EPOS – European Plate Observing System

Research Infrastructure EPOS-PL

**Build in framework of
EPOS – European Plate Observing System
Co-financed under Action 4.2: Development of modern research
infrastructure of the science sector in the Operational Program Smart
Growth**

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EPOS- European Plate Observing System
POIR.04.02.00-14-A0003/16

Priority IV: **INCREASING THE RESEARCH POTENTIAL**
Action 4.2: **DEVELOPMENT OF MODERN RESEARCH INFRASTRUCTURE OF THE SCIENCE SECTOR**

Period of realization: 2016 - 2021
Project value: 62 558 323,87 PLN
ERDF co-financing: 47 399 281,47 PLN

Beneficiary:

**Instytut Geofizyki
Polskiej Akademii Nauk**

Konsortium members:

EPOS-PL Consortium members

Institute of Geophysics, Polish Academy of Sciences, IG PAS

Academic Computer Centre *CYFRONET* AGH University of Science and Technology , ACC Cyfronet AGH

Central Mining Institute, CMI

Institute of Geodesy and Cartography, IGC

Wrocław University of Environmental and Life Sciences, WUELS

Military University of Technology, MUT

Polska Grupa Górnicza SA , PGG [Polish Mining Group]

Research Infrastructure EPOS-PL

European Plate Observing System (EPOS)
