National report of Slovakia 2014

Branislav Droščák, Karol Smolík, Miroslav Roháček, Elena Beňová [1)], Ján Hefty, Juraj Papčo, Ľubomíra Gerhátová, Marcel Mojzeš [2)]

1) Geodetic and Cartographic Institute Bratislava
2) Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of theoretical Geodesy

EUREF 2013, annual symposium
3-7.June 2013, Vilnius, Lithuania

Outline

- Slovakian activities related to EPN
- Status, activities and news from
  - national spatial network and **SK*POS*** (Slovak real time positioning service)
  - national levelling network
  - national gravimetric network
- Activities of Slovak university of Technology
- Other news from Slovakia

Activities related to EPN
Slovakian contribution to EPN (May 2014)

MOPI
From 1996
only GPS
admin: SUT

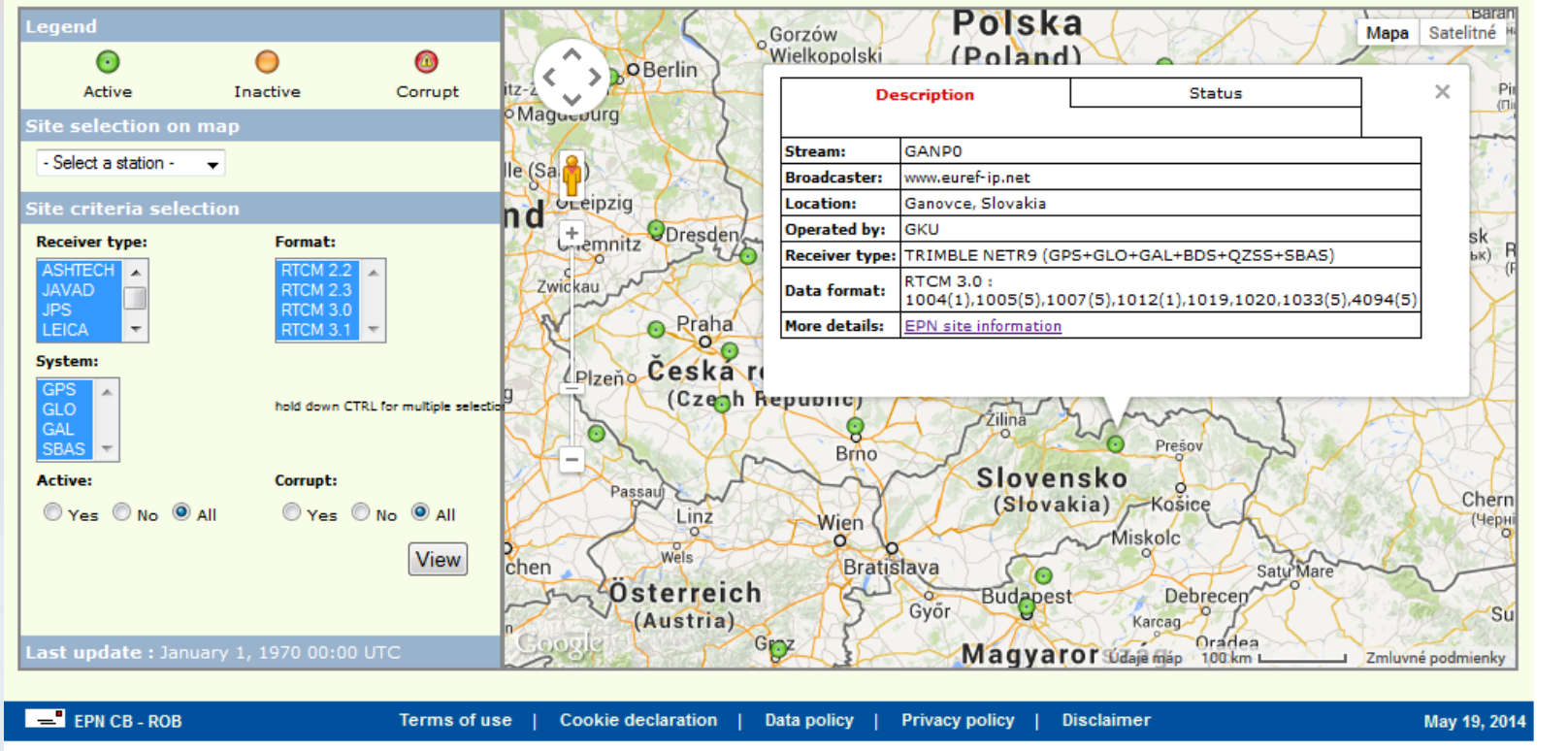
BBYS
From 2007
GPS+GLONASS+Galileo
SK*POS*
admin: GKU+TOPU

