NATIONAL REPORT OF POLAND TO EUREF 2013

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Symposium of the IAG Subcommission for Europe
European Reference Frame – **EUREF 2013**
Budapest, Hungary, 29 - 31 May 2013

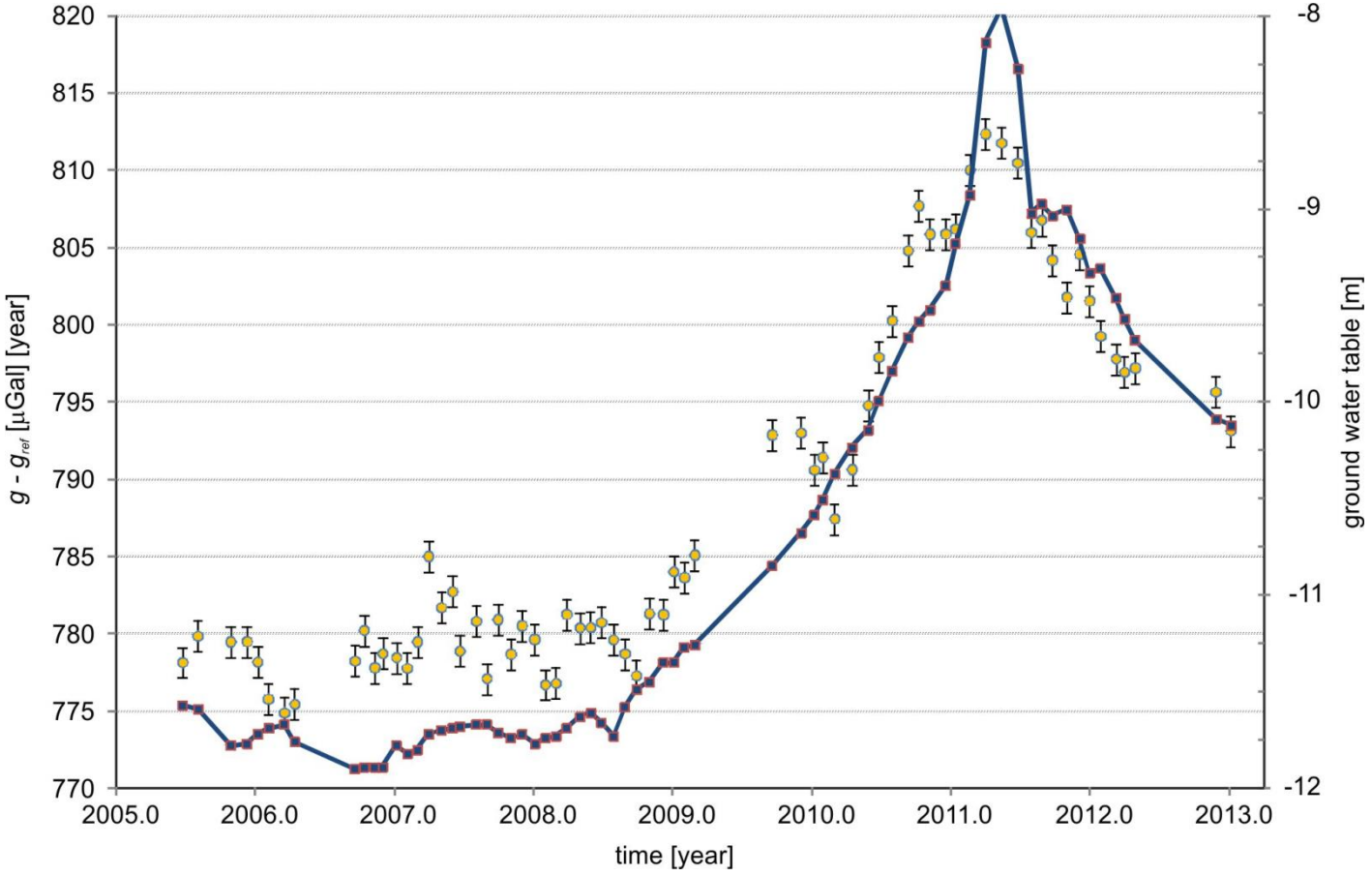
Main geodetic activities at the national level in Poland since 2011

- maintenance of the gravity control
- geodetic control
- vertical control
- operational work of permanent EPN/IGS stations
- data processing at Local Analysis Centres at WUT and MUT
- GNSS for meteorology
- monitoring of ionosphere
- status of the ASG-EUPOS network in Poland
- local GNSS networks in Poland
- the use of data from satellite gravity missions
- Earth tides monitoring
- activity in SLR
- geodynamics

Maintenance of national gravity control (1)

