National Report of the Czech Republic

Czech Office for Surveying, Mapping and Cadastre:

Land Survey Office,

Department of Geodetic Control

Research Institute of Geodesy, Topography and Cartography,

Geodetic Observatory Pecný

Administration of CZEPOS network

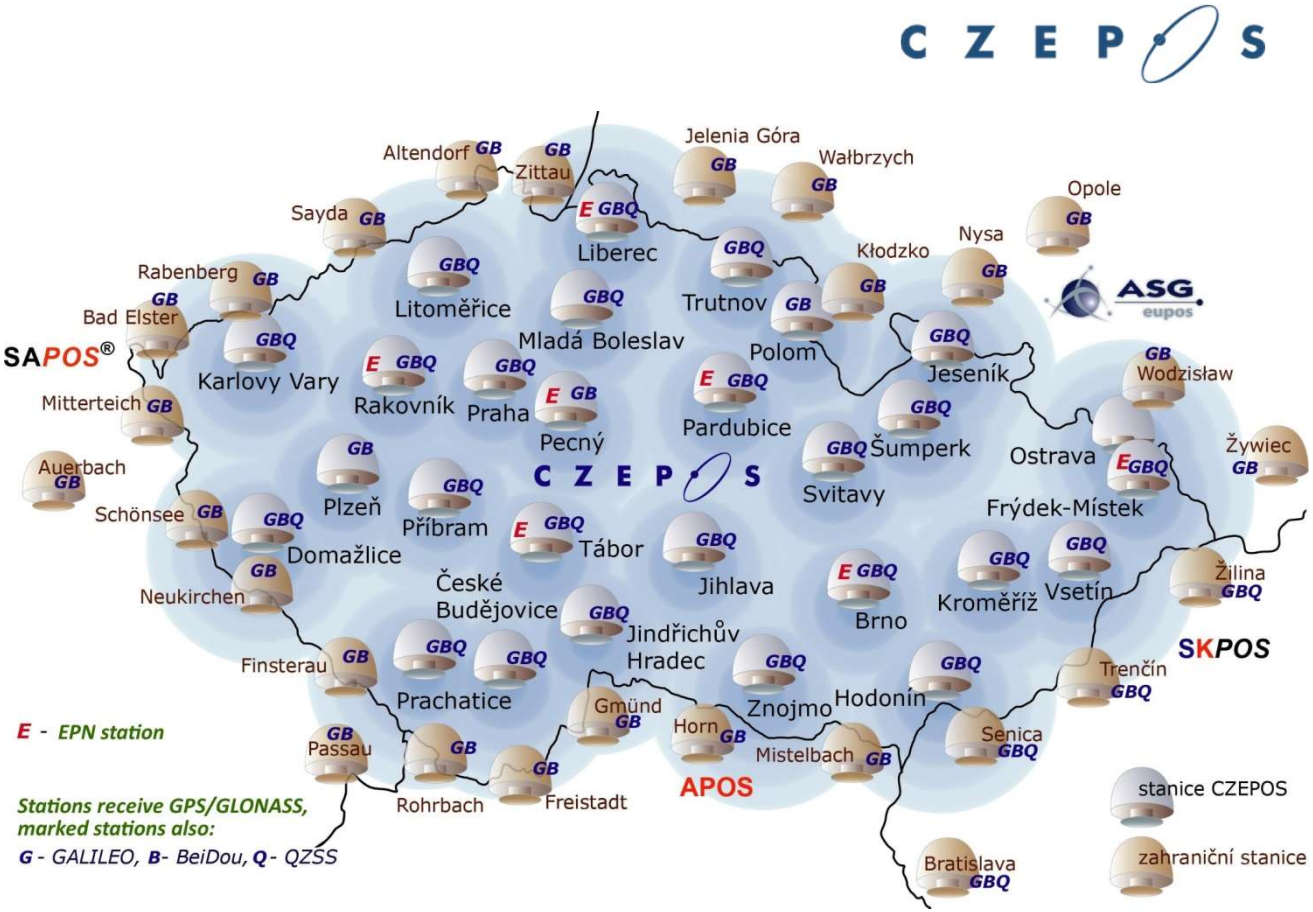
- 28 Czech stations
- 27 neighboring stations

- real-time services
- post-processing products
- GPS/GLONASS

since 2017
Galileo + BeiDou

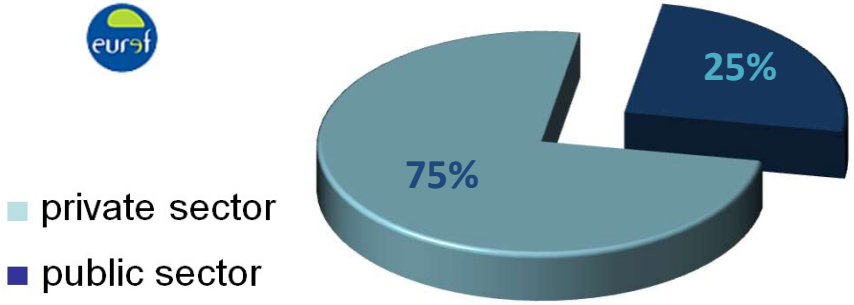
- 7 stations involved in EUREF - EPN
- cooperation within projects:

