:

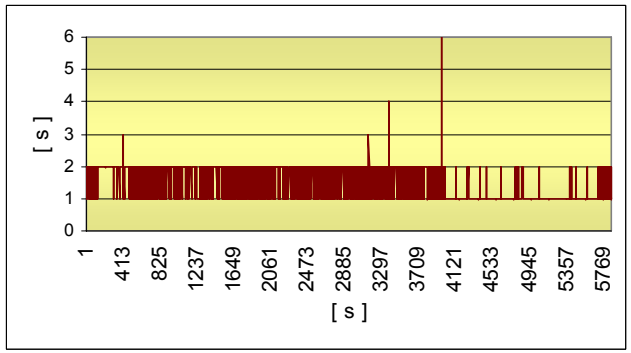
OBSERVING SYSTEM

SOME RESULTS OF STUDIES ON ACCESSIBILITY AND REALIABILITY OF RTK MEASUREMENTS BY INTERNET





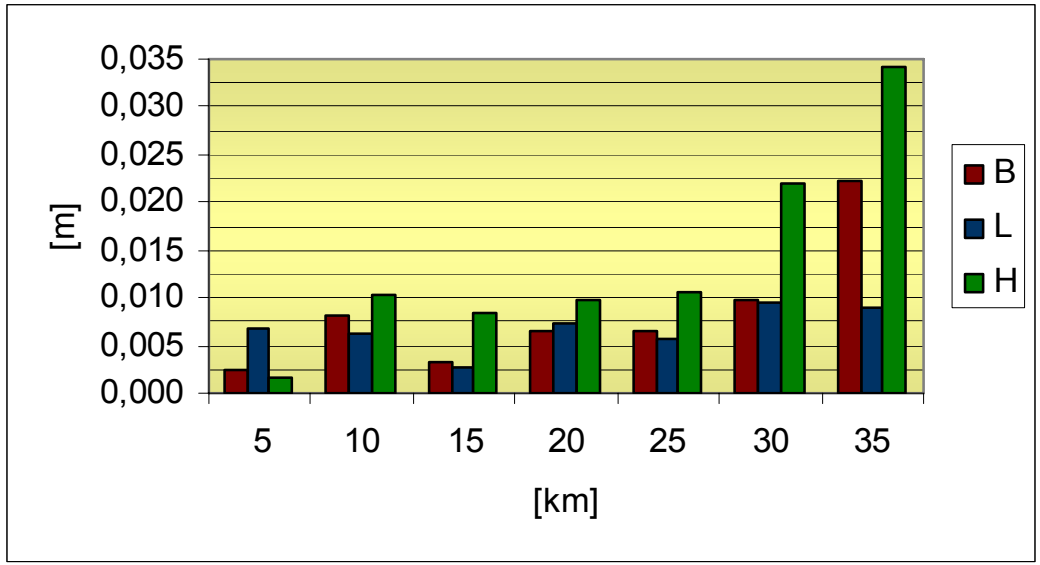
Time of way of pockets from base station to caster and rover user



Correction delay

OBSERVING SYSTEM

SOME RESULTS OF STUDIES ON ACCESSIBILITY AND REALIABILITY OF RTK MEASUREMENTS BY INTERNET



Standard deviations

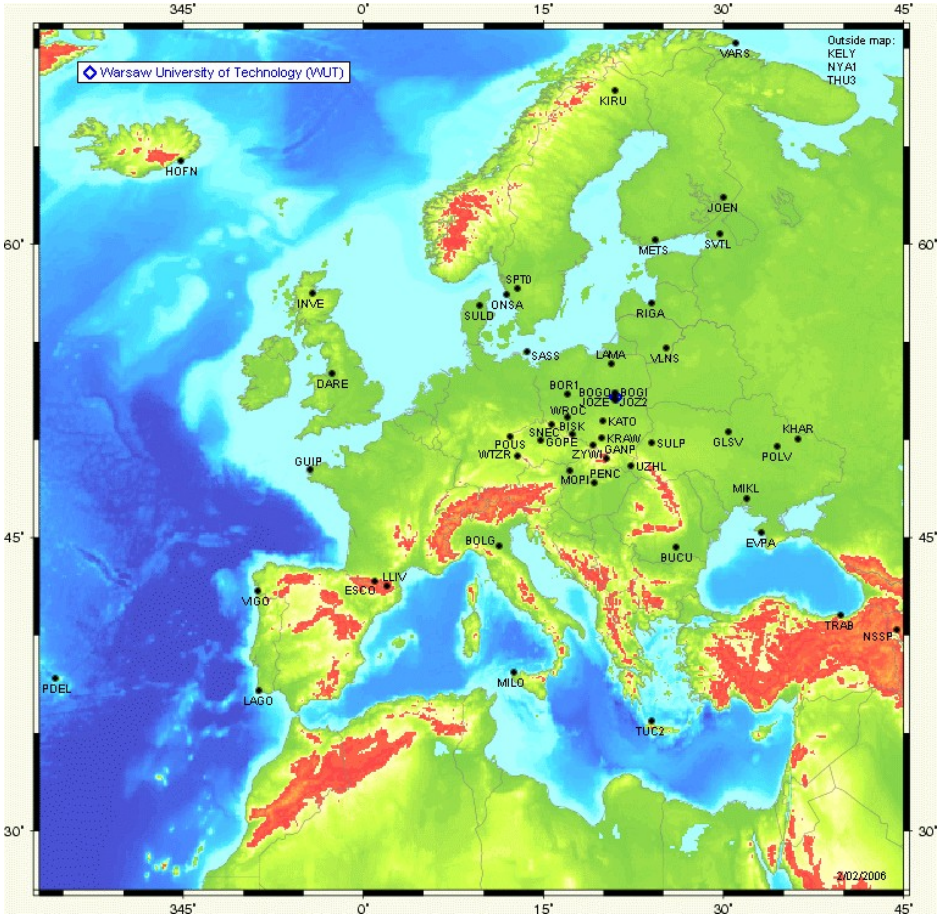
STRUCTURE OF THE GPS ANALYSIS CENTRE

GPS ANALYSIS CENTRE CONSIST OF:

- WUT EPN LOCAL ANALYSIS CENTRE
- JONOSPHERE RAPID ANALYSIS CENTRE
- NRT TROPSPHERIC DELAY ESTIMATION
- USER AUTOMATIC ON–LINE SERVICE OGPSP
- CERGOP DATA PROCESSING CENTRE

STRUCTURE OF THE GPS ANALYSIS CENTRE

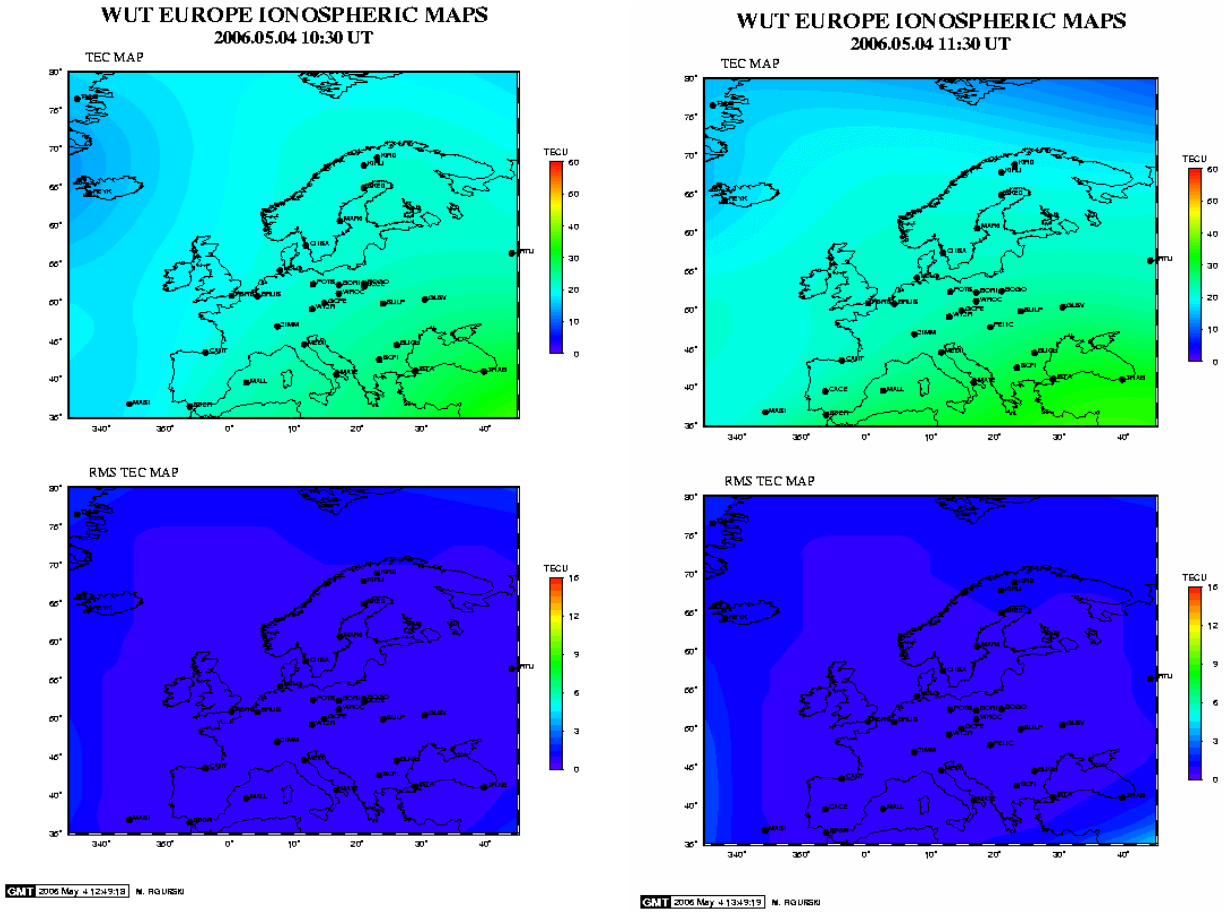
WUT EPN LOCAL ANALYSIS CENTRE



Map of the EUREF station processed by the WUT EPN LAC

STRUCTURE OF THE GPS ANALYSIS CENTRE

JONOSPHERE RAPID ANALYSIS CENTRE



Maps of the ionosphere processed by the WUT EPEN LAC Regional Rapid Service

http://leo.wic.wat.edu.pl/~abwe

STRUCTURE OF THE GPS ANALYSIS CENTRE

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.