MOP2
From 2008
GPS+GLONASS
SK*POS*
admin: SUT

GANP
From 2003
GPS+GLONASS+Galileo
IGS/EPN
SK*POS*
admin: GKU

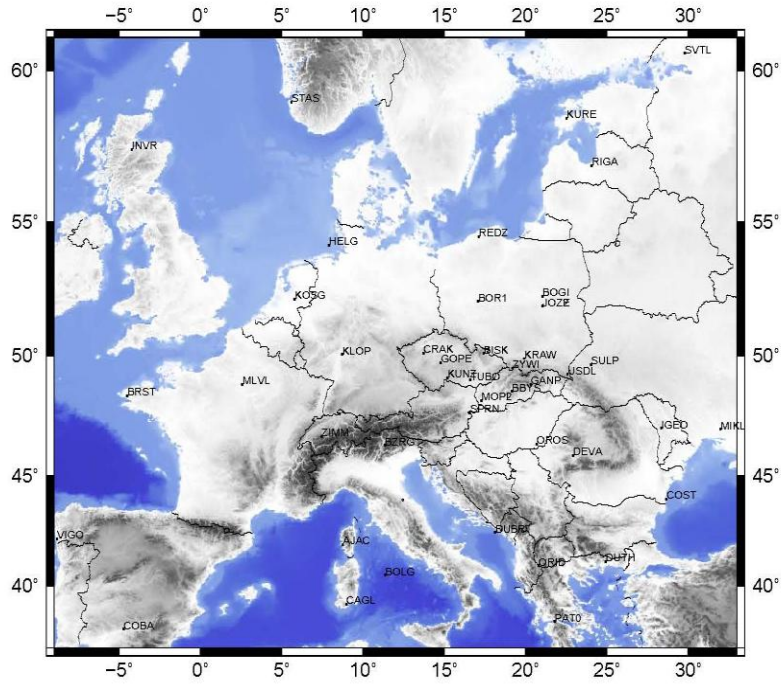
Activities related to EPN
EUREF real-time

- **GANP** station contributes to real-time project
  - RTCM 3.0



Activities related to EPN
EPN Local analysis center SUT

- **EPN Local Analysis Center - Slovak University of Technology**



Current network configuration (out of boundary: REYK, QAQ1)

PROCESSING STRATEGY	
Software	: Bernese GPS Software, version 5.0
Orbits and EOPs	: IGS final
Observations	: GPS
Elevation Cutoff	: 3°
Antenna PCV Model	: absolute
Ambiguity Resolution	: QIF
Troposphere	: dry Niell (a priori), wet Niell (estim.), gradients
Ocean Loading	: FES2004
Reference Frame	: IGS05 / IGS08 (since week 1632)
Reference Point	: BOR1
Products submitted	: SUTWWWW7.SNX weekly snx file SUTWWWWN.SNX daily snx file SUTWWWWN.TRO daily troposphere solution
ALL PROCESSING OUTPUTS	
Daily solution	: CRD, COV, SNX, ION, INX, TRO, TRP
Weekly combination	: CRD, COV, SNX, OUT, SUM
4-hour solution	: CRD, COV