EUPOS, EPOS, GISCAD-OV



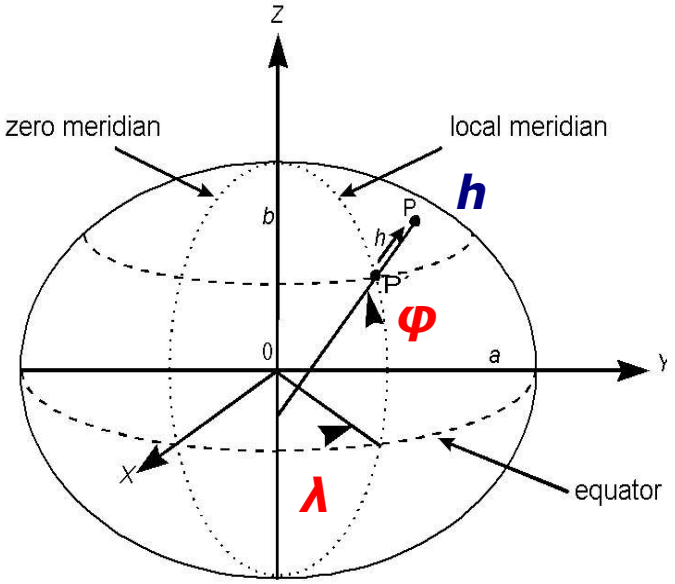
2021/04: 2065 users

since 2021 HxGN SmartNet

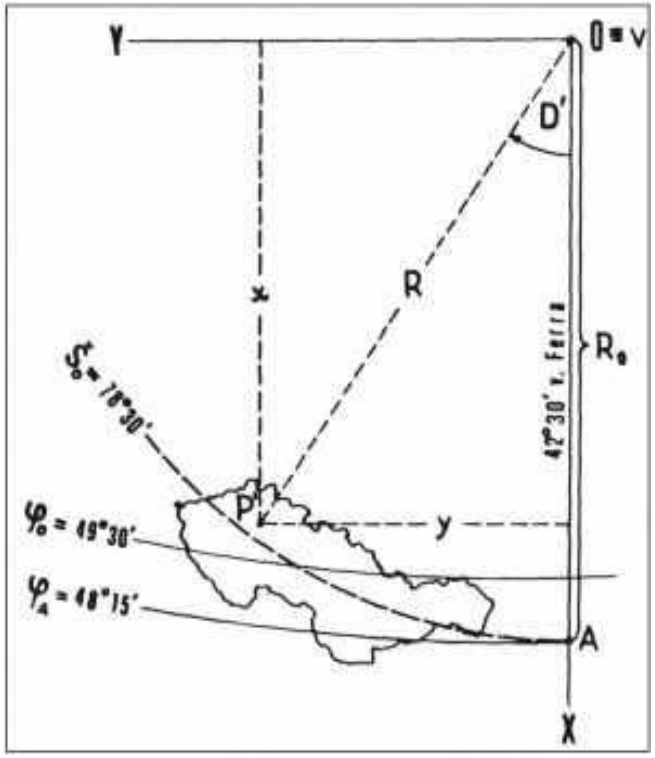


Reference Frames - Positional Transformation

European Terrestrial Reference System 1989 (ETRS89)