Jozefoslaw Astrogeodetic Observatory of WUT

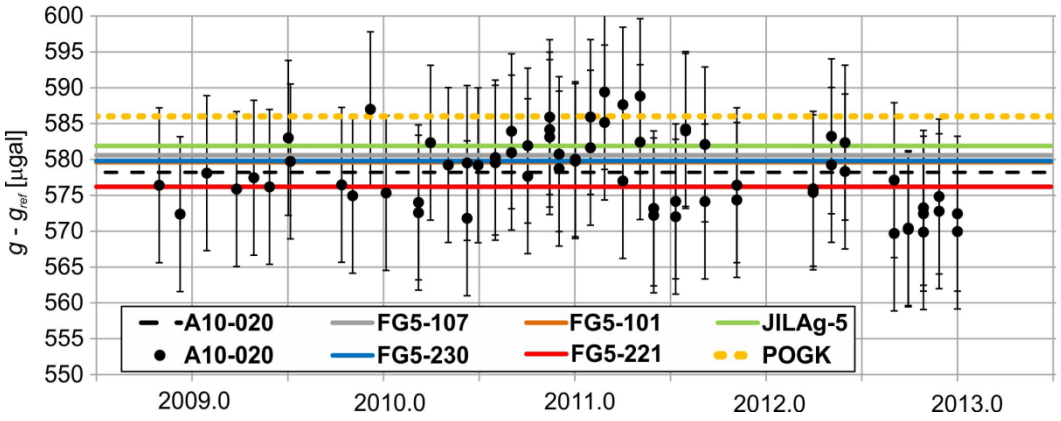
1. quasi-permanent absolute gravity measurements with FG5-230

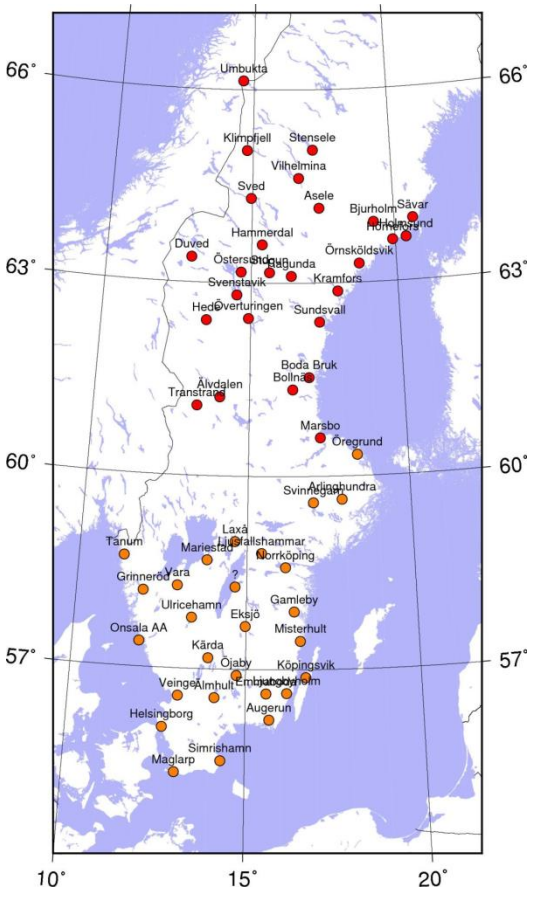


Maintenance of national gravity control (2)

