National report of Slovakia 2017

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EUREF 2017, annual symposium
17.-19.May 2017, Wroclaw, Poland

Outline

- Slovakian activities towards to EPN
- News from:
  - SK*POS*® (Slovak real time determination system)
  - national levelling network
  - national gravimetric network
- Research and development
  - Geodetic and Cartographic Institute activities
  - Slovak University of Technology activities
  - Slovak Academy of Sciences activities
- Other news

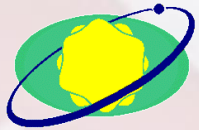
Slovakian EPN Operational and Local analysis centers

Geodetic and Cartographic Institute Bratislava (GKÚ) – EPN OC

Slovak University of Technology in Bratislava (SUT) – EPN LAC

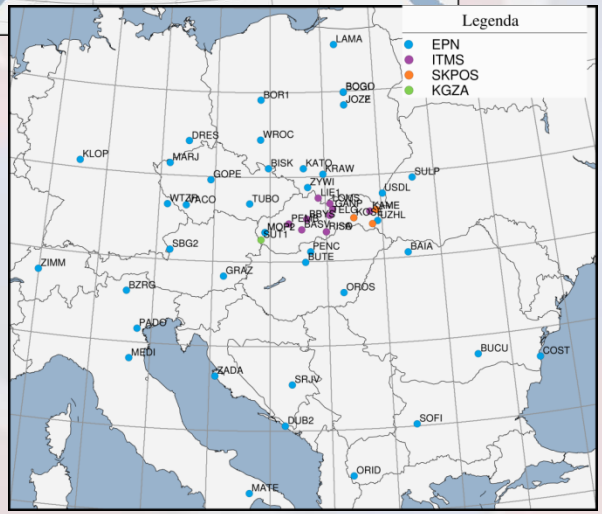
SUT - EPN Local analysis center activity

Bernese GNSS Software
Version 5.2
used since GPS week 1883



EPN subnetwork computation:

- 56 EPN permanent stations, 8 EPN permanent stations added to SUT network solution (GPS week 1908: CASE, 1910: AUBG, DILL, GOR2, LEIJ, 1936: ADAR, SCIL, SNEO).
- New reference frame (IGS14) and an updated set of antenna calibrations (igs14.atx) are used: GPS week 1934.

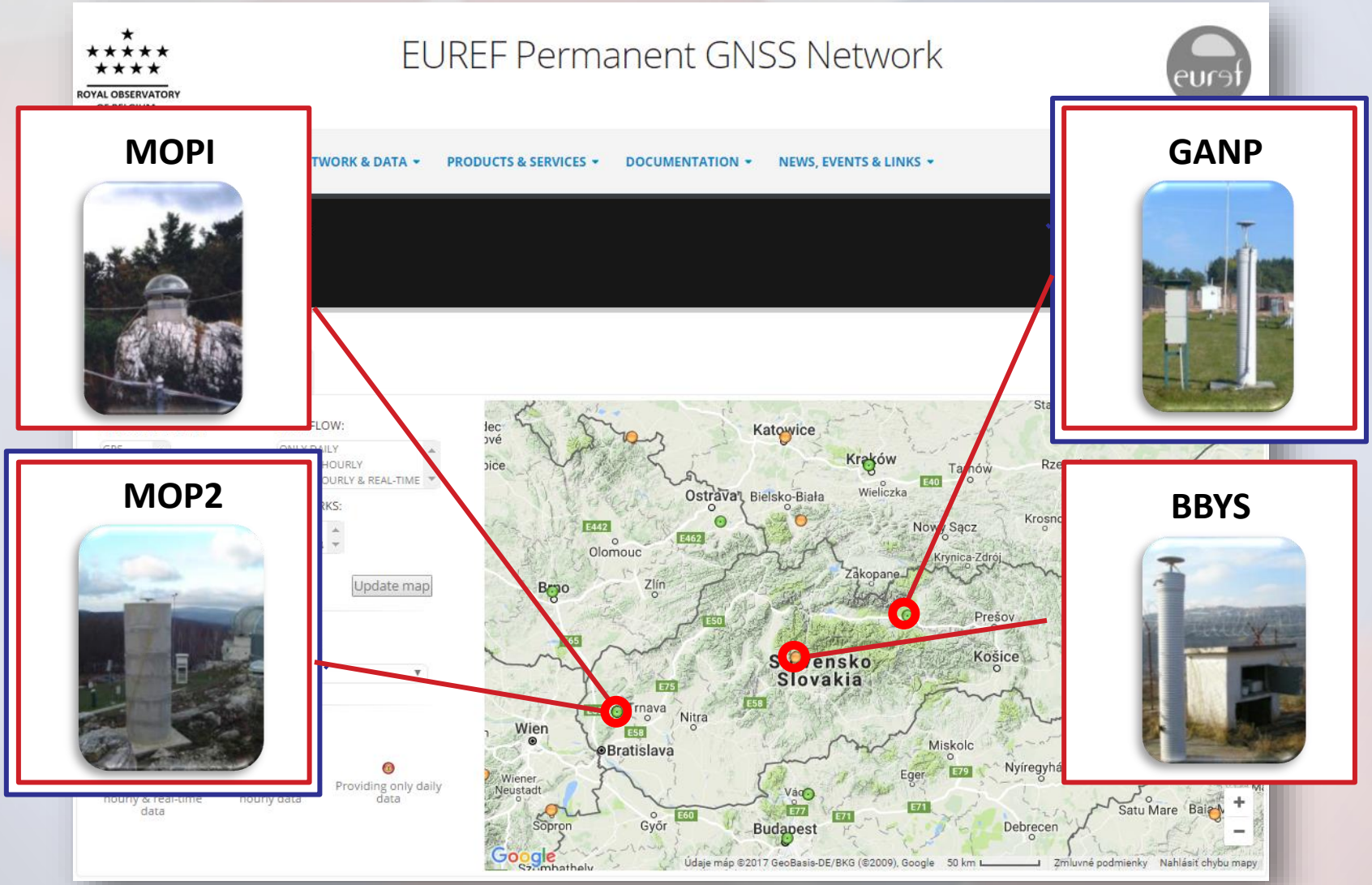


CEPER network computation:

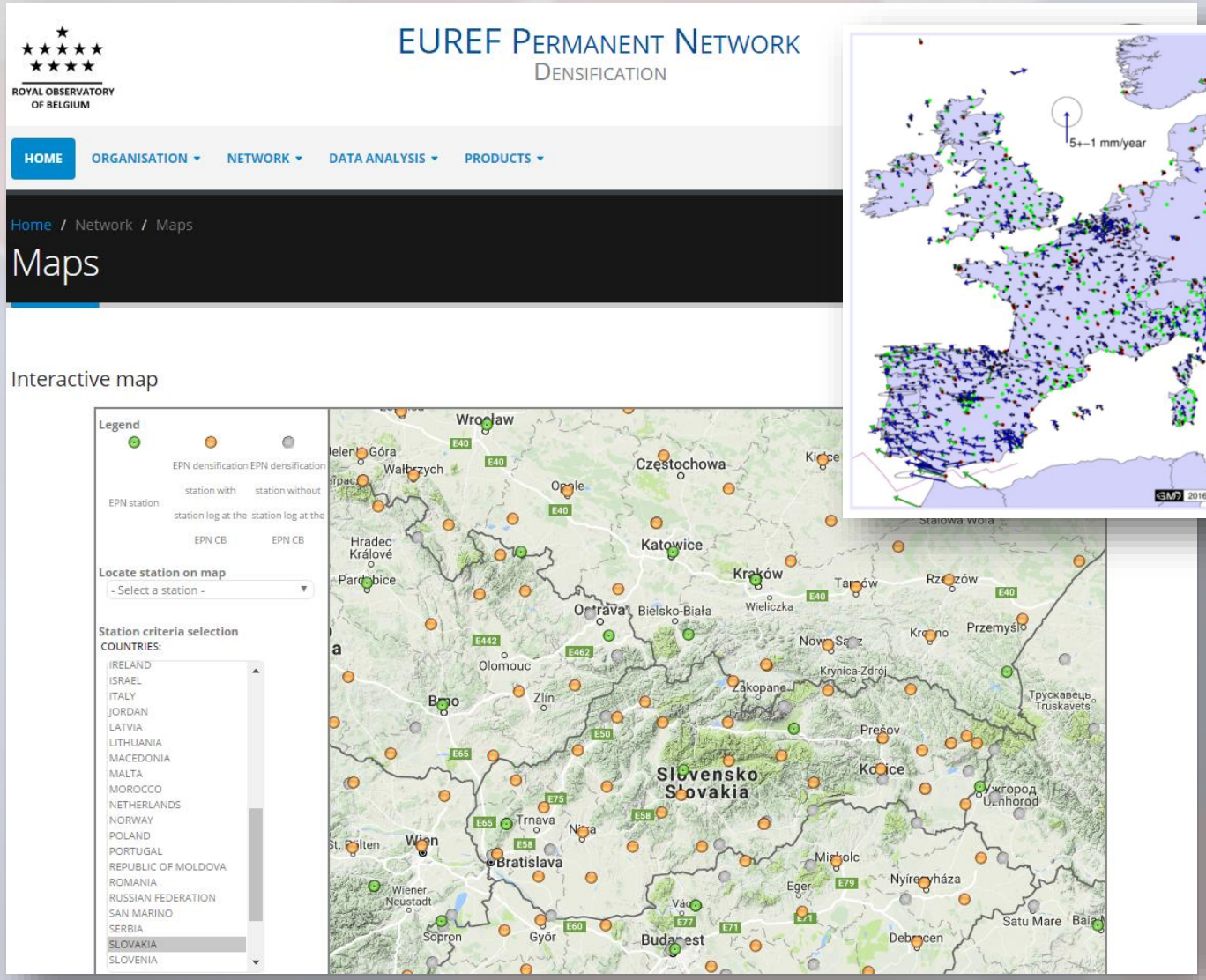
- 55 permanent stations in region of Central Europe,
- GPS/GLONASS and GLONASS only solutions: GPS week 1774.

Slovakian EPN permanent stations

Slovakian EPN Real-time service permanent stations



Slovakian contribution to EPN Densification (31 permanent stations)