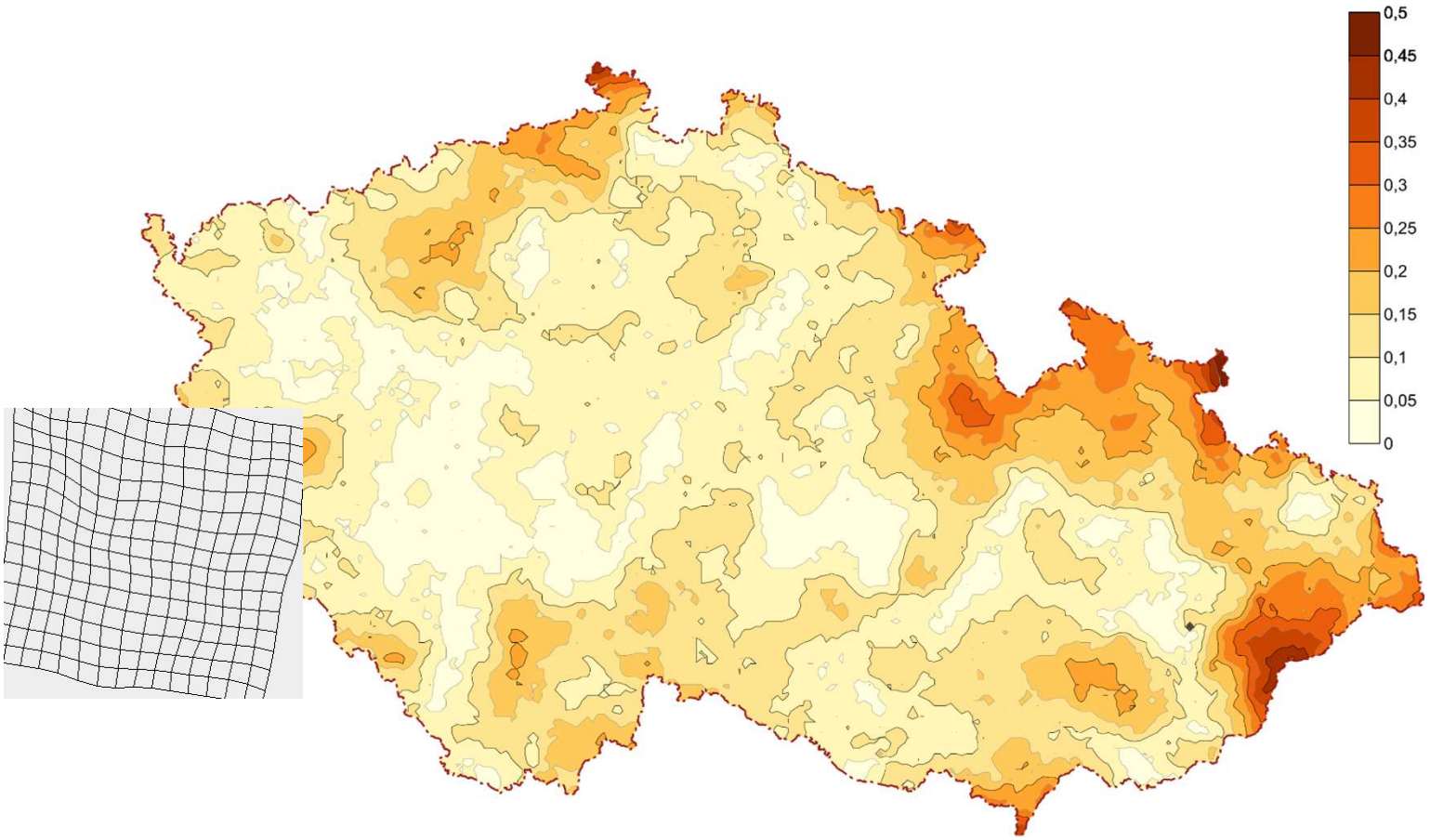


Coordinate System of Uniform Trigonometric Cadastral Network (S-JTSK)



1. 3D Helmert transformation
2. equations of Krovak projection
3. Interpolation in the grid of local differences