Borowa Gora Geodetic-Geophysical Observatory of IGiK

1. quasi-permanent absolute gravity measurements with A10-020

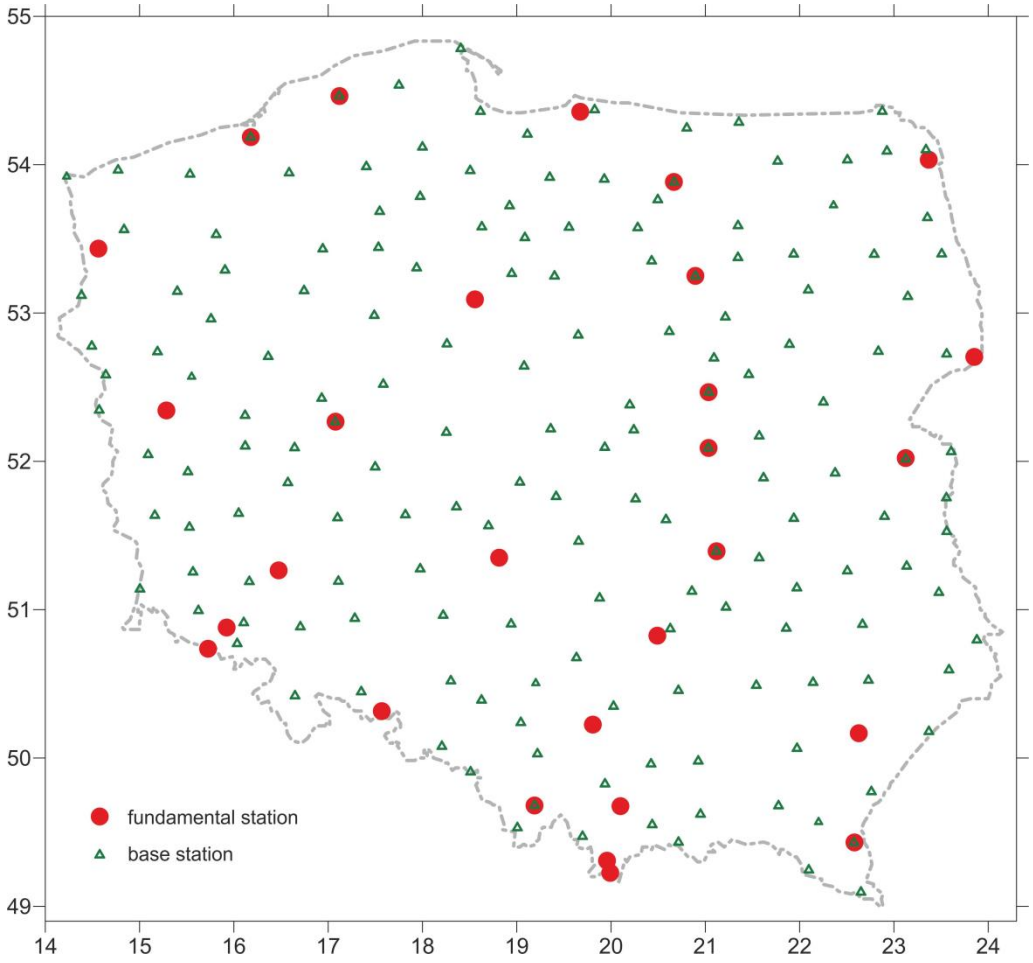




2. re-survey of the gravity network with A10-020 of IGiK in Sweden

Maintenance of national gravity control (3)

Modernization of the gravity control in Poland (WUT & IGiK) (2012-2014)



Project

Absolute gravity stations

27 – fundamental stations (FG5)

169 – base stations (A10)

87 – POGK

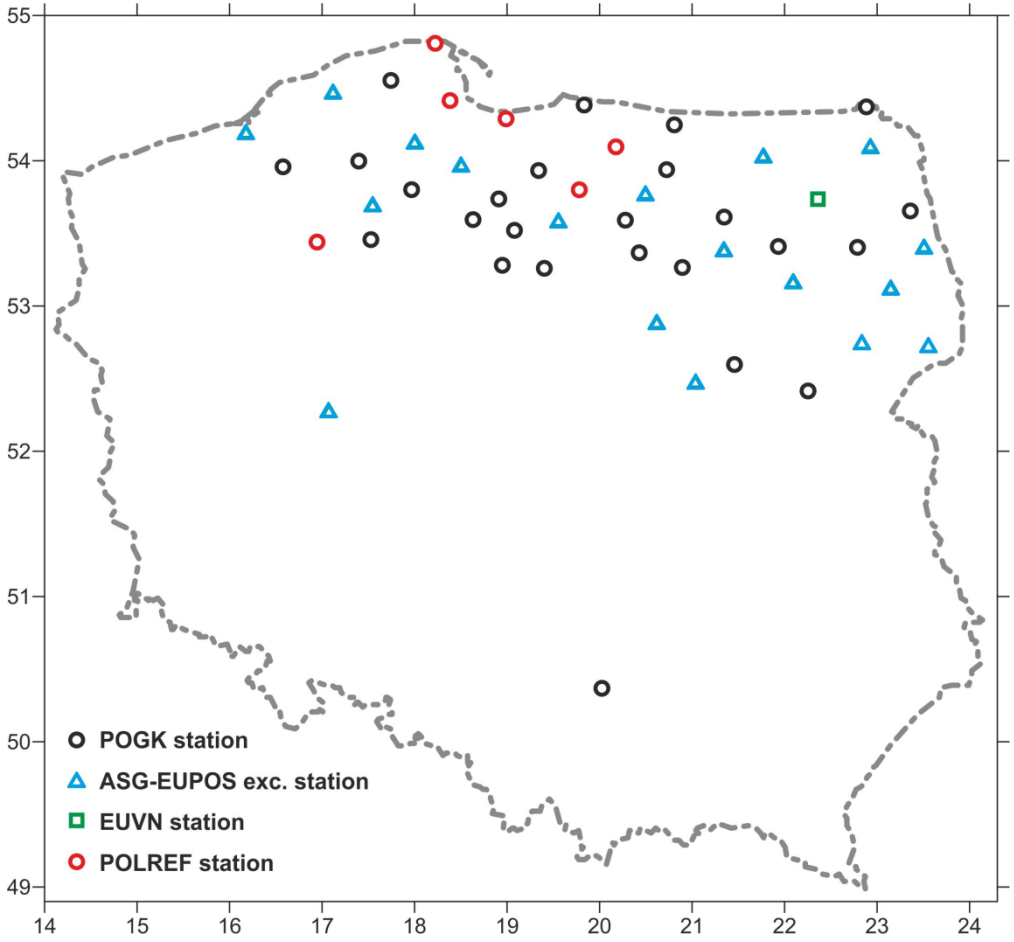
63 – ASG-EUPOS (exc)

9 – POLREF

5 – EUVN

Maintenance of national gravity control (4)

Modernization of the gravity control in Poland (IGiK) (2012-2014)



