S**K***POS*® – NOT ONLY POSITIONING SERVICE
R&D PROJECTS SUPPORTER

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International scientific and methodological conference KOLOS 2014

The 1st conference within the project Space emergency system

December 4-6 2014, Stakčín & Kolonica saddle, Slovakia
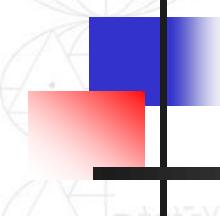
Agenda

- Geodetic and Cartographic Institute Bratislava
  - Geodetic controls department

- **SK*POS*®**
  - what is it
  - infrastructure status in December 2014
  - information about number of users, type of users etc.

- Contribution with **SK*POS*®** data to research and development projects
  - Own activities
  - Collaboration with other institutions
  - Planned activities

- Conclusion

Geodetic and Cartographic Institute (GKÚ)
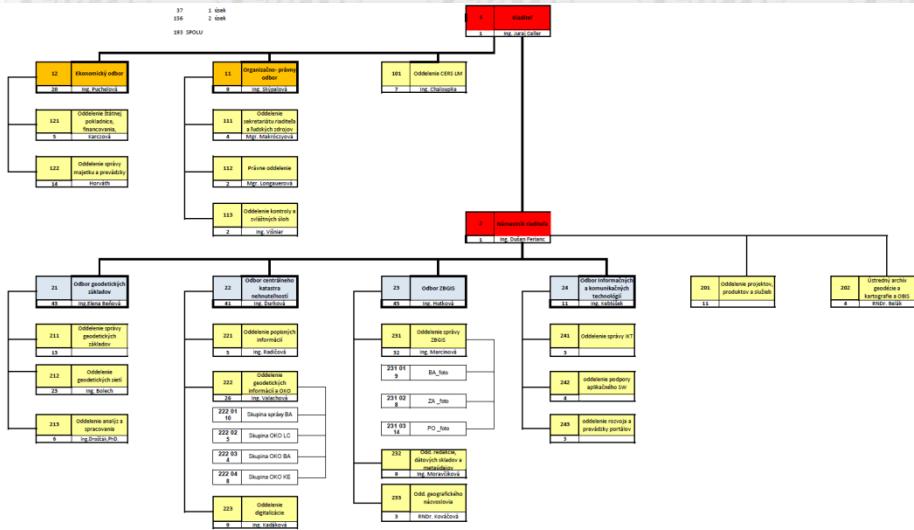
- **Budget organisation**
- **Under patronate of Geodetic, Cartographic and Cadastral authoroty of the Slovak republic (ÚGKK SR)**
- **193 employees**
- **6 departments and 20 sections**

Geodetic controls department Structure

Geodetic controls department
Ing. Branislav Droščák, PhD.

Geodetic controls administration
Ing. Elena Beňová

Geodetic controls networks
Ing. Václav Bolech

Geodetic controls analysis
Ing. Emília Havlíkova

ISGZ group

SK*POS* group

Maintanance Group 1

Maintanance Group 2

Levelling Group 1

Levelling Group 2

Levelling Group 3

Border maintanance Group 1

Border maintanance Group 2

Border maintanance Group 3

Gravimetry Group 1

GNSS a SK*POS* data processing

Levelling processing

Geodetic controls department
Main tasks

Geodetic and Cartographic Institute Bratislava
Geodetic controls department

1. Administration and realization of the geodetic reference systems in Slovakia

2. Providing of the reference base for correct work in geodetic reference systems

Reference base

- Geodetic controls points of National spatial, National levelling, National gravimetric and National trigonometric networks

- Services which enable to work in or transform data between geodetic reference systems ($SKPOS^®$ service, transformation service)
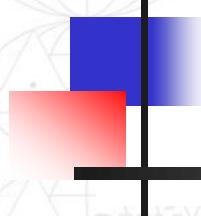
SKPOS®
Slovak real-time positioning service

SK*POS*®
Slovak real-time positioning service

- **S**K*POS*® is Slovakian public real time positioning service which enables registered users to correctly work in ETRS89 and S-JTSK systems via

  - transmitted corrections in RTCM or CMR data formats

  - RINEX data files (for postprocessing)
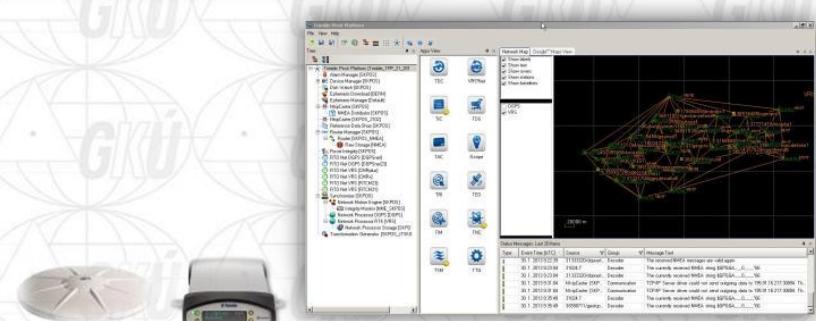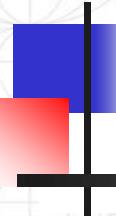
SK*POS*®
Fundaments (main elements)

- **SK*POS*®** composed of
  - **GNSS permanent stations**
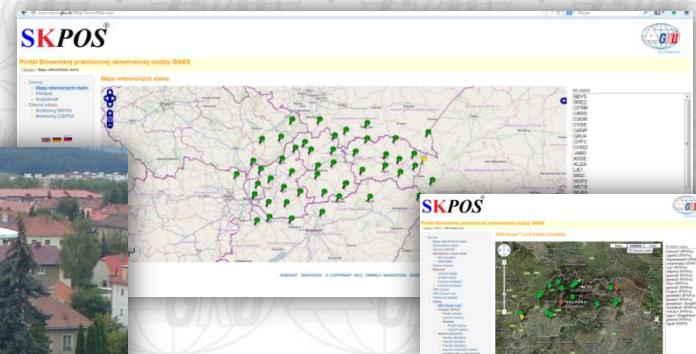
  - **National service center** with service control software

  - **Private WAN network** which joins permanent stations with National service center

SKPOS®
GNSS stations infrastructure (status in Dec 2014)

- **32 Slovakian permanent stations (14 individual calibrated)**
  - All stations with TRIMBLE receivers and antennas
  - All stations observe GPS+GLONASS signals (few Galileo and BeiDou)
- **18 foreign permanent stations (APOS, gnssnet.hu, CZEPOS, ASG-EUPOS, ZAKPOS)**