Positional Transformation – grid of local differencies

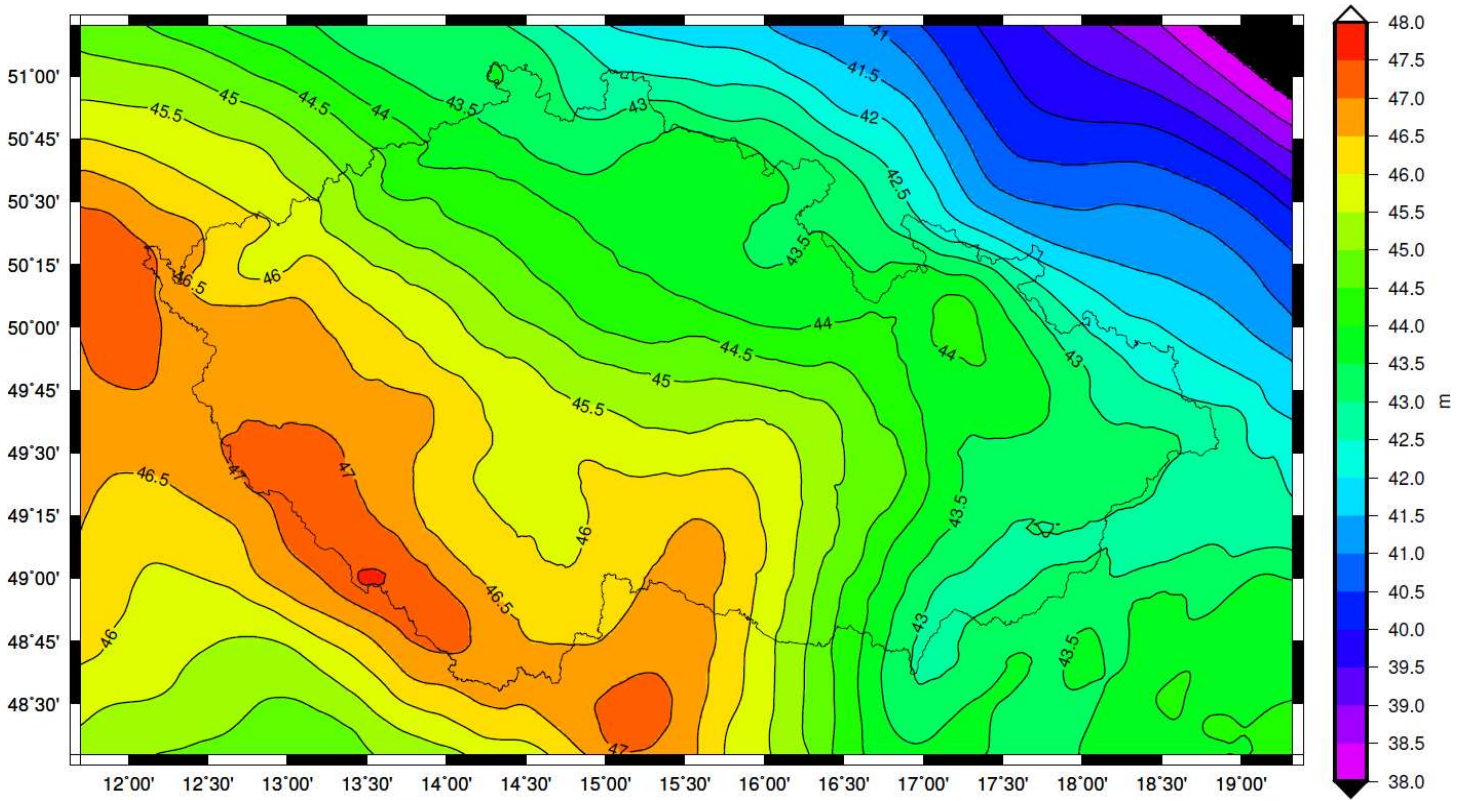


- **actual realization 2017**
  - **computed from 4000 identical points observed with GNSS**
- **2018 – … further identical points are observed**

Reference Frames - Height Transformation

European Terrestrial Reference System 1989 (ETRS89) ellipsoidal heights GRS80

Baltic Height System (national realization - Bpv)

