National Report of Poland

T. Liwosz[1], P. Dykowski[2]

[1]Warsaw University of Technology, Poland
[2]Institute of Geodesy and Cartography, Poland

EUREF Symposium 2023

Gothenburg, Sweden, May 23–26, 2023

Institutions providing contribution to the report

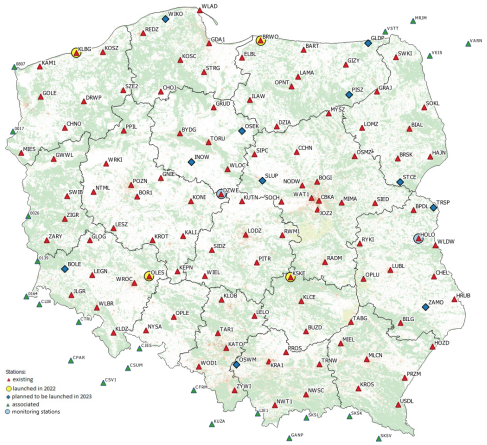
The report presents the geodetic activities of the following Polish institutions during the last year:

- Head Office of Geodesy and Cartography (GUGiK)
- Institute of Geodesy and Cartography (IGiK)
- Military University of Technology (MUT)
- Space Research Centre of the Polish Academy of Sciences (SRC)
- University of Warmia and Mazury in Olsztyn (UWM)
- Warsaw University of Technology (WUT)
- Wroclaw University of Life Sciences (WUELS)

ASG-EUPOS – Polish national GNSS permanent network

Head Office of Geodesy and Cartography

- Presently ASG-EUPOS network consists of 107 GNSS stations
  - 4 new GNSS stations installed in 2022
- Further densfication in progress to increase availability and accuracy of real time services:
  - 11 additionas stations planned for 2023
- Since October 2, 2022 all services are provided free of charge
- Modernization of IT infrastructure to provide access to more users and connection streams



Vertical network

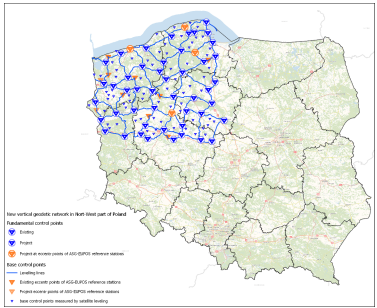
Head Office of Geodesy and Cartography (GUGiK)

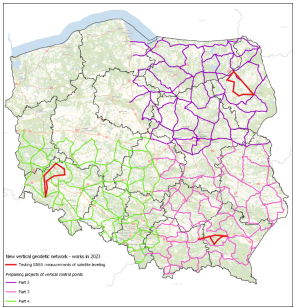
Vertical network

GUGiK continued preparatory works for the new levelling campaign in Poland.

- In 2022 the design of the campaign was completed for 25% of the area of Poland: 87 levelling lines (3217 case control points), 51 nods with additional 71 control points (dedicated for GNSS measurements)
- ASG-EUPOS eccentric stations included as nodal points
- The designing work for the remaining part of Poland to be completed in 2023

2022





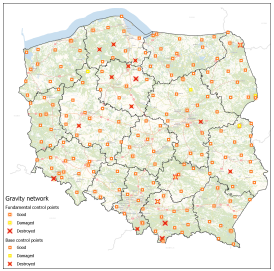
2023

Maintenance of gravity control network

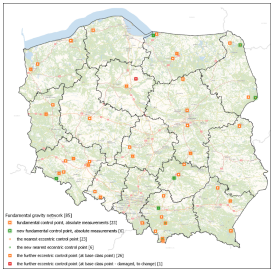
Head Office of Geodesy and Cartography (GUGiK)

Gravity

- In 2022, the gravity control network in Poland was examined in the field by WUT (at the request of GUGiK).
  - 6 new fundamental and 1 base gravity control points established
- Remeasurement of the entire fundamental gravity control network planned in 2023