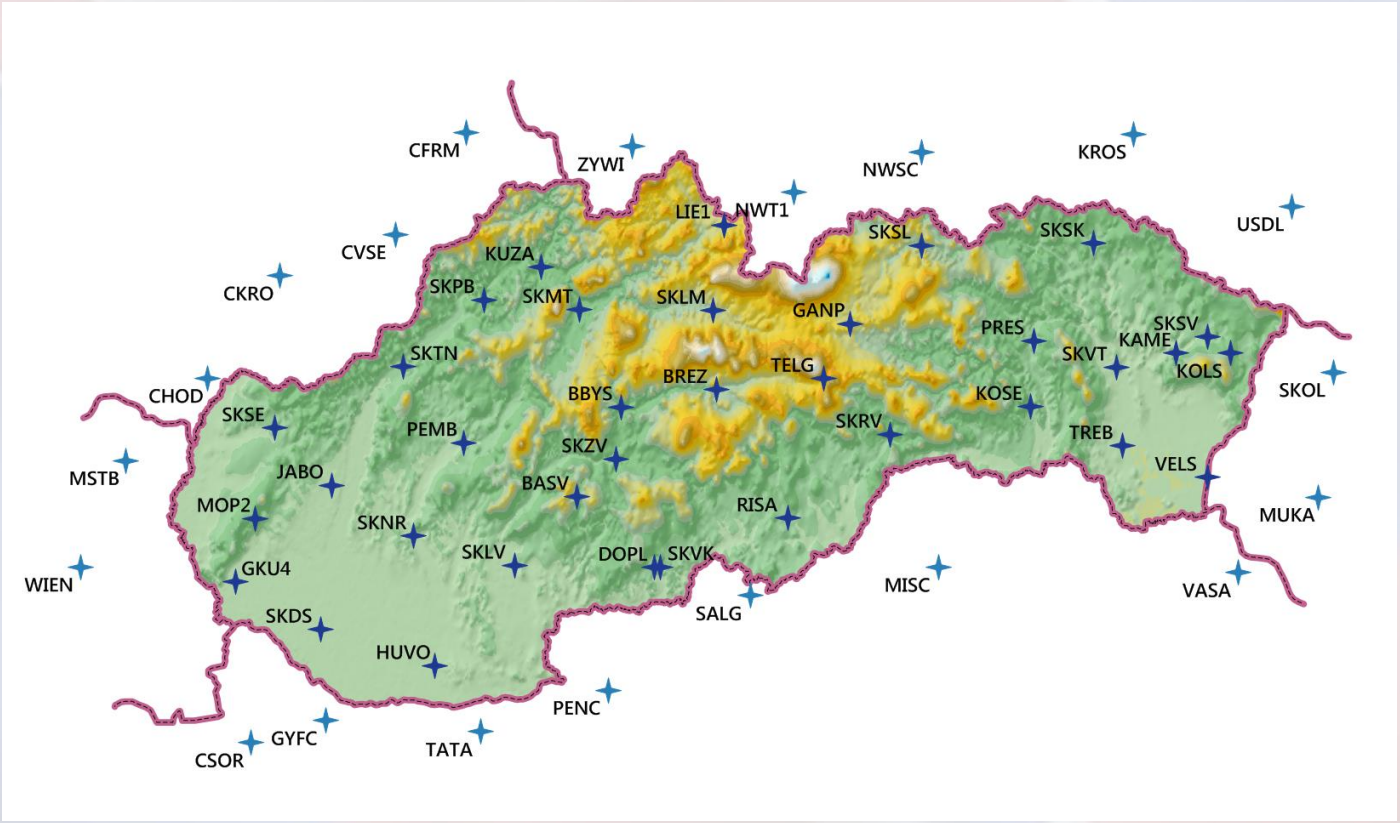


Slovak real-time determination system - SK*POS*®

SKPOS®

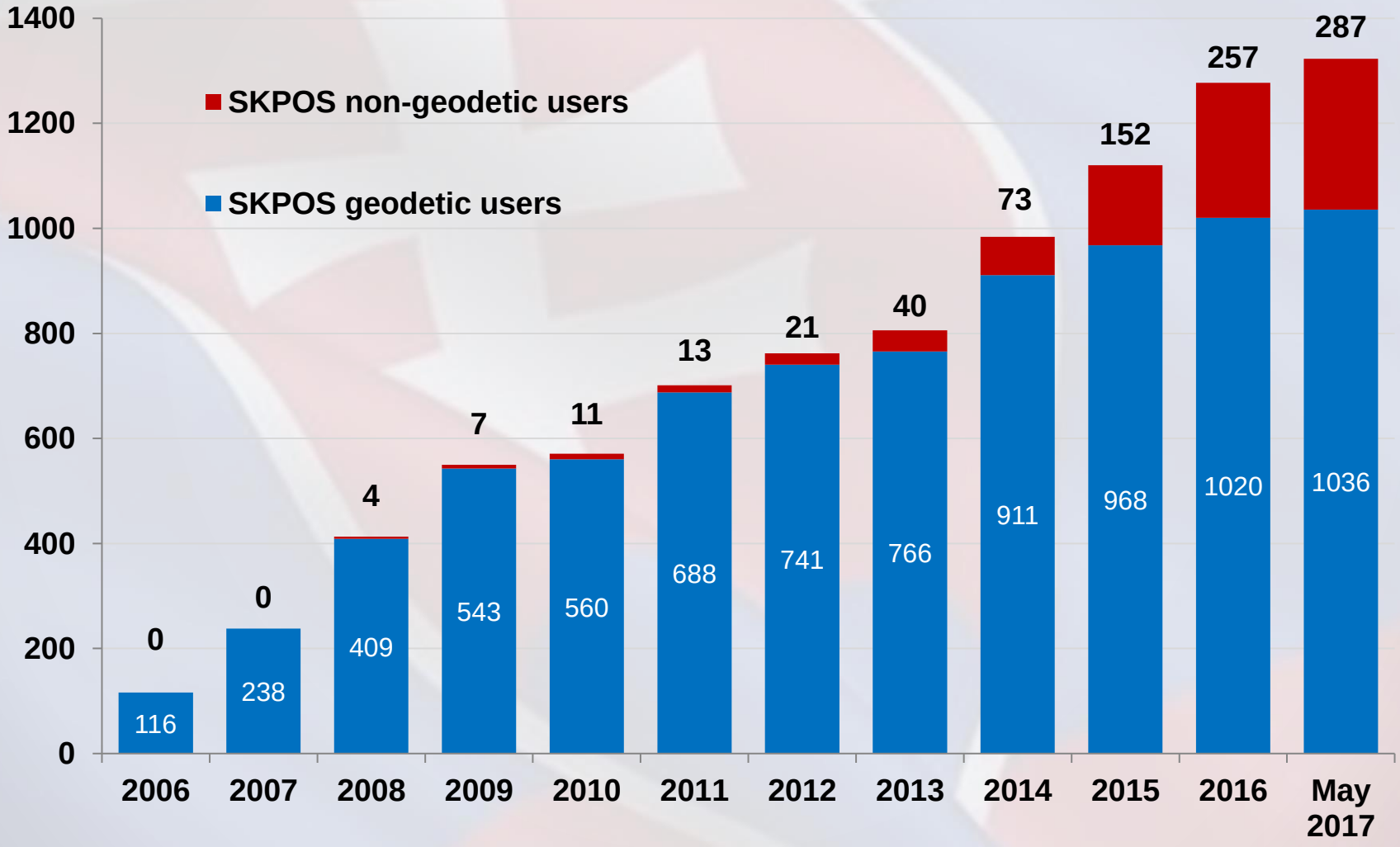
Reference stations infrastructure (May 2017)

- **34 Slovakian reference stations (14 individual calibrated)**
  - 29/34 stations observe GPS+GLONASS+Galileo
  - Network density: average distance is 44,6 km
- **20 foreign reference stations (APOS, gnssnet.hu, CZEPOS, ASG-EUPOS, ZAKPOS)**



SKPOS®

Number of users



SKPOS®

Type of users

- Surveying fields (cadastre, surveying, mapping, GIS) - **78%**
- Other fields (precise agriculture, machine guarding) - **22%**

SKPOS®

Packages - data formats - charges

Package	Content	Duration	Format	Flat rate
SKPOS_mm	RINEX 1000 h	year	RINEX 2.x, 3.x	50 €
SKPOS_cm (year)	RTK unlimited + 50 h RINEX	year	NEW RTCM 2.3, 3.1, RTCM 3.2 MSM CMRx, CMR+	50 €
SKPOS_cm (month)	RTK unlimited	month	NEW RTCM 2.3, 3.1 RTCM 3.2 MSM CMRx, CMR+	19 €
SKPOS_dm	DGNSS unlimited	year	RTCM 2.1	20 €

SKPOS®

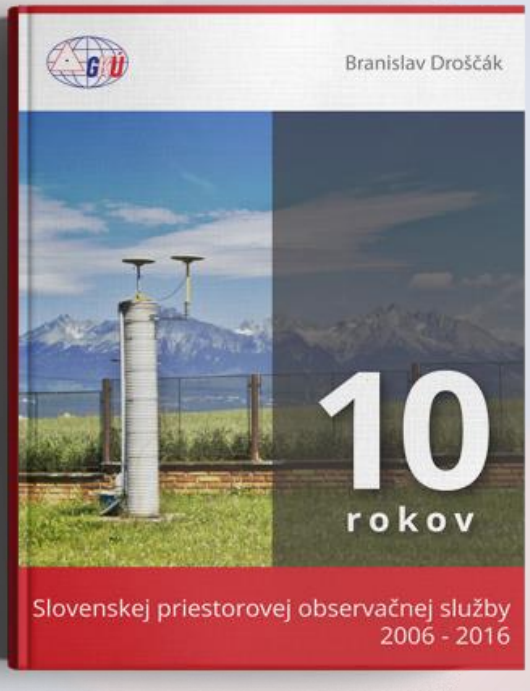
10 years anniversary (2006 – 2016)

- **User seminary - SKPOS 2016**
  - Dates: 19.10.2016 and 20.10.2016 in Bratislava
  - Partners: ÚGKK SR and Geotronics Slovakia s.r.o
  - Number of participants: over 150
  - Feedback: well appreciate

SKPOS®

10 years anniversary (2006 – 2016)

- New book: 10 years of SKPOS (in Slovak)
- New SKPOS promo brochure



SKPOS®

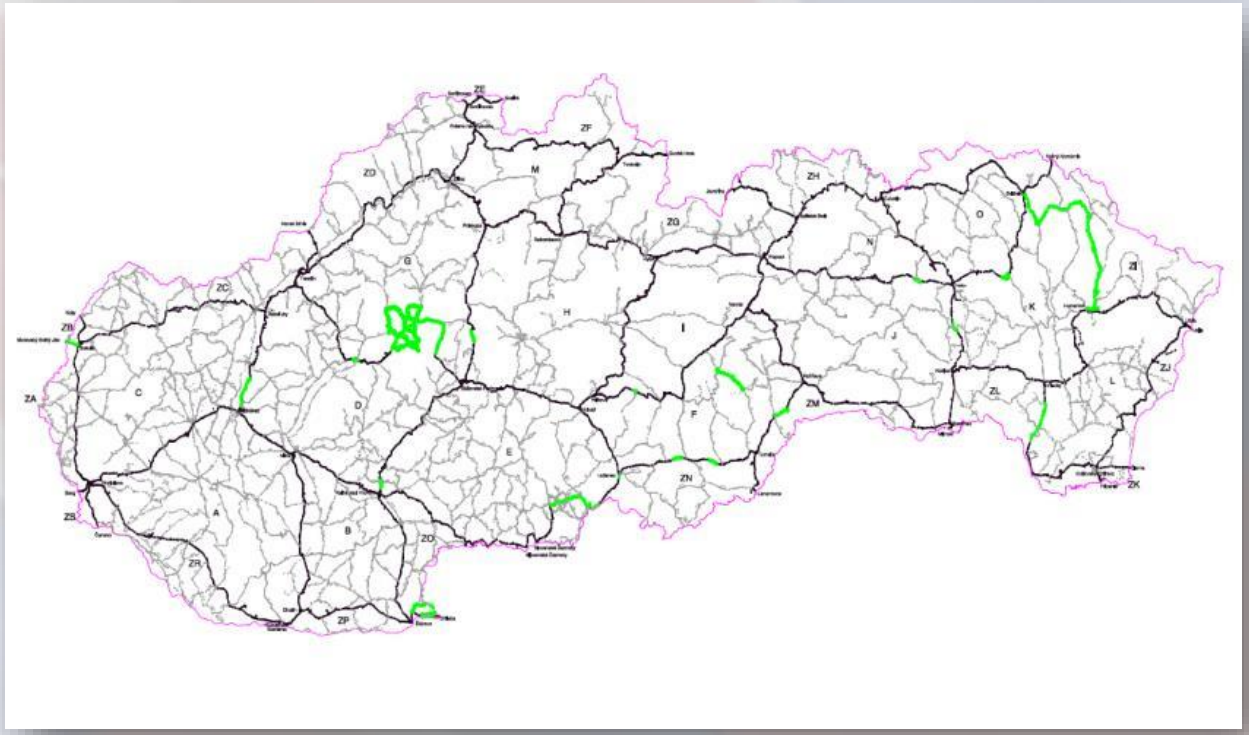
New guideline for users

- Name of the guideline: Usage of Slovak real-time determination system for surveying
- Aim:
  - to define unified procedure of SKPOS usage for surveying in Slovakia
  - to improve the quality and the level of professionalism of surveying using SKPOS