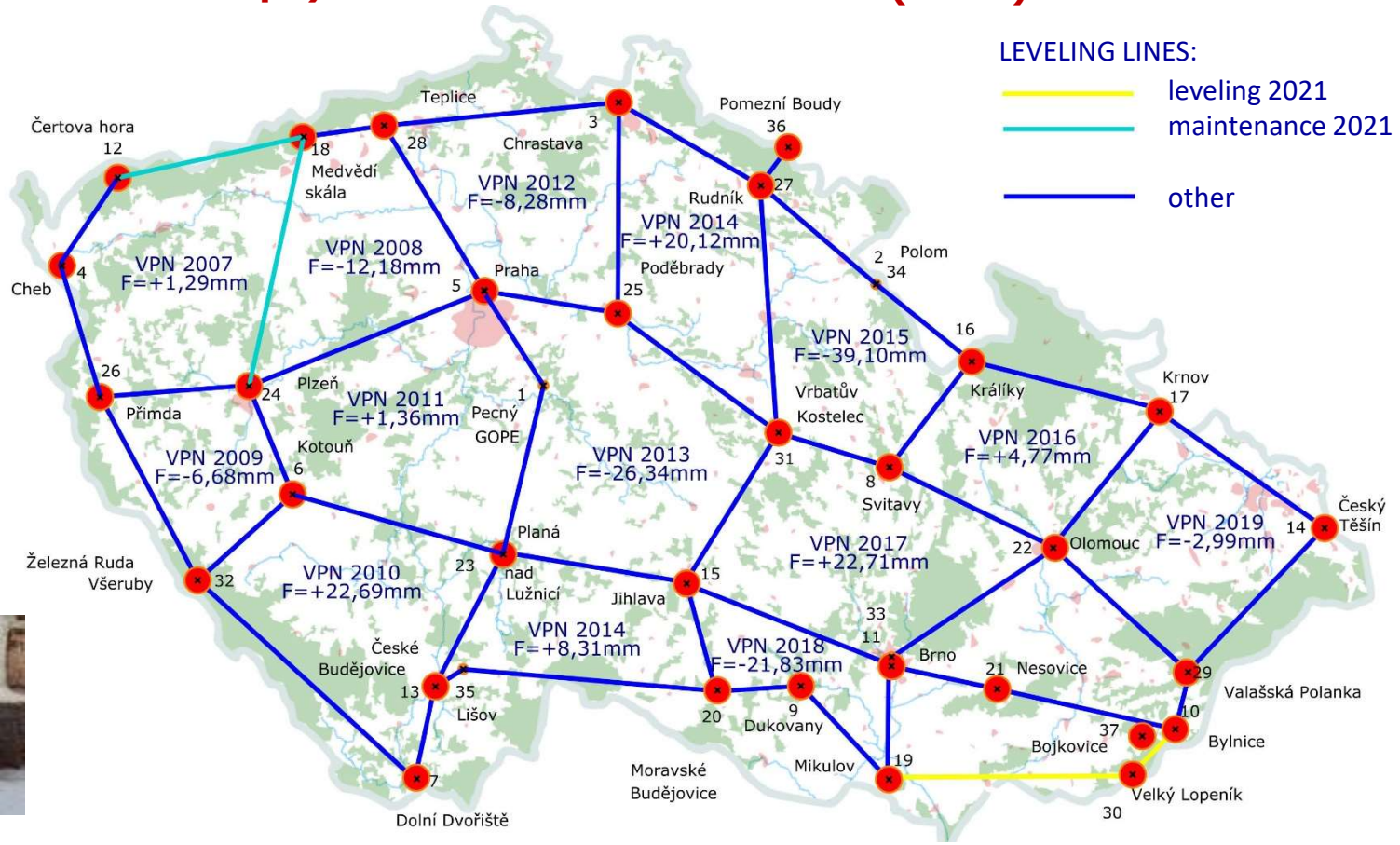


Quasigeoid QGZÚ-2014

- computed in cooperation with Research Institute of Geodesy and Cartography
- **new GNSS/gravimetric measurements**

Height Transformation

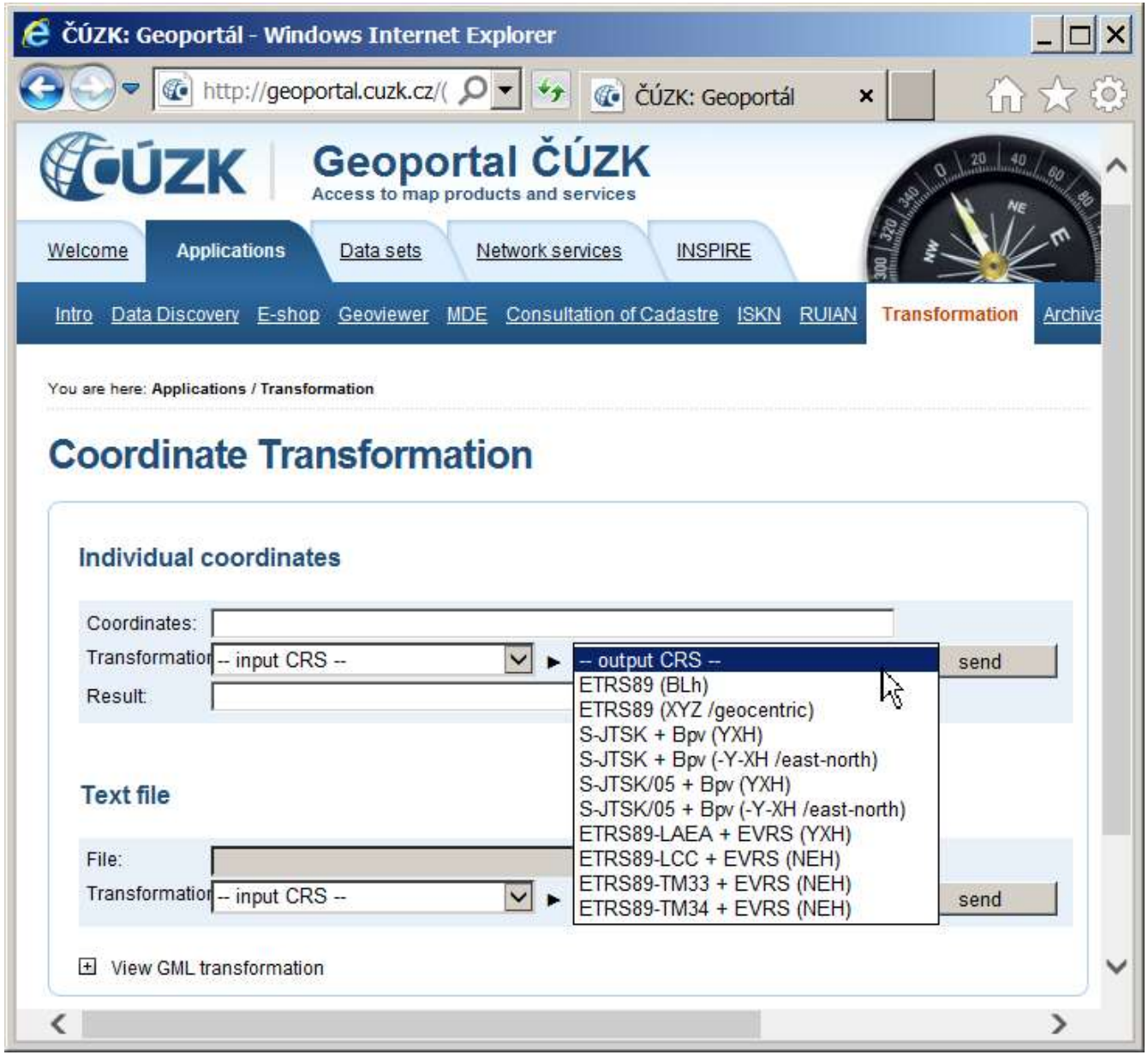
Baltic Height System (national realization - Bpv) ⟷ **European Vertical Reference System (EVRS)**



