EUREF 2019 Symposium

Tallinn, Estonia, May 22 – 24, 2019

EUREF Related Activities 2018 - 2019
National Report of the Czech Republic

Prepared by Jan Řezníček[1] and Jaroslav Šimek[2]

[1]Land Survey Office, Department of Geodetic Control

[2]Research Institute of Geodesy, Topography and Cartography

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National Mapping and Cadastral Service of the CR

Top authority (NMCA): Czech Office of Surveying, Mapping and Cadastre

Cadastral Offices: Information System of Cadastre of Real Estates

Land Survey Office: Administration, realization and maintenance of geodetic control networks, state map work, fundamental database of geographical data (ZABAGED), databases of geodetic point fields, geodetic portal

Research Institute of Geodesy, Topography and Cartography: fundamental and applied research in geodesy, contribution to international scientific services (IAG), standardization and metrology (long lengths, gravity acceleration, time and frequency, 3D-position)

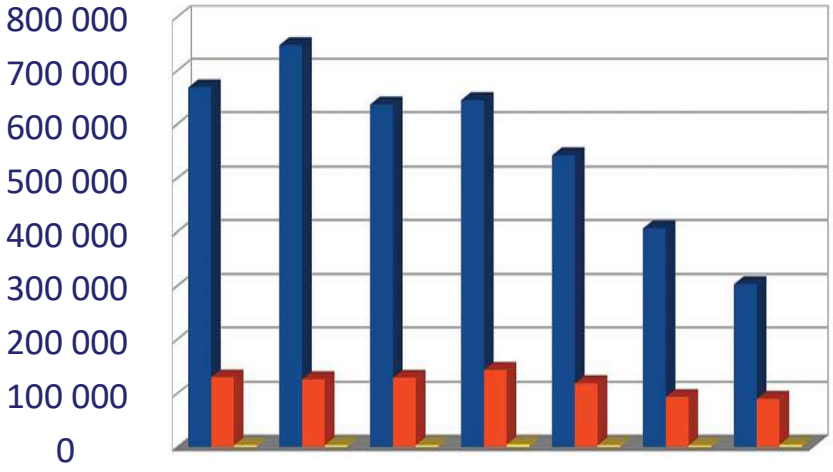
GRF Realization in the Czech Republic

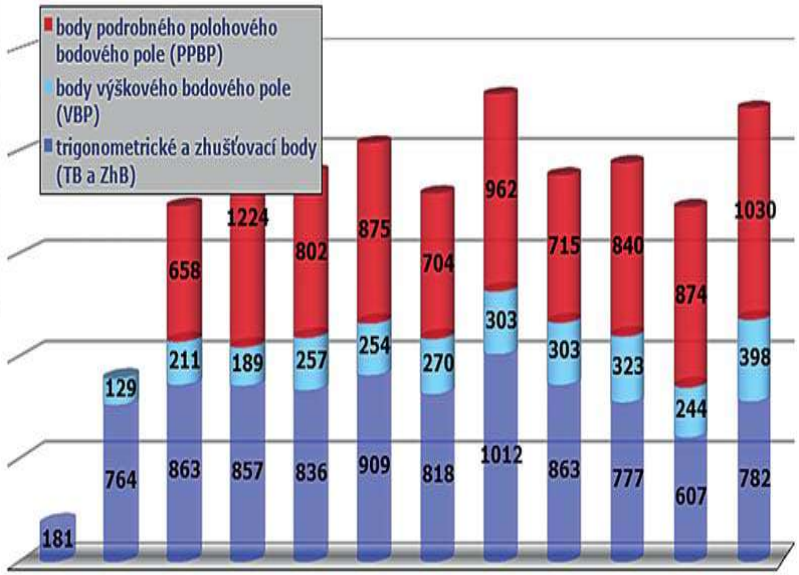
- Czech Republic – area 78,864 km^2
- 28 + 27 CZEPOS stations (LSO)
- 75,132 triangulation points
- 35,314 associated points
- 1313 levelling lines – total 24,754 km
- 119,555 levelling benchmarks (82,722 of the Czech State Levelling Network, 12 fundamental benchmarks)
- 462 gravity control stations
- > 40,000 TP with directly measured ETRS89 coordinates

LSO – main achievements 2018 - 2019

- Maintenance of 280 triangulation points
- 502 km of very precise levelling
- 815 detailed gravity points (for QG improvement)
- Administration and development of CZEPOS
- Modernization of CZEPOS equipment
- Very precise height determination of 6 CZEPOS stations
- New version of ETJTZU 2018 transformation program and transformation tables for transformation ETRS89 – S-JTSK