National levelling network

National levelling network

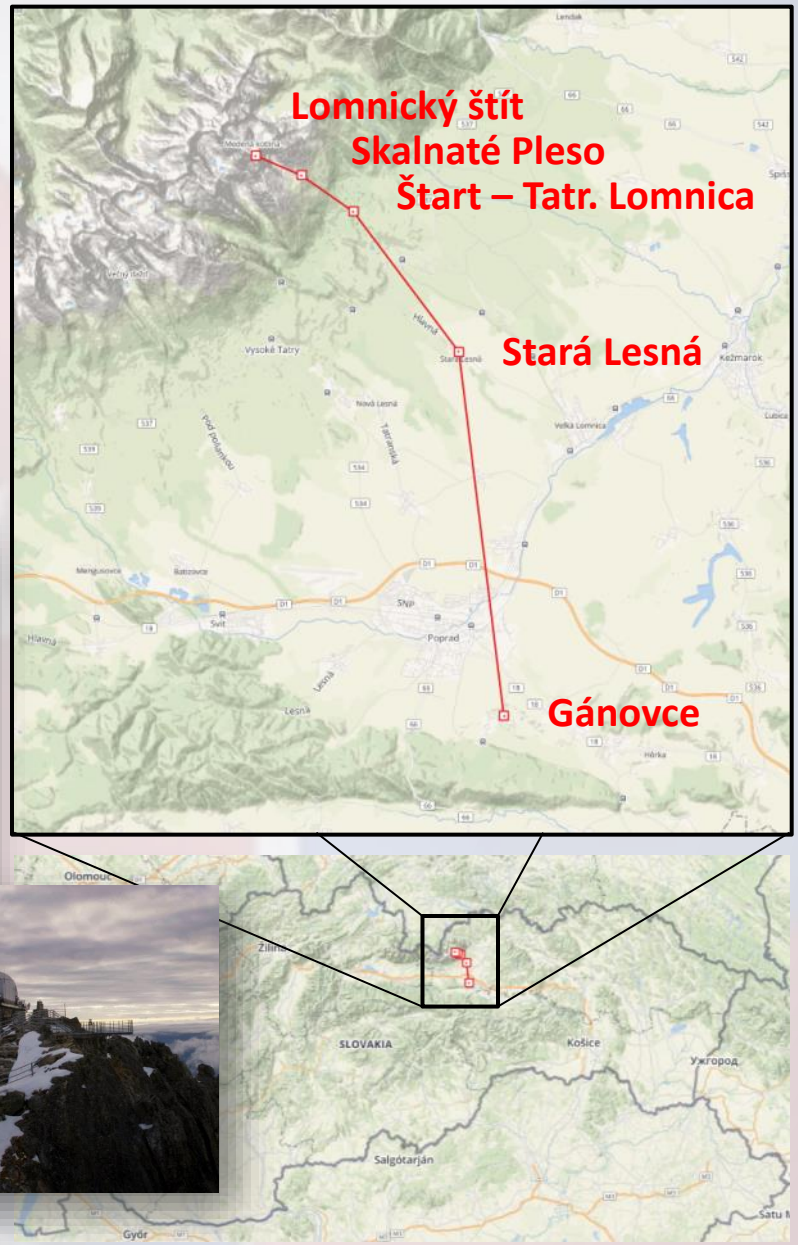
- 585 km of the new levelling lines measured in 2016
- work done by 3 levelling groups
- Target for 2020 year: The new national vertical reference system realization



National gravimetric network

National gravimetric network
New vertical gravimetric baseline

- Locality: Tatra mountains
- 5 points
- Gravity difference: 4406,6 µGal
- Height difference: 1935 m
- Highest point: Lomnicky peak 2634 m
- measurements done by FG5X-251 (GOP, CZE)



Geodetic and Cartographic Institute Bratislava
Research and development activities