Infrastructure is an interdisciplinary and interoperable research infrastructure which gathers data from measurement networks scattered all around the Europe. Processed, standardized and integrated data is stored in databases connected with web portals, where the data can be visualized and analyzed with the use of dedicated applications and visualizations.

EPOS programme

The EPOS programme is the largest Europe's infrastructural project in the Earth Sciences.

EPOS mission is to integrate the diverse and advanced European Research Infrastructures for solid Earth science, and build on new e-science opportunities to monitor and understand the dynamic and complex solid-Earth System. EPOS will identify existing gaps and promote implementation plans with environmental, marine and space science to help solve the grand challenges facing the Earth and its inhabitants.

The European EPOS programme was planned until 2040. Currently, from 2015 to 2019, it has its third stage, the Implementation Phase (EPOS-IP). EPOS-IP project "European Plate Observing System Implementation Phase" (financed under Horizon 2020)
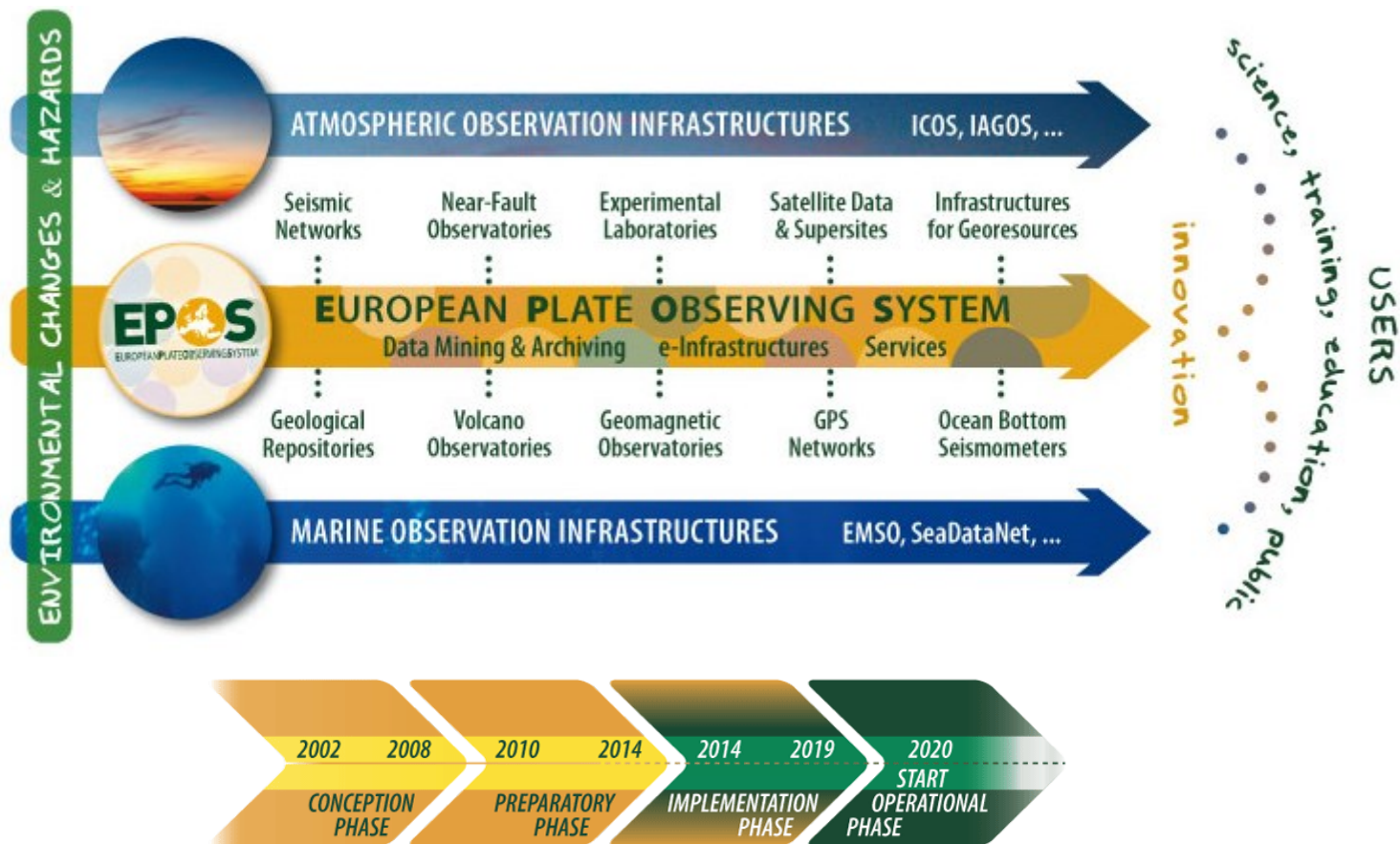
Program EPOS