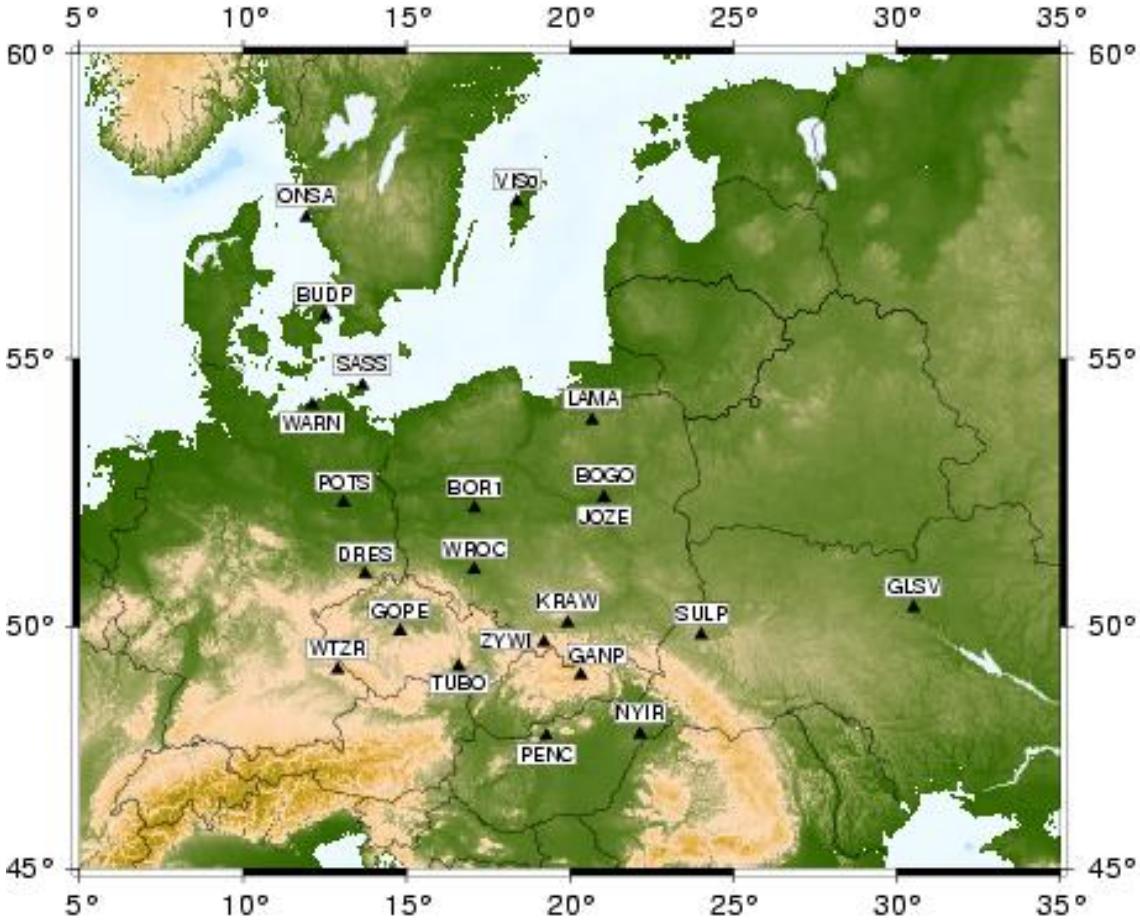
Solution minutes:

- Bernese GPS Software v. 4.2,
- coordinates of all stations are fixed to EUREF weekly solutions,
- IGS Ultra Rapid orbits are used,
- no *a priori* tropospheric model, Dry Niell as mapping function, ZTDs estimated every hour,
- observation sampling 30 sec, weighting 1/cos (z), cut off: 10°
- sliding window: 4 hours, no ADDNEQ, RINEX files concatenated (teqc)
- ambiguities are resolved using QIF.

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

STRUCTURE OF THE GPS ANALYSIS CENTRE

NRT TROPSPHERIC DELAY ESTIMATION



Map of test NRT campaign stations

STRUCTURE OF THE GPS ANALYSIS CENTRE

NRT TROPSPHERIC DELAY ESTIMATION

NTR SOLUTION ZTD AND RAPID IGS SOLUTION DIFFERENCES

station	averaged difference (NRT-PW) - (rapid IGS)	averaged absolute difference	No. of points
BOR1	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	550
ONSA	1.62	6.08	541

STRUCTURE OF THE GPS ANALYSIS CENTRE

USER AUTOMATIC ON–LINE SERVICE OGPSP

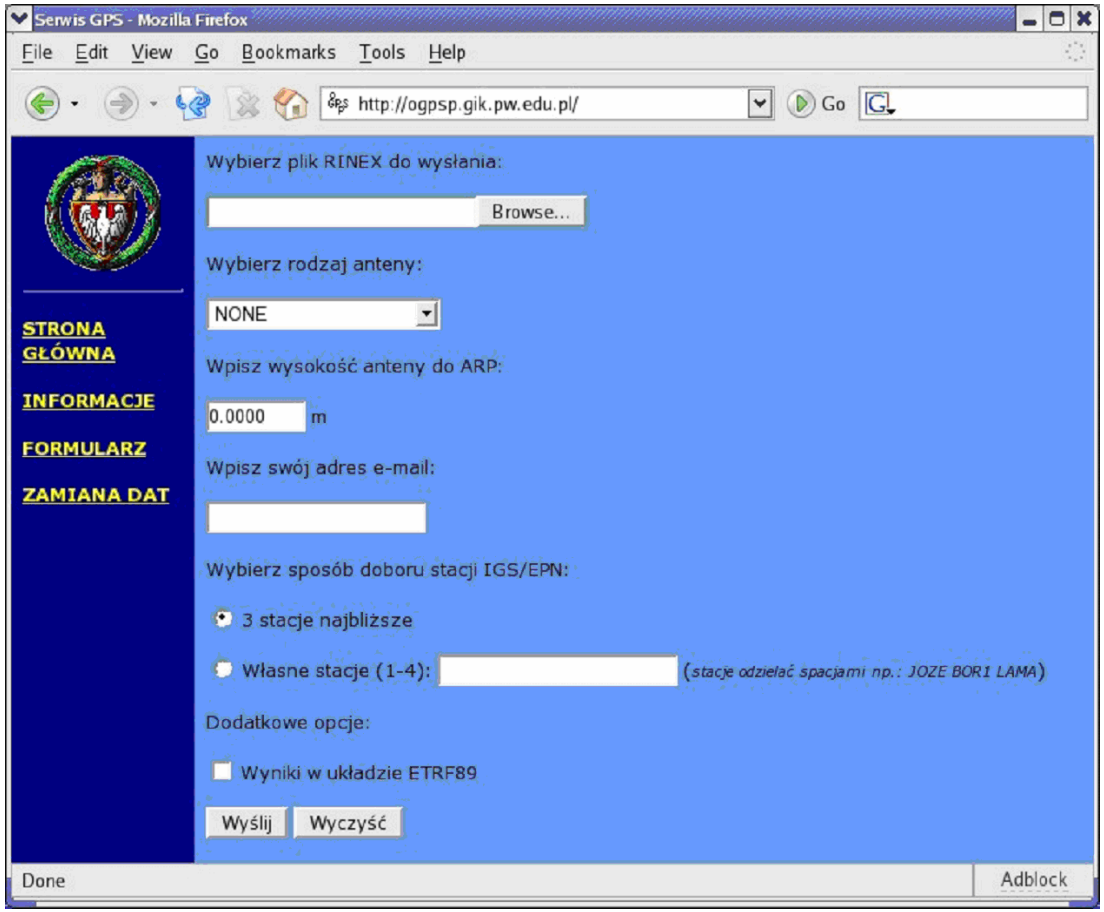
The system uses subset of EPN/ IGS GPS stations in Central Europe and is based on Bernese GPS Software version 4.2 (Linux platform) but original panels and BPE are not used. All necessary scripts for preparation input files -I, -F, -N, processing control, data download, error/exception handling etc.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