Projects supported by data from SK*POS*®

EPN
EUREF permanent network

october 2003

EUREF-IP
project

march 2007

National center for diagnosing the Earth surface deformations in Slovakia

december 2010

SES
Space emergency system

december 2014

november 2006

IGS
IGS permanent network

april 2010

ECC
EUPOS combination center

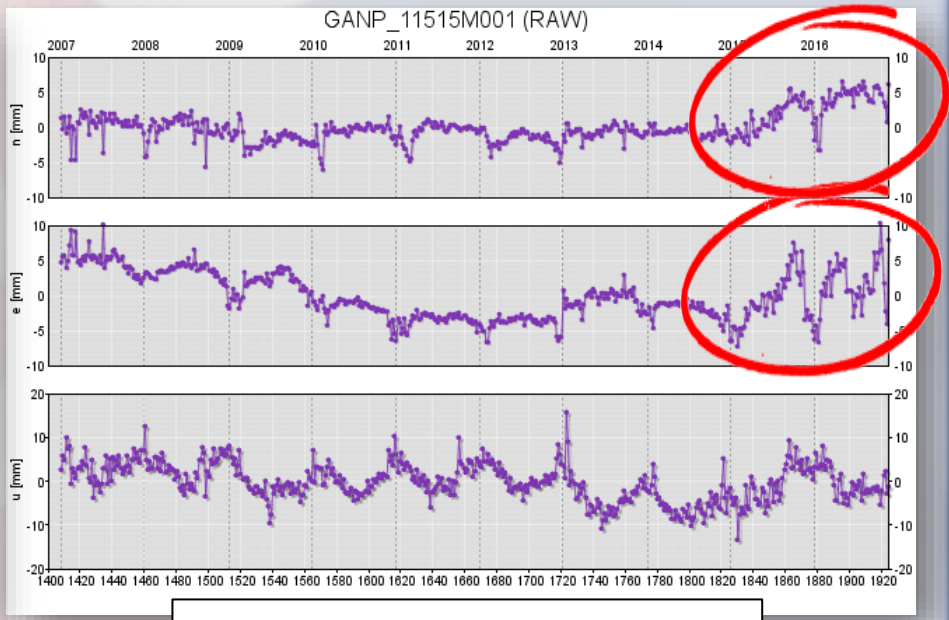
may 2014

EUPOS
monitoring system

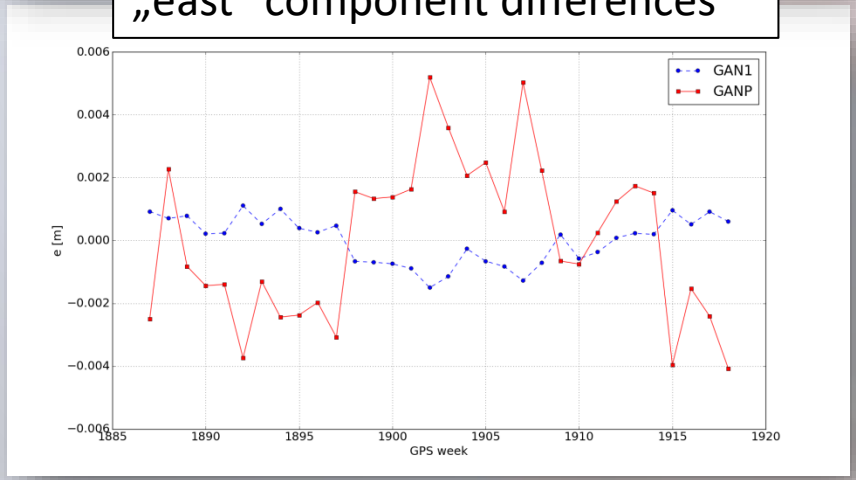
july 2015

EGVAP

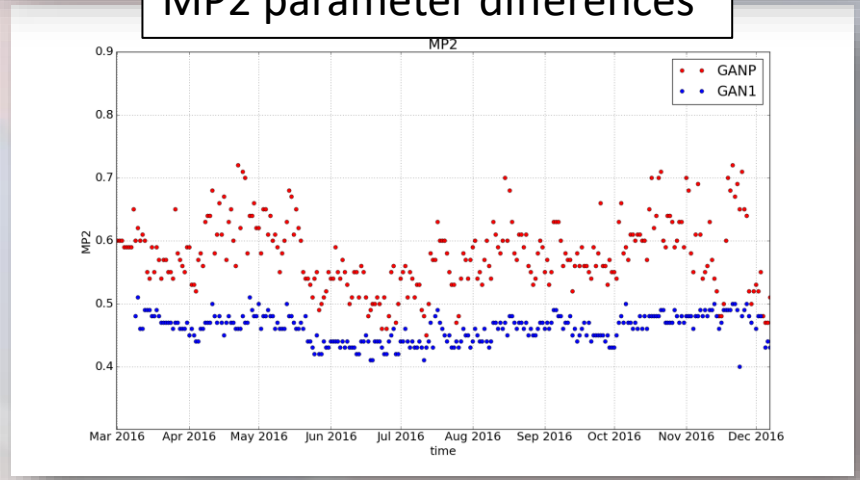
EPN, IGS and SK*POS*® permanent station GANP (Gánovce) analysis

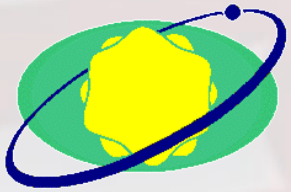


„east“ component differences



MP2 parameter differences

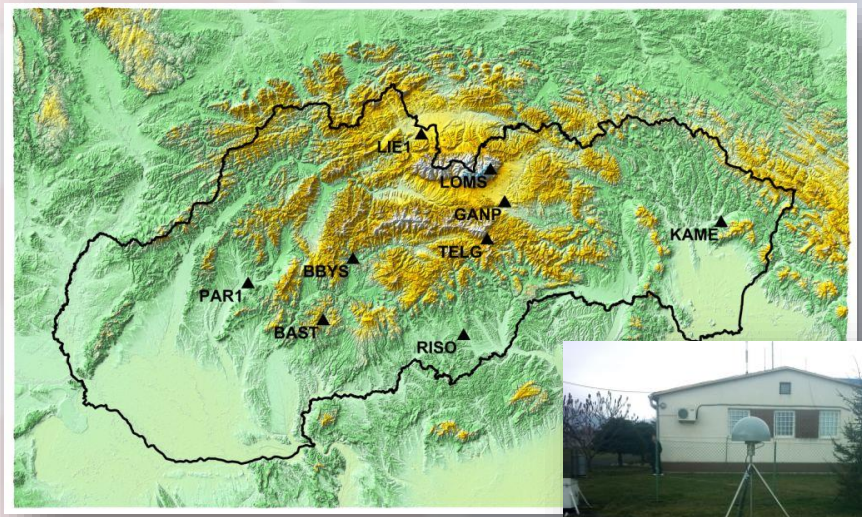


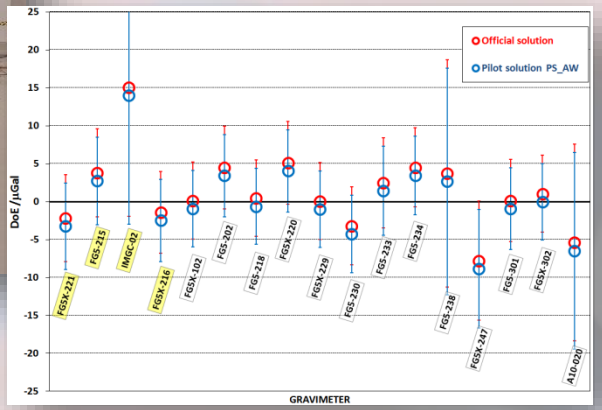


Slovak University of Technology
Research and development activities

National center for diagnosing the Earth surface deformations in Slovakia

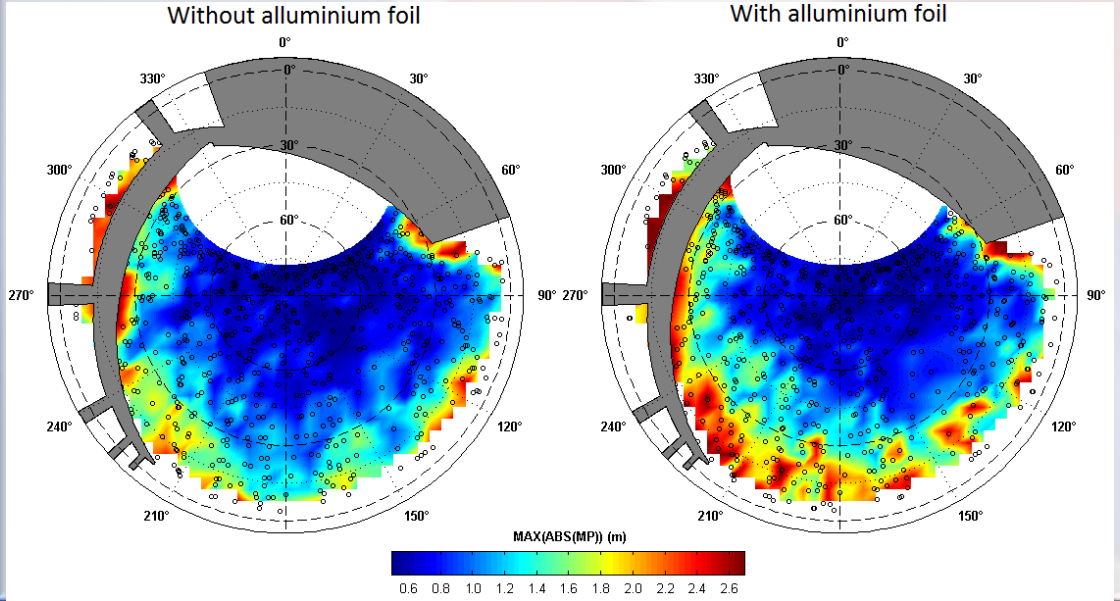
- ITMS research project
- 9 absolute gravity / GNSS permanent stations
- Activity in 2016:
  - FG5 gravitimeter comparison in Luxembourg