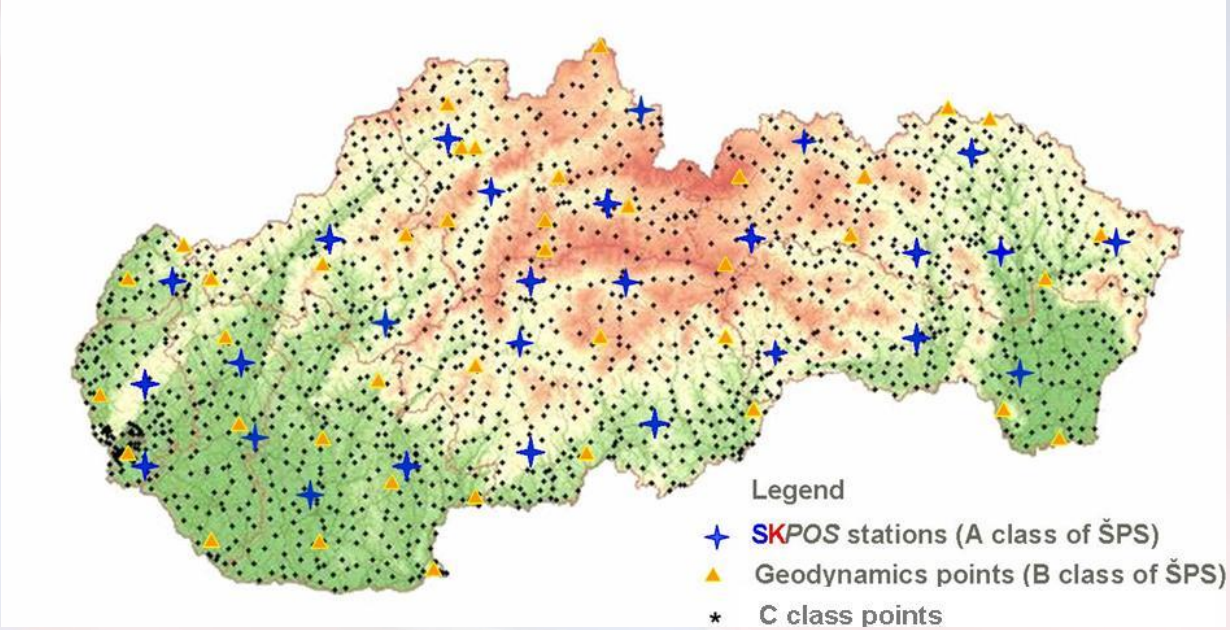
- Standard continual processing of EPN subnetwork

Status, activities and news from national spatial network (GNSS positioning)