Feedback with users – accesses and reports





Accesses to geodetic points databases in the period 2012 - 2018

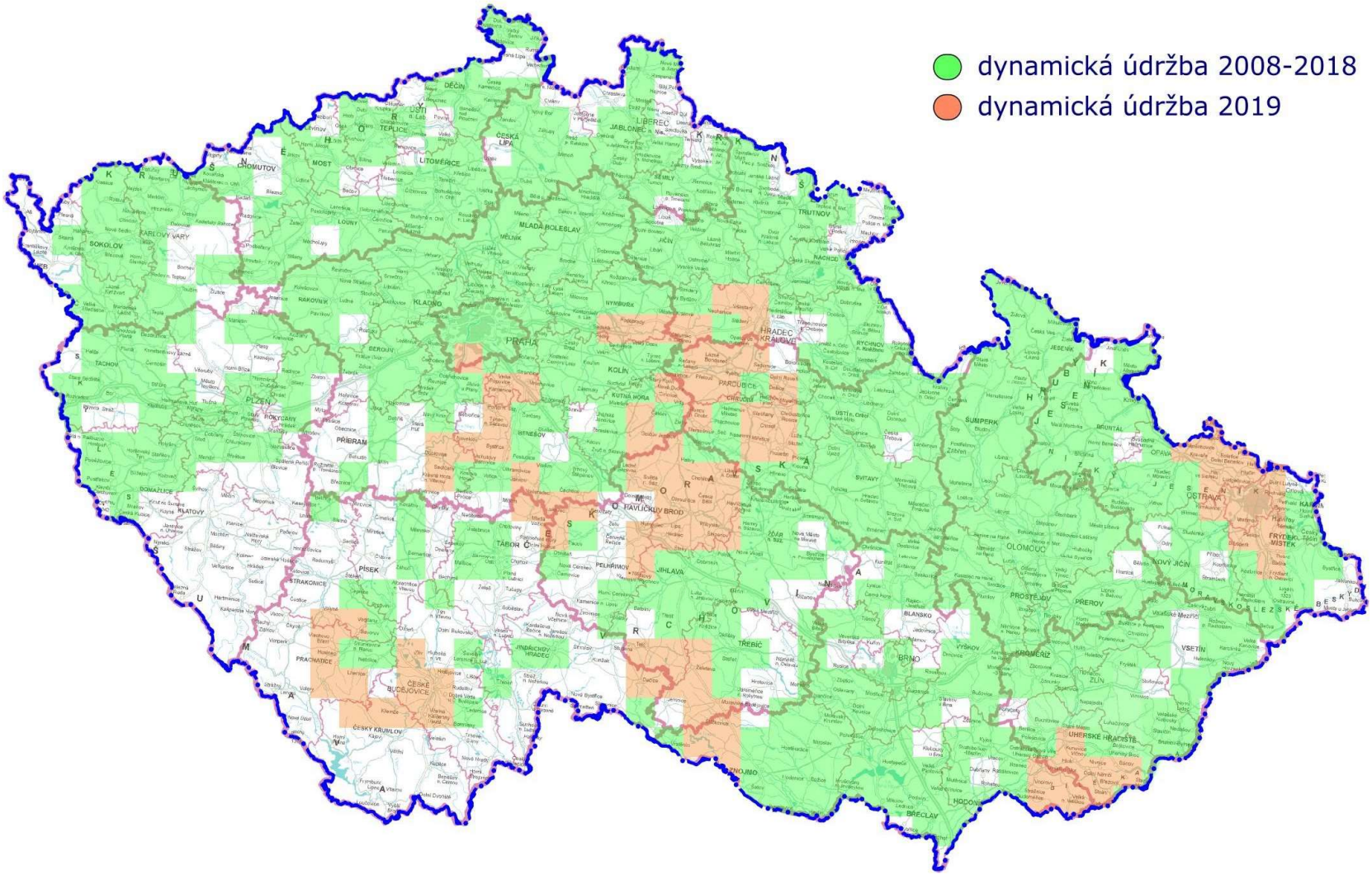
Blue: position

Magenta: heights

Yellow: gravity

LSO – Dynamic maintenance 2018 - 2019

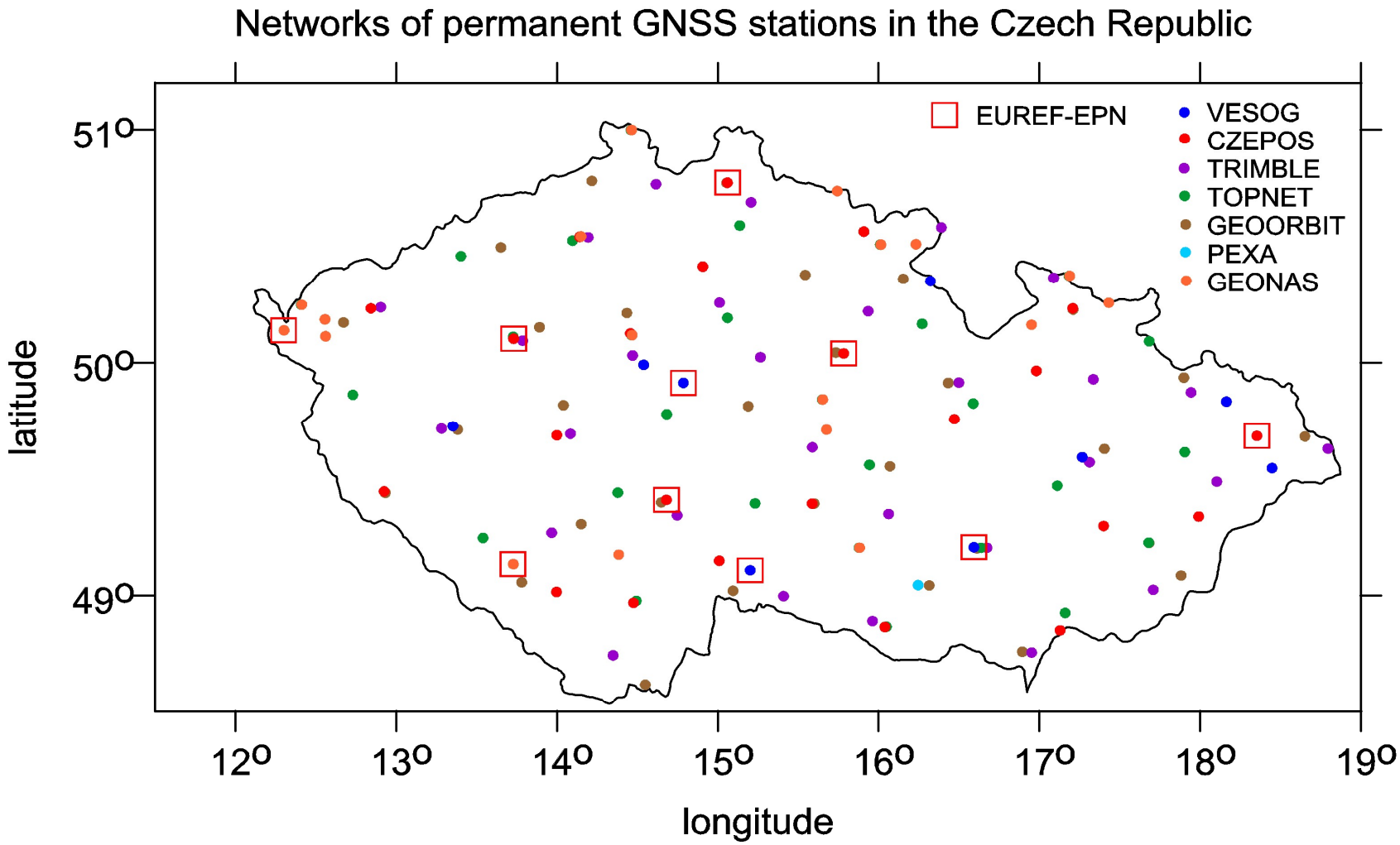
Údržba základního polohového bodového pole



GNSS CORS in the Czech Republic – Status 2019

- Fundamental Geodetic Observatory Pecný – GOPE, http://www.pecny.cz (IGS, EPN, CZEPOS, VESOG, E-GVAP II, SPMS, MGEX …)
- CZEPOS: http://czepos.cuzk.cz, Czech Positioning System, **28 PS**, operated by the Land Survey Office since 2004/2005 + **27 PS** of neighbour countries
- GEONAS: http://geonas.irsm.asc.cz, **19 PS**, experimental monitoring network operated by the Institute of Rock Structure and Mechanics, Acad. Sci. CR
- VESOG: http://pecny.asu.cas.cz/vesog/, research and experimental GNSS network operated by the RIGTC GOP and academic institutions, **8 PS**
- TopNet: http://www.geodis.cz, **27 PS**, includes also 11 GEONAS and 3 VESOG PS, operated by the private company GEODIS Brno
- Trimble VRS NOW Czech: http://www.geotronics.vrsnow, 2**9 sites** + 8 sites of Trimble VRS NOW Deutschland, operated by Geotronics Praha, s.r.o. private company
- GEOORBIT https://www.geoorbit.cz, **30 PS,** geoobchod, s.r.o.
- several smaller networks or individual stations, operated by private companies, e.g. *byS@T,* PEXA and others
- **Total: 139 permanent stations, 11 EPN**

CORS Operating in the Czech Republic in 2019



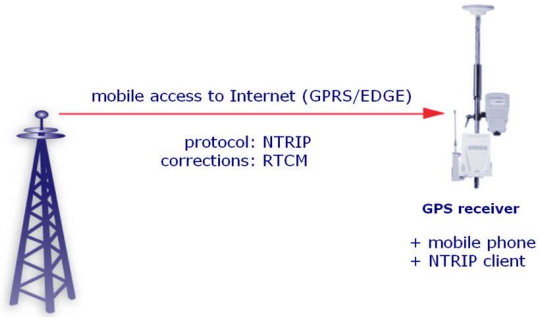
Administration of CZEPOS network (1)