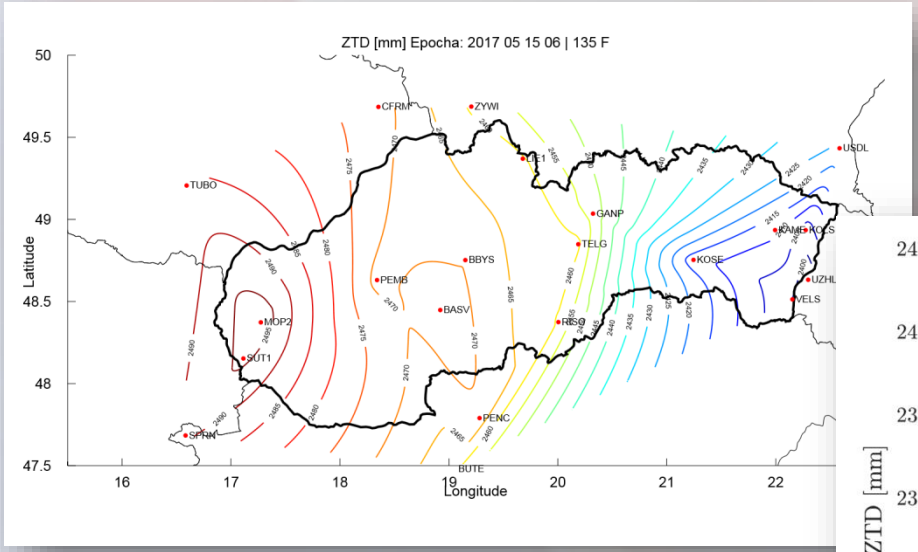
Code multipath experiment

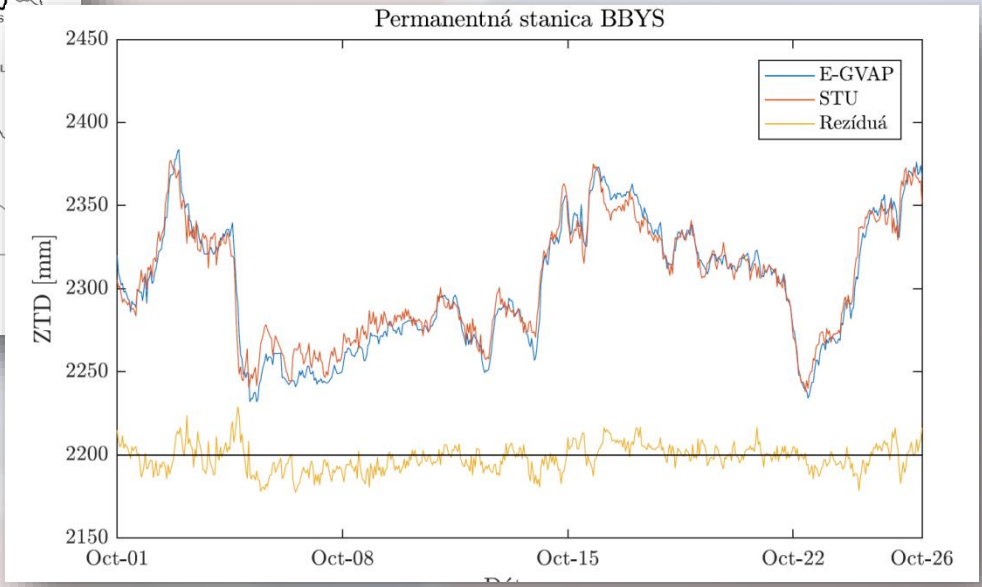
- Two measurement epochs were performed with aim to show contribution of material reflection properties.
- Code multipath statistics MP1, MP2 for GPS signals shows increase up to 60% at point situated in 3 m distance from the wall.



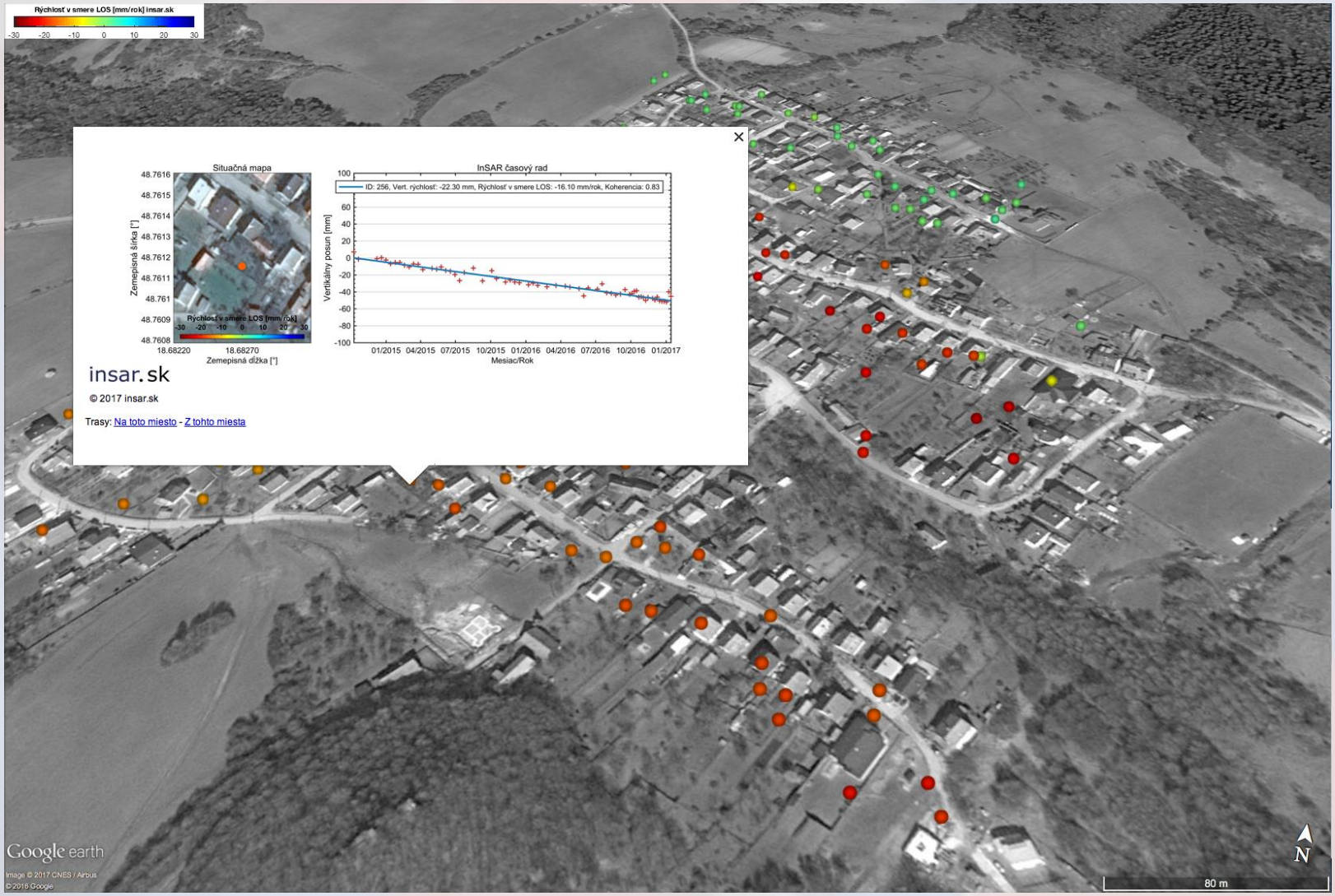
GNSS meteorology - ZTD and PWV computation SUT own solution

- Near real time GNSS processing in Bernese SW 5.2
- Latency 55-60 min
- Meteorological data from SHMU (Slovak meteorological service)
- 36 GNSS reference stations