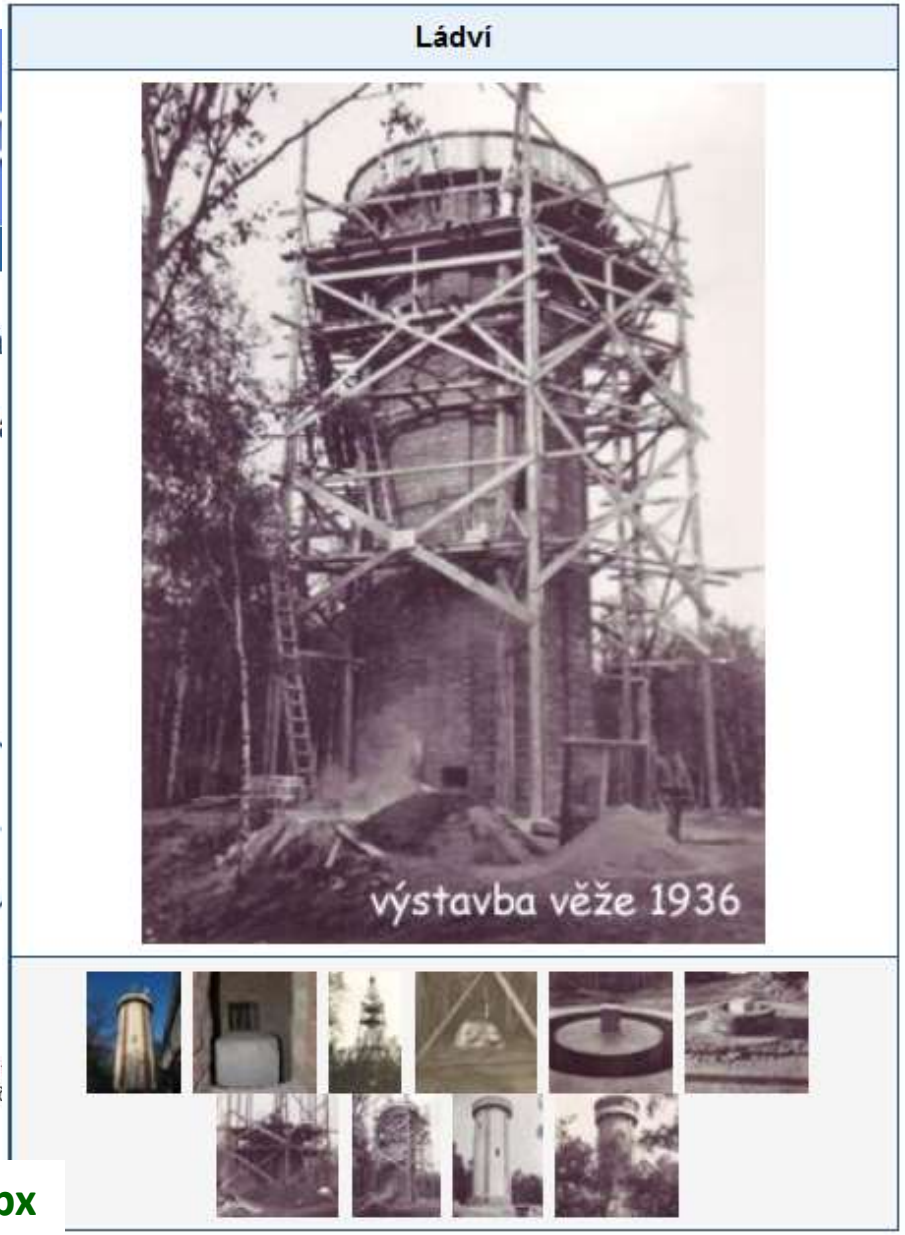
National realization of EVRS - precise leveling → grid densification

results of leveling 2007 – 2018 were sent to BKG → **part of EVRF2019**

Transformation Service of Geoportal ČÚZK



Popularization of historical trigonometric points



https://bodovapole.cuzk.cz/vyznamneTB.aspx

Research Institute of Geodesy, Topography and Cartography

Geodetic Observatory Pecný (GOP) - Research Activities

- **GNSS** (Global Navigation Satellite Systems) – data collection, data quality control, data dissemination, precise analysis of regionally and globally collected data – GOP DC – 600+ stations
- **DORIS** (Doppler Orbitography and Radiopositioning Integrated by Satellites) – precise analysis of globally collected data,
- **Gravity field modelling** – ground data collection and analyses, processing of data from Low-Earth Orbiter missions and satellite altimetry,
- Interdisciplinary research including **software development** – models and precise products for autonomous positioning applications, meteorology and climatology applications, geophysics and geodynamics applications,
- Applied research towards **geodetic reference frame realization** and maintenance (ETRS89, absolute gravity network)
- Applied **research in metrology** (long lengths, gravity, 3-D position, calibrations of instruments)