Legend
- 🔵 Trimble NetR8 receiver
- ⚫ Trimble NetR9 receiver
- 🟡 Trimble NetR5 receiver
- ⭕ Individual calibrated antenna
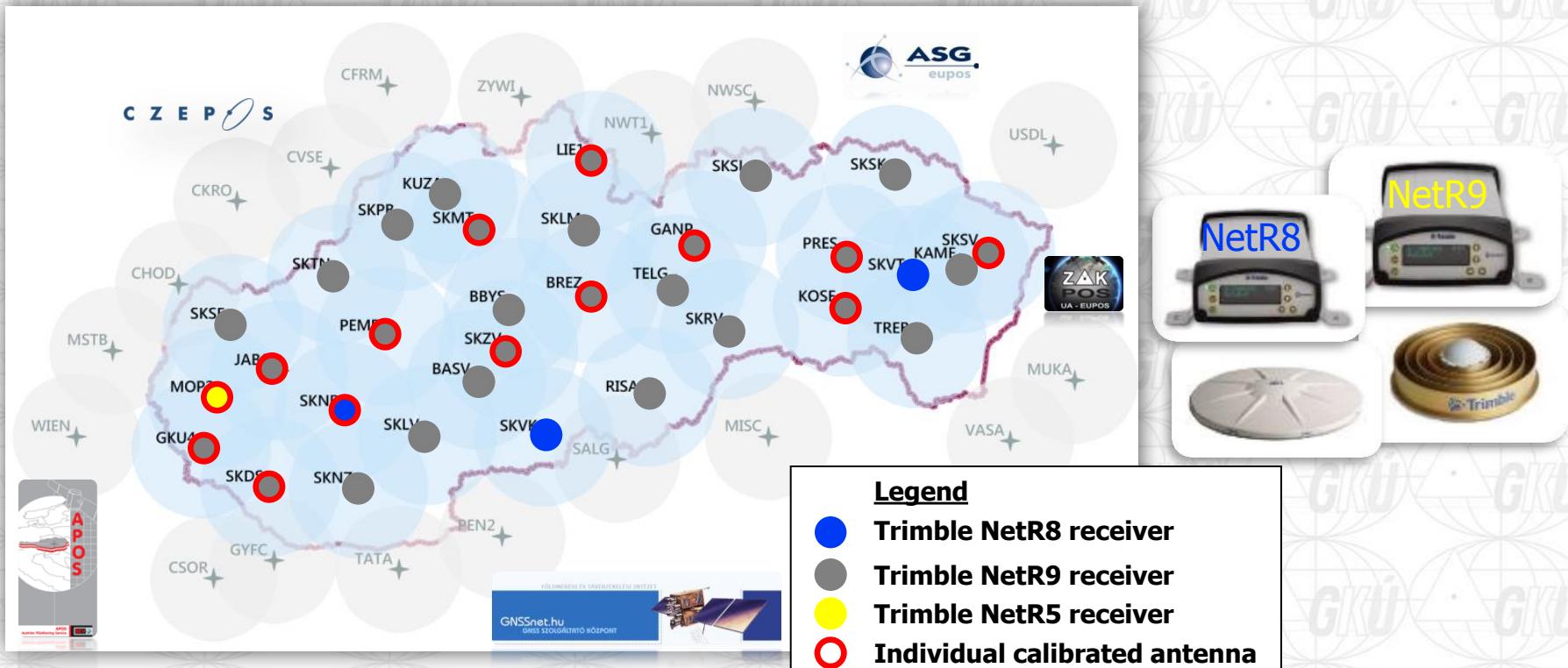
SK*POS*® permanent stations
Types of monumentation

SK*POS*®
National service center and its activities

- National service centre
  - Situated on GKÚ Bratislava

- Web
  - www.skpos.gku.sk

- Routine activities
  - Service administration
  - Service quality monitoring
  - Data archivation and service backups
  - Users administration and contracts managment

SKPOS®
Control software

Trimble Pivot Platform ver. 3.1.5
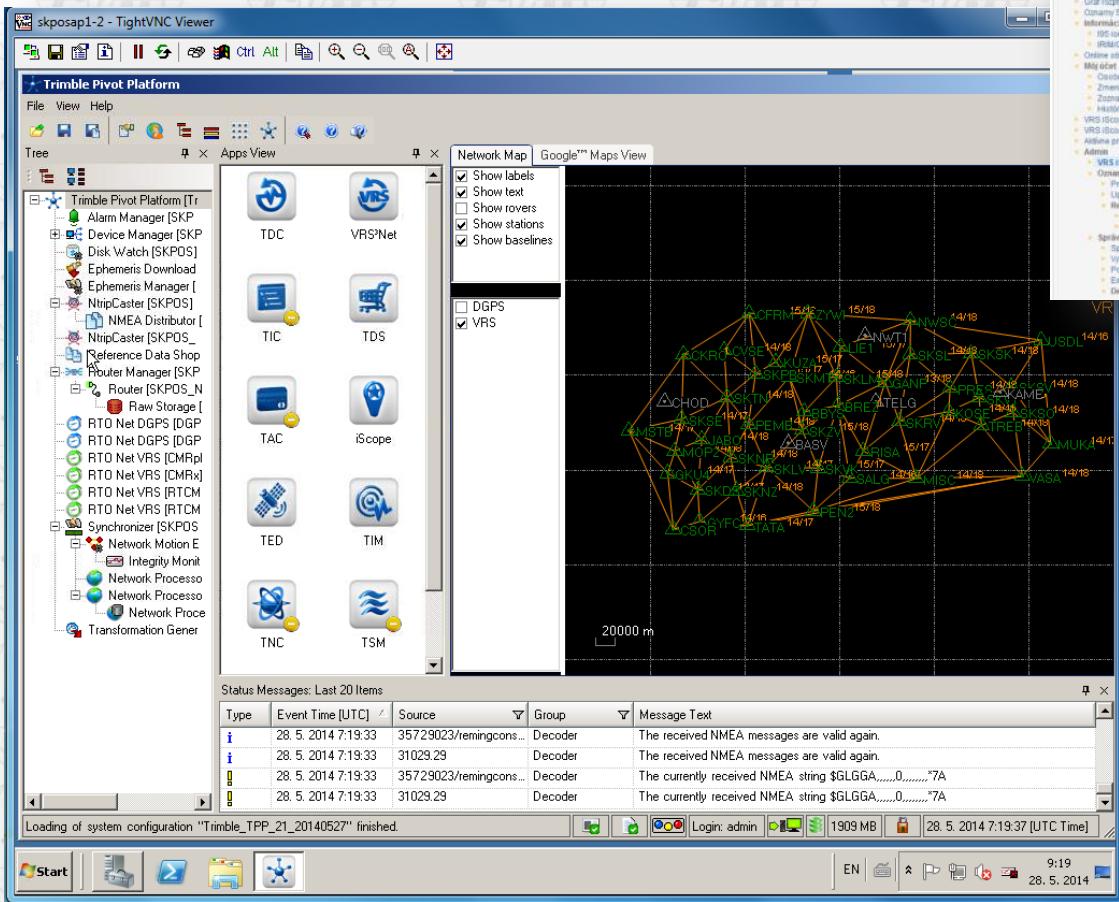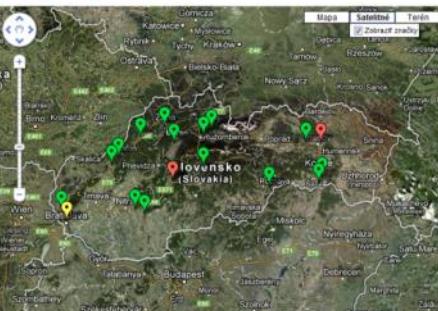
I-Scope modul
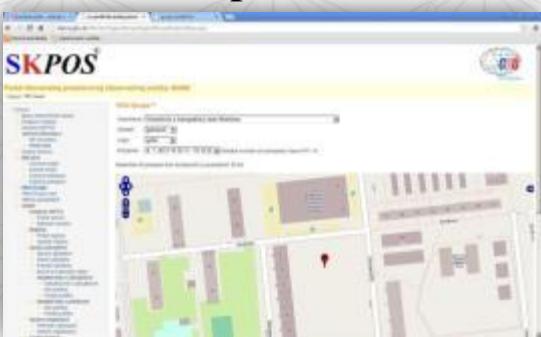
SKPOS®
Service principle

