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

ASTRO-GEODETIC OBSERVATORY IN JOZEFOSLAW

CURRENT ACTIVITIES OF THE ASTRO-GEODETIC OBSERVATORY IN JOZEFOSLAW
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

Zmiana poziomu wody [m]

OBSERVATION SYSTEM

-11.5
-11.6
-11.7
-11.8
OBSERVING SYSTEM

Pressure [hPa]:

8th Bilateral Geodetic Meeting Poland-Italy, Wroclaw, Poland, 22-24 June 2006
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 TROPSHERIC 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
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 \textit{a priori} tropospheric model, Dry Niell as mapping function, ZTDs estimated every hour,
• observation sampling 30 sec, weighting $1/\cos(z)$, cut off: $10^\circ$
• 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 TROPSHHERIC DELAY ESTIMATION

Map of test NRT campaign stations
### STRUCTURE OF THE GPS ANALYSIS CENTRE

**NRT TROPSHERIC DELAY ESTIMATION**

<table>
<thead>
<tr>
<th>station</th>
<th>averaged difference (NRT-PW) - (rapid IGS)</th>
<th>averaged absolute difference</th>
<th>No. of points</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOR1</td>
<td>1.82</td>
<td>7.42</td>
<td>626</td>
</tr>
<tr>
<td>GOPE</td>
<td>5.15</td>
<td>8.52</td>
<td>529</td>
</tr>
<tr>
<td>POTS</td>
<td>1.7</td>
<td>7.43</td>
<td>899</td>
</tr>
<tr>
<td>WTZR</td>
<td>1.88</td>
<td>7.06</td>
<td>1027</td>
</tr>
<tr>
<td>HOFN</td>
<td>-2.05</td>
<td>7.24</td>
<td>550</td>
</tr>
<tr>
<td>ONSA</td>
<td>1.62</td>
<td>6.08</td>
<td>541</td>
</tr>
</tbody>
</table>
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
STUDIES ON DEFORMATION OF THE EARTH CRUST

Tidal observations

Amplitude factor:

Tidal analyses 2002-2005

Phase shift [°]:

\[ m_0^{2002-2005} = 8.4 \text{ nm/s}^2 \]

\[ m_0^{2002} = 4.4 \text{ nm/s}^2 \]

\[ m_0^{2003} = 4.5 \text{ nm/s}^2 \]

\[ m_0^{2004} = 4.6 \text{ nm/s}^2 \]

\[ m_0^{2005} = 2.3 \text{ nm/s}^2 \]
STUDIES ON DEFORMATION OF THE EARTH CRUST

June 2005

Absolute gravity observations
STAUDIES ON DEFORMATION OF THE EARTH CRUST

[nm/s²]

Absolute gravity observations
CURRENT ACTIVITIES OF THE ASTRO-GEODETIC OBSERVATORY IN JOZEFOSLAW

STUDIES ON DEFORMATION OF THE EARTH CRUST

SUPPORTING OBSERVATIONS:

• ambient pressure, temperature and humidity;
• soil moisture;
• rainfalls;
• ground water table;
• snow coverage.
Studies on deformation of the Earth crust

Supporting observations

\[
\Delta g [\text{nm/s}^2] = -3.450 \Delta p [\text{hPa}]
\]
\[
\Delta u [\text{mm}] = 0.3575 \Delta p [\text{hPa}]
\]
STAUDIES ON DEFORMATION OF THE EARTH CRUST

Ground water level investigations:

![Diagram of ground water level investigations with layers of sand and clay, and a piezometer indicating ground water level.]
Ground water level [m]:

\[ \Delta H \] = 102.7 \cdot \Delta H [m]

Effect on gravity [nm/s^2]:

\[ \Delta g [\text{nm/s}^2] = 102.7 \cdot \Delta H [\text{m}] \]
STAUDEIES ON DEFORMATION OF THE EARTH CRUST
STUDIES ON DEFORMATION OF THE EARTH CRUST

Soil moisture [%]:

![Soil moisture graph showing data points and trend lines.](image-url)
STUDIES ON DEFORMATION OF THE EARTH CRUST

Rainfalls [mm/m²]:

[Graph showing rainfall data for the period from 2005-03-01 to 2005-10-25]
CURRENT ACTIVITIES OF THE ASTRO-GEODETIC OBSERVATORY IN JOZEFOSLAW

STUDIES ON DEFORMATION OF THE EARTH CRUST

ET26
FG5 230

Calibration
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;
- Development of GPS ppp technology for geophysics, geodesy and navigation;
- Studies on improvement RTK GNSS technology using IP technology;
- Real time GNSS data processing.
ACKNOWLEDGEMENTS

Research are performed in the frame of statutory works and supported by the grant of the Ministry of Science and Higher Education SPUB: 134/E-365/SPUB/T12/031/2005. Special thanks to Professor Marcin Barlik for make the access to first FG-5 data and cooperation.
Thank you for attention