Realization in 2012

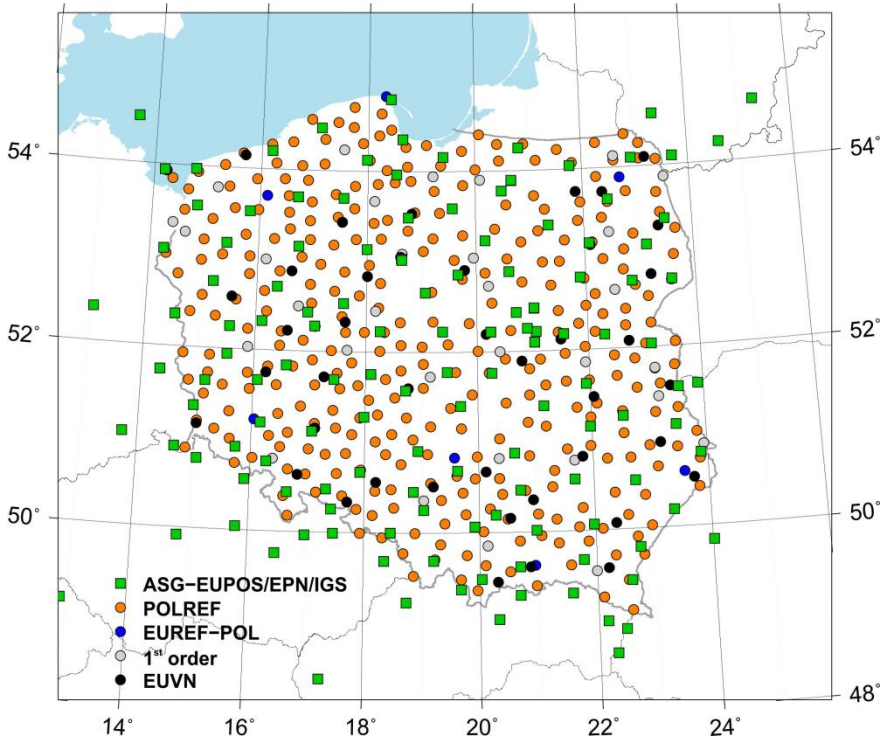
Absolute gravity stations

50 – base stations (A10-020)

50 – vertical gravity gradients

Geodetic control (1)

New reference datum for national permanent station network ASG-EUPOS (Head Office of Geodesy and Cartography)



Integration

of the
ASG-EUPOS reference station network
with
1st order geodetic control network
(including EUREF-POL, EUVN , and POLREF points)

- **GNSS data from almost 700 permanent or epoch stations (2008-2011)**
- **Bernese GPS software (WUT&SRC PAS)**
- **elevation masks: 5º and 10º**
- **final solution in ITRF2005 and ETRF2000 at epoch 2011.0**

Geodetic control (2)

New reference datum for national permanent station network ASG-EUPOS (Head Office of Geodesy and Cartography)

New reference frame

PL-ETRF2000 (epoch 2011.0)

has been introduced into the Polish technical standard (*Regulation of the Council of Ministers of 15 October 2012 on spatial reference system in Poland*)

Currently there are in use two realizations of ETRS89 in Poland

PL-ETRF2000 - recommended to be used in GNSS surveying with ASG-EUPOS corrections

EUREF89 - still be maintained in an interim period as reference for geodetic network

Geodetic control (3)

New reference datum for national permanent station network ASG-EUPOS (Head Office of Geodesy and Cartography)

Transformation parameters from ETRF89 (EUREF89) to PL-ETRF2000 on 2011.0 epoch

T_1 [cm]	T_2 [cm]	T_3 [cm]	R_1 ["]	R_2 ["]	R_3 ["]
-27.33 ±2.81	-37.49 ±2.85	22.37 ±2.03	0.01301 ±0.00086	-0.01048 ±0.00109	-0.00156 ±0.00083

Vertical control

New vertical datum in Poland
(Head Office of Geodesy and Cartography)

4th levelling campaign in Poland which started in 1998 has been finished

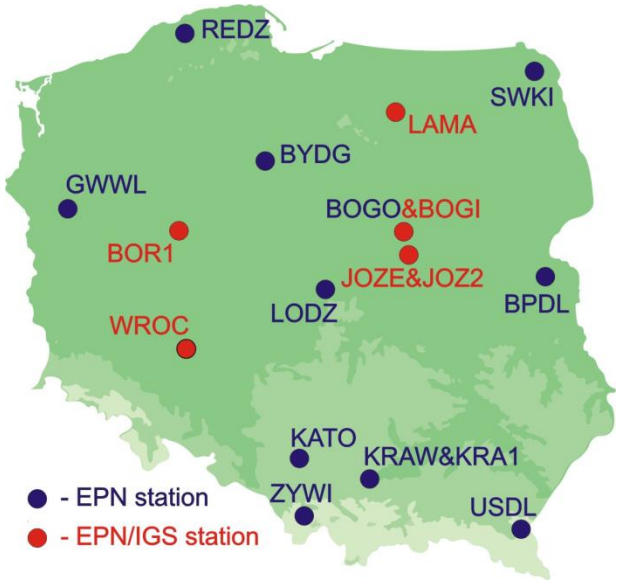
2003 - 1st order levelling network was completed
(16 226 benchmarks and 17 516 km of 382 levelling lines)
2012 - 2nd order levelling network was completed
(25 868 benchmarks over 17 930 km of levelling lines
and adjusted in Kronstadt2006 datum

Final adjustment of both networks will be performed in 2013
in EVRF2007-NH vertical datum
- the new vertical datum in Poland since 1 January 2014