SKPOS® User
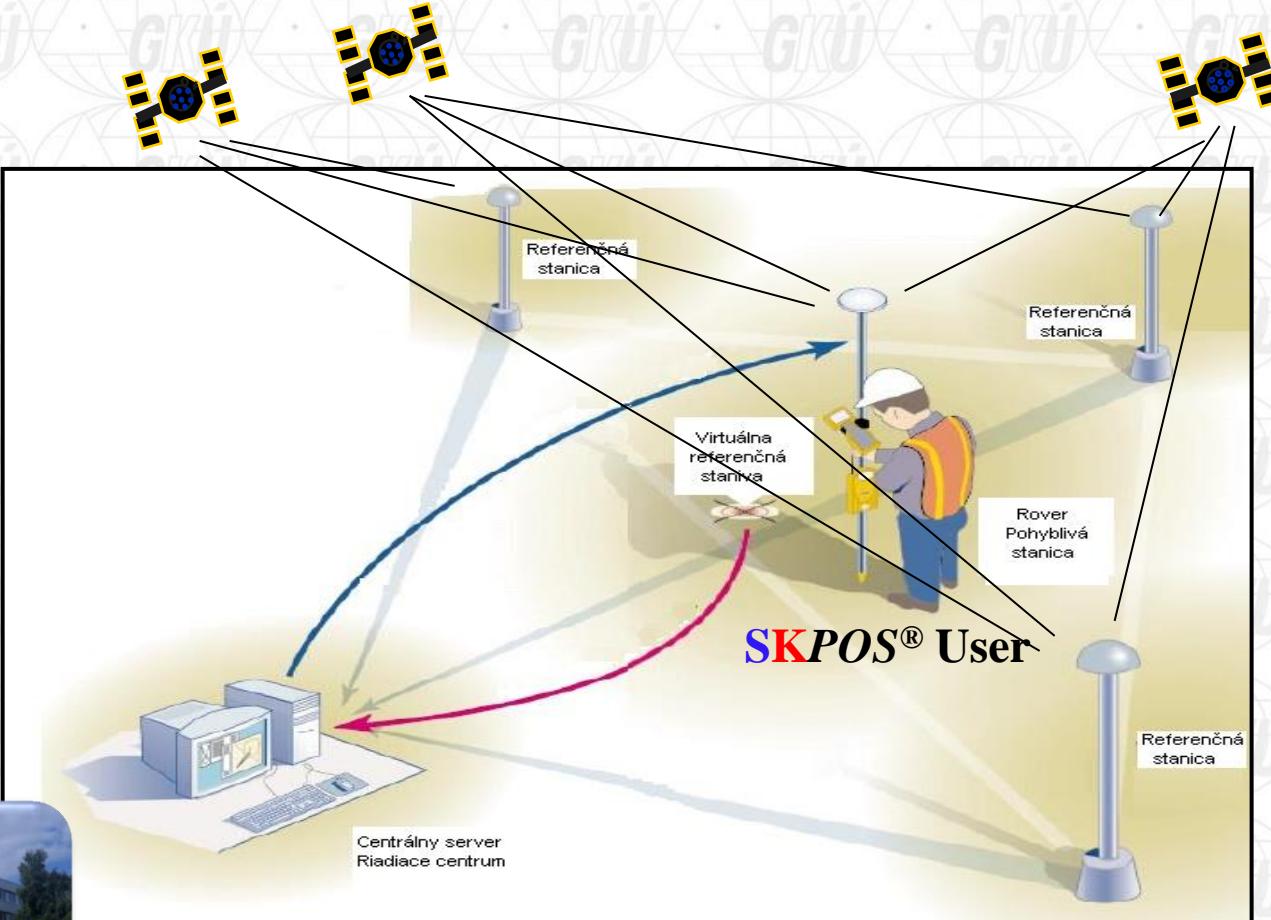
SKPOS® National service center
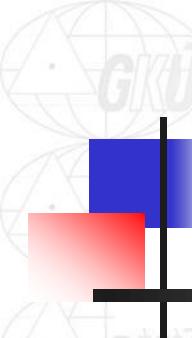
SKPOS®
Services (mountpoints)

Only network solution (Network RTK in VRS concept) is provided!
No single station!

Service (mountpoint) name	Accuracy	Data format	Interval
SKPOS_MM for post-processing (VRS or permanent station data)	mm - cm	RINEX: 2.10, 2.11, 3.0 DAT, TGD, T01, T02	1 sec. – x sec.
SKPOS_CM_23 **SKPOS_CM_31** **SKPOS_CM_CMRX** **SKPOS_CM_CMR+** for RTK	2 – 4 cm	RTCM 2.3 RTCM 3.1 CMRX CMR+	1 sec.
SKPOS_DM_SVK **SKPOS_DM_SVK_23** for DGNSS	0,3 – 1 m	RTCM 2.1 RTCM 2.3	1 sec.

SKPOS®
Charges

Post processing 1000 hours RINEX files	RINEX 2.x, 3.x	50 € / 365 days
Network RTK (year) 1000 hours network RTK 50 hours RINEX files	RTCM 2.3, 3.1, CMRx, CMR+	50 € / 365 days (from 1.5.2014)
Network RTK (month)	RTCM 2.3, 3.1, CMRx, CMR+	19 € / 30 days
DGNSS	RTCM 2.1	20 € / 365 days

SKPOS®
Number of users (December 2014)

- over 950 users

- number is still increasing

SKPOS® RTK users

Year	Users
2007	238
2008	413
2009	550
2010	571
2011	701
2012	762
2013	806
December 2014	950
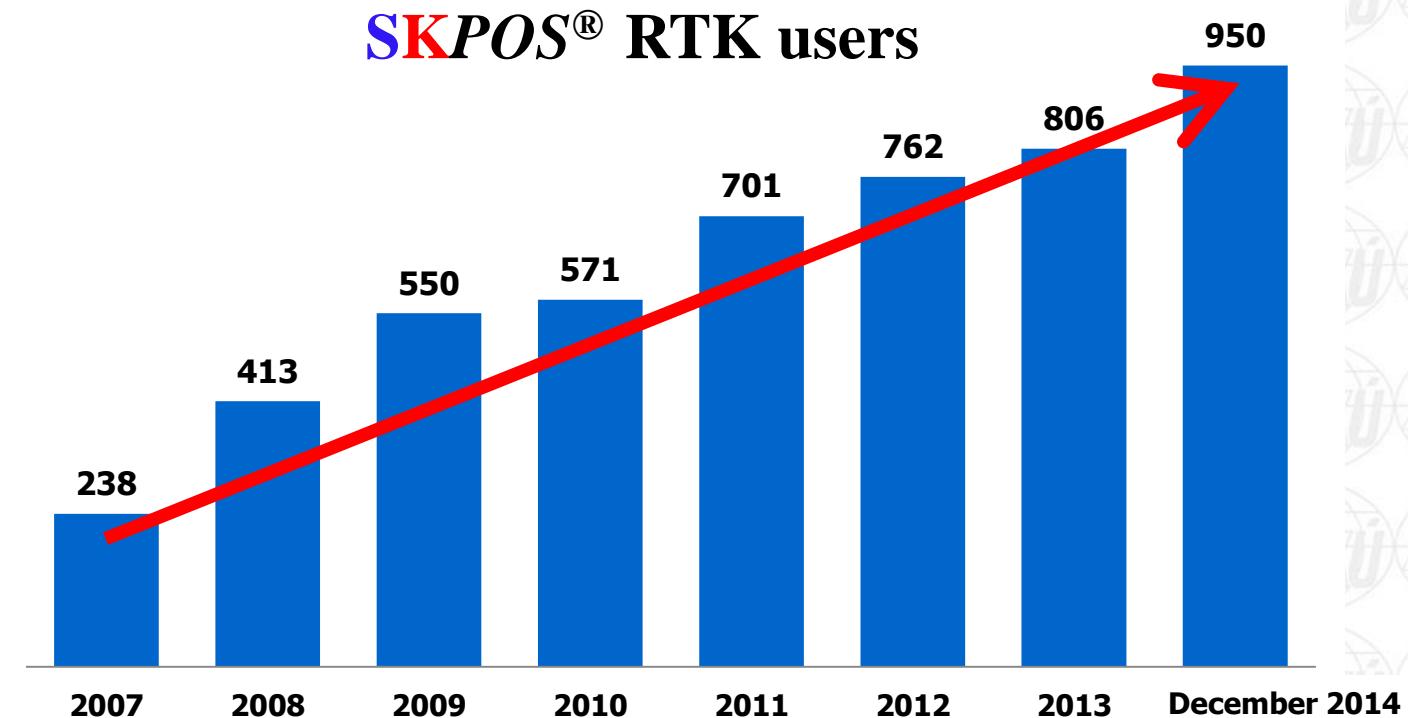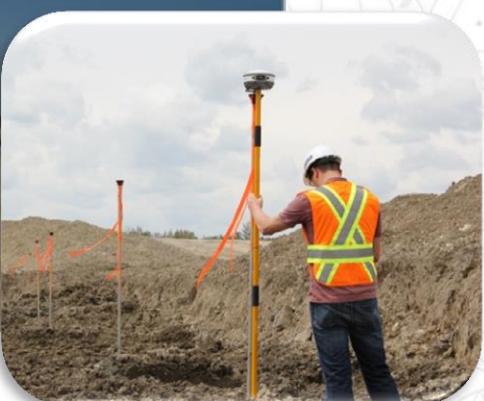
SKPOS®
Type of users