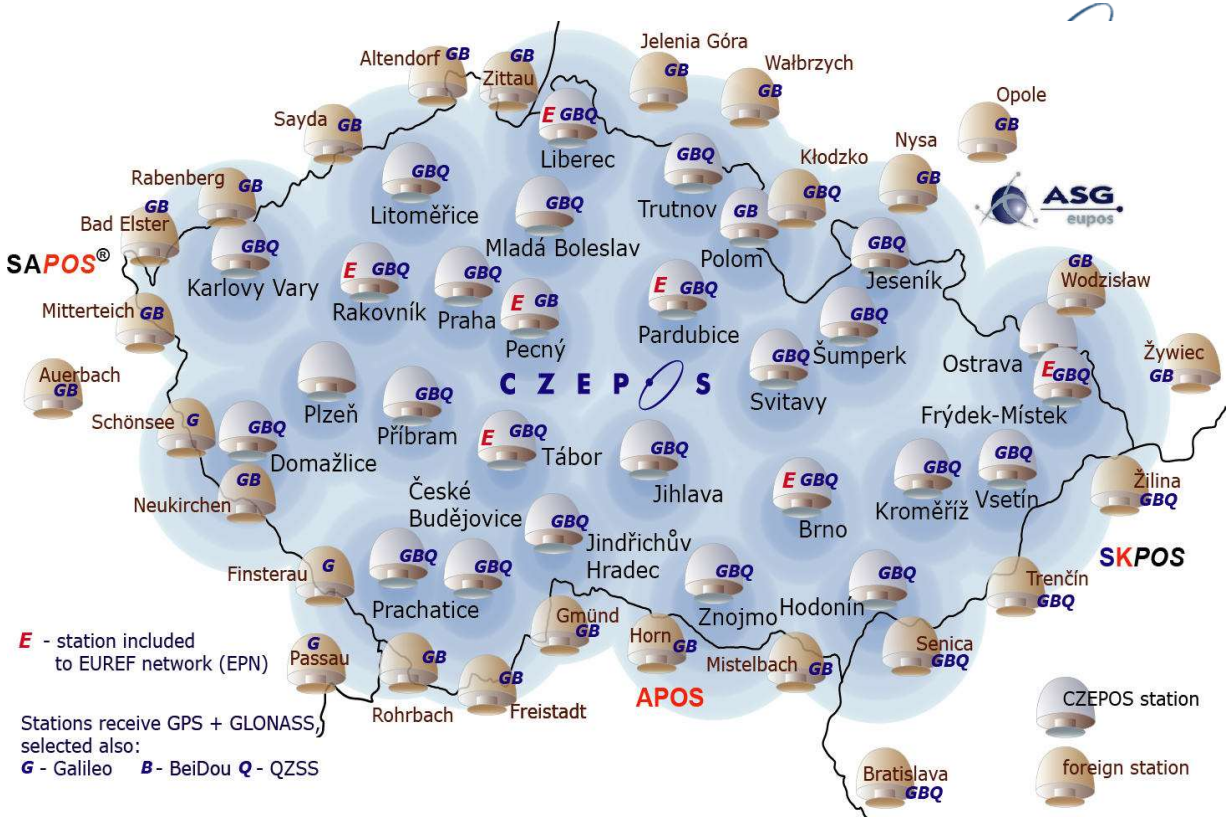
- 28 Czech stations
- 27 neighboring stations

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

Since 2017 Galileo + BeiDou

23 of 28 stations



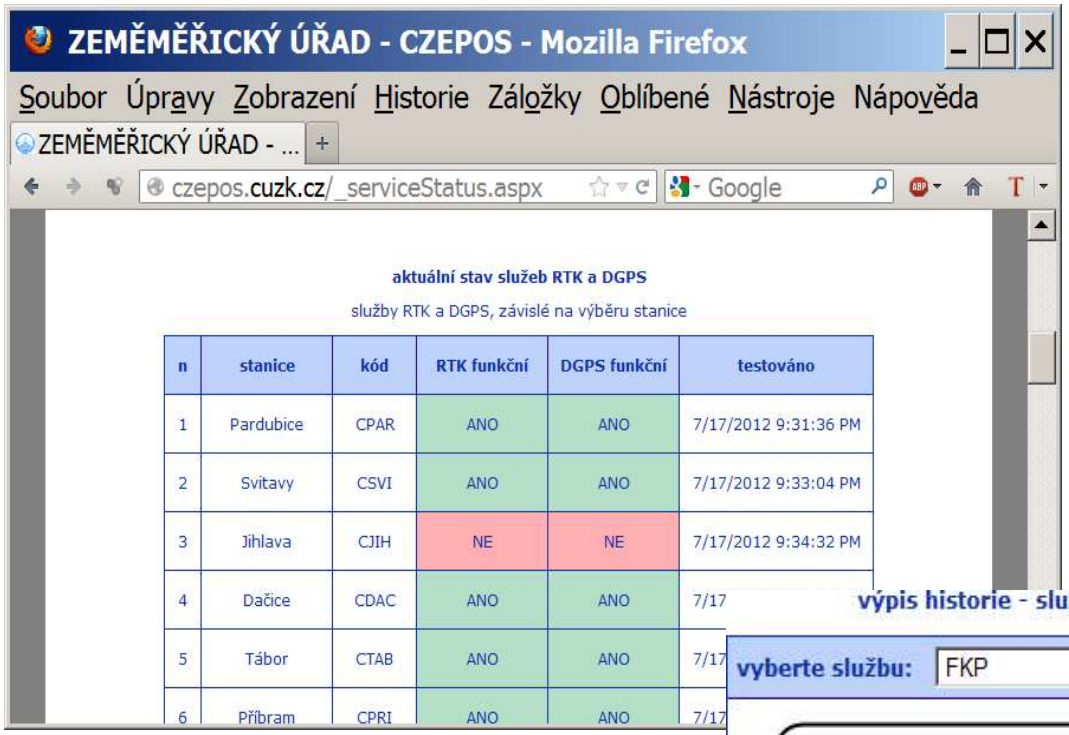


- 7 stations involved in EUREF permanent network (EPN)
- cooperation within EUPOS project

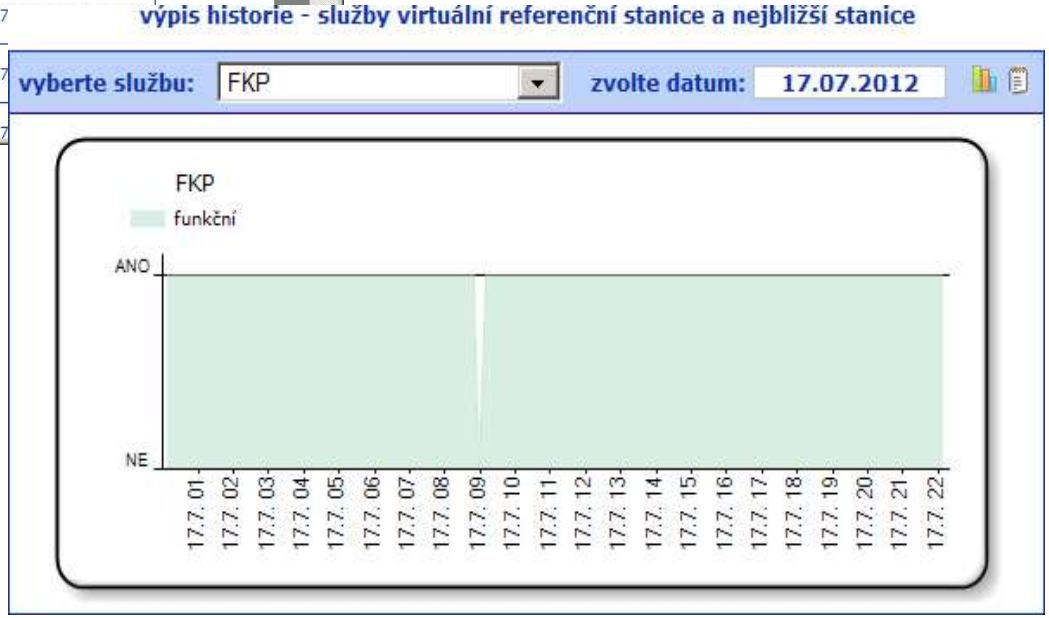
EUPOS European Position Determination System