EPOS Architecture
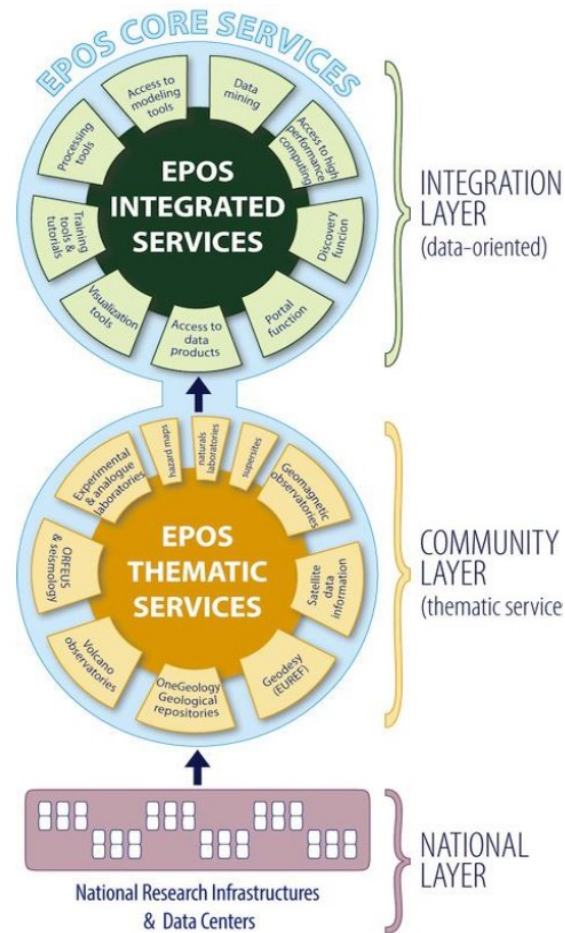
The Integrated Core Services (ICS) represent the novel e-infrastructure that will allow access to multidisciplinary data, products (including synthetic data from simulations, processing and visualization tools), and services to different stakeholders, including but not limited to the scientific community (i.e., users).