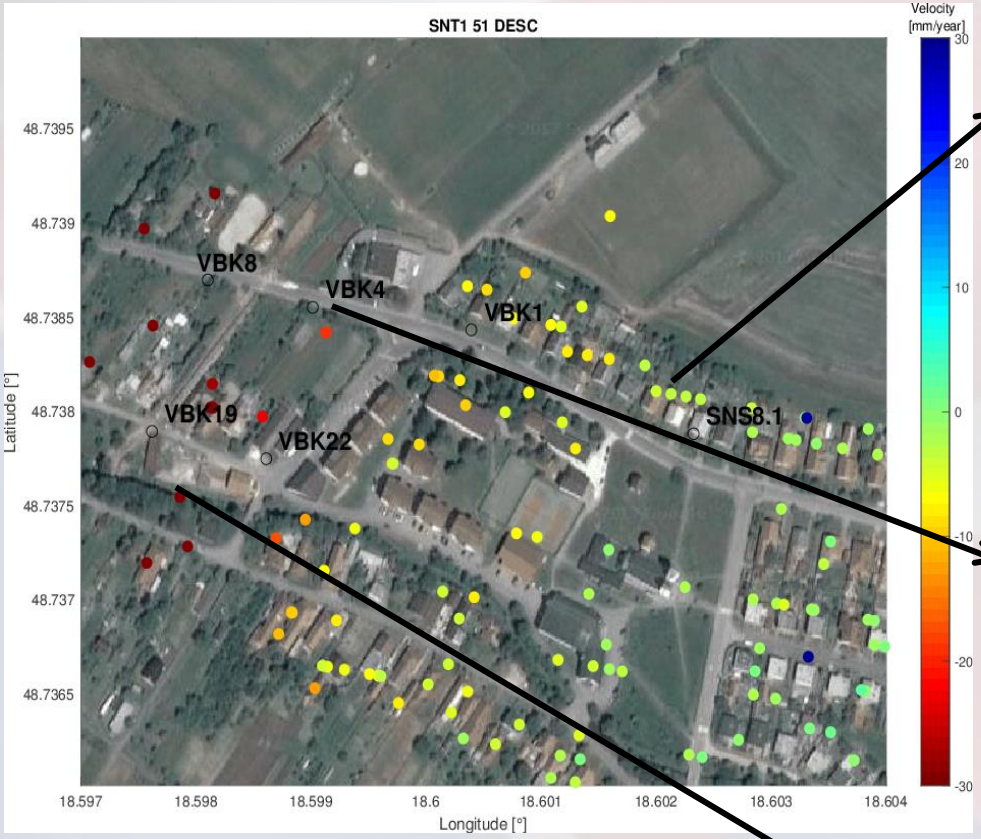


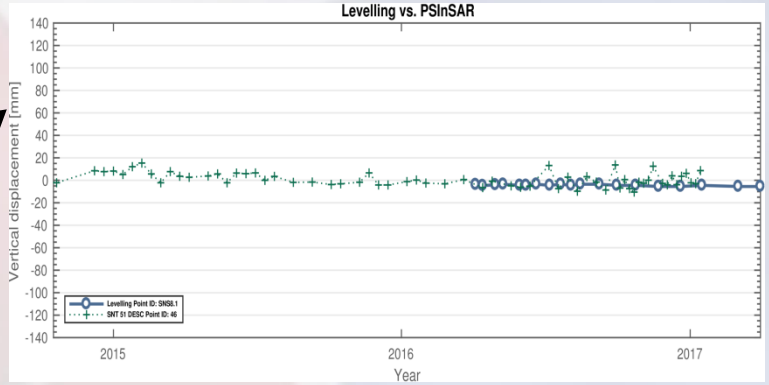


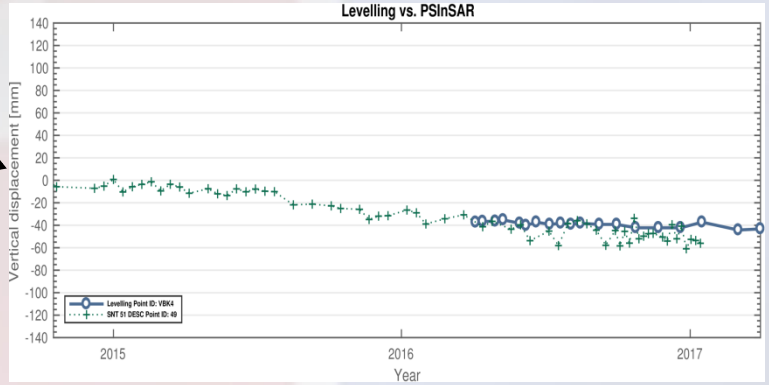
Multi-sensor InSAR deformation monitoring: Geohazards - landslides, PRIEVIDZA, SENTINEL-1 (2014 -2017)

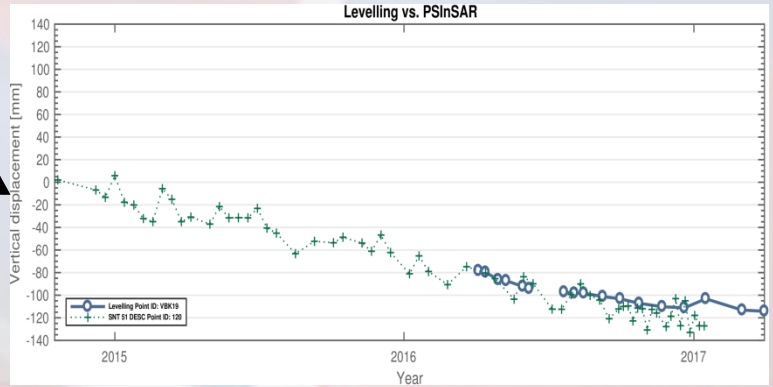


Geohazards Landslides – undermined area Koš – comparison with levelling







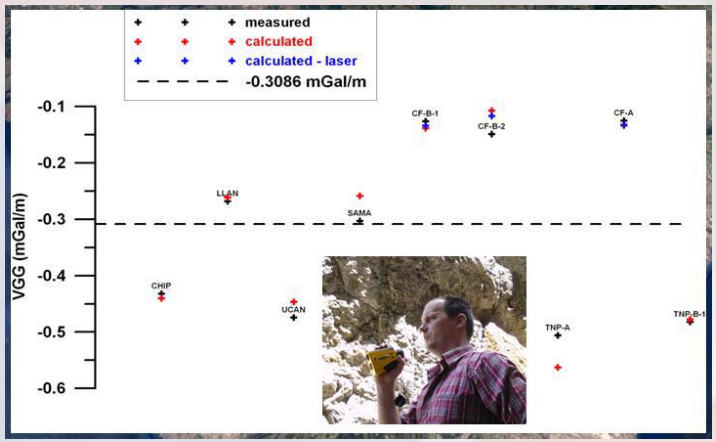


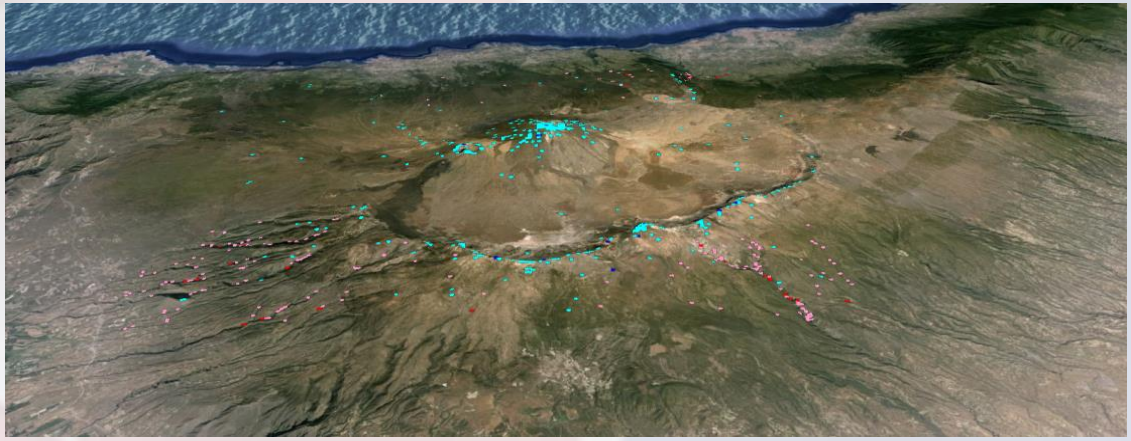
GEOHAZARDS – UNDERMINED AREA, KOŠ, SENTINEL-1 (2014 -2017) COMPARISON WITH LEVELLING

Slovak Academy of Science
Research and development activities

PREDICTION OF VERTICAL GRADIENTS OF GRAVITY (VGG)

- Prediction of VGGs based on modelling the topographic gradient effect with use of high resolution high accuracy DTMs (Zahorec, Papčo, Vajda)
- Verification by in situ observations (Tenerife, June 2016)
- Applications in geodesy, geophysics and geodynamics