Operational work of permanent GNSS IGS/EUREF stations

EPN stations in Poland

- Biala Podlaska (BPDL)
- Borowa Gora (BOGI)
- Borowa Gora (BOGO)
- Borowiec (BOR1)
- Bydgoszcz (BYDG)
- Gorzow Wielkopolski (GWWL)
- Jozefoslaw (JOZE)
- Jozefoslaw (JOZ2)
- Katowice (KATO)
- Krakow (KRAW)
- Krakow (KRA1)
- Lamkowko (LAMA)
- Lodz (LODZ)
- Redzikowo (REDZ)
- Suwalki (SWKI)
- Ustrzyki Dolne (USDL)
- Wroclaw (WROC)
- Zywiec (ZYWI)



EPN Stations participating in EUREF-IP

- ♥ BOGI
- ♥ BOR1
- ♥ JOZ2
- ♥ KRA1
- ♥ KRAW
- ♥ LAMA
- ♥ WROC

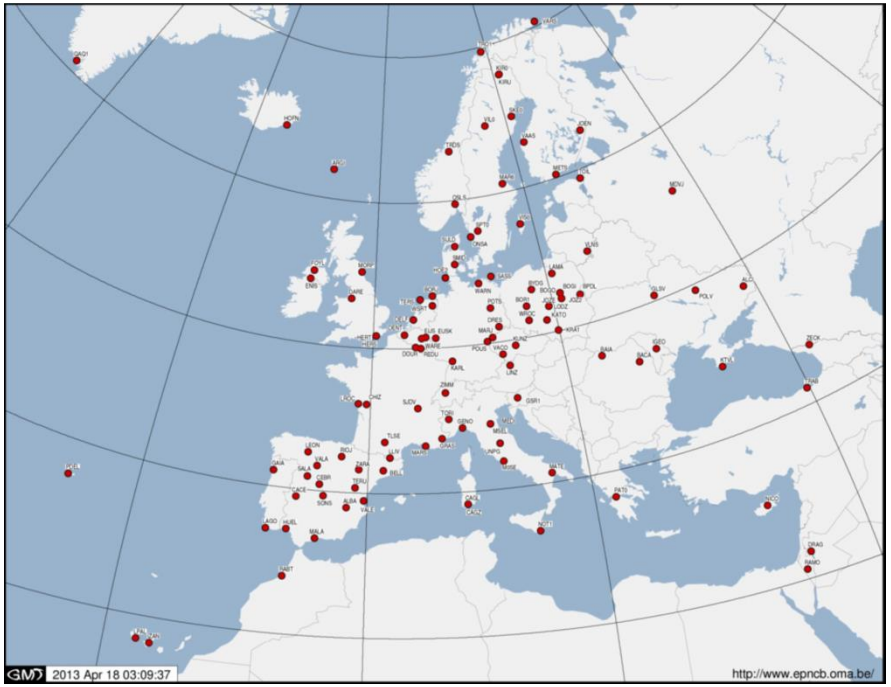
Data processing at LACs

WUT

data from 79 EPN stations routinely processed

MUT

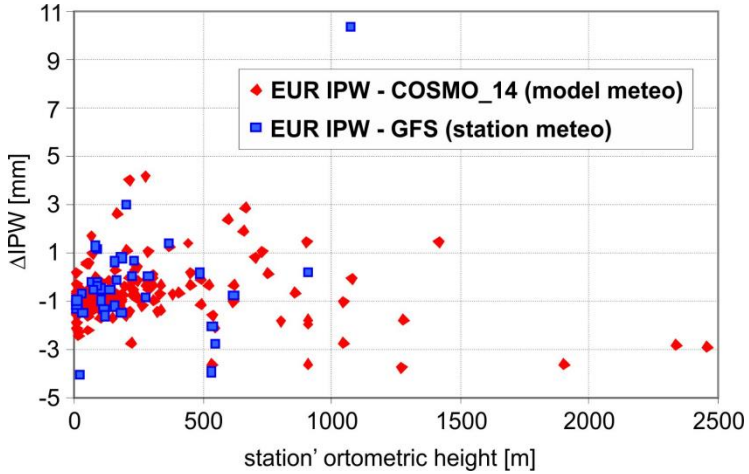
data from 117 EPN stations routinely processed

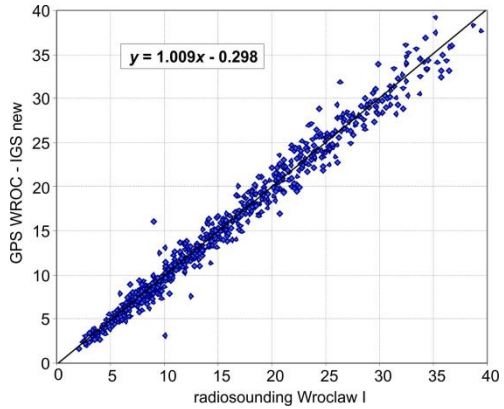


GNSS for meteorology (1)