S**K***POS*®
Usage

- S**K***POS*® usage
    - Surveying fields (cadastre, surveying, mapping, GIS) - **92%**
    - Other fields - **8%**

S**K***POS*®
Usage

- S**K***POS*® usage
  - Surveying fields (cadastre, surveying, mapping, GIS) - **92%**

■	Cadastre	24%
■	Engineering - construction	19%
■	Mapping – thematic maps	15%
■	Mapping – different activity	14%
■	Engineering – road construction	9%
■	Land consolidation	5%
■	GIS – data collection	4%
■	Engineering – control and deformation measurements	4%
■	GIS - thematic maps	3%
■	Terrestrial photogrammetry and scanning	1%
■	Aerial photogrammetry and scanning	1%
■	Other	1%
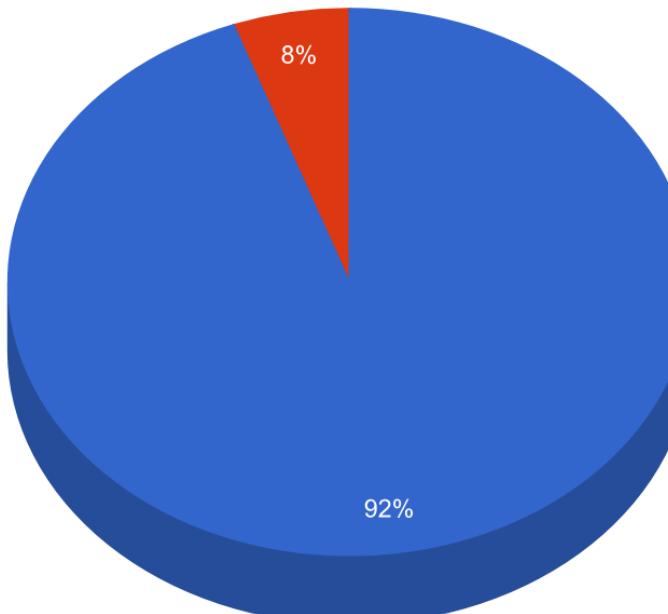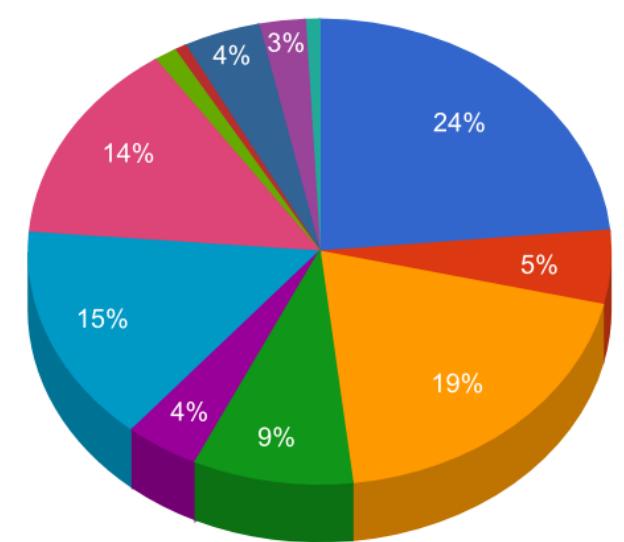
S**K***POS*®
Usage

- S**K***POS*® usage
  - Other fields - 8%

  Other than surveying, cadastre, cartography, geodesy, GIS etc.

🟥	Precise farming	73%
🟪	Other	7%
🟨	Pipeline transport	7%
🟪	Mining	2%
🟦	Construction – control of machines	3%
🟥	Air transport	3%
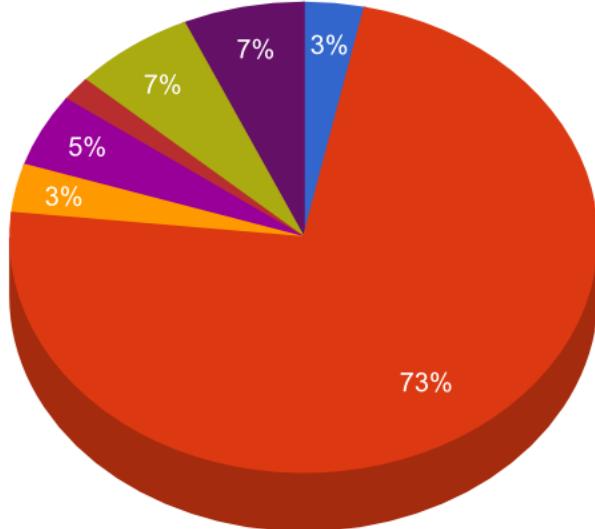
SKPOS®
Portal and registration to the service

http://skpos.gku.sk/RegisterAccount.aspx

Contribution with **S****K***POS*® data to research and development

Own (GKÚ) activities

GKU run **SK***POS*® stations for geodynamics purposes
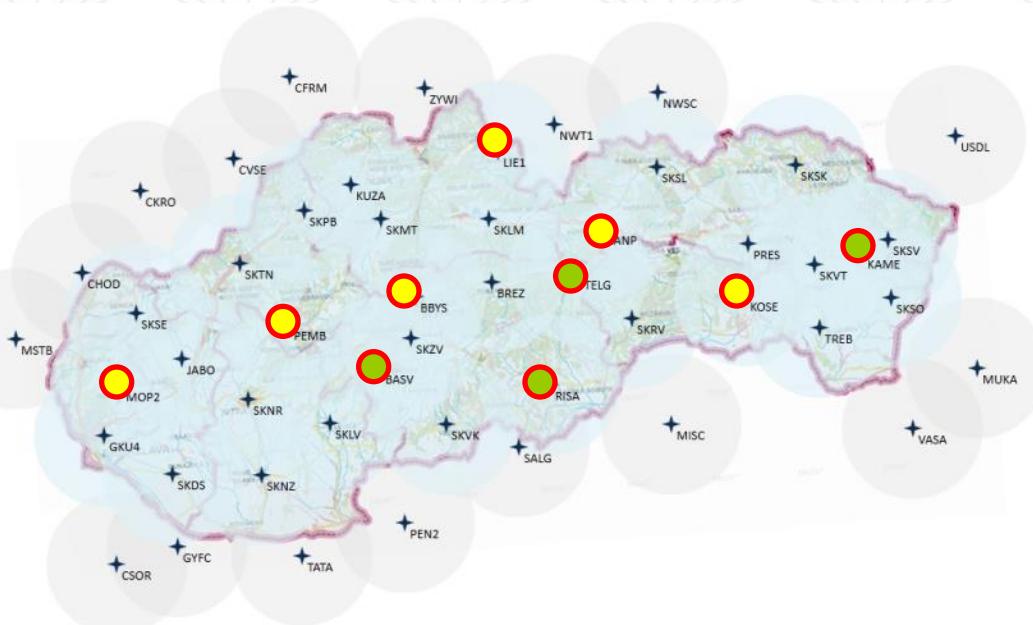
10 special Pilier/pier & deep drilled braced monumentation