Gravity control network review



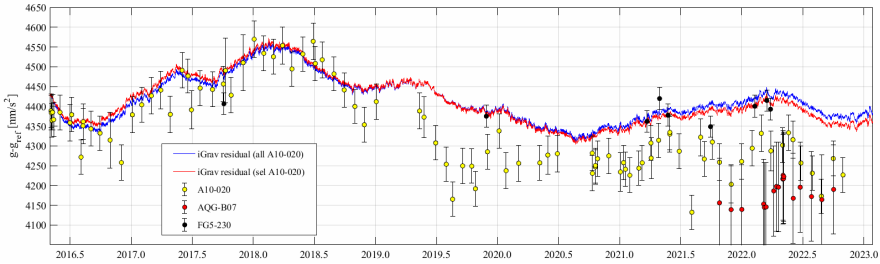
Measurement plan 2023

Gravity reference value in Poland

Institute of Geodesy and Cartography (IGiK), Warsaw University of Technology (WUT)

Gravity

- Maintenance of gravity reference value continued in Borowa Gora Geodetic-Geophysical Observatory
  - Gravity determinations with A10-020 (IGiK) and FG5-230 (WUT) absolute gravimeters along with continuous gravity records with iGrav-027 superconducting gravimeter
  - First promising results with AQG-B07 absolute quantum gravimeter (IGiK)
- Validation of all 3 absolute gravimeters from Poland at NKG-CAG absolute gravimeter comparison in Onsala, Sweden in 2022



Maintenance of magnetic control network

Head Office of Geodesy and Cartography (GUGiK), Institute of Geodesy and Cartography (IGiK)

Magnetic control network

In 2022, the maintenance works were also performed on magnetic control network by IGiK (at the request of GUGiK):

- four new fundamental magnetic control points were established and the components of magnetic field were measured on these stations
- eccentric fundamental control points were examined as well

Activities related to EPN GNSS analysis

- Two EPN Analysis Centres continued regular processing of GNSS EPN data:
  1. Military University of Technology (**MUT**) (final and rapid solutions, 159 EPN stations)
  2. Warsaw University of Technology (**WUT**) (final and rapid solutions, 153 EPN stations)
- During the last several months the activities concerned also the switch to the IGS20 reference frame.

WUT and MUT also continued work as the EPN Analysis Combination Centre. The tasks of the ACC were:

- preparations for the switch to the IGS20 in EPN analysis
- combination and analysis of EPN AC solutions
- maintaining ACC web site

Selected scientific research areas in Poland in 2022/2023

Wroclaw University of Life Sciences (WUELS):

- Potential usage of GNSS for the terrestrial reference frame scale realization
- GNSS orbit modelling
  - combination of SLR and GNSS data for the improvement of orbit determination
  - study of general relativity effects acting on GNSS satellites
  - study on the orbital signals in GNSS time series and their mitigation (e.g., by multi-GNSS combination)
- Improvement in troposphere modelling (estimation of troposphere biases) for SLR observations
  - improvement of SLR solutions, e.g., better repeatability of SLR station coordinates

Selected scientific research areas in Poland in 2022/2023

University of Warmia and Mazury, Olsztyn (UWM):

- Improvement of the Modified Ambiguity Function Approach (MAFA) method (developed at the UWM) for the ambiguity resolution
  - e.g., optimization of the search step; increasing the performance of the method in fast GNSS relative positioning
- GNSS-based studies of the ionosphere
  - monitoring of the ionosphere at high altitudes
  - developing algorithm to provide more detailed picture of plasma irregularities (using ROTI and relative STEC parameters)
  - the impact of ionosphere irregulartities on precise GNSS positioning

Warsaw University of Technology (WUT):

- Advanced methods for GNSS positioning
  - analysis of the measurement noise of GNSS observations

Military University of Technology (MUT):

- Determination of strain rates and stress for Poland

Other activities

Other geodetic and scientific activities in Poland in 2022 included:

- operational work of EPN/IGS permanent stations
- operational work at satellite laser ranging station (BORL) in Borowiec
- positioning using smartphones and low-cost GNSS receivers (UWM)
- monitoring of troposphere (UWM)
- modelling precise geoid (WUELS)
- the use of data from satellite gravity missions (IGiK)

The full report describing geodetic and scientific activities in Poland will be also available in written form.