2019/01: 1697 users

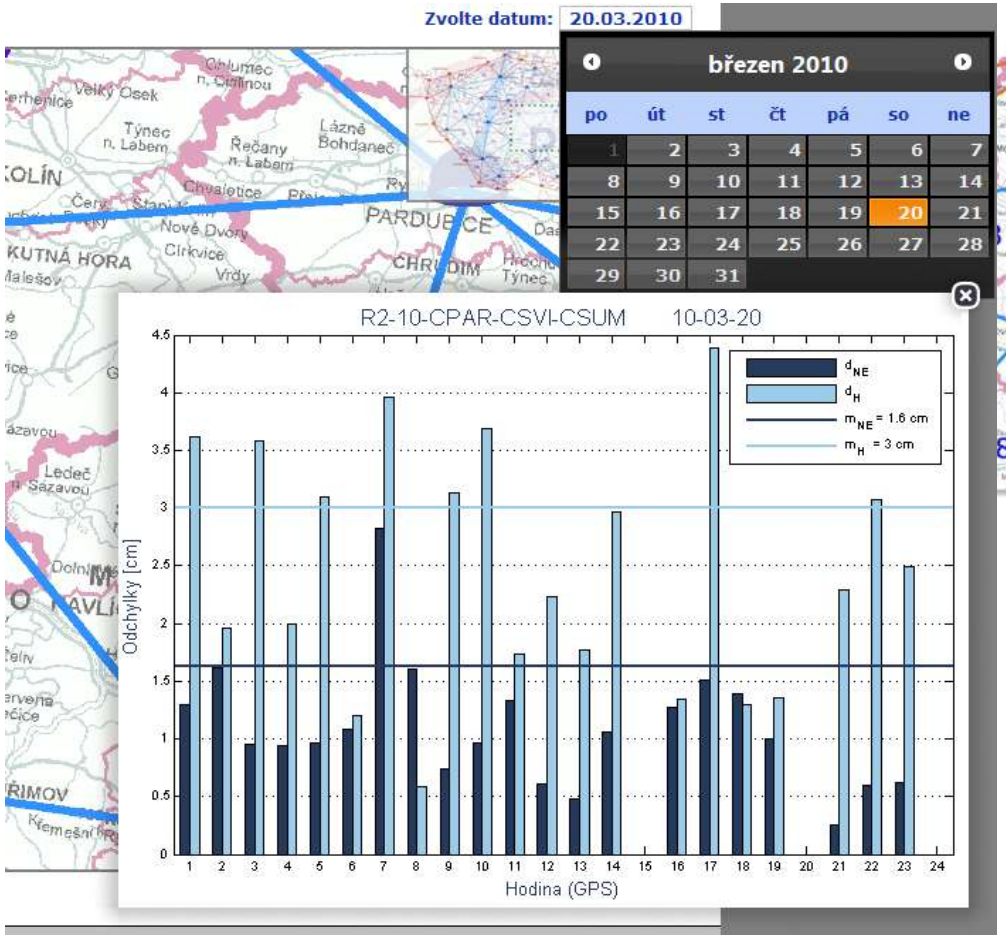
Administration of CZEPOS network (2)



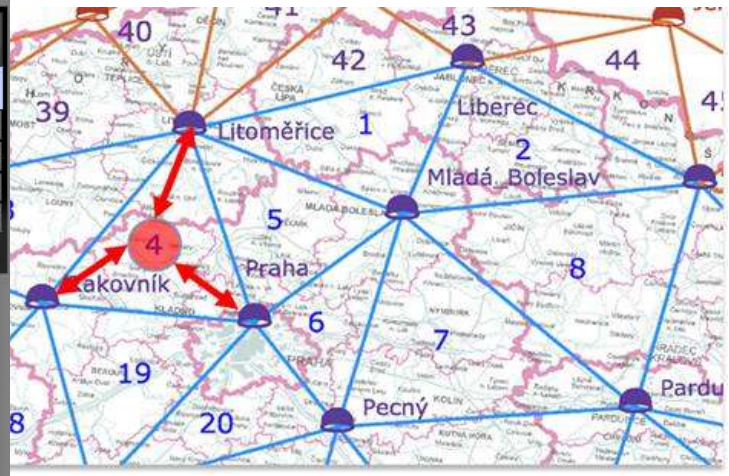
- monitoring of operation – availability, functionlity, quality and integrity
- Web access



Administration of CZEPOS network (3)



- monitoring of accuracy



- Internet application, created in cooperation with CTU

- 75 testing areas on the territorry of CR including border areas

- there are 3 testing baselines in each area

- each baseline is tested from RTK x VRS service

Administration of CZEPOS network (4)

•monitoring of stability

Monitoring permanentních stanic GNSS - Windows Internet Explorer

http://oko.pecny.cz/monitor/#c

Monitoring permane...

Monitoring permanentních stanic GNSS

Dočasné uživatelské rozhraní do doby, než bude služba umístěna na webu ČUZK

VUGTK

Vyvinuto ve VUGTK, GO Pecny

Statuty stanic a souřadnice pro konkrétní den | Aktuální ověřené souřadnice | Celkový přehled | Nápověda | Webová sluzba

Nahoru

1. Statuty stanic a souřadr

Stav pro den 20.1.2015 (úterý) - poslední vypočtený den

Vybrat: poslední | včera | předevčírem | -3 dny

Statuty stanic a ověřené souřadni

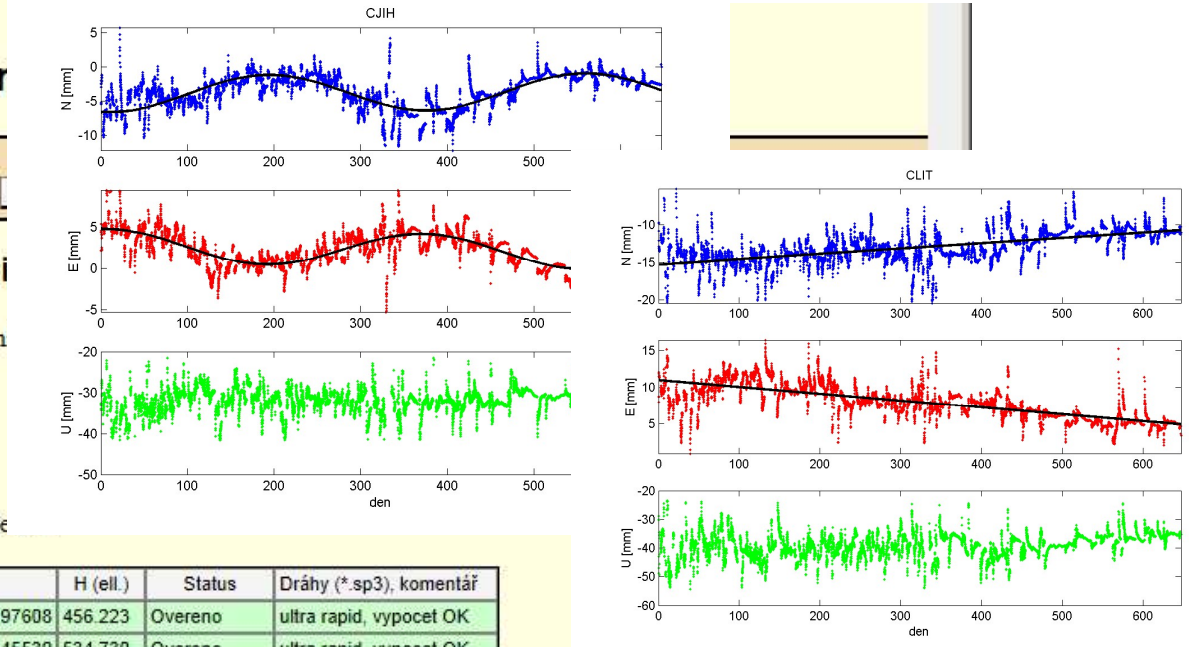
Výsledky pro síťová řešení (z ultra rapid řešen