STRUCTURE OF THE GPS ANALYSIS CENTRE

USER AUTOMATIC ON–LINE SERVICE OGPSP

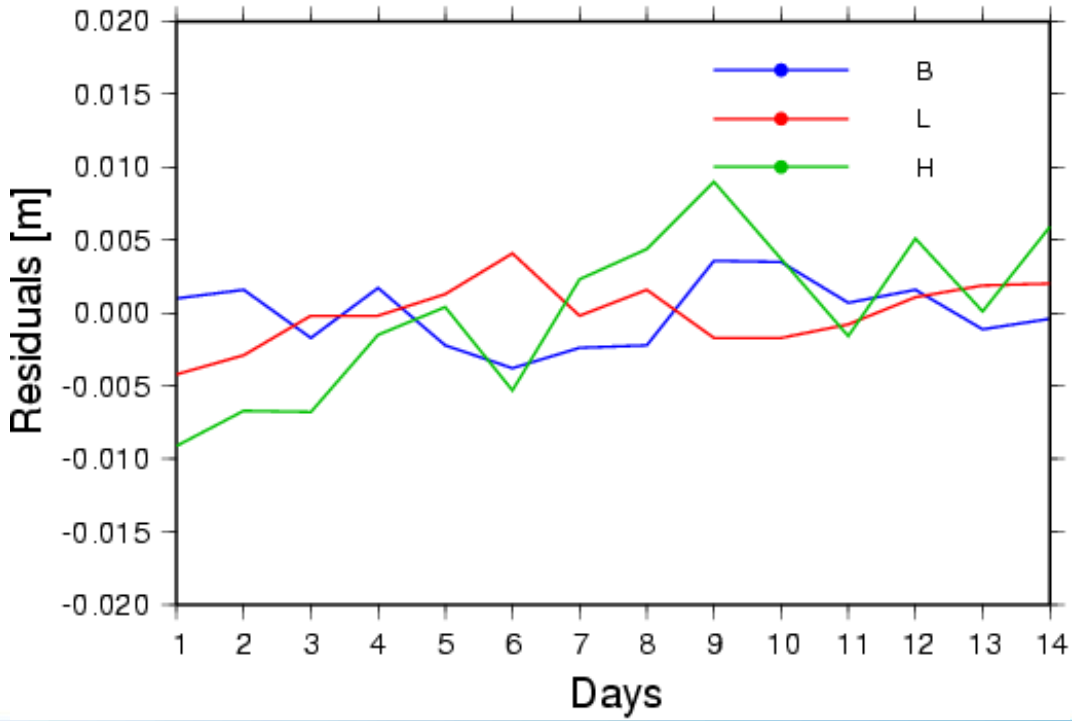


OGPSP service - main webpage ***http://ogpsp.gik.pw.edu.pl***

STRUCTURE OF THE GPS ANALYSIS CENTRE

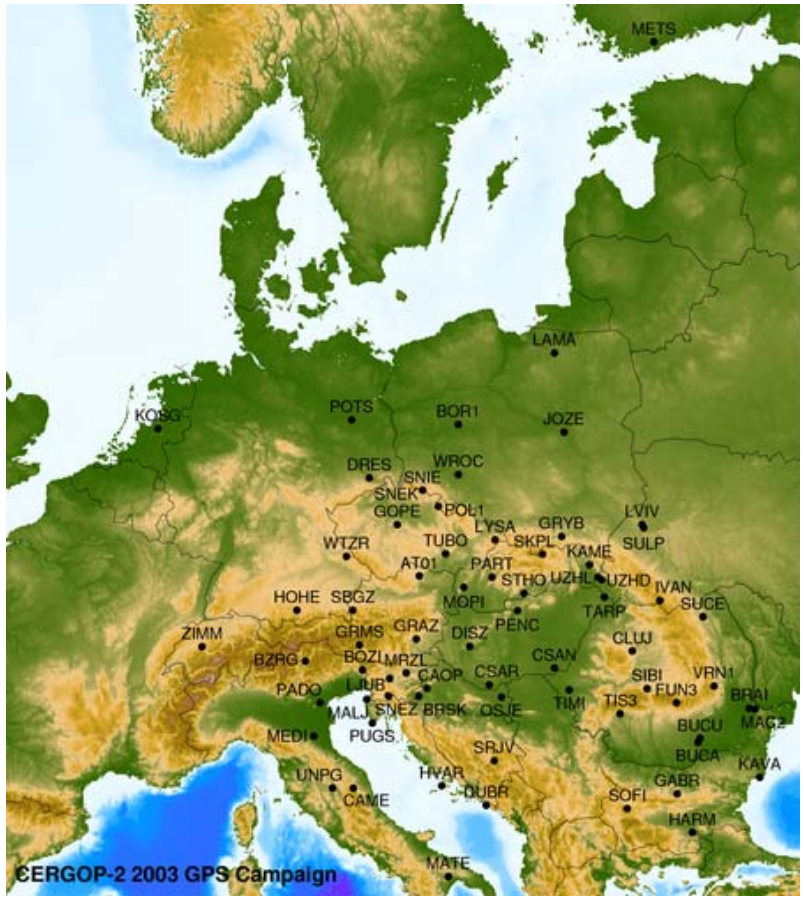
USER AUTOMATIC ON–LINE SERVICE OGPSP

PPP studying.
We are going to implement PPP method into our Internet based service for automated GPS data processing.