National spatial network (ŠPS)
national ETRS89 representative in Slovakia

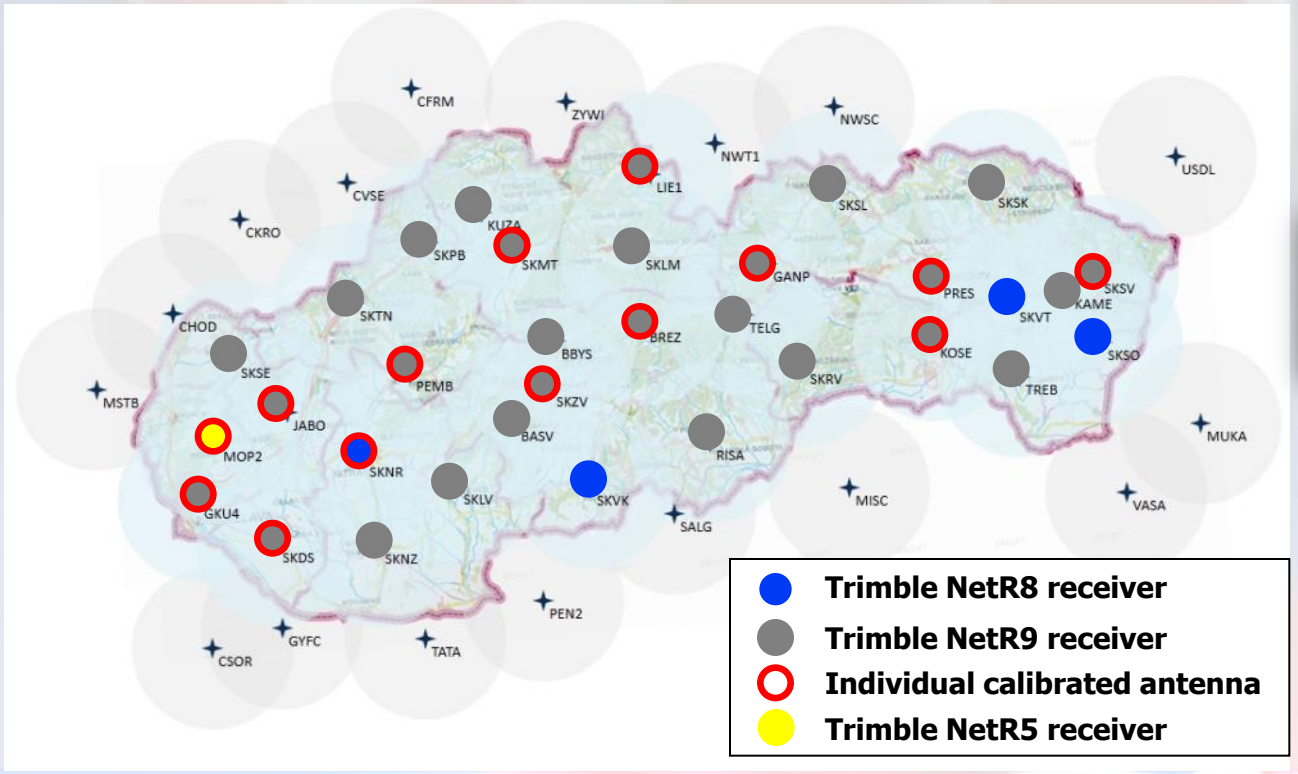
- Active part (permanent stations) – **Class A = SK*POS*®**
- Passive part (geodetic controls fields)
  - **Class B** – geodynamics points (Hz 5-6mm, V 12-15mm)
  - **Class C** – reference geodetics points (Hz 1cm, V 2cm)
  - **Class D** – other points with ETRS89 coordinates (Hz 3cm, V 5.5cm)

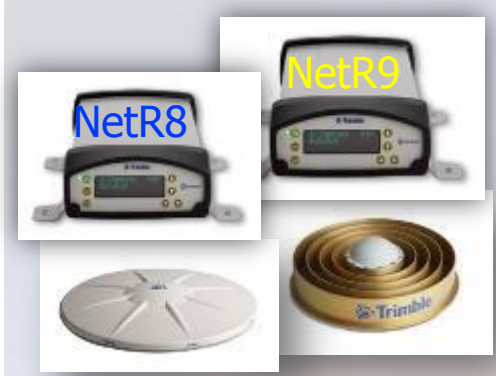
Class	*Number of points*
A	33 + 17
B	71
C	1 650
D	2 900



SKPOS® Slovak real time positioning service infrastructure (status in May 2014)