Síť	Výsledek
CZEPOS	CZEPOS : Síťové řešení ověřeno
TRIMBLE	Trimble VRS NOW : Síťové řešení neověřeno

Výsledky pro jednotlivé stanice z ultra rapid ře

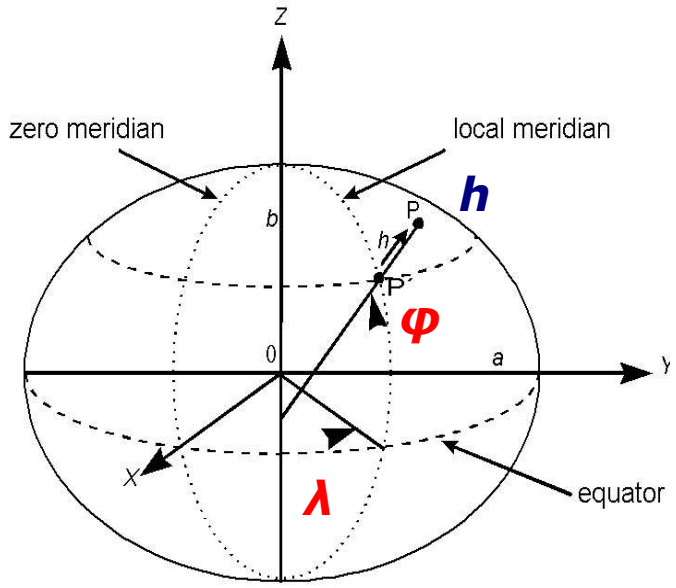
Stanice	Popis	B			L			H (ell.)	Status	Dráhy (*.sp3), komentář
CBUD	České Budějovice	48	58	3.47154	14	28	30.97608	456.223	Overeno	ultra rapid, vypocet OK
CDAC	Dačice	49	04	47.20485	15	26	12.45539	534.730	Overeno	ultra rapid, vypocet OK
CDOM	Domažlice	49	26	45.25334	12	55	26.77675	519.603	Overeno	ultra rapid, vypocet OK

Cooperation with Research Institute of Geodesy and Cartography

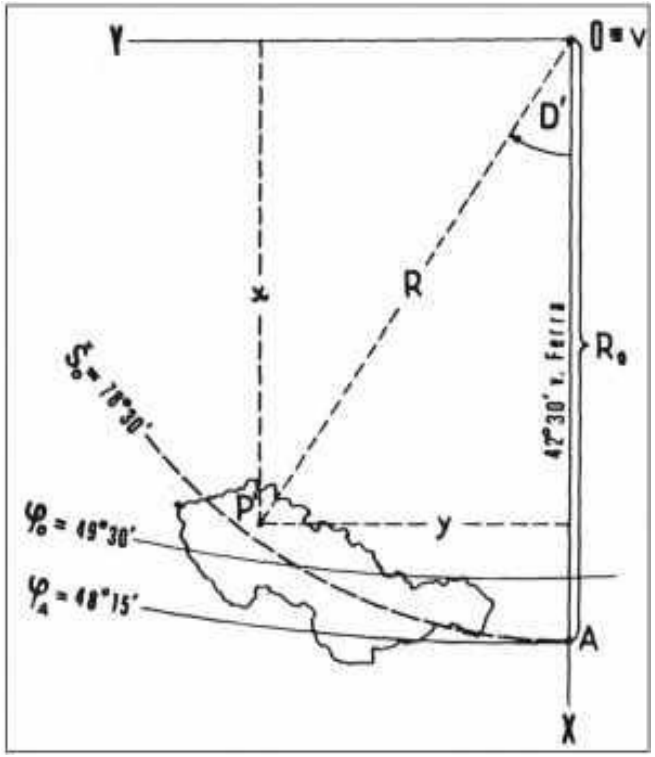


Reference Frames - Positional Transformation

European Terrestrial Reference System 1989 (ETRS89)

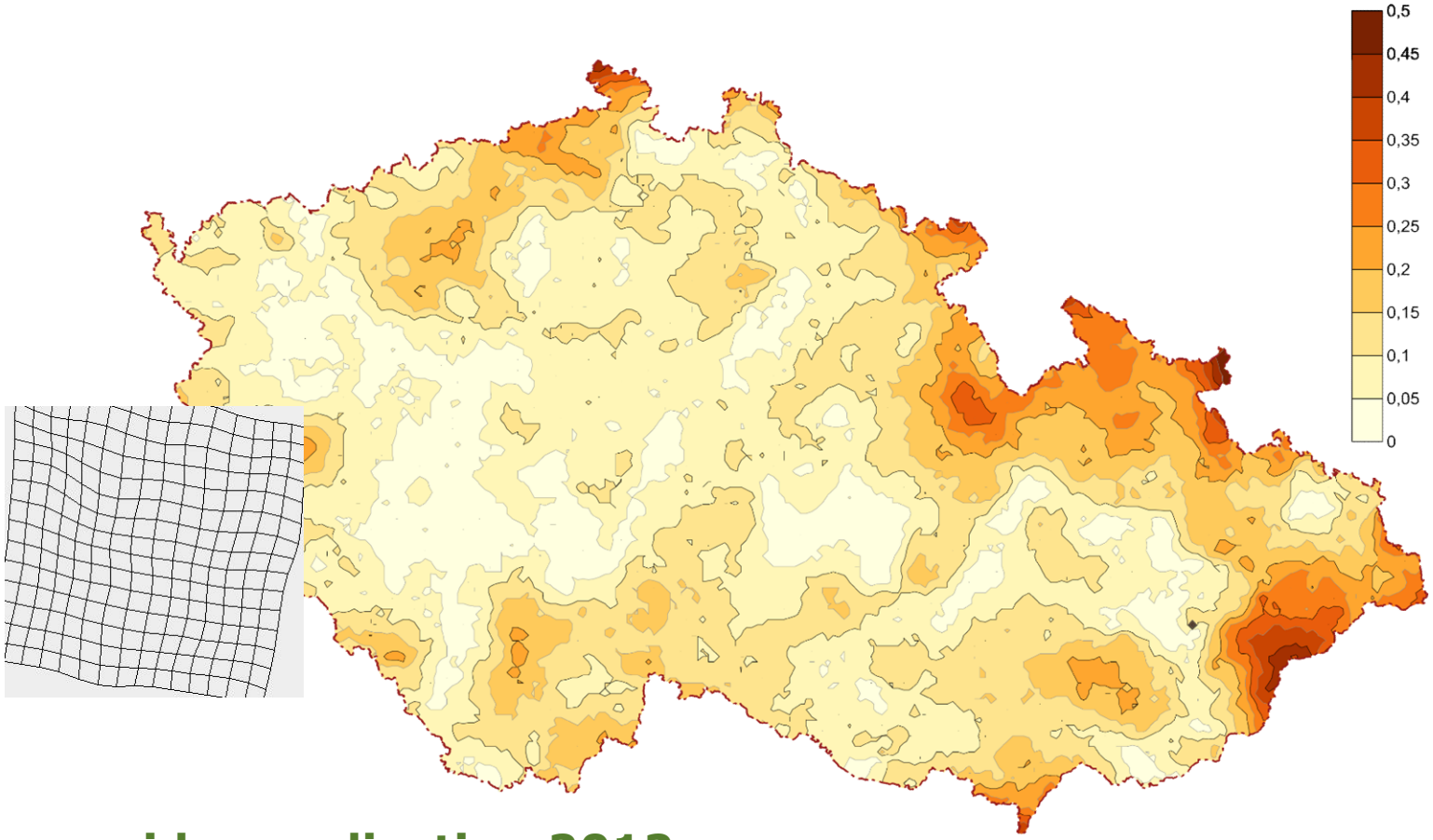


Coordinate System of Uniform Trigonometric Cadastral Network (S-JTSK)