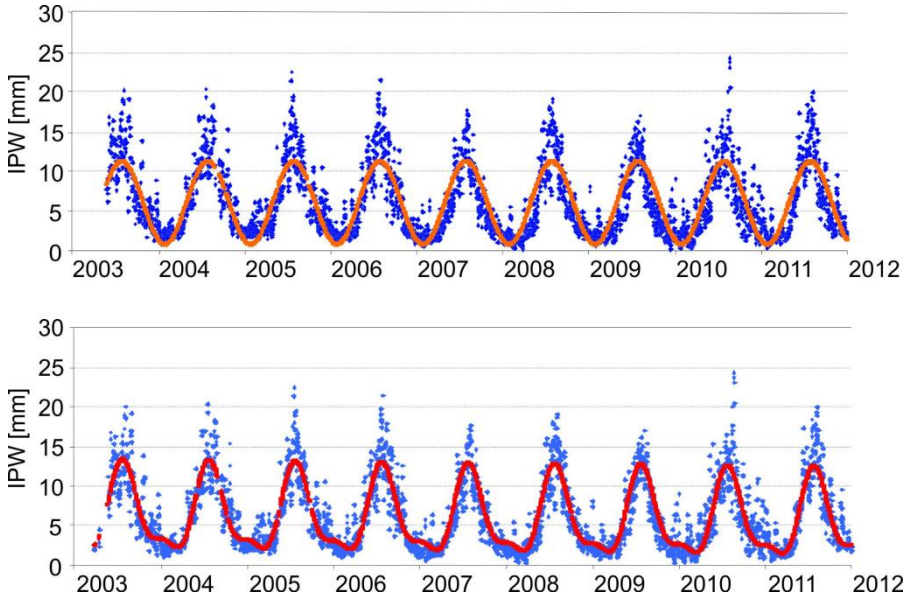
WUT

1. ZTD form WUT LAC solutions
2. IPW from GNSS, NWP and radiosounding





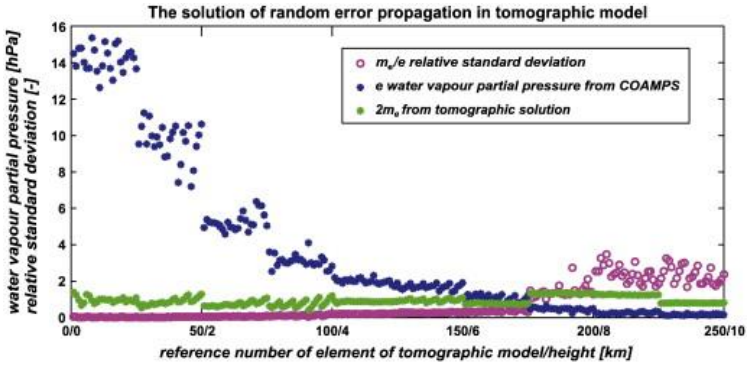
IPW model for THU2 from IGS tropospheric product

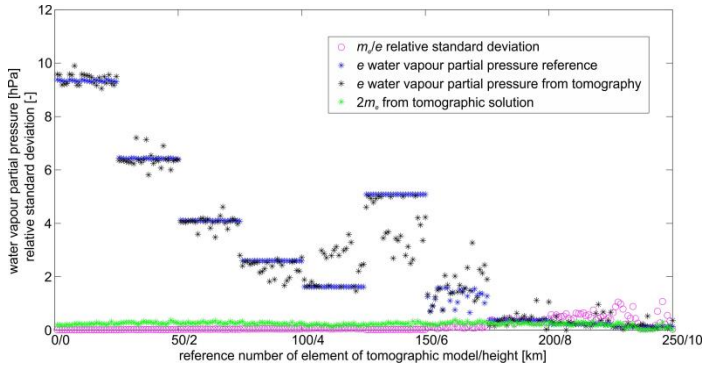


GNSS for meteorology (2)

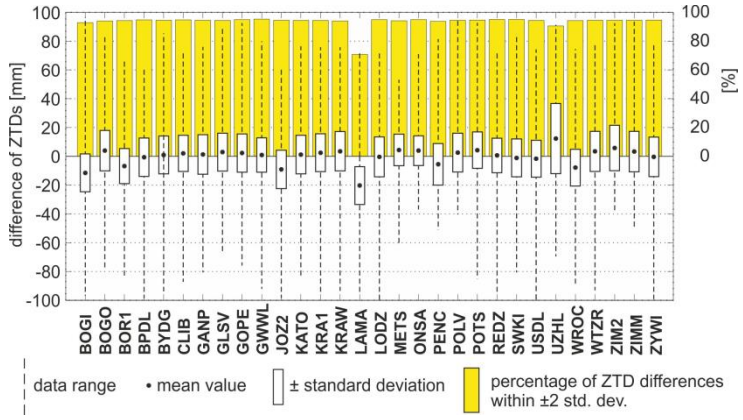
Wroclaw Univ. of Envir. & Life Sciences

GNSS tomography model - NRT IWP

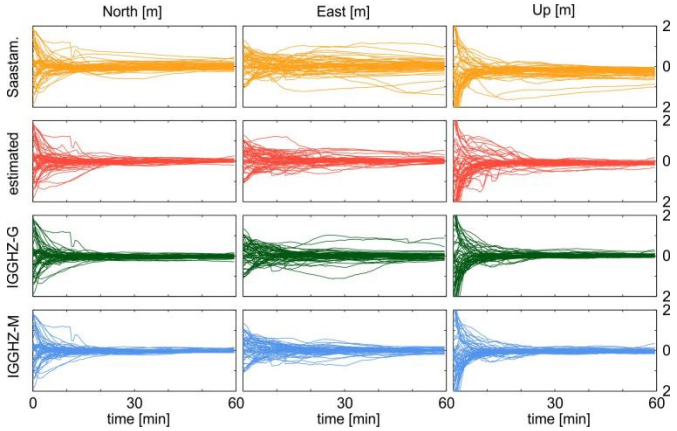




NRT ZTD estimation service



PPP in various scenarios of trop. est.