Routine precise S**K**_POS_® data processing on GKÚ

- Precise GNSS data processing
  - Scientific Bernese GNSS software v5.2
  - ITRS (ITRF2008)
  - Antenna absolute phase center models
  - Precise IGS ephemerids
  - GPS+GLONASS
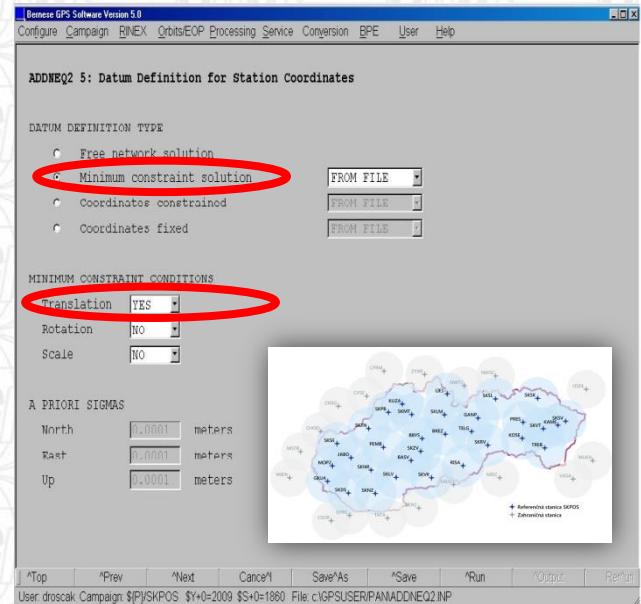
- Adjustment
 - Minimal Constraint – no net translation condition on the selected EPN stations

- Results
  - SINEX files
  - XYZ coordinates + covariancies

# Precise **S**K*POS*® data processing
Processing network
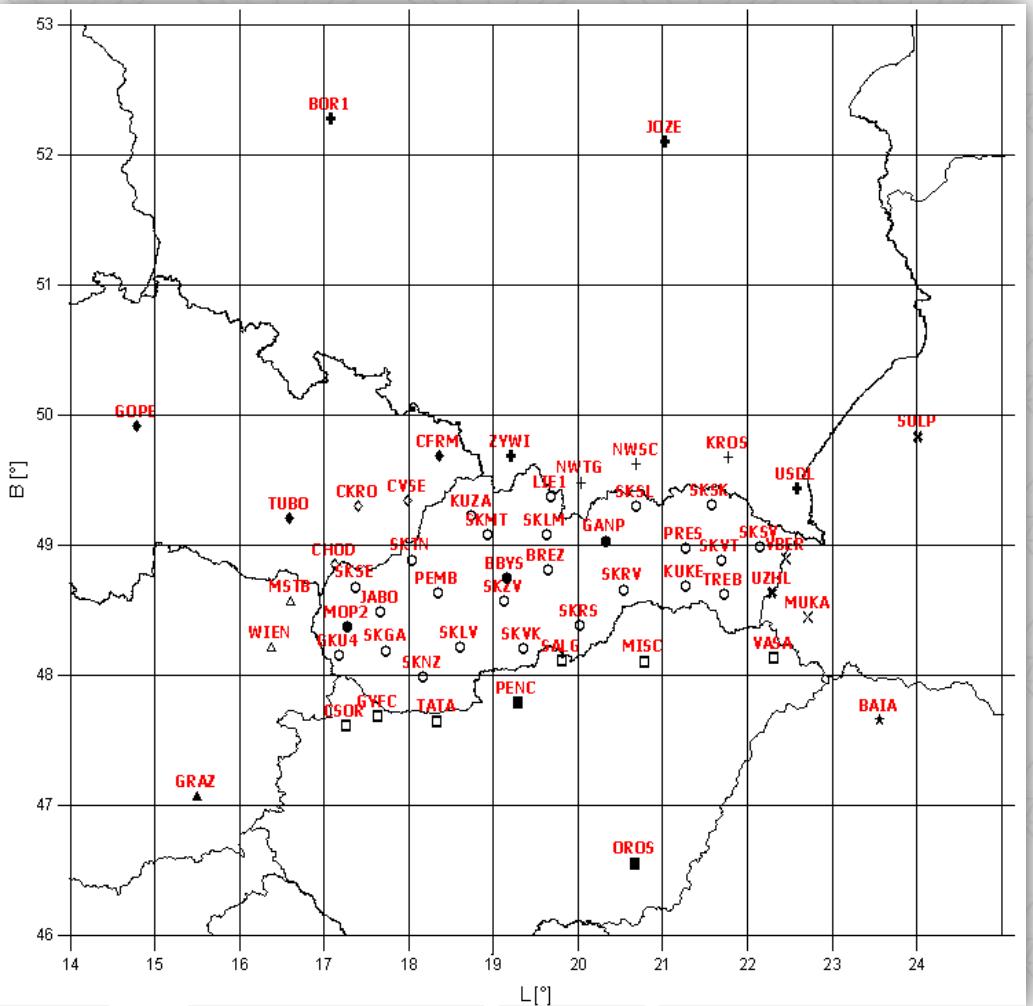
- **S**K*POS* int   30/1 EPN
- **S**K*POS* ext   2/2 EPN
- APOS   3/1 EPN
- GNSSnet.hu   8/2 EPN
- CZEPOS   6/3 EPN
- ASG-EUPOS   7/4 EPN
- ZAKPOS   3/1
- EPN   2

Total   61 stations

# Contribution to geokinematics of Slovakia
Scheme of processing

- 1. **Trend estimation** = interplate velocities estimation

(Estimated station velocities represents motions of particular)

- 2. **Velocities visualization via vector field**
  - Hz plane
  - V plane

- 3. **Motions interpretations**

2 mm
SKTRF09
SKPOS
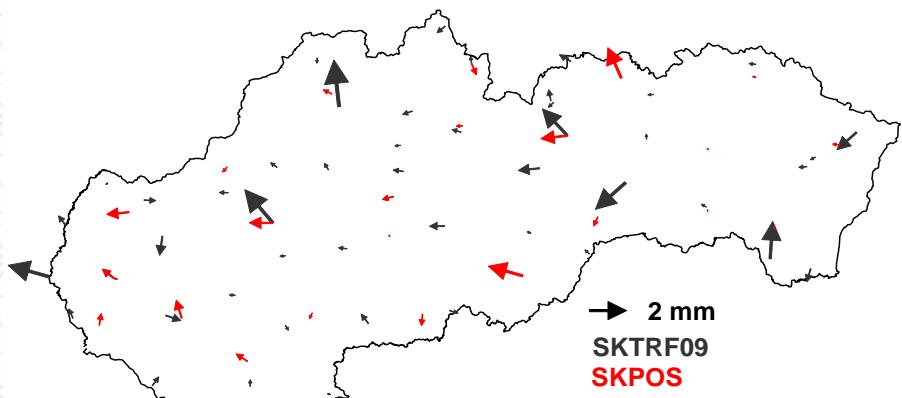
Slovakia geodynamics
Example of the result