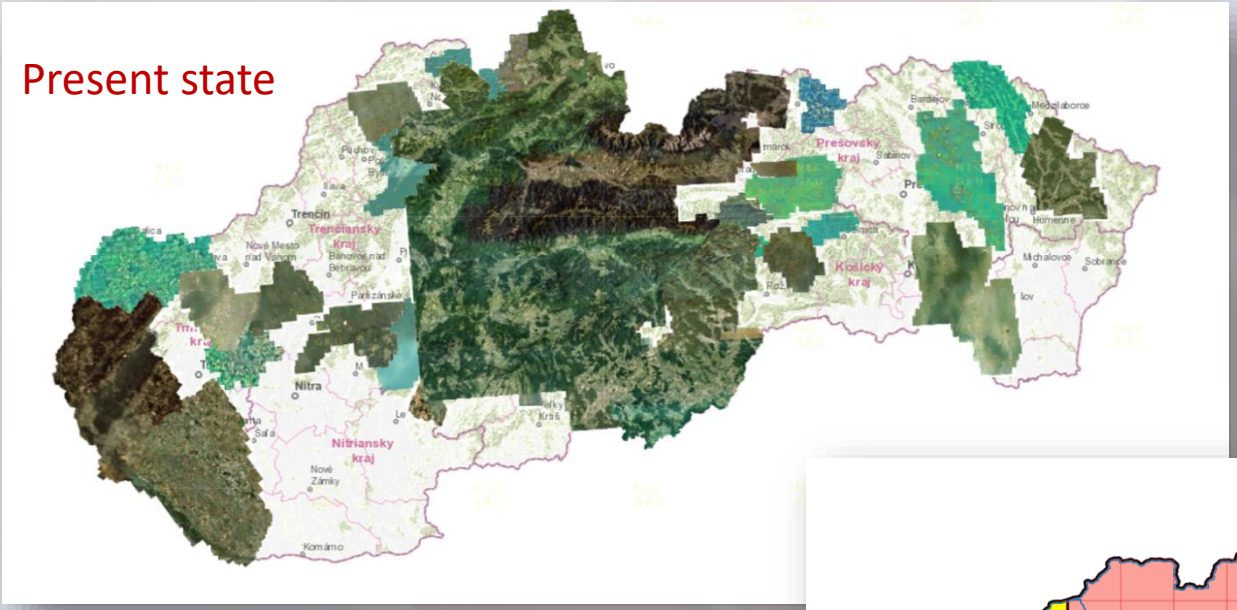
ÚGKK SR
Úrad geodézie, kartografie a katastra Slovenskej republiky

Other news

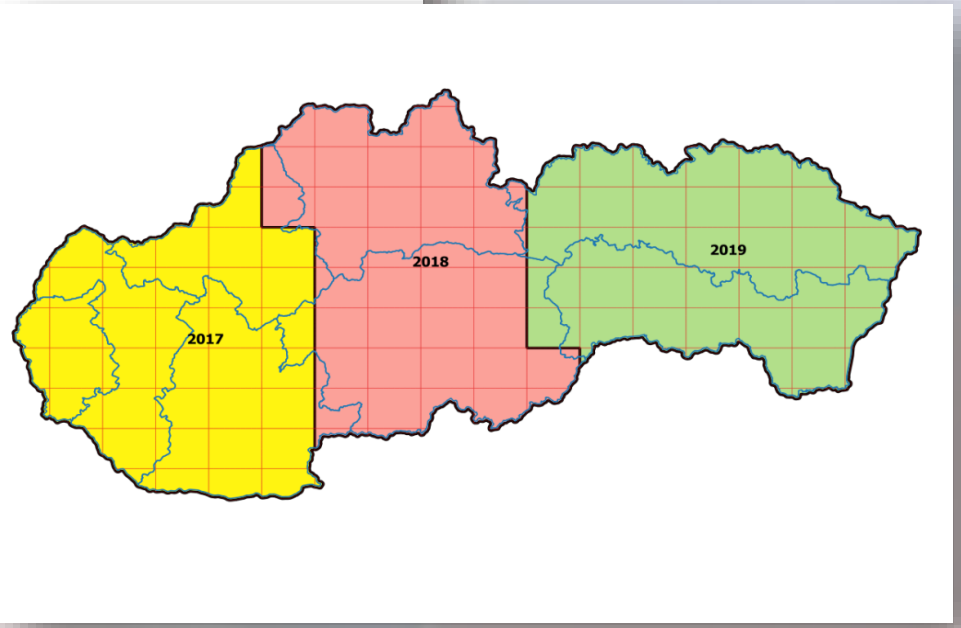
Geodesy, Cartography and Cadastre Authority of Slovak Republic

Orthophotos of Slovakia

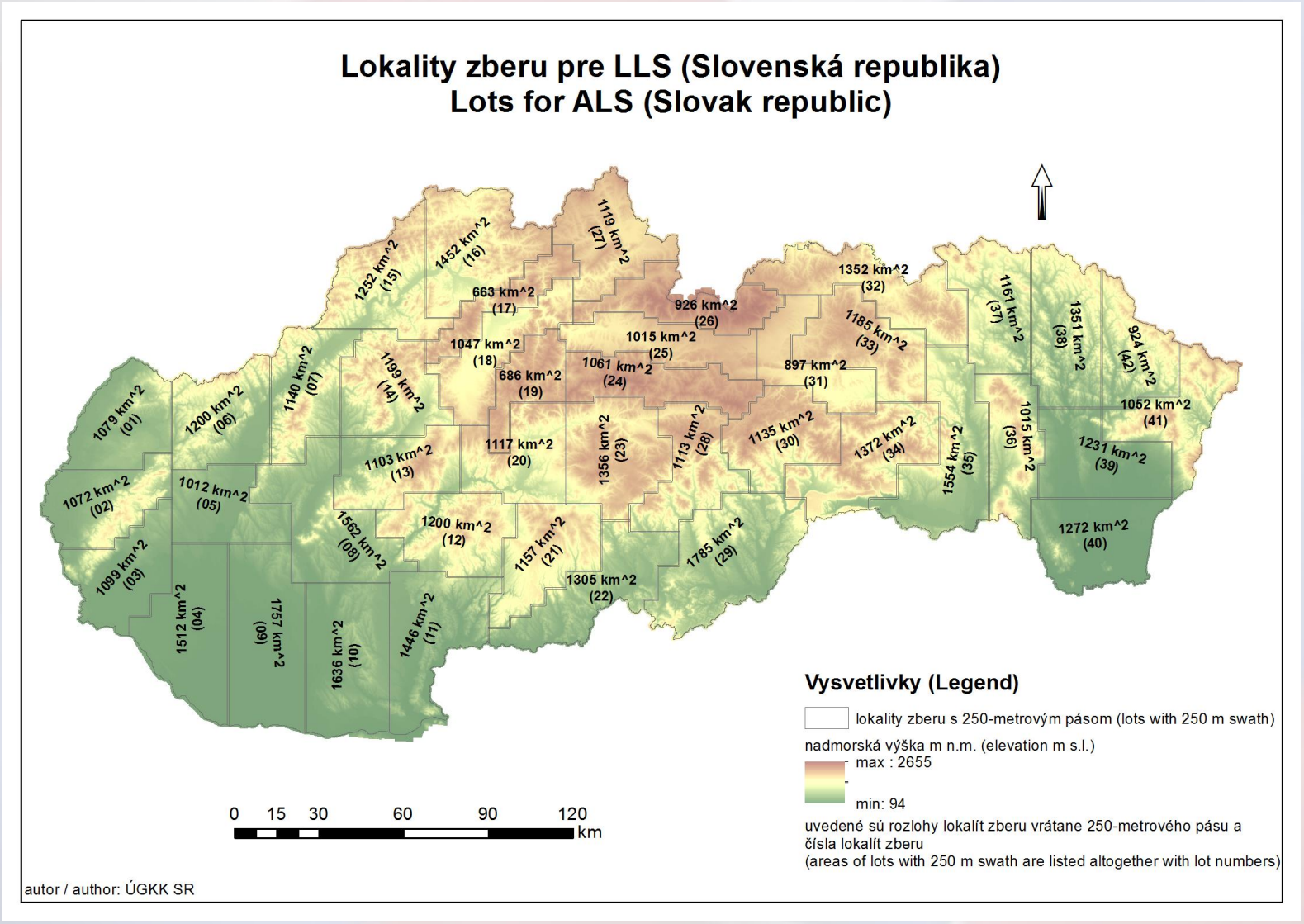
Present state



Plan – cooperation between GCCA and Ministry of agriculture



Digital elevation model



Thank you
for your attention