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

Positional Transformation – grid of local differencies

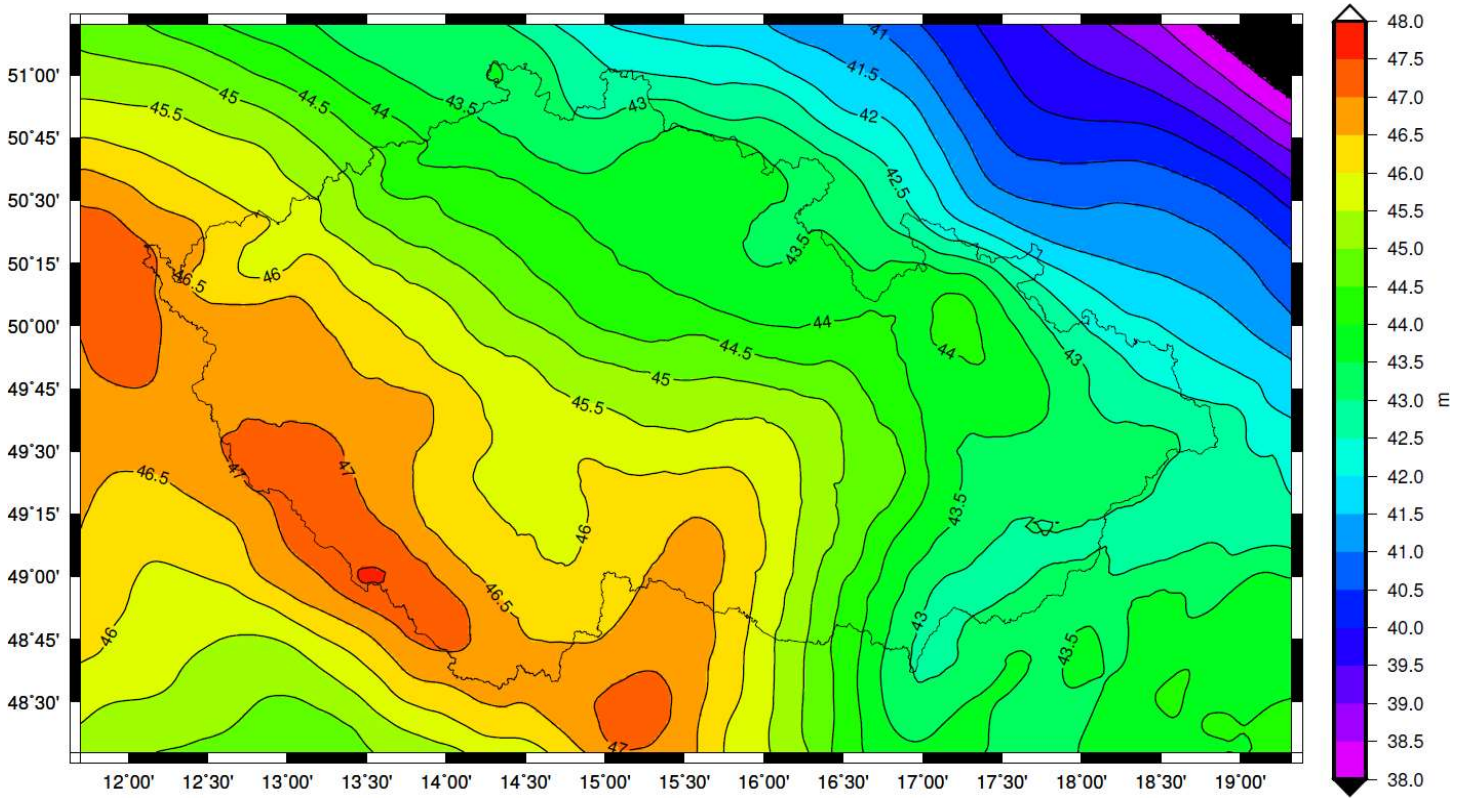


- Previous grid — realization 2012
- New realization 2018:
  - new GNSS measurements 2014-2017, smoother changes
  - higher density of points in the areas of state boundaries

Reference Frames - Height Transformation

European Terrestrial Reference System 1989 (ETRS89) ellipsoidal heights GRS80

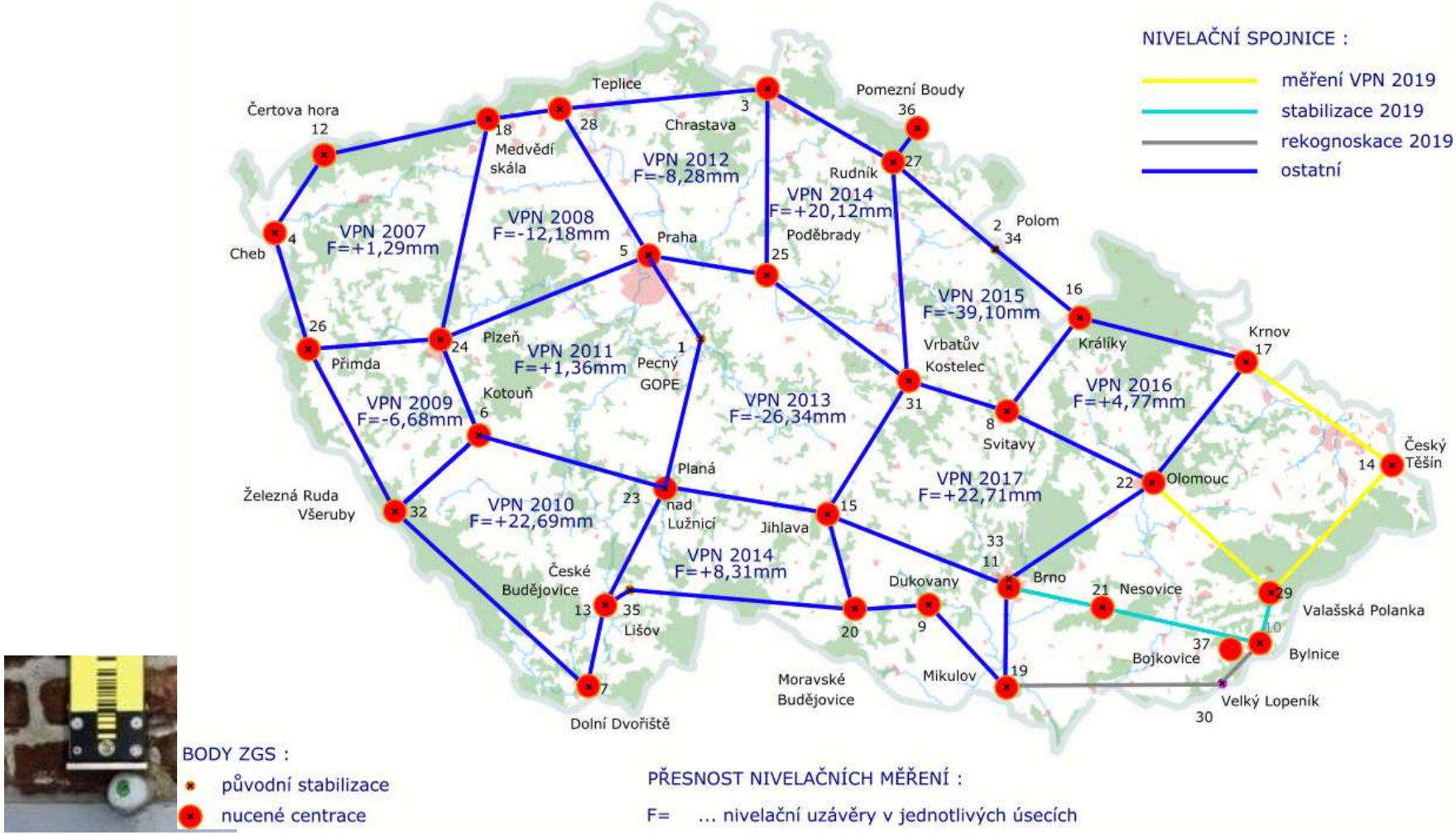
Baltic Height System (national realization - Bpv)