STRUCTURE OF THE GPS ANALYSIS CENTRE

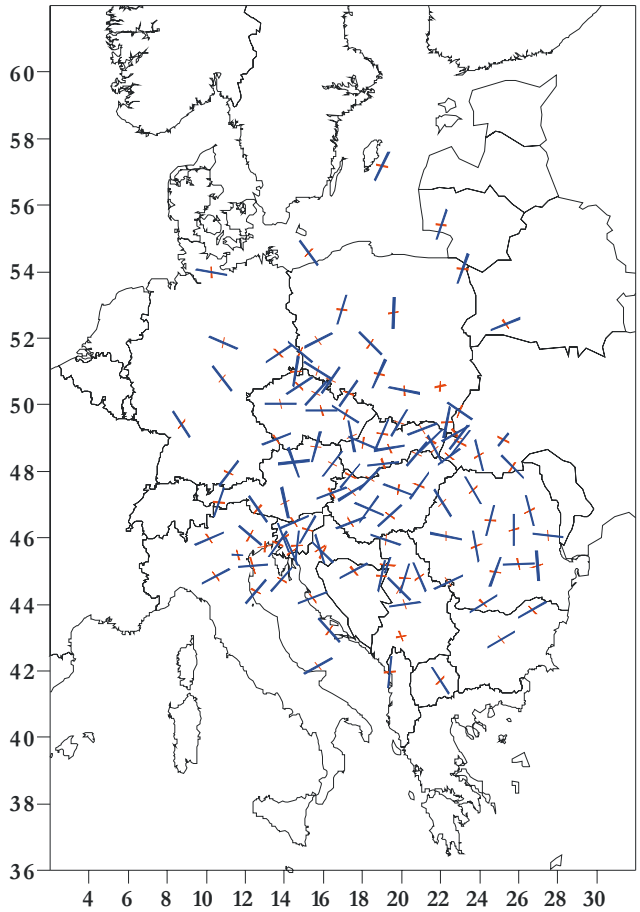
CERGOP DATA PROCESSING CENTRE



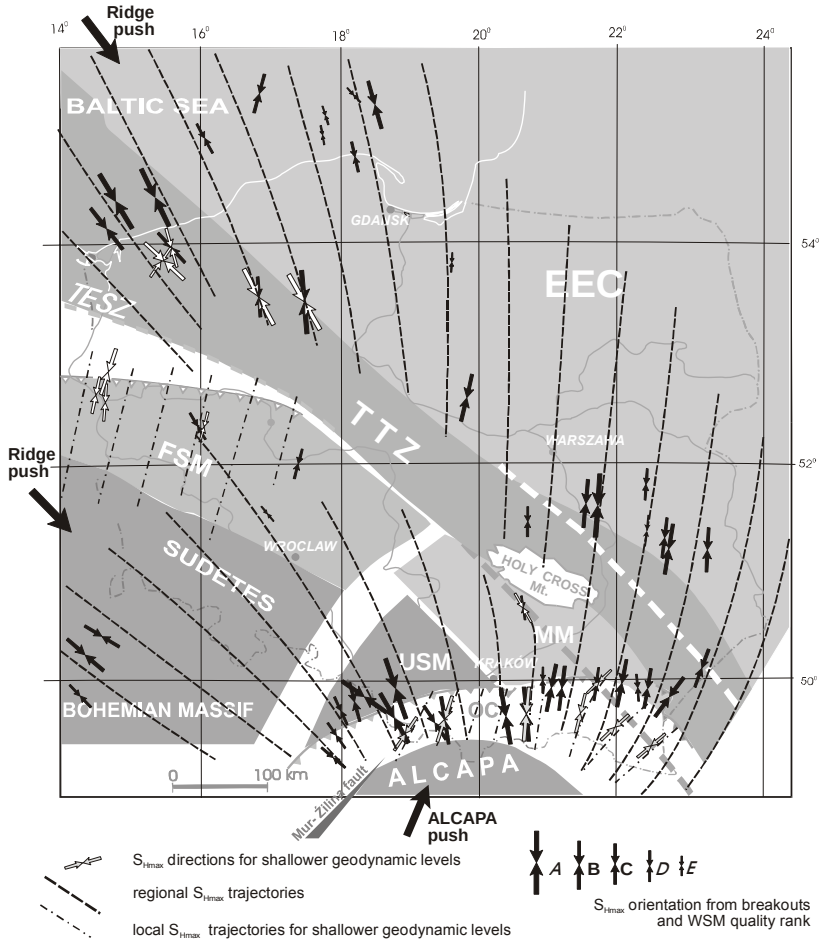
Map of the CERGOP2'2003 stations

STRUCTURE OF THE GPS ANALYSIS CENTRE

CERGOP DATA PROCESSING CENTRE

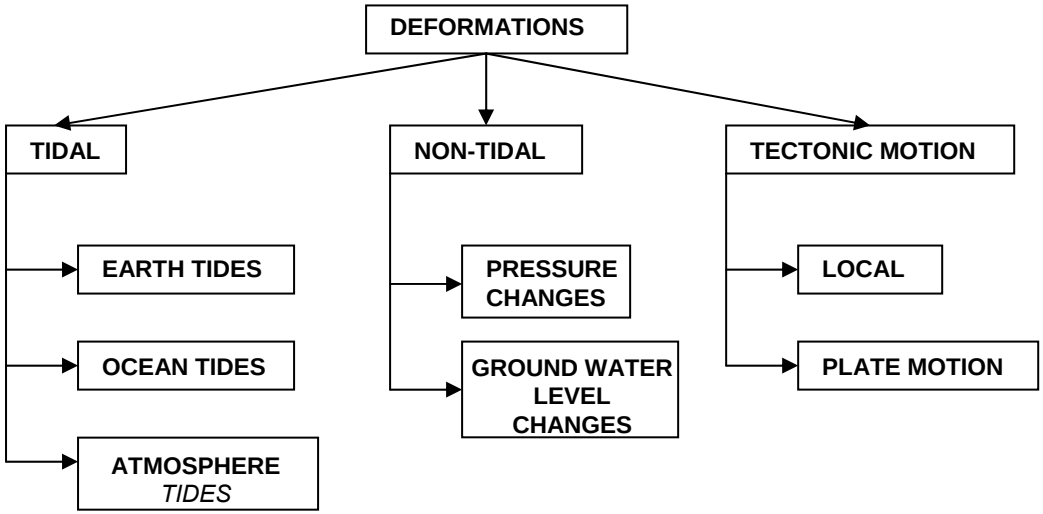


Principal directions of the strain



Model Jarosinskiego

STAUDIES ON DEFORMATION OF THE EARTH CRUST

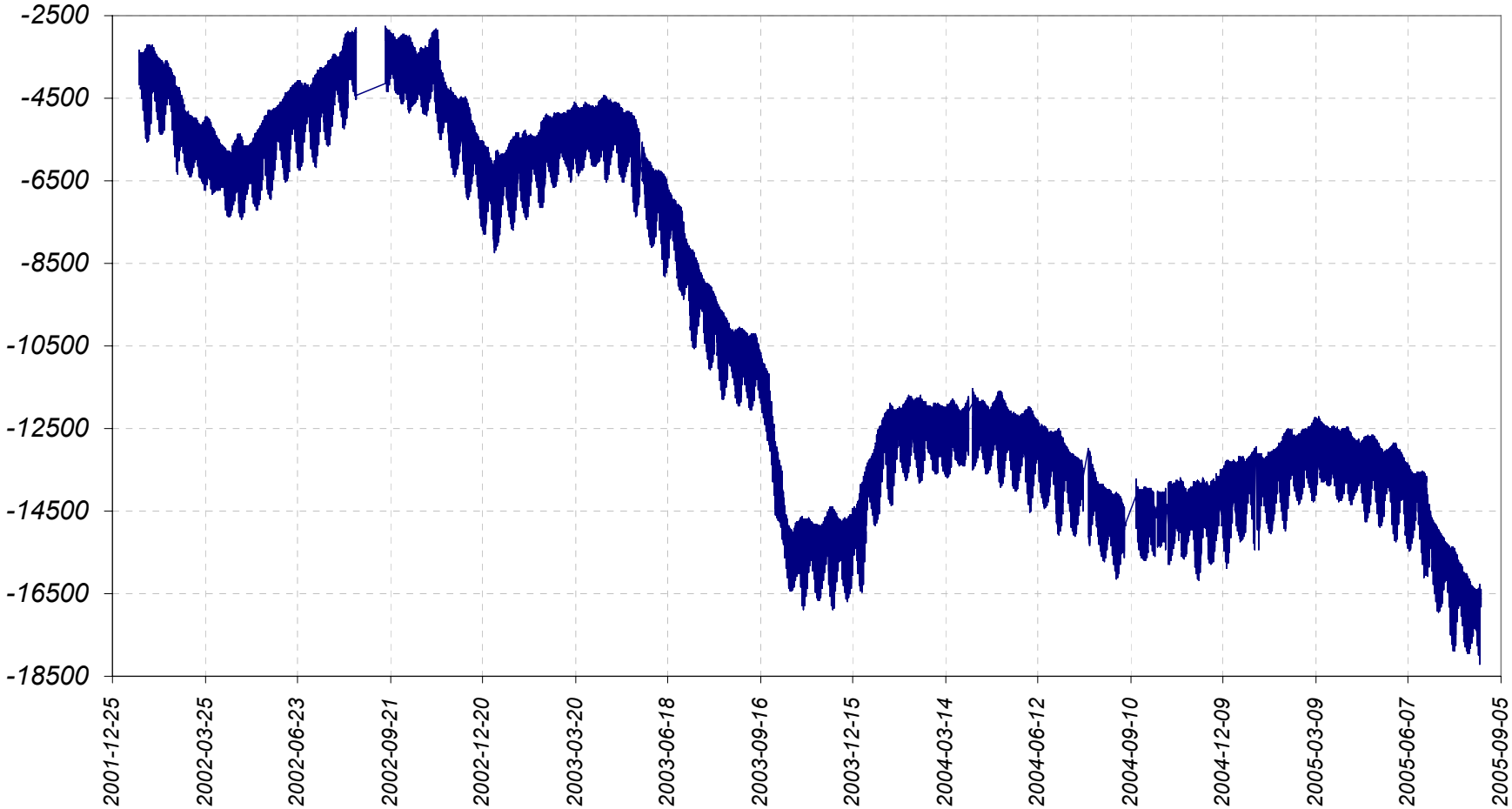


Types of deformations

STAUDIES ON DEFORMATION OF THE EARTH CRUST

Tidal observations

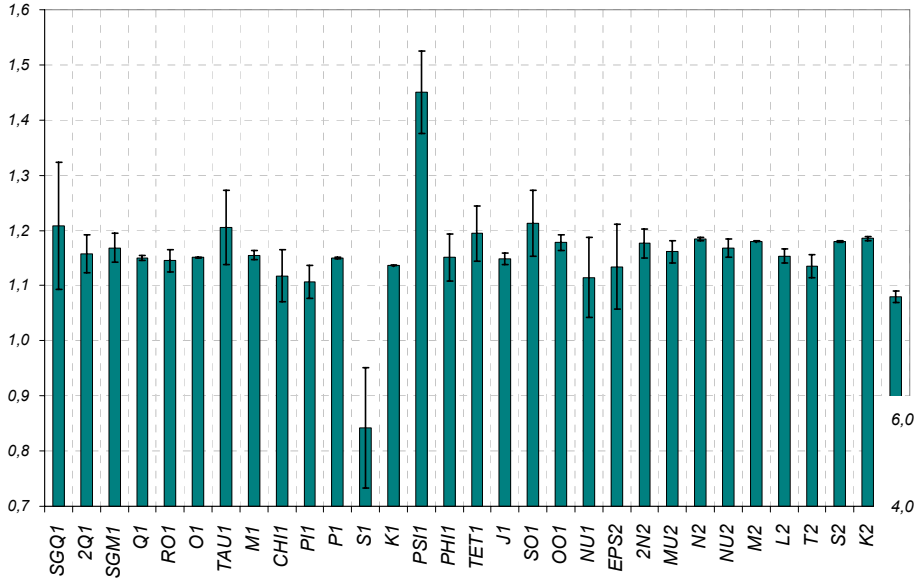
STAUDIES ON DEFORMATION OF THE EARTH CRUST