The Thematic Core Services (TCS) are the community-specific integration (e.g., seismology, volcanology, geodesy, experimental laboratories, etc). They represent transnational governance frameworks where data and services are provided to answer scientific questions and where each community discusses their specific implementation. IGF PAS coordinates the Thematic Core Service of Anthropogenic Hazard (TCS-AH) under the EPOS-IP project.

The **National Research Infrastructures (NRIs)** represent the underpinning EPOS data providers that will guarantee access to quality-checked data and products. Financing entirely from national funds.

IS-EPOS

During 2013-2015 as part of the project

DIGITAL RESERCH SPACE OF INDUCED SEISMICITY FOR EPOS PURPOSES

Co-finansed from the funds of the European Regional Development Fund (ERDF) as part of the Operational Programme Innovative Economy (OP-IE) were apear :

Induced Seismicity Research Infrastructure Center

and

IS-EPOS Platform,
- In future, services of built TCS-AH under the EPOS program.

I layer – RI EPOS-PL

The first layer of RI is built by so called **Research Infrastructure Centers** (RICs).

- **CIBIS** – Induced Seismicity Research Infrastructure Center,   IG PAS, CMI, MUT

- **CIBOGM** - Geomagnetic and Magnetotelluric Observations
  Research Infrastructure Center,   IG PAS, IGC

- **CIBAL** - Analytical Laboratories Research Infrastructure Center,   IG PAS

- **CIBDG** - GNSS Data Research Infrastructure Center,   MUT, WUELS

- **CIBOG -** Gravimetric Observations Research Infrastructure Center,   IGC

- **CIBSBL -** Lithospheric Research Infrastructure Center,   IG PAS

- **GGOS-PL++** - Global Geodetic Observation System in Poland.   WUELS, IGC, CMI
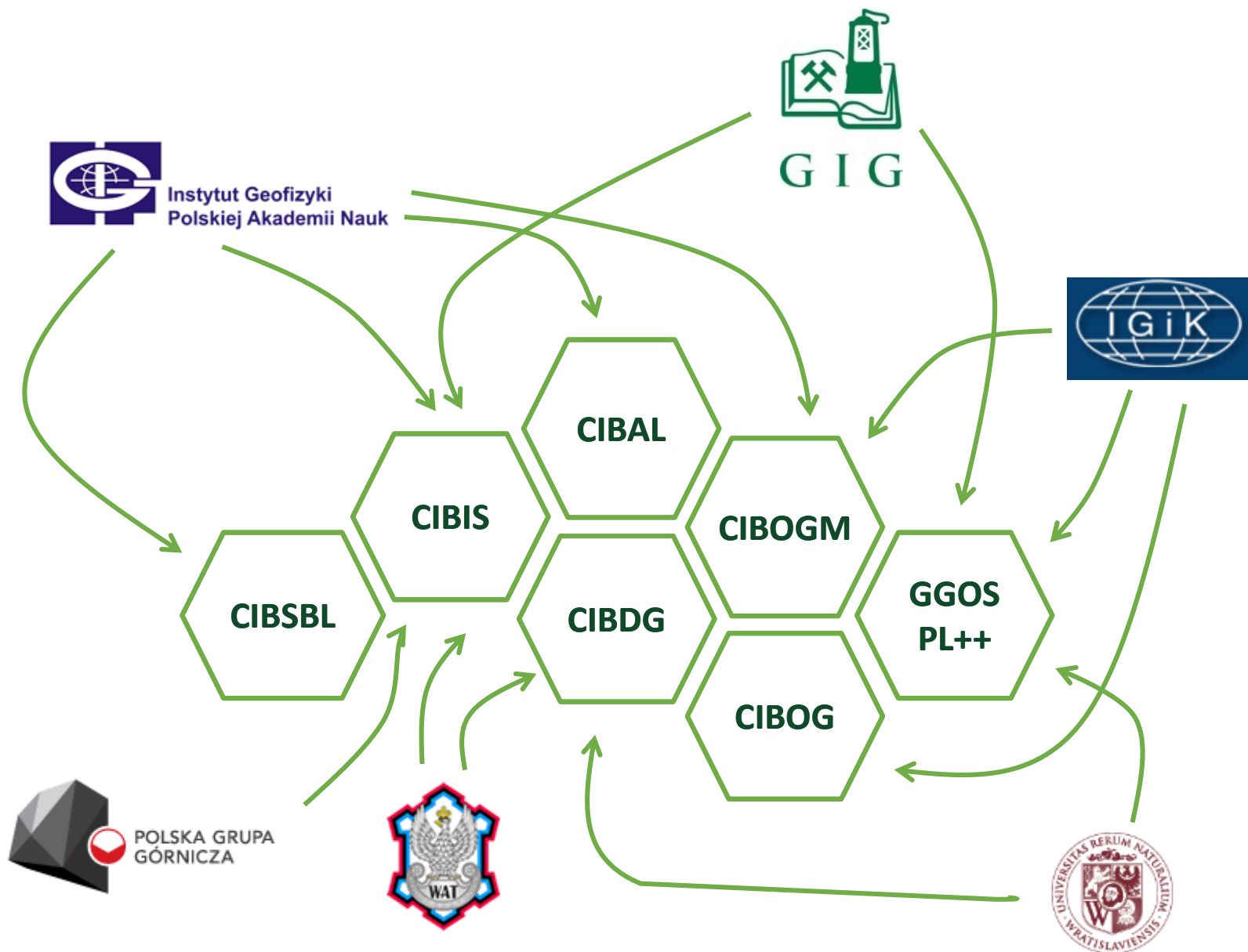
II layer – RI EPOS-PL