GNSS for meteorology (3)

University of Warmia and Mazury, Olsztyn

1. Accuracy analysis of two near real-time tropospheric delay estimation models IGGHZG and IGGHZM in fast-static precise positioning (*evaluation by comparison with tropospheric Zenith Total Delays obtained from ASG-EUPOS network final solution and UNB3m model*)

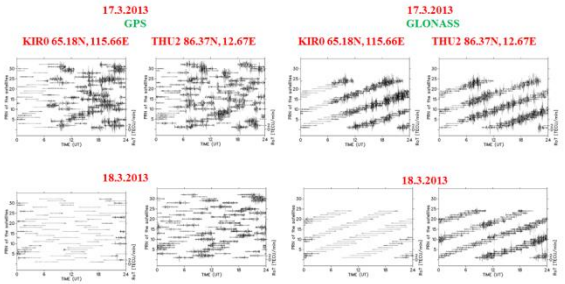
Monitoring ionosphere

University of Warmia and Mazury, Olsztyn

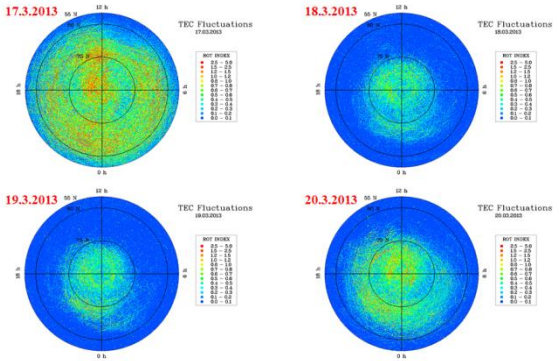
1. Study of dynamics of latitudinal profiles and structure of mid- and high-latitude ionosphere with the use of GPS/GLONASS observations from about 200 stations of IGS, EPN and POLENET networks

- **analysis of the application of the ground-based GNSS observations to create maps of the electron concentration variability at high latitudes of the northern hemisphere**