Tidal observations

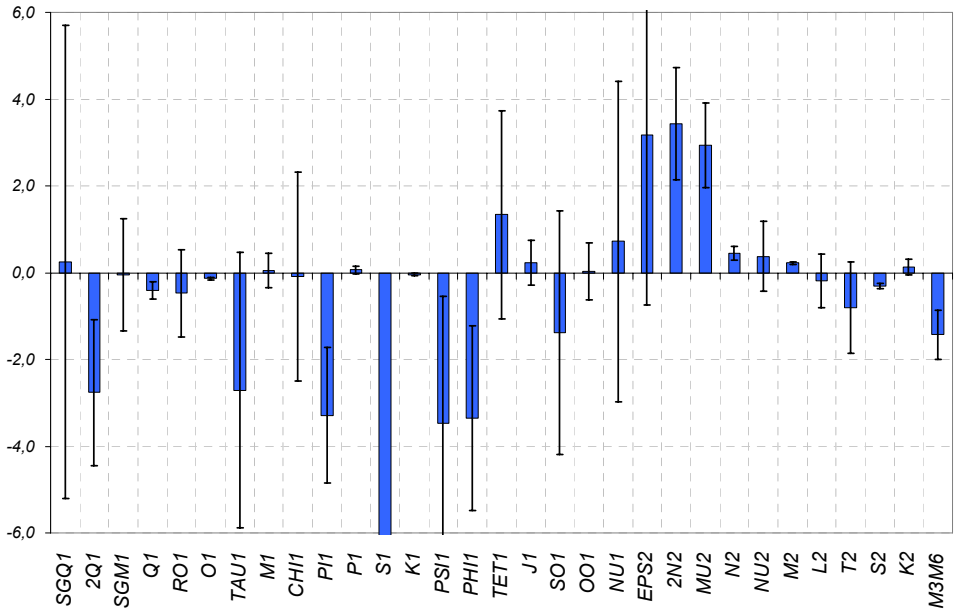
STAUDIES ON DEFORMATION OF THE EARTH CRUST

Amplitude factor:



Tidal analyses 2002-2005

Phase shift [°]:



$m_{0\ 2002\text{-}2005} = 8.4\ nm/s^2$

$m_{0\ 2002} = 4.4\ nm/s^2$

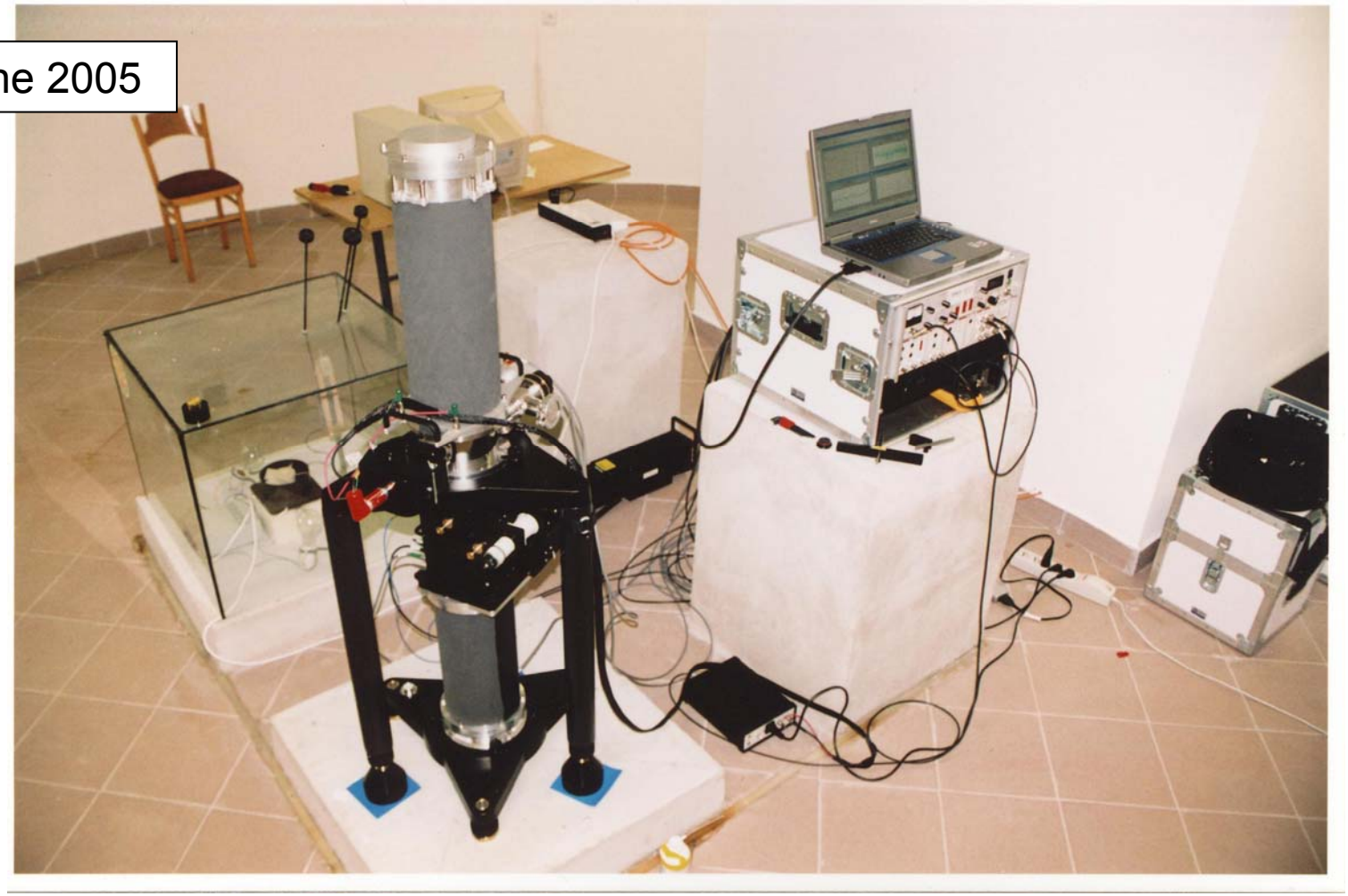
$m_{0\ 2003} = 4.5\ nm/s^2$

$m_{0\ 2004} = 4.6\ nm/s^2$

$m_{0\ 2005} = 2.3\ nm/s^2$

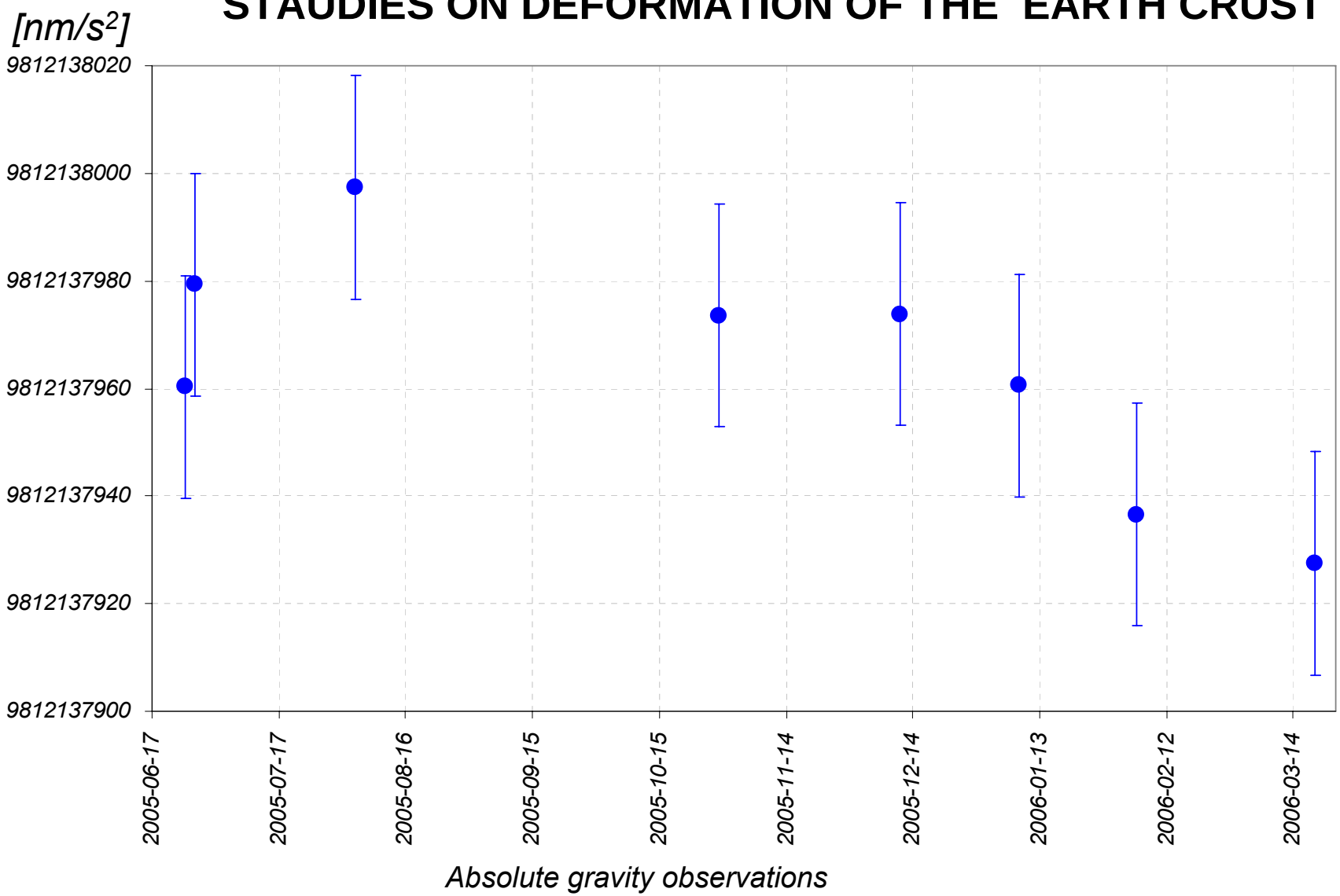
STAUDIES ON DEFORMATION OF THE EARTH CRUST