Development of Interplate velocities (Horizontal)
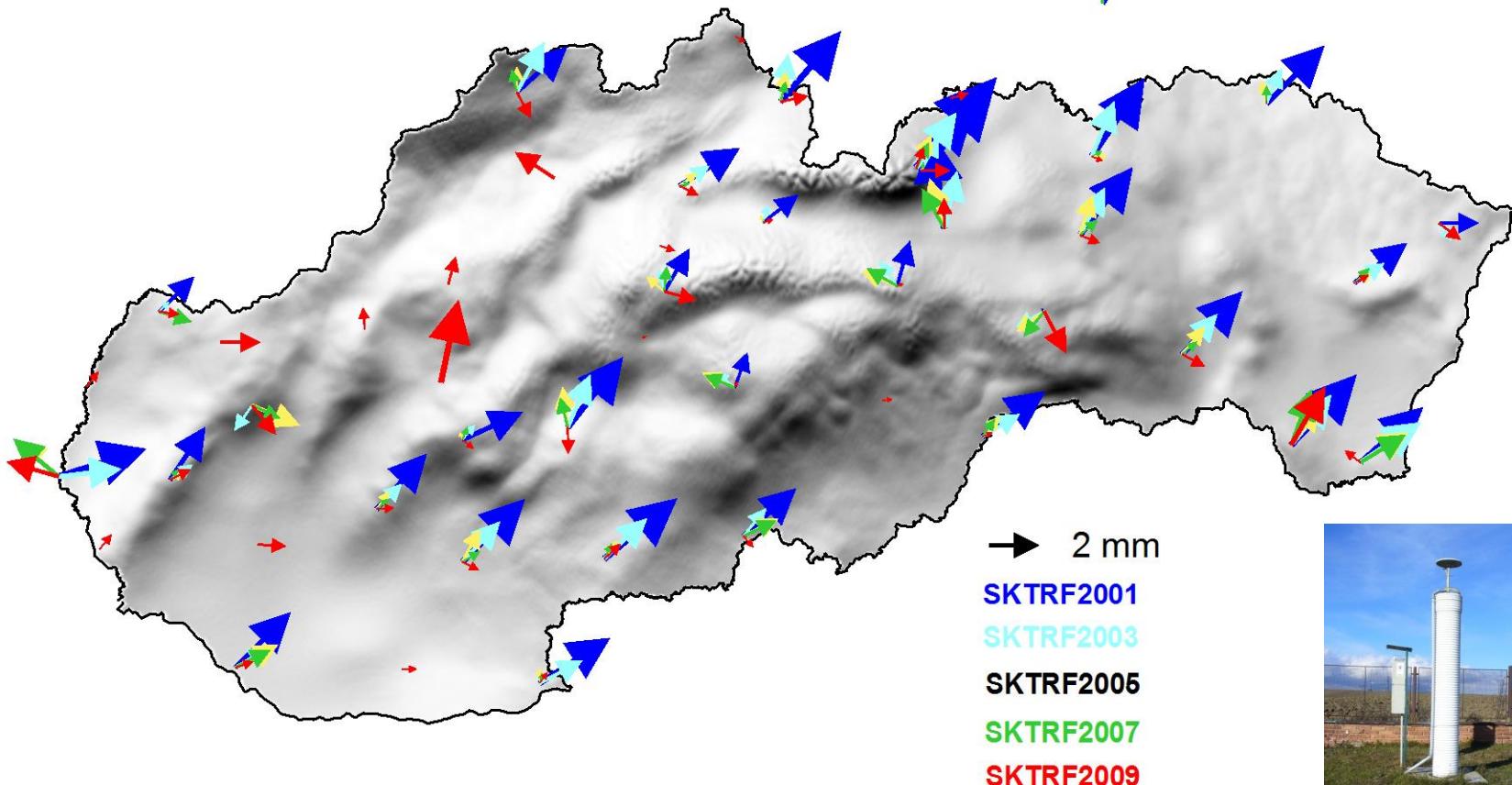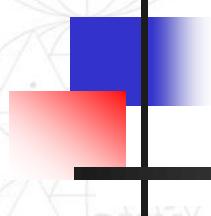
→ 2 mm

SKTRF2001
SKTRF2003
SKTRF2005
SKTRF2007
SKTRF2009

Contribution with **S****K***POS*® data to research and development

Collaboration with other institutions

SK**POS®**
active part of EUPOS®
European Position Determination System

- Follows *EUPOS* initiative standards

- Keeps information in *EUPOS* station database

- Contributes to *EUPOS* combination centre (SINEX GKU)

- Leads EUPOS working group on service monitoring
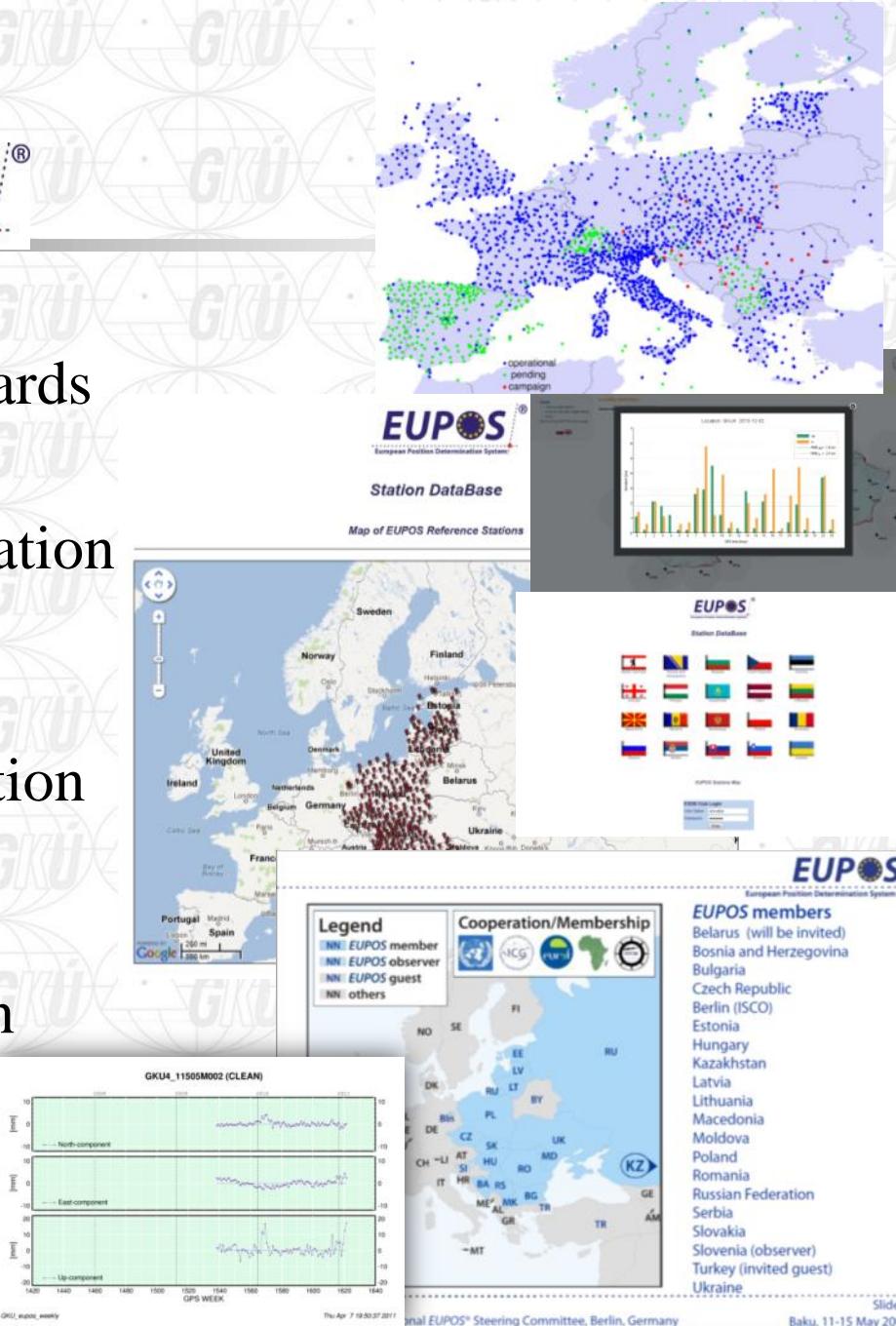
Contribution to „European" geokinematics

- **GKU contributes to ECC = *EUPOS* Combination Center**
  - SINEX files with GKU acronym: **GKUwwww7.SNX**

- **ECC aim**
  - Creation of European interplate velocity model = base for the new ETRS89 definition