<u>Integration of infrastructure</u> in the scale of Poland.

Measurement polygons for the integrated observation of geodynamic processes are going to be built. The first polygons from the group of **MUSE - Multidisciplinary Upper Silesian Episode** will be built in mining and post-mining areas of Upper Silesian Coal Basin (Poland).

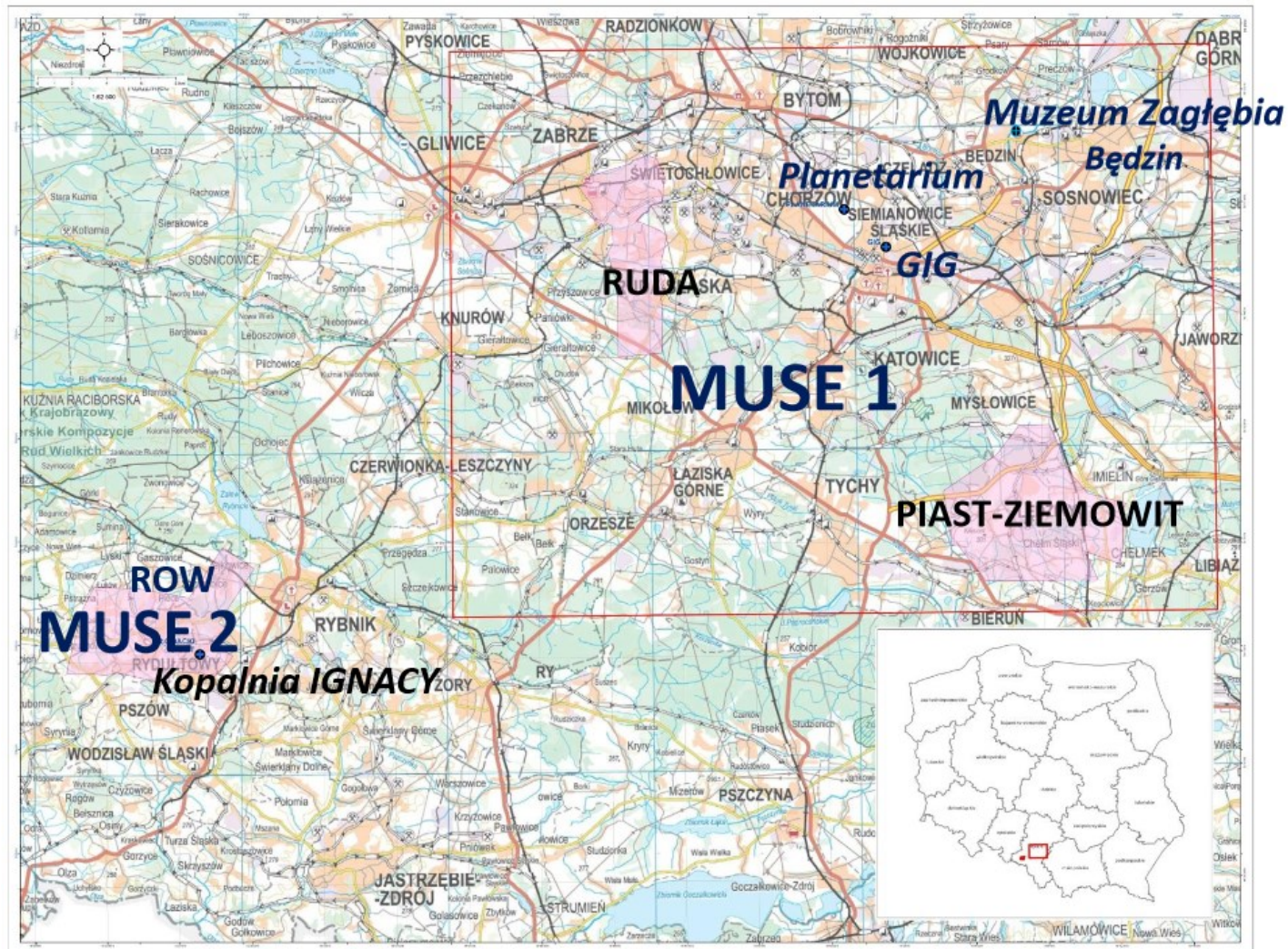Collected data and products will be integrated as a **MUSE** and shared through **IS-EPOS platform** (https://tcs.ah-epos.eu).