Major Space Oriented Projects & References

- **E-GVAP** – The EUMETNET EIG GNSS Water Vapour Programme (2005–2019, *EUMETNET service*)
- **GRC -** Galileo Reference Centre – Member states (2018 – 2022), GSA
- **DORIS** as an integral part of the reference system and GGOS realization (2018 – 2022)
- **Distributed system** of observatory and on-site measurements of geophysical fields (included in EPOS, 2017 – 2020)
- **EPOS** – **European Plate Observing System**, Implementation Phase (2015–2019, *H2020*)
- **SPMS** – **EGNOS Service Performance Monitoring** (2015–2022), *GSA*
- **Processing of 100+ globally distributed stations for precise GNSS orbits and clocks**

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Other projects running in 2019 - 2021

- Research towards International Gravity Reference systém and Frame (cooperation with BGI, IGETS)
- Improving accuracy and reliability of absolute gravity measurements in CR – vertical gradients, seasonal variations, standardization of processing)
- Development of troposphere model for improving GNSS height comonent
- Observation techniques at GOP – operation centre for 158 GNSS stations (36 of them as a seismic hazard monitoring array in Greece); absolut and superconducting gravity – contribution to BGI and IGETS; monitoring of meteorological and hydrological parameters
- Calibration of GNSS receivers (calibration and test baseline/network)
- Maintenance of National Gravity standard (AG FG5215/HS5 and FG5X-251/HS5)
- Contributon to national time and frequency standard
- Data Quality Control for Italian GPS Fiducial Network (collaboration with e-GEOS and ASI)
- Development and testing software for transformation ETRS89/JTSK

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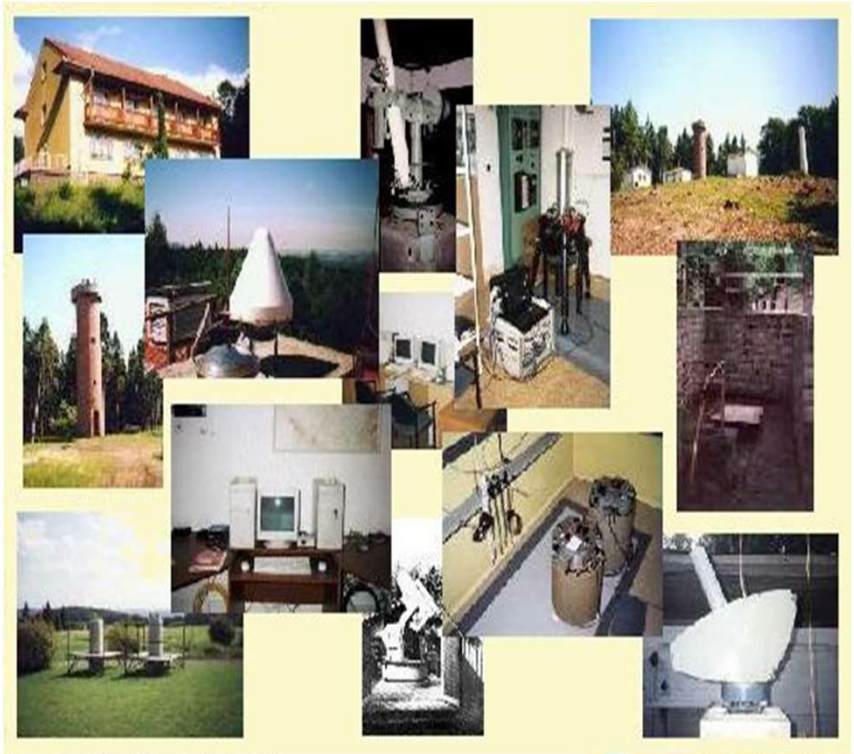
GOP – Labs and Equipment

- 12 precise (geodetic) **GNSS receivers** (6 employed in Greece),
- **atomic Cs-clock** (a part of national group standard of time and frequency)
- **passive H-maser**,
- **2 absolute** (FG5 and FG5X), **3 relative and 1 superconducting gravimeter** OSG; national gravity standard
- **water vapour radiometer**
- **3-D VBB seismometer**
- various **meteorological and environmental sensors**,
- **test and calibration baseline for 3-D positioning using GNSS** (national reference standard).



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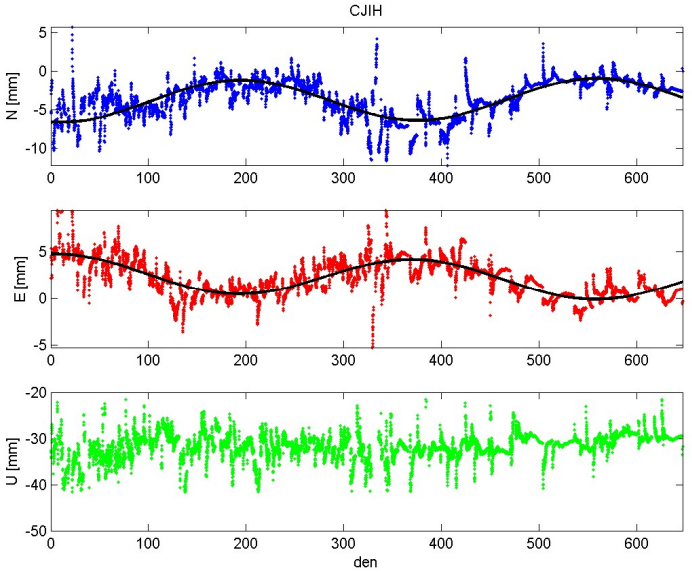
GOP: Monitoring and Reporting of all Active CORS Stations in the Czech Republic