- **ECC leader: Ambrus Kenyeres (FOMI - Hungary)**
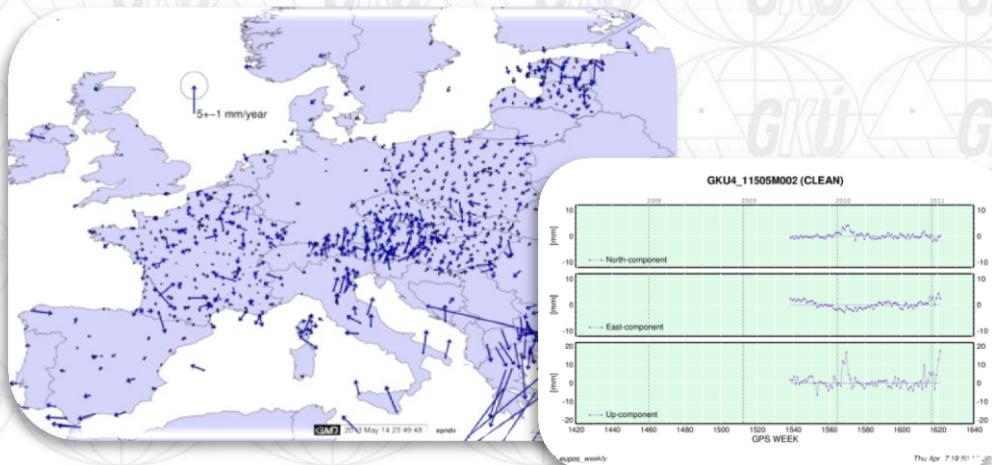
Contribution to „European" geokinematics
A.Kenyeres (from status report – October 2013)

- operational
- prepared
- campaign

10+−2 mm
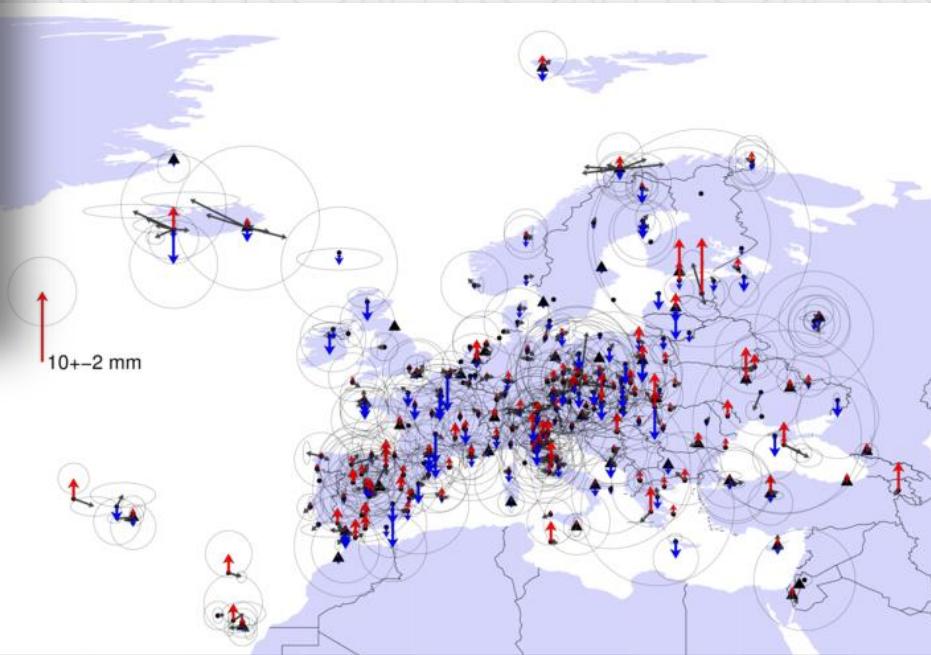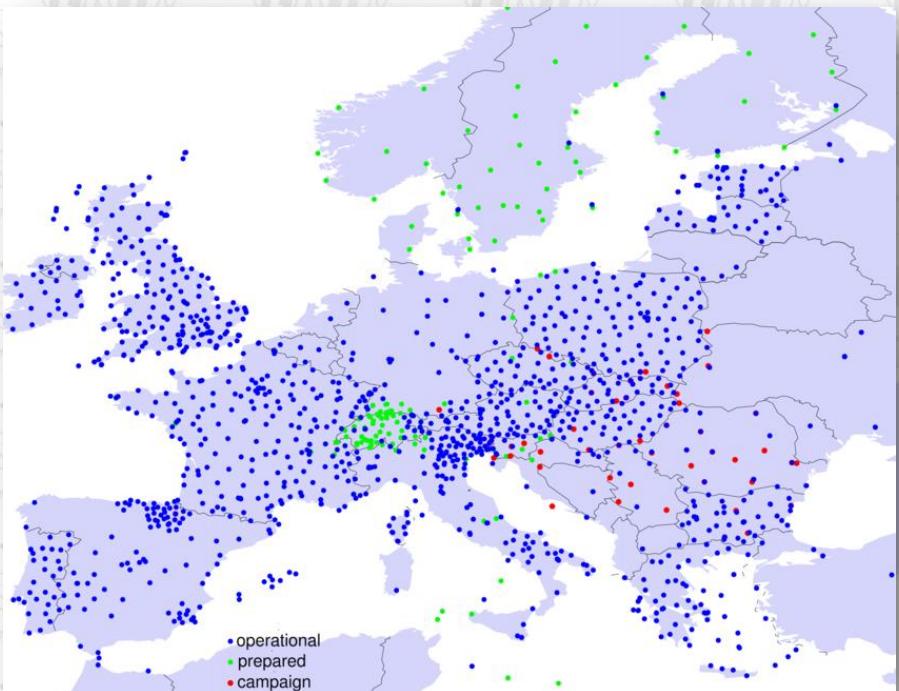
Contribution to „European" geokinematics
A.Kenyeres (from status report – October 2013)
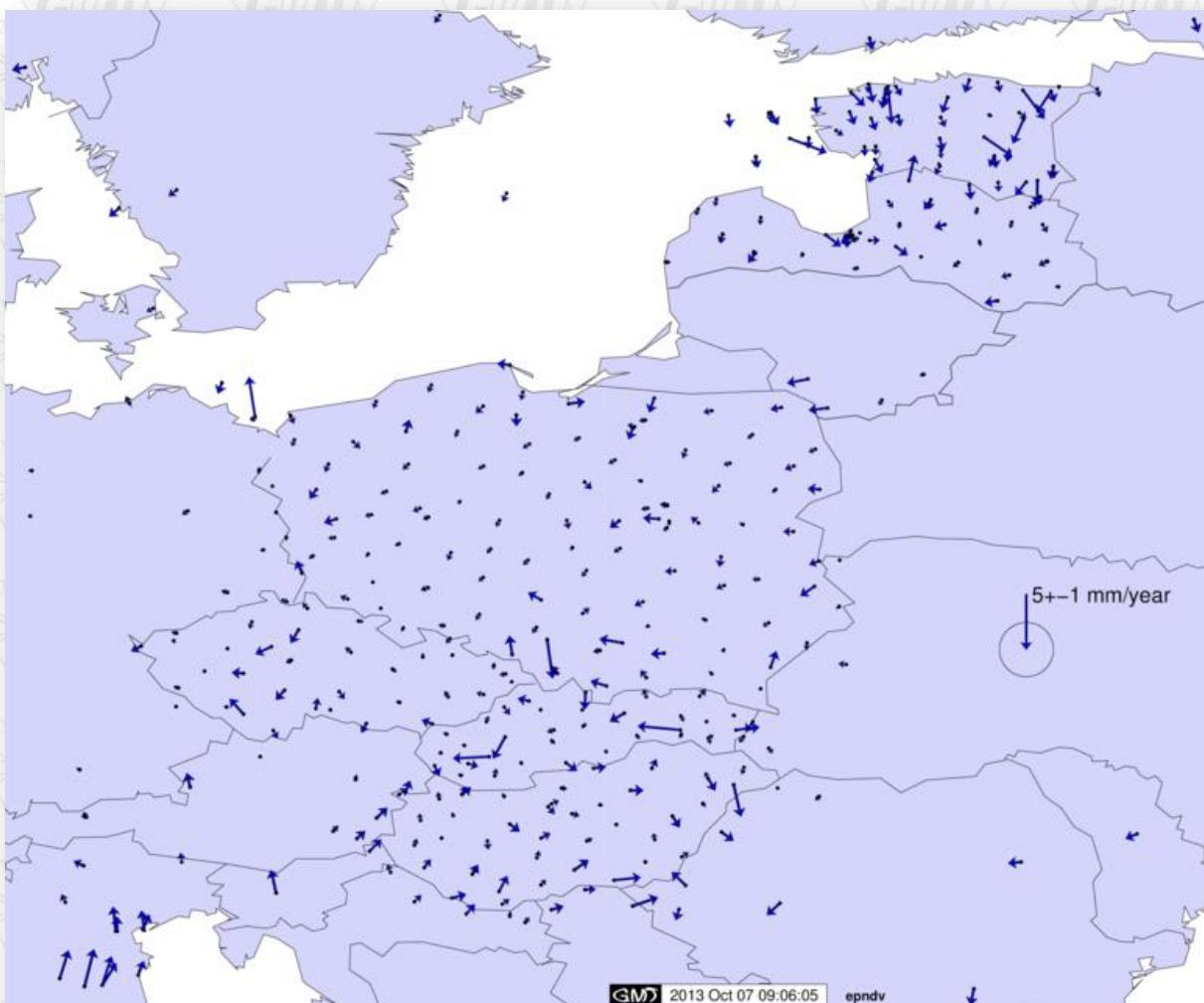
- ECC results:
  - agreed with GKÚ solution