epos pl

MUSE polygons

MUSE 1 – observation and measurements

Post mine area of Upper Silesian Coal Basin (Poland):

- Tidal gPhone gravimete
- Epoch gravimetric measurements
- GNSS receivers
- Satellite photo
- Regional geological model 3D
- Upper Silesian Seismological Net (development)
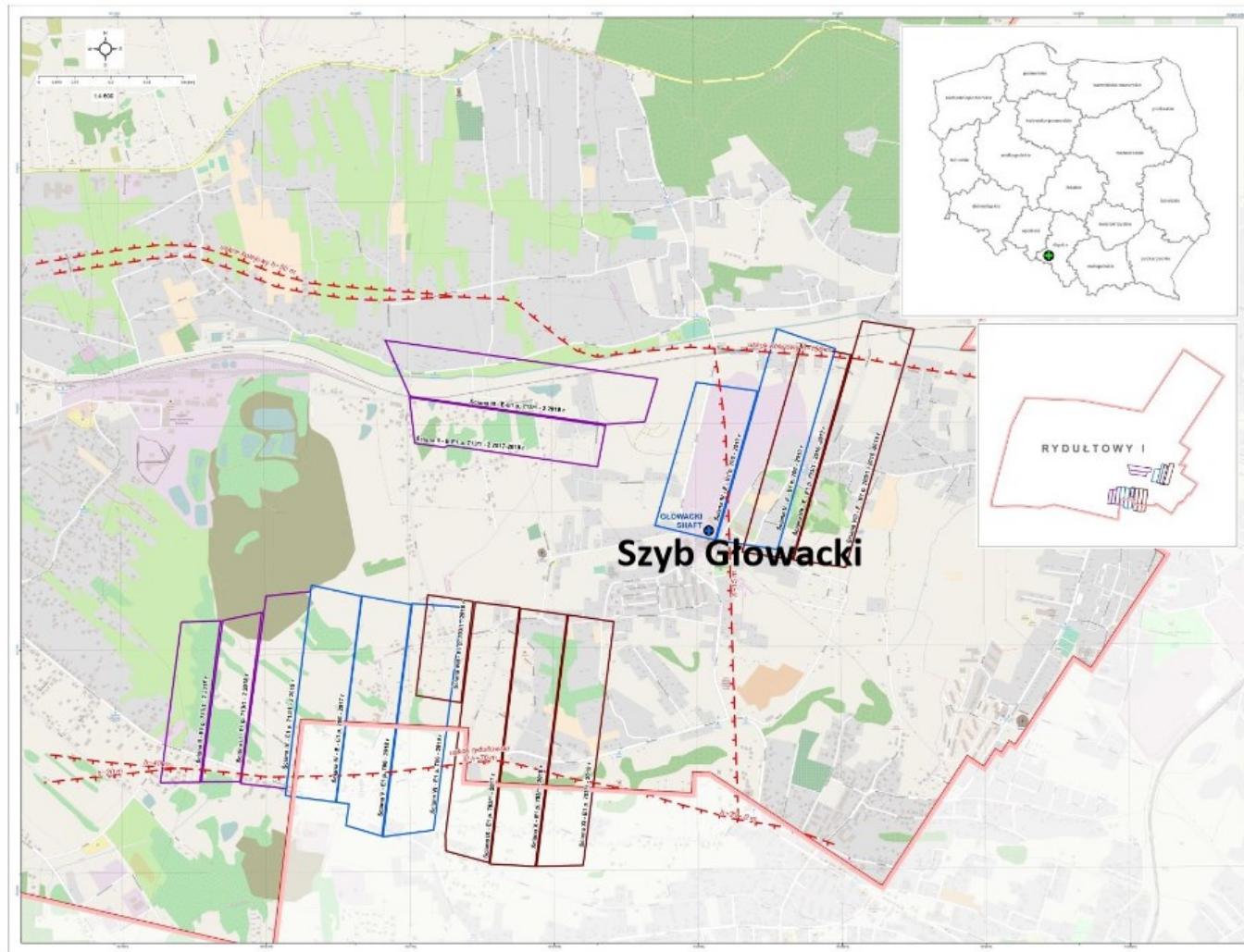
Mine areas