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

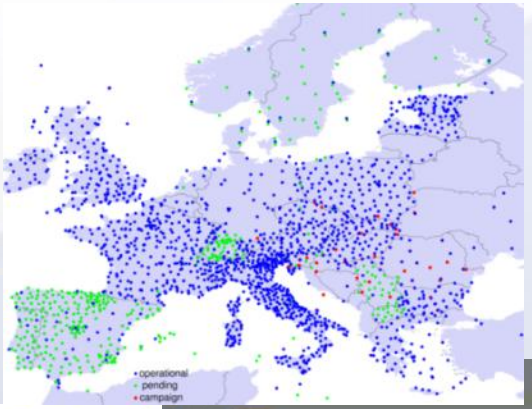




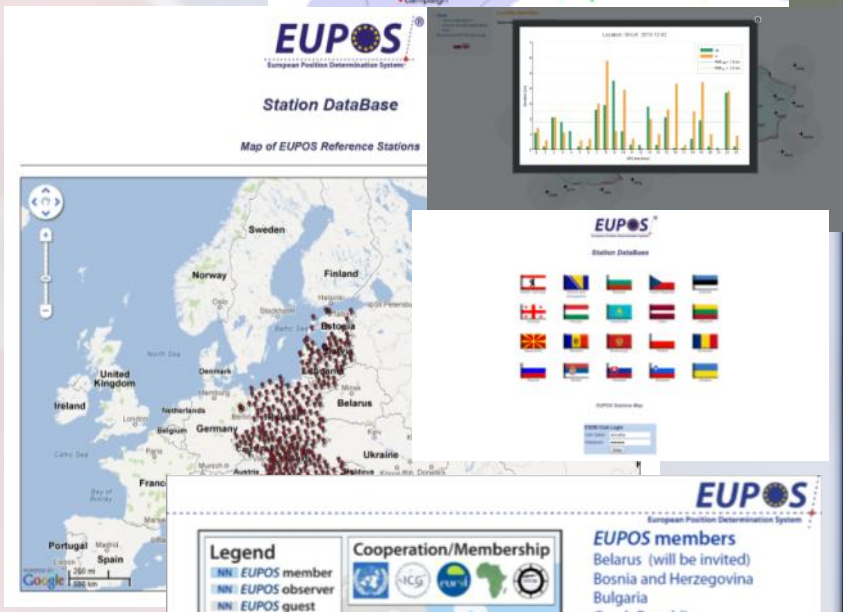
SKPOS®

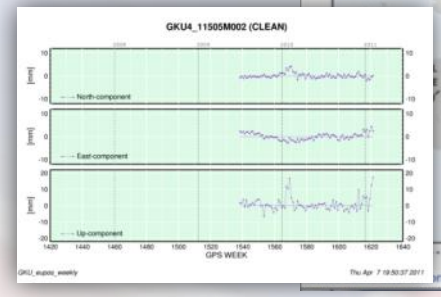
active part of EUPOS®

European Position Determination System



- Follows *EUPOS* standards
- Keeps information in EUPOS station database
- Contributes to *EUPOS* combination centre (SINEX GKU)
- Leads EUPOS working group on service monitoring