Quasigeoid QGZÚ-2014

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

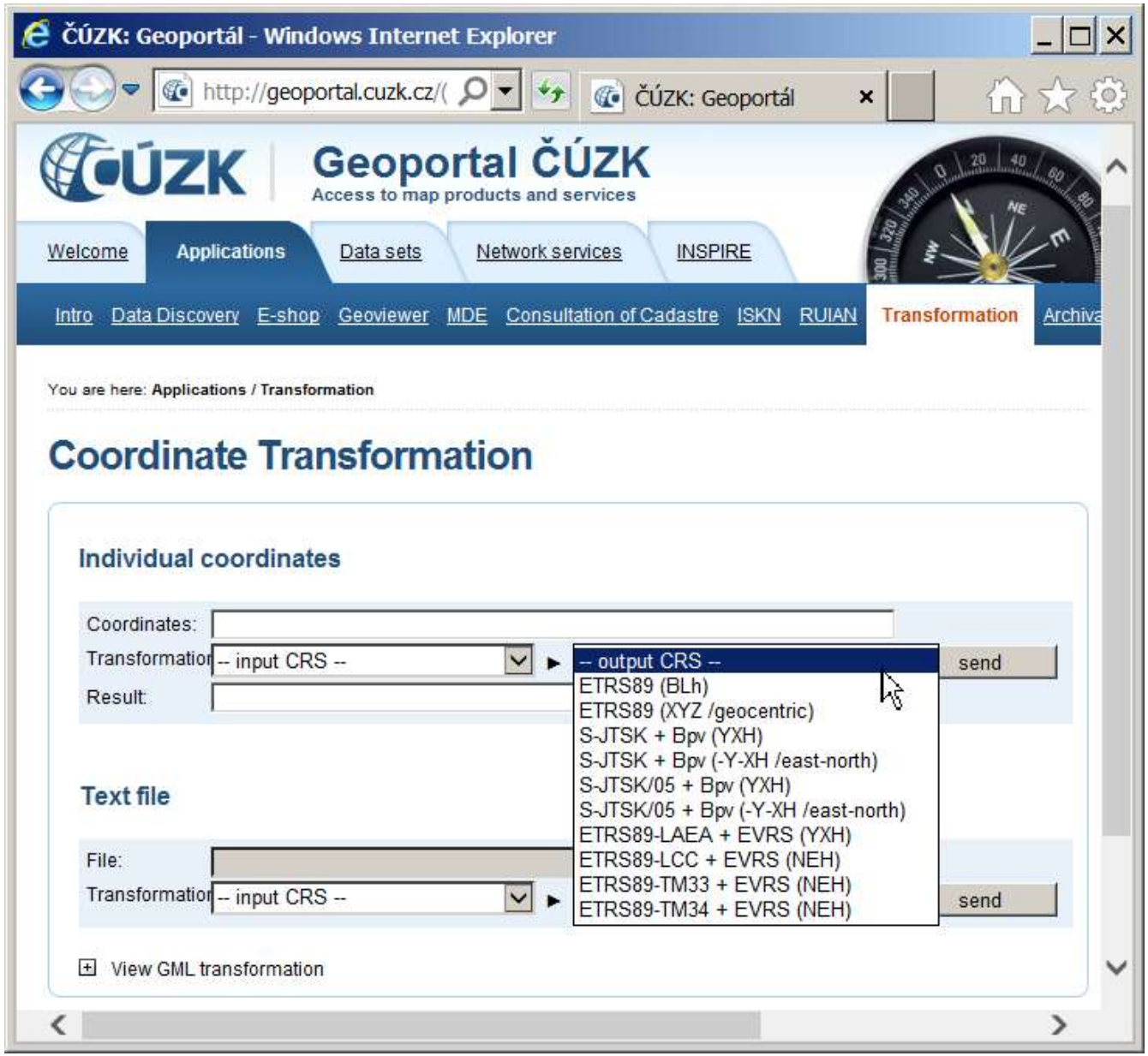
Geometry + Gravity Space: Combined Geodetic Network



National realization of EVRS - precise leveling → grid densification

2018: results of leveling 2007 – 2016 were sent to BKG (UELN center)

Transformation Service of Geoportal ČÚZK



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
- **DORIS** (Doppler Orbitography and Radiopositioning Integrated by Satellites) – **AC,** precise analysis of globally collected data
- **Fundamental research in terrestrial gravimetry** (AG and SG)
- **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 Current Projects (1)

- **E-GVAP** – The EUMETNET EIG GNSS Water Vapour Programme (2005–2019, *EUMETNET service*)
- **EPOS** – **European Plate Observing System**, Implementation Phase (2015–2019, *H2020*) – coordination of GLASS
- **Galileo Reference Centre – Member States –** (GSA/GRANT/04/2016) - consortium of 20 institutions of 12 countries
- **SPMS** - **EGNOS Service Performance Monitoring** (2015–2022, GSA/GRANT/EGNOS/01/2014)
- **DORIS as an integral part of eference systems and GGOS realization** (Min. Edu. CR, LTT18012)
- **Advanced Methods of Processing Absolute Gravity Measurments** (GA CR 16-14105S)
- **Distributed System of Observatory and in situ Measurements of Geophysical Fields** (Min. Edu. CR, LM2015079)
- **Sustainability Support of NTIS Centre** (Min. Edu. CR LO1506)

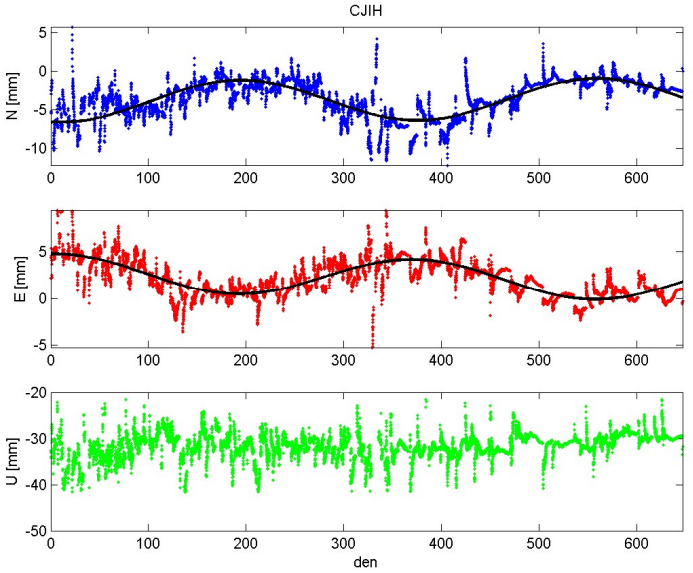
Major Current Projects (2)