June 2005



Absolute gravity observations

STAUDIES ON DEFORMATION OF THE EARTH CRUST



STAUDIES ON DEFORMATION OF THE EARTH CRUST

SUPPORTING OBSERVATIONS:

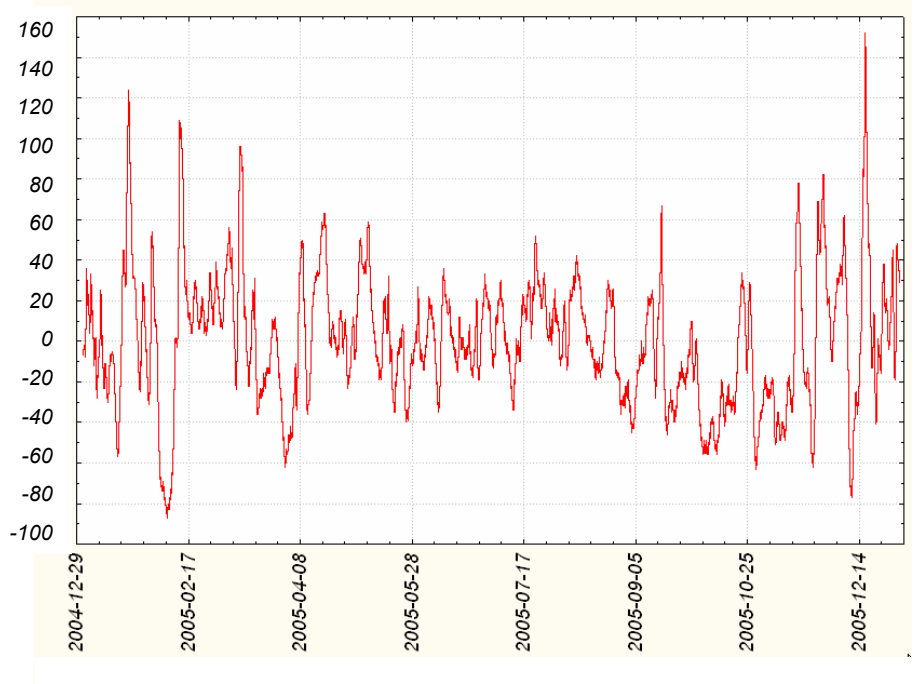
- *ambient pressure, temperature and humidity;*
- *soil moisture;*
- *rainfalls;*
- *ground water table;*
- *snow coverage.*

STAUDIES ON DEFORMATION OF THE EARTH CRUST

Supporting observations

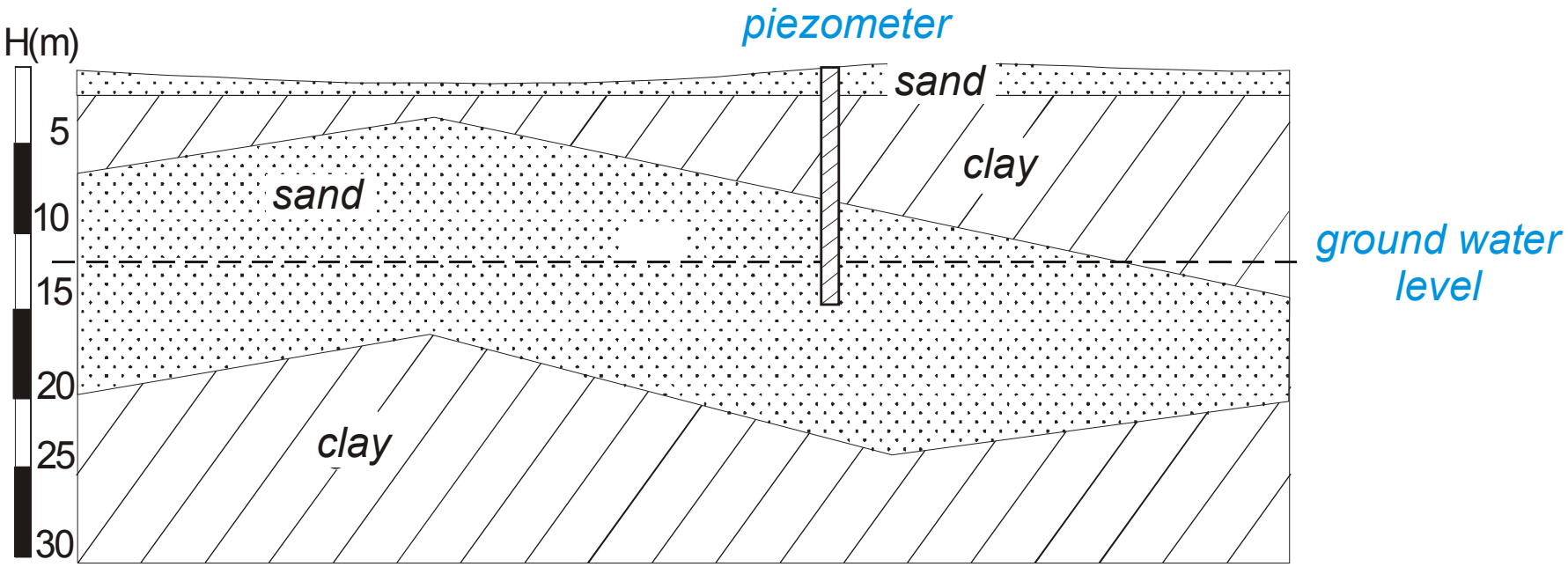
$$\Delta g\left[nm/s^2\right] = -3.450 * \Delta p[hPa]$$
$$\Delta u[mm] = 0.3575 * \Delta p[hPa]$$

Atmospheric effect [nm/s²]:



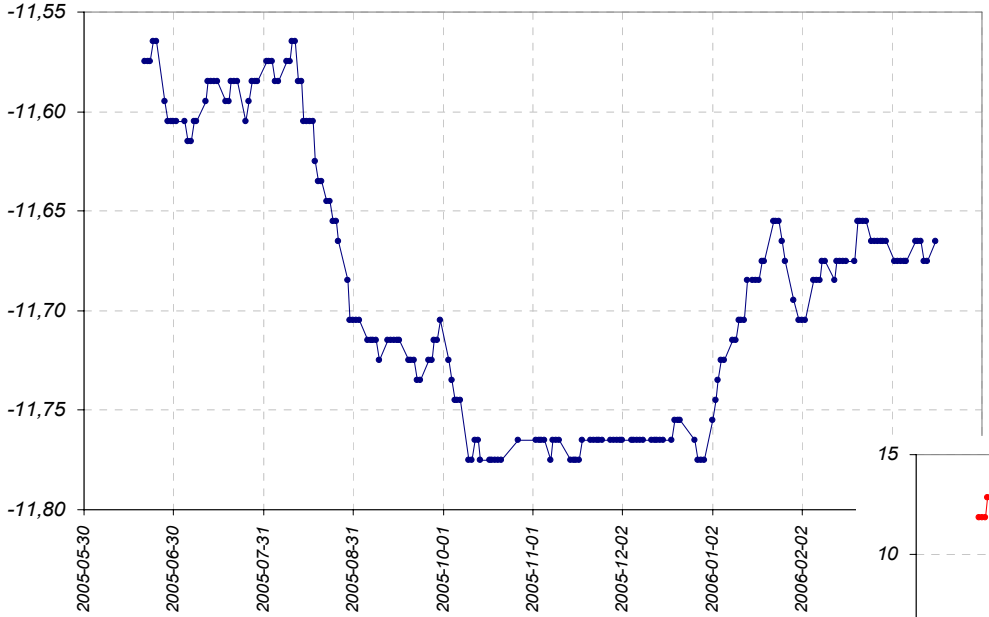
STAUDIES ON DEFORMATION OF THE EARTH CRUST

Ground water level investigations:

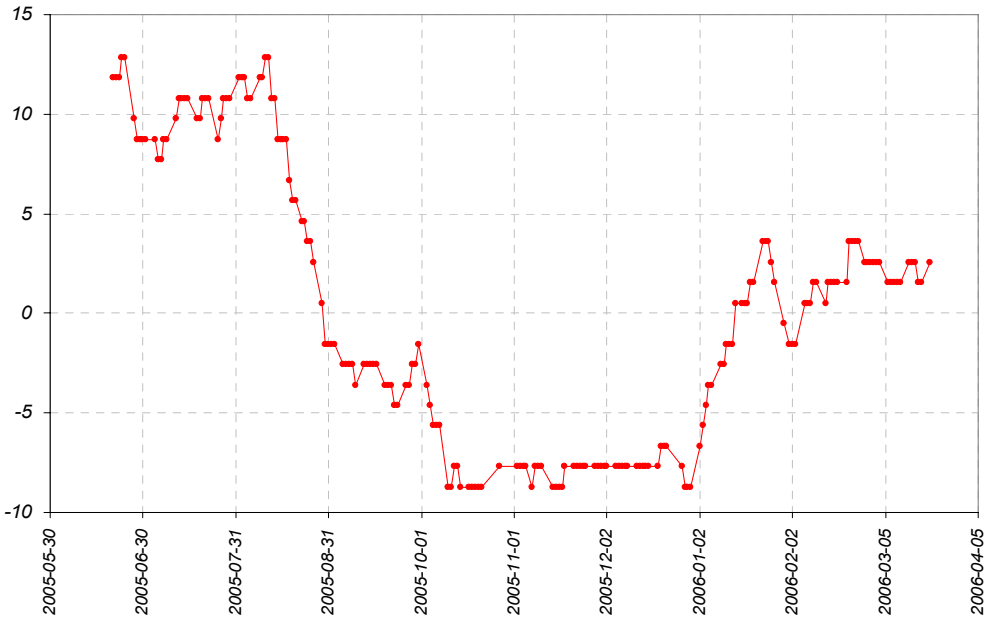


STAUDIES ON DEFORMATION OF THE EARTH CRUST

Ground water level [m]:

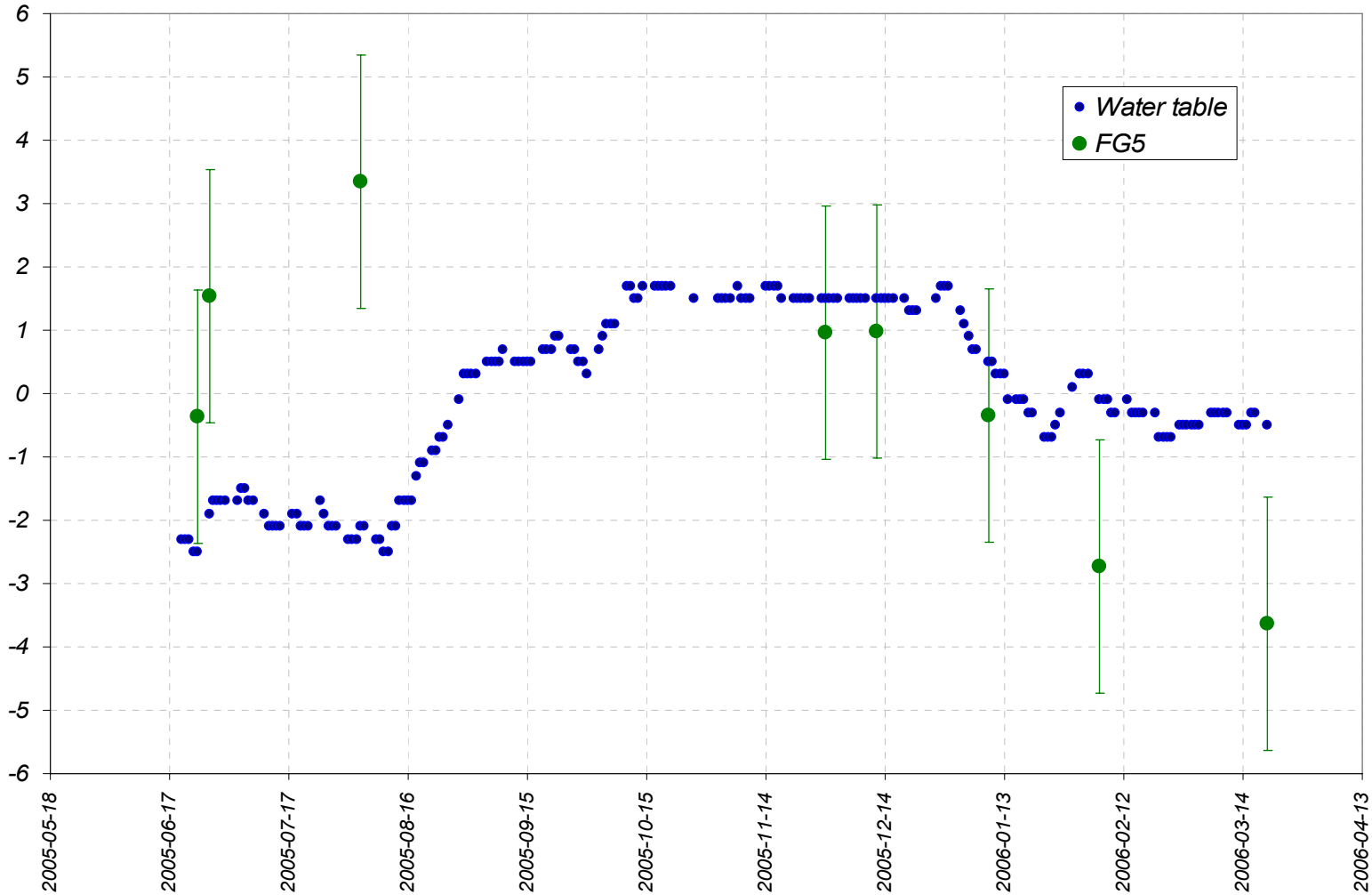


Effect on gravity [nm/s²]:



$$\Delta g\,[\mathrm{nm/s^2}] = 102.7 \cdot \Delta H\,[\mathrm{m}]$$

STAUDIES ON DEFORMATION OF THE EARTH CRUST



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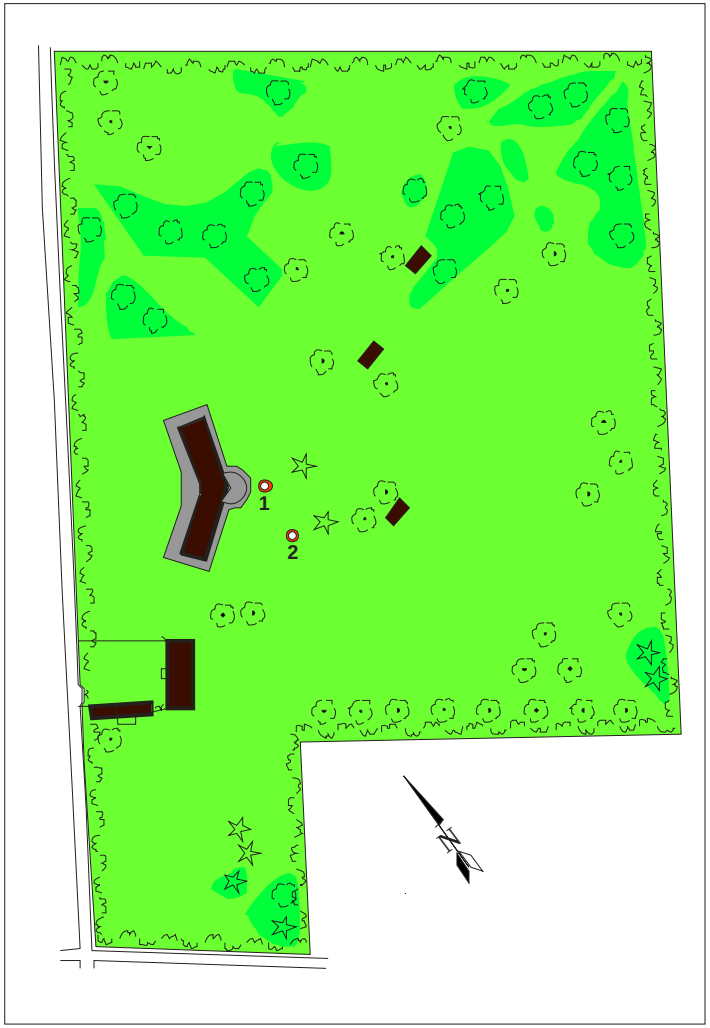
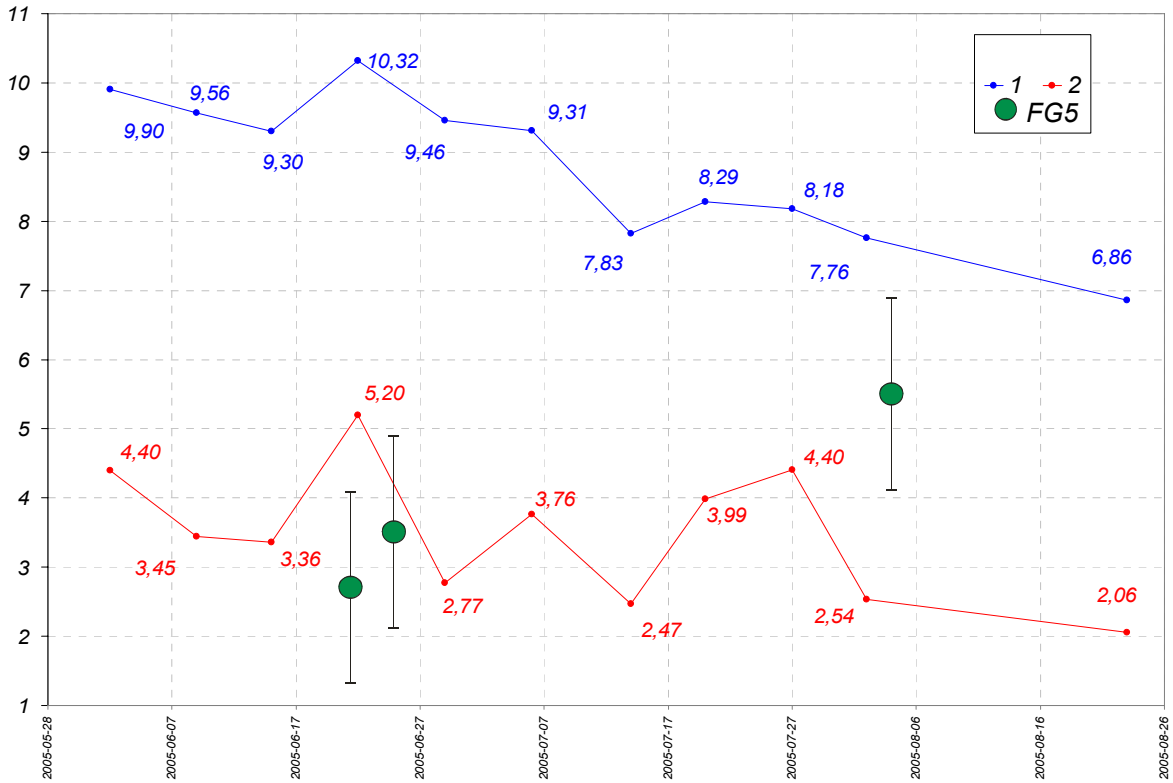
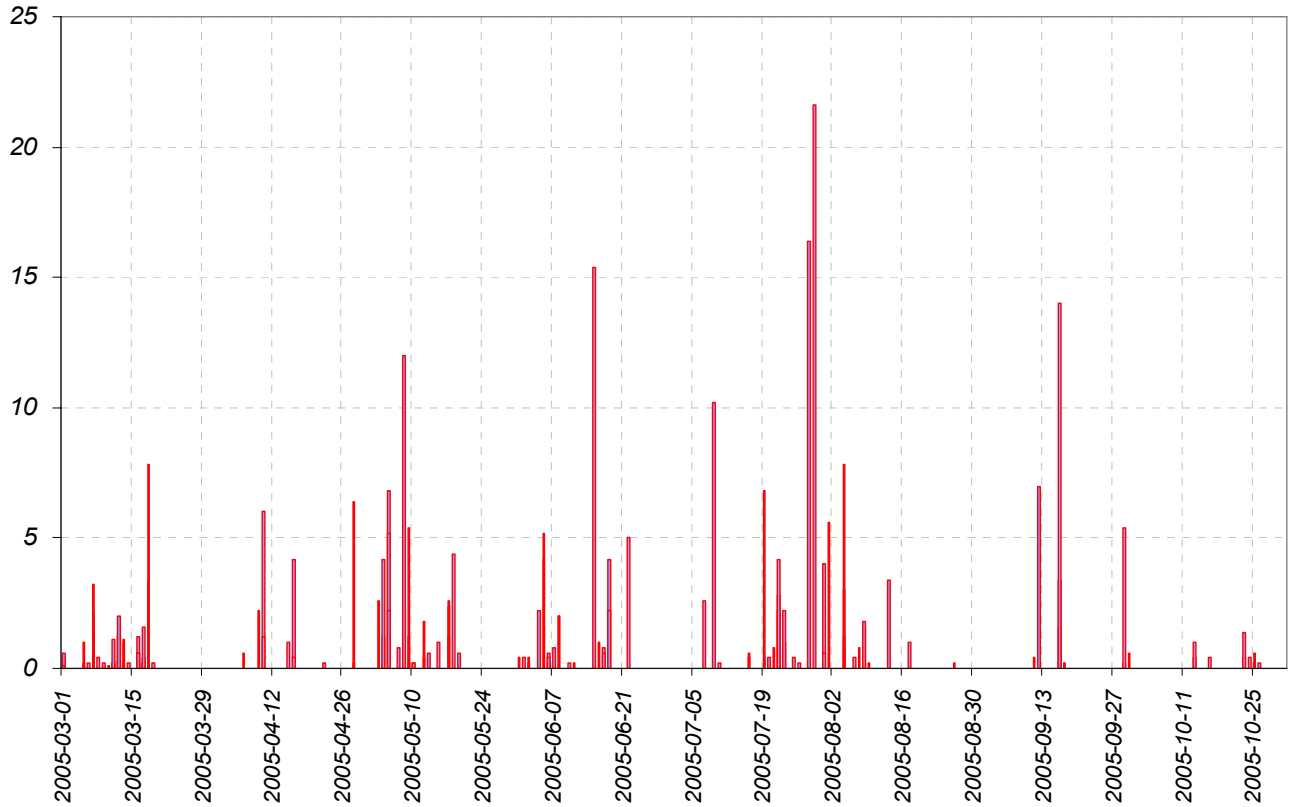


Soil moisture [%]:

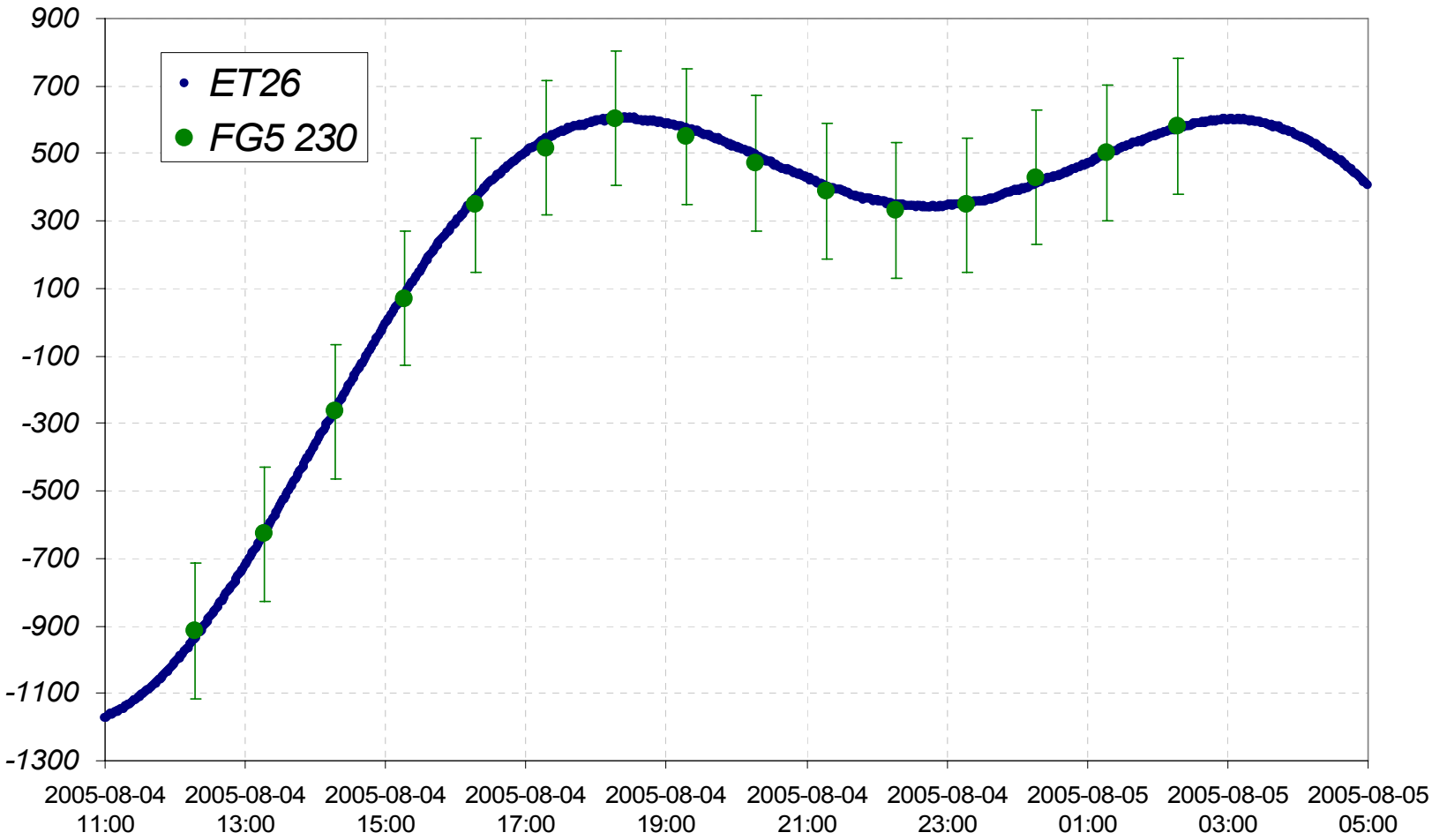


STAUDIES ON DEFORMATION OF THE EARTH CRUST

Rainfalls [mm/m²]:



STAUDIES ON DEFORMATION OF THE EARTH CRUST



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, at its influence to station position and gravity;
- Determination of the secular variations of the gravity;
- Studies on the earth tide using two gravity meter;
- NRT data processing looking for its implementation to numerical models for weather prediction;
- Evaluation on-line automatic service for GPS data processing OGPSP;
- Devlopment of GPS ppp technology for geophysics, geodesy and navigation;
- Studies on improvement RTK GNSS technology using IP technology;
- Real time GNSS data processing.

ACNOWLEGEMENTS

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Special thanks to Professor Marcin Barlik for make the access to first FG-5 data and cooperation.

Thank you for attention