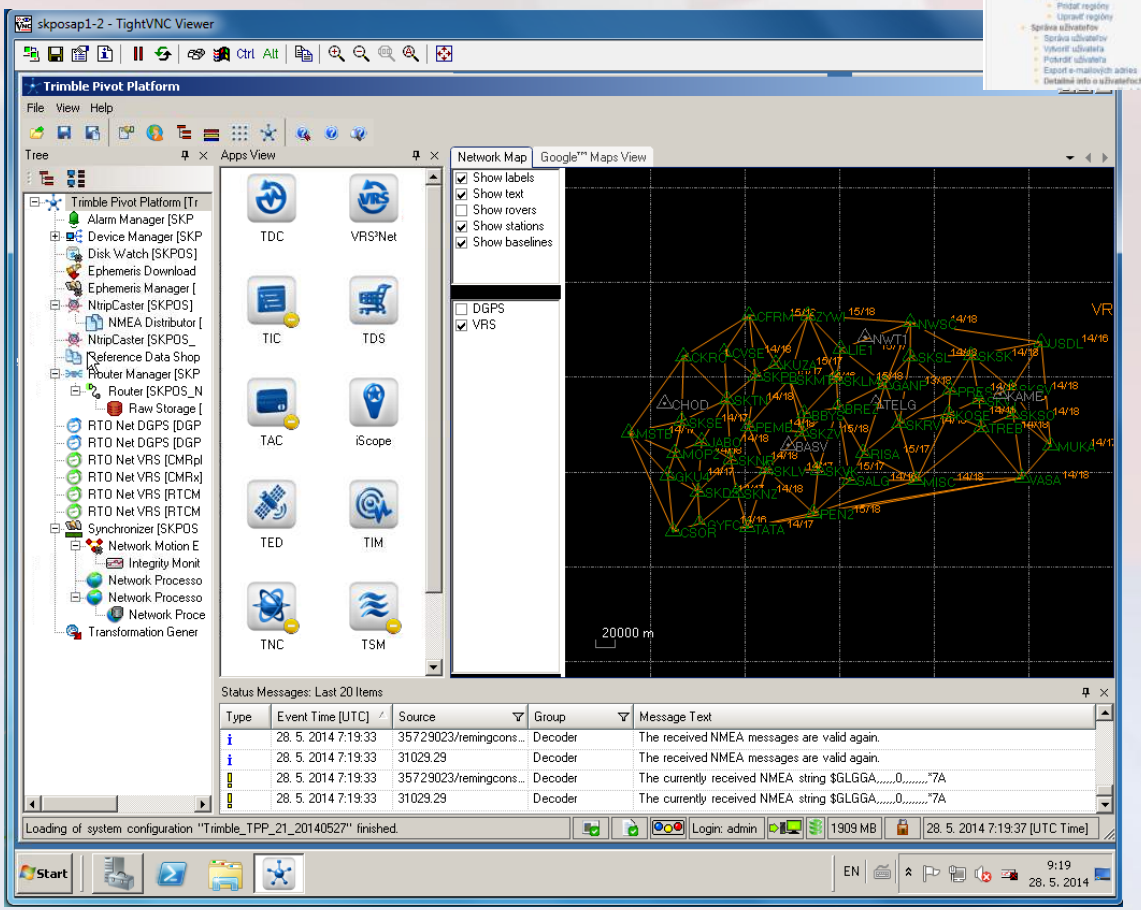


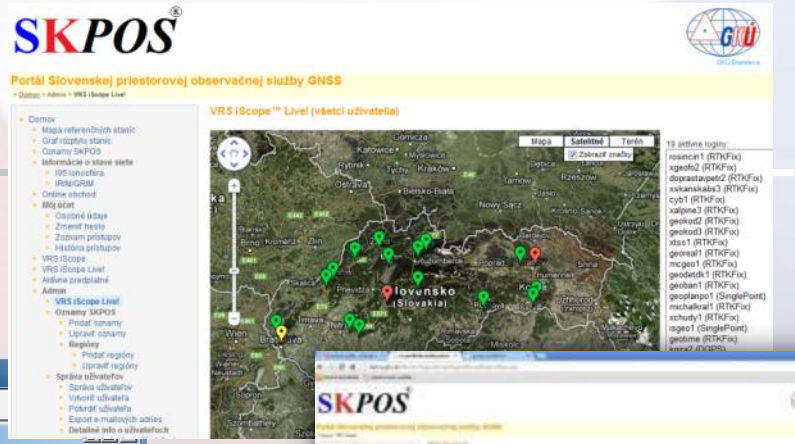
SKPOS®
National service center and its activities

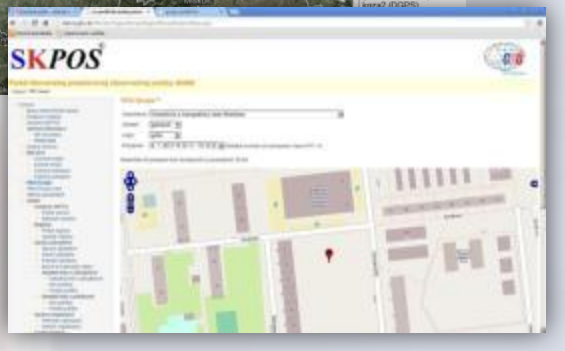
- National service centre
  - GKÚ Bratislava
- Web
  - www.skpos.gku.sk
- Routine activities
  - Service administration
  - Service quality monitoring
  - Data archivation and service backups
  - Users administration and contracts managment