- **GNSS Operation and Data Centres of GOP** (CUZK-18288(2015-2022) – GNSS Operation Centre GOP 158 stations, 11 GNSS PS VESOG, GOP DC for 600+ stations and IGS and EPN products, GOP gravimetric laboratory (superconducting and 2 absolute gravimeters, meteorological stations, soil hydrology monitoring array)
- **Monitoring and Reporting of GNSS Technological Infrastructure** (CUZK-02324/2014-2022) – monitoring all GNSS CORS in CR, testing and certification of transformation programmes etc.)
- **IGMA -** International GNSS Monitoring and Assessment, task force of the International Committee on GNSS (ICG) (2017–2020, UN)
- **Calibration of GNSS receivers** – GNSS Test and Calibration Baseline Skalka
- **GNSS Data Quality Control for Italian GNSS Fiducial Network** (cooperation with e-GEOS, s.p.a. and ASI)

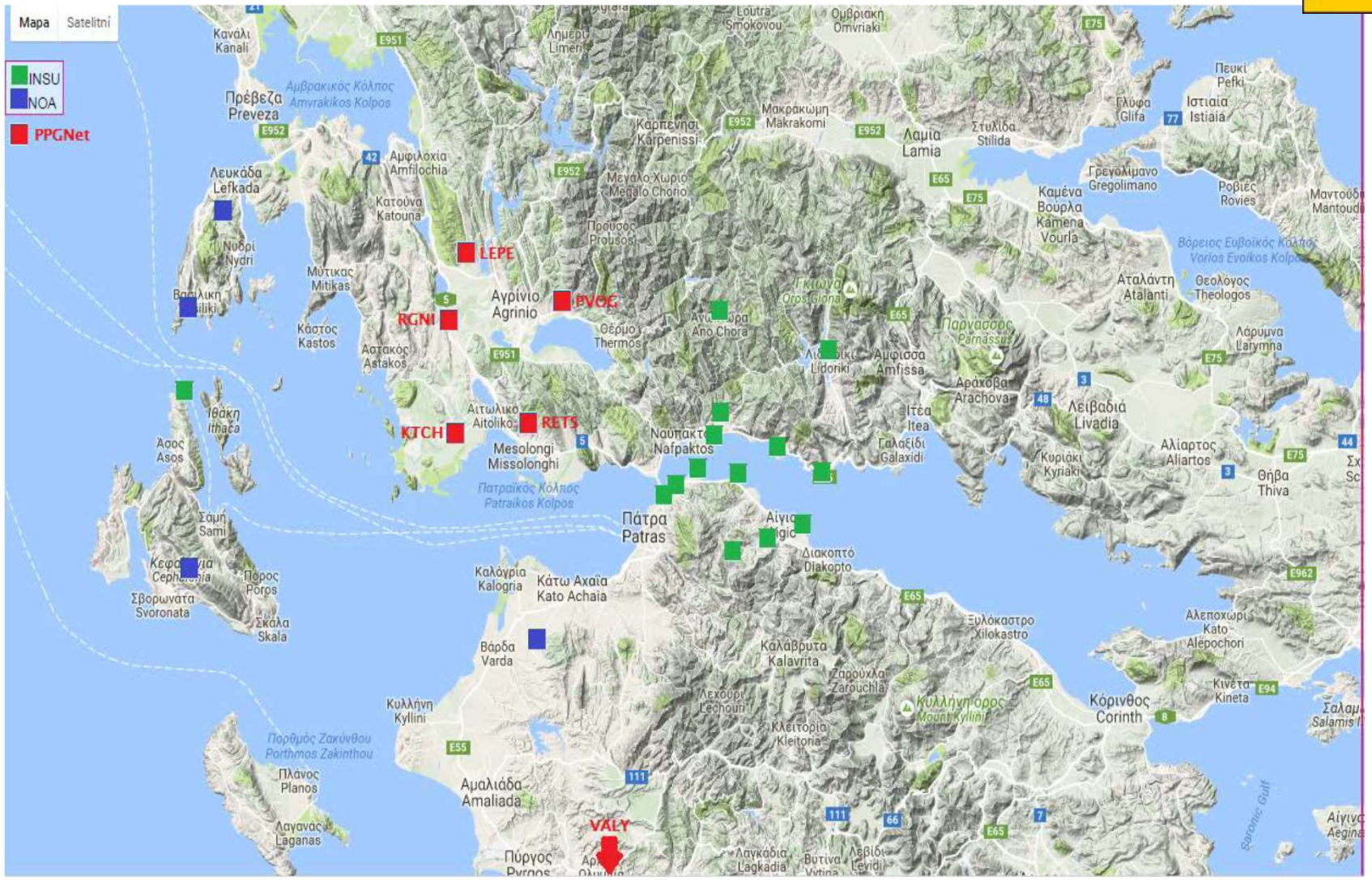
Research Institute of Geodesy, Topography and Cartography

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)



GOP GNSS CORS Array in Greece



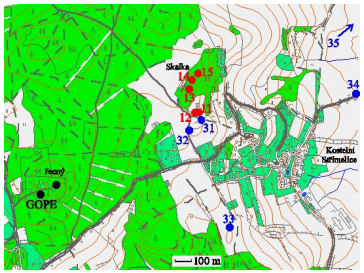
RIGTC/GOP Activities in Metrology

National standards – maintenance, investigation, administration

- Long lengths (calibration baseline Koštice, 100 m – 10000 m, Laser Tracker Leica AT 401)

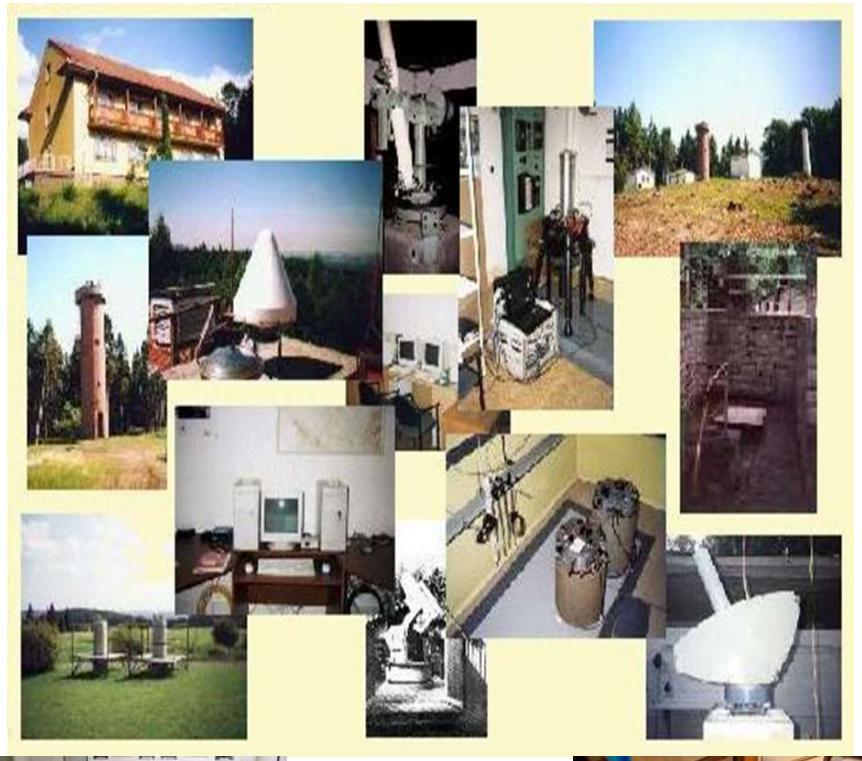
- Gravity (AG FG5 + FG5X) - works towards a group standard)
- Time and frequency – Cs clock Symmetricom + H-maser, woks towards a group standard (with IFE Asci CR)

- 3D position – GNSS test and calibration baseline (national reference standard)



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).



thank you for your attention!

for more detailed information please visit
http://czepos.cuzk.cz
http://www.cuzk.cz
http://pecny.cz

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