  - confirm that permanent stations on buildings can help to European geokinematics

  - confirm that central Europe is stabile part of Eurasian tectonic plate

Activities related to EUREF Permanent Network
S K POS® contribution to EPN and IGS

EUREF PERMANENT NETWORK

EPN CB HOME

ROB ★★★★★
GNSS RESEARCH GROUP ★★★★

EUREF

- **Contribution to EPN, IGS**

Daily and hourly observation and navigation data - RINEX 2.11 including L5, RINEX 3.02

- **EUREF-IP project**

Observation data from GANP in Real-time – NTRIP protocol, RTCM 3.1.

GANP
- Od: 2003
- GPS, GLONASS,
- Galileo, BeiDou
- EPN, IGS, EUREF-
- Admin: GKÚ

Locate station on map
- Select a station -

Station criteria selection

Receiver manufacturer:
AOA
ASHTECH
JAVAD

Antenna manufacturer:
3S NAVIGATION
AOA
ASHTECH
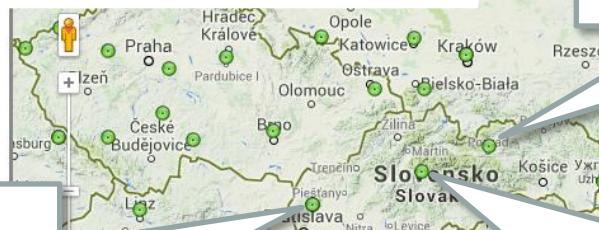
MOP2
- Od: 2008
- GPS, GLONASS
- EPN
- Admin: STU
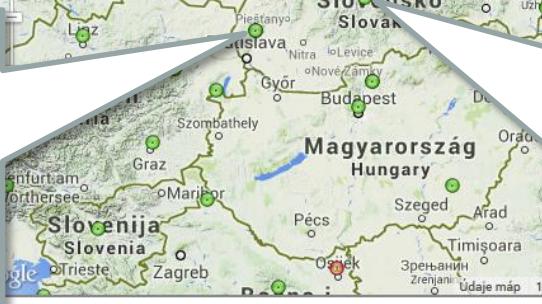
BBYS
- Od: 2007
- GPS, GLONASS,
- Galileo, BeiDou
- EPN
- Admin: GKÚ + TOP

SKPOS® contribution to „*National center for diagnosting the earth surface deformations in Slovakia*" project

http://www.geokinematika.sk

Contribution with **S****K***POS*®* data to research and development

development

Planned activities

# Planned collaboration with Vihorlatská hvezdáreň
SES project

- Collaboration between GKÚ and Vihorlatska hvezdareň
- Agreement prepared for signature
- KOLS permanent station will be part of **SK***POS*®

- GKU plan to support SES project with:
    - KOLS permanent station data provision
    - 8 **SK***POS*® permanent stations

http://www.meteognss.net/
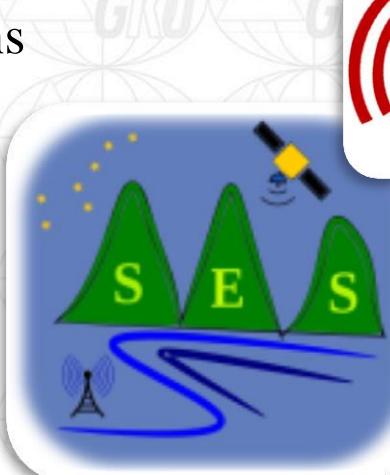
Planned contribution to E-GVAP programme

- E-GVAP = The EUMETNET GNSS water vapour programme

- GKU plan to
  - contributs with **SK***POS*® data to computation of water vapour above the **SK***POS*® sites in NRT
  - computes and sends ZTD data to E-GVAP centers for water vapour computations
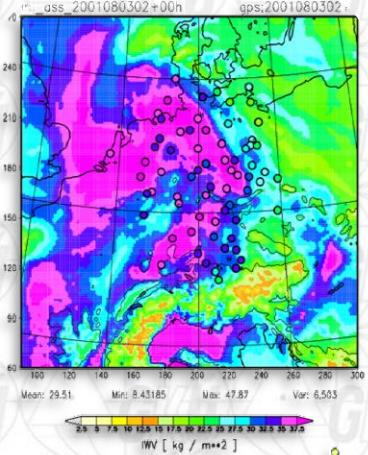
EUMETNET
The Network of European Meteorological Services

Planned contribution to MGEX project

- ## GKU plan to
  - contributs with **S**K*POS*® station GANP to MGEX (Multi GNSS experiment project)

- ## MGEX
  - IGS scientific project to track, collate and analyze all available GNSS signals. Analysis centers will attempt to estimate inter-system calibration biases, compare equipment performance and further develop processing software capable of handling multiple GNSS observation data

The MGEX Network

An overview of the current MGEX network is shown in the map below. For detailed information on individual stations see the IGS station list. The latetst MGEX site logs are available from the IGS MGEX site log archive.
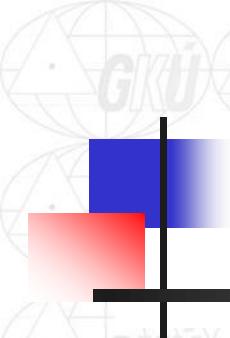
Conclusion

- As you could see in the slides before, **S**K*POS*® is not only the positioning service for Slovakian land surveyors but with its data from permanent stations also contributes to different research and developments projects and activities

- It is planned to continue in those activities, because there is no other public network in Slovakia which will be able to do this

- From this point of view we can said, that GKU (with **S**K*POS*® data) is successful supporter of different useful R&D projects and programmes
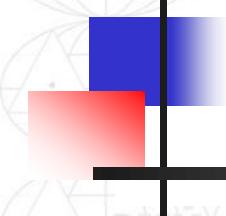
Thank you for your attention

Geodetic and Cartographic Institute BRATISLAVA

branislav.droscak@skgeodesy.sk