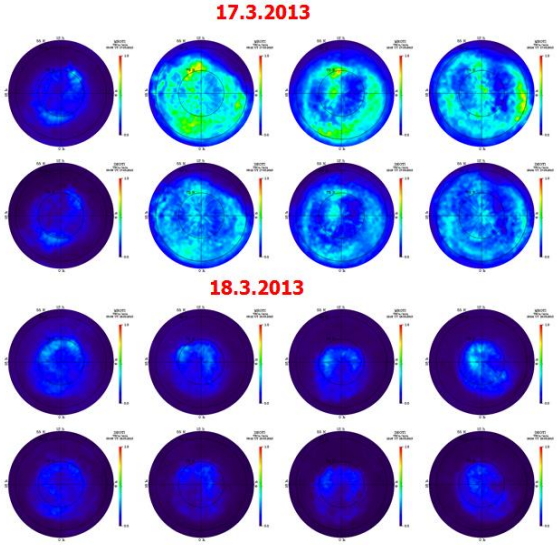
Changes of ROT



Daily maps of ROTI index



Subdaily maps of MROTI and DROTI



ASG-EUPOS network in Poland

Head Office of Geodesy and Cartography

Reference stations of ASG-EUPOS network

- **100 of the Polish part**
- **22 foreign**

- **upgrade**
- **4 new stations tested**
- **3 stations replaced**

- **ETRF2000 coordinates since 1 May 2012**

- **free of charge services**

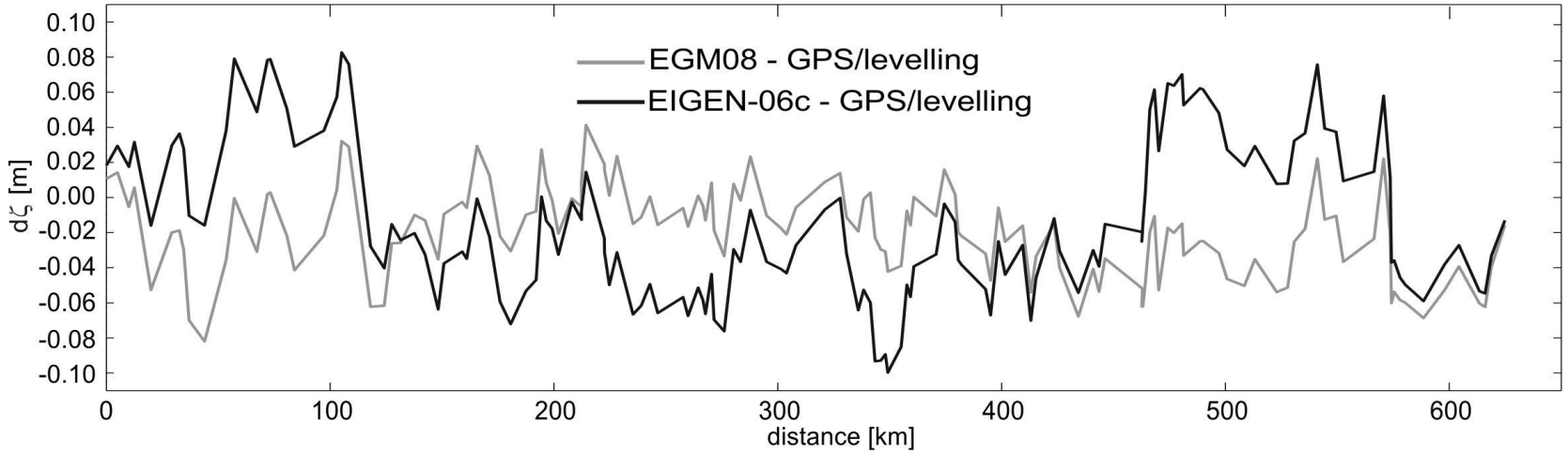
- **growing number of regular users (>8500)**
- **RTK service most popular (up to 700 simult. conn.)**

Use of data from satellite gravity mission

Institute of Geodesy and Cartography, Warsaw

- **analysis of temporal variations of the gravity field over Europe from GRACE data in terms of geoid height and mass variation**

- **accuracy assessment of the 3rd release of GOCE GGMs**



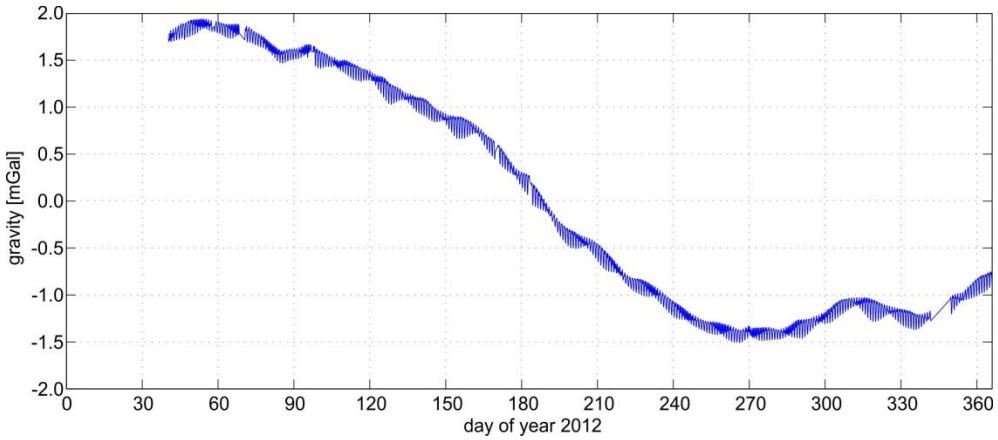
Earth tides monitoring

Jozefoslaw Astrogeodetic Observatory of WUT

- **gravity record using LCR ET-26 gravimeter since January 2002**
  - **analysis of tidal record**

Borowa Gora Geodetic-Geophysical Observatory of IGiK

- **gravity record using LCR G gravimeter since January 2010**
  - **analysis of tidal record**



Satellite Laser Ranging

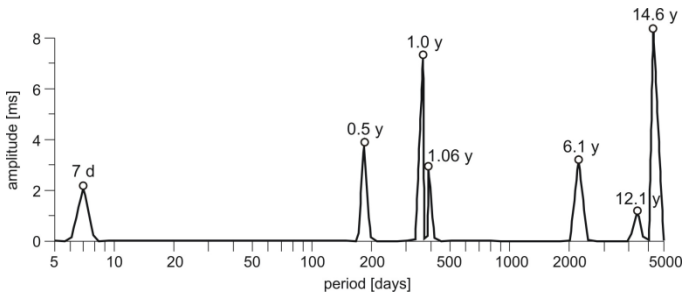
SRC PAS Borowiec station operates within ILRS and EURULAS

- **no SLR observations in 2012 – laser damage**
- **analysis of SLR data**
  - **quality estimate of reference frames**
  - **acuracy estimate of SLR data**
  - **satellite orbit analysis**

Geodynamics (1)

Institute of Geodesy and Cartography, Warsaw

- complex spectral analysis of a long-standing rotational time data series from 1986.0-2010.6 based on astronomical observations conducted at Borowa Gora Observatory



WUT

- investigation of the influence of continental water storage on geodetic measurements
- evaluation of the effect of atmospheric loading using data from the ASG-EUPOS network
- investigation of the effects of direct gravitational and indirect deformation on the gravity networks

Geodynamics (2)

Research network GGOS-PL

- established in 2011
- integrates research activity of 8 Polish observatories
- joint research projects and joint activities to raise standards and services
- cooperation with national and international research institutions involved in monitoring the Earth and its environment