Ruda mine

- Mine underground seismic network SOS 64-128
- Mine underground underground network for stress measurement SOS-stress
- Numerical model - dynamics of blasting
- Geological-mining model 3D

Piast-Ziemowit mine

- stations for measuring the rotation effects
- Upper Silesian Seismological Net (development)
- Surface ground motion network
- Satellite photo
- Geological-mining model 3D

MUSE 2 – mine area – ROW mine

MUSE 2 - observation and measurements

Mine area – ROW mine
- Aerial laser scanning - terrestrial satellite photo
- Tidal gPhone gravimete
- Probes for measuring groundwater levels in boreholes
- **Periodic gravimetric, GNSS, radar and seismic measurements**
- Stations for measuring the rotation effects
- Seismic and geotechnical sensors at the boreholes near to fault
- Mine underground seismic network SOS 64-128
- Measurement of gaps in buildings
- Inclinometer
- Geological-mining model 3D

Periodic gravimetric, GNSS, radar and seismic measurements (1)

Bock Y., Prawirodirdjo L., Melbourne T. I. (2004), Detection of arbitrarily large dynamic ground motions with a dense high-rate GPS network, Geophys. Res. Lett.
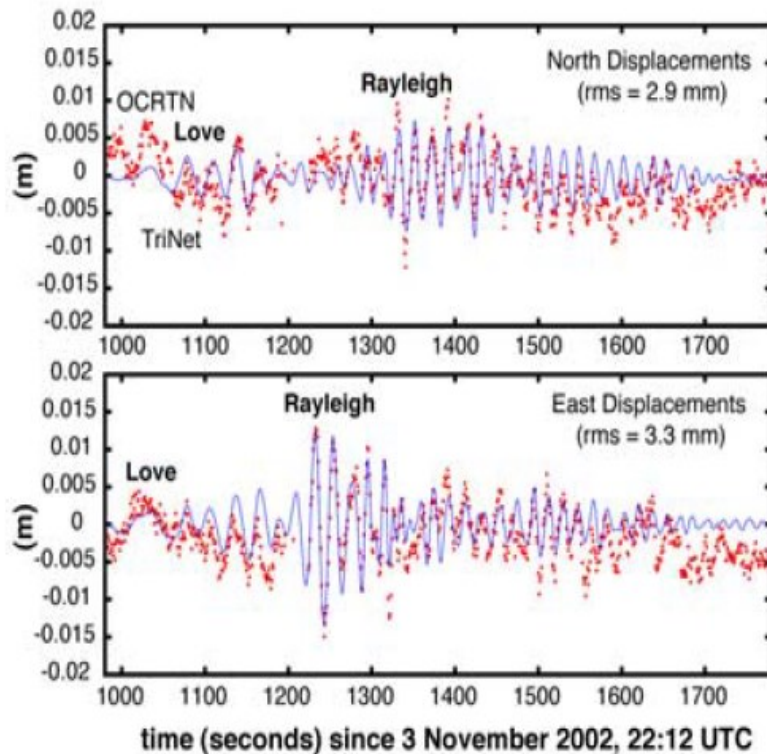
Przemieszczenia ze stacji OEOC
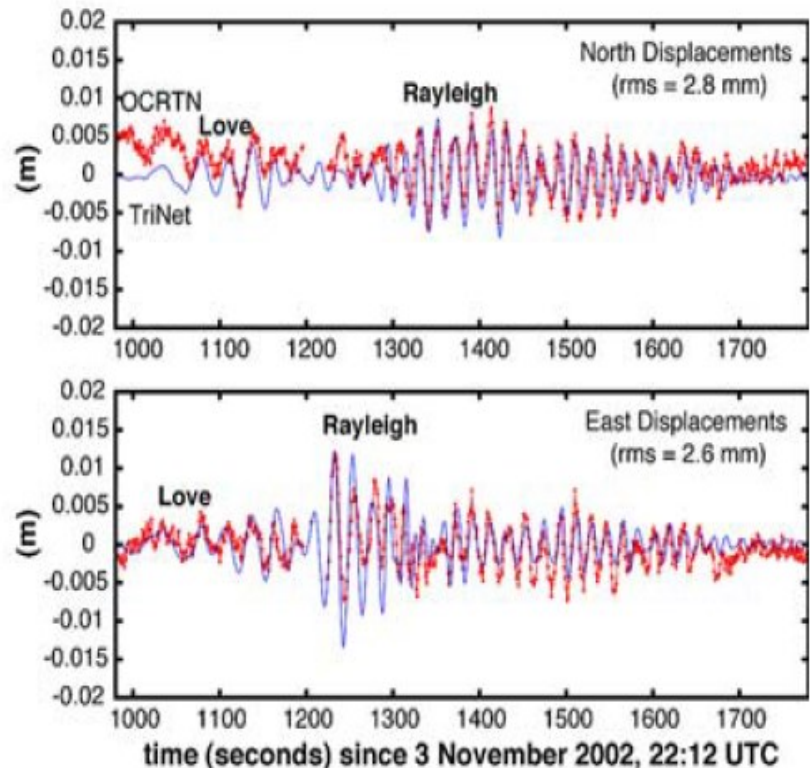
Przeliczone przemieszczenia
ze stacji FVPK, OEOC, SBCC

Comparison of N E displacement form GPS i seismometers – RMS ~3 mm

Periodic gravimetric, GNSS, radar and seismic measurements (1)

Analysis of timeseries of permament stations LEGN, GLOG and Rudna associated with mining tremor