- Check of stability and quality
- Currently **123 stations included in monitoring**
- Rapid solution used as a basis
- EPN processing standards and guidelines
- 8:00 UTC the daily solution compared with coordinates + statistical test
- Limits: 7mm, 7 mm and 15 mm for N,E,U components
- Reporting for NMCA (National Mapping and Cadastre Administration)



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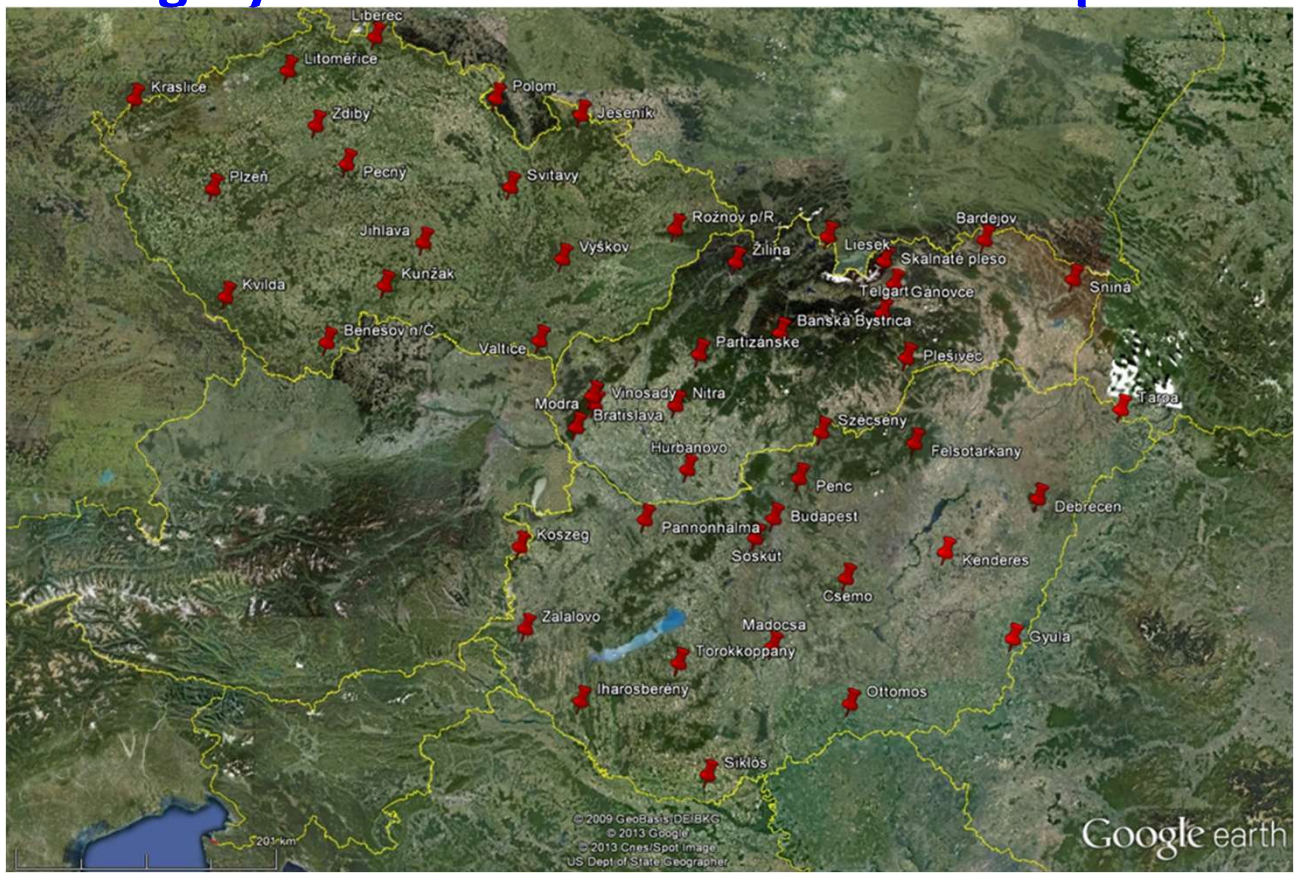
GOP Contribution to Gravity Reference Frame Realization and Maintenance in Czechia, Slovakia and Hungary: Repeated Absolute Gravity Measurements: 2019 – 2021 6 stations in Hungary and 7 stations in the Czech Republic



thank you for your attention

Jan Řezníček
Jaroslav Šimek