- **Significant only in vertical direction**

- **Before tremor upthrust, after subsidence**

- **no horizontal displacement recoded,**

- **oscilation in horizontal direction**
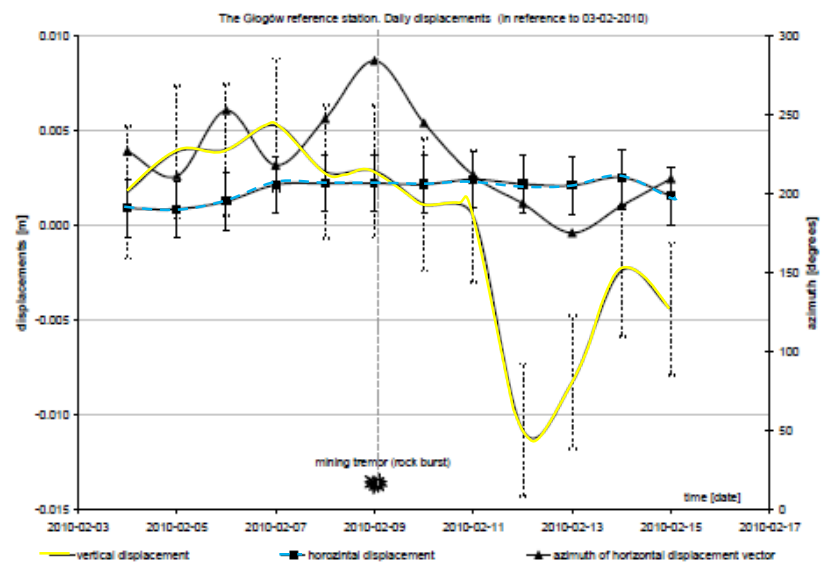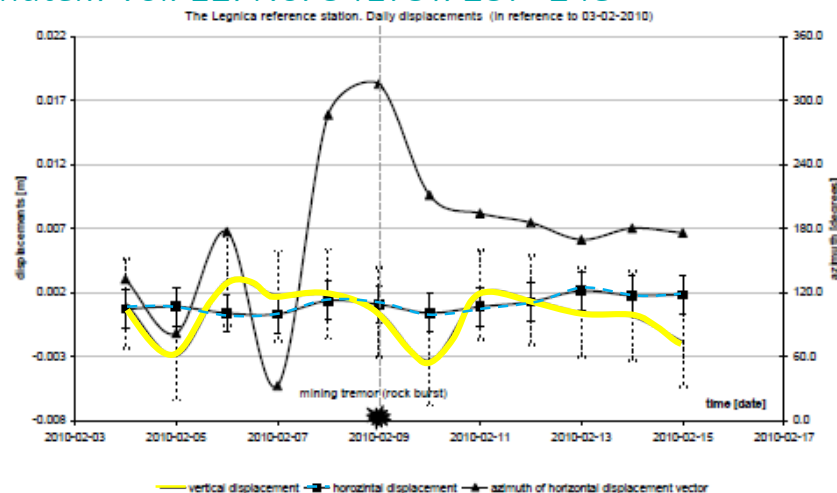
Layer III – IB EPOS-PL

Integration of infrastructure in the european scale.

National RI are being integrated in European scale, in so-called EPOS Thematic Core Servises**.**

In Poland is coordinated construction of the aforementioned **Thematic Core Services – Anthropogenic Hazard (TCS AH).**

Science-Research Platform

The main goal of the platform is to enable computational experiments.

- Private space (workspace) for conducting research / analysis and space for group work,

- The ability to manage the available data or private data,

- The ability to perform computational experiments - simple operations (eg. Visualizations or data conversions), as well as to enable submission of a wide variety of computing tasks in their complex strings,

- The ability to integrate their own applications and share them.

The platform will be based on existing solutions – new functionality of **IS-EPOS platform**

Access rules

- Research Infrastructure will be used mainly for scientific purposes (non-commercial). The access to build RI will be open and free for scientific community and academia.

- SME and institutional representatives will have paid access for the RI. The cost will depend on the amount of the data, software and other products shared for the integration and the roles of this users.

- The access rules to RI will be based on the user class.

Commercial access

For commercial use following elements of RI are foreseen, in particular:

- Access to the data and products,

- Access to services,

- Preparing analyses, expertise, research etc.

- Access to e-science web platform for data integration,

- Integration of the third party data and publishing it on the web platform,

- Integration of measurement results and techniques with data access on the web platform,

- Design of measurement networks and access to its results on the web platform.

In case of the last three points providing specialized software services or scientific analysis upon the collected data is also possible on demand. This service may cover single area of interest or multidisciplinary analysis following MUSE approach

Noncommercial access

- Research Infrastructure will be used mainly for <u>scientific purposes</u> (non-commercial).

- EPOS-PL RI will support the scientific research in various fields of Solid Earth (The Scientific Agenda).

- <u>The educational role</u> of the planned RI is also important.

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