SKPOS®
control software

Trimble Pivot Platform ver. 2.5.7







I-Scope modul

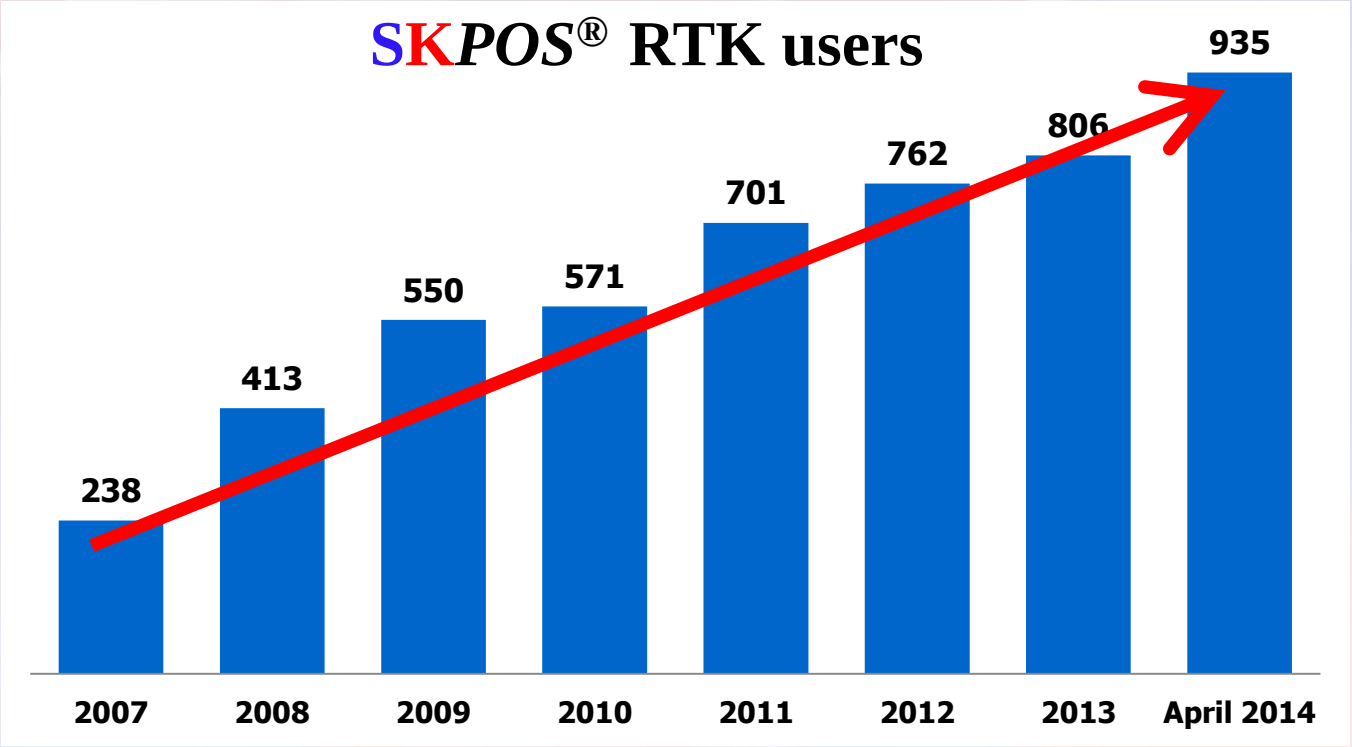
SKPOS®
services (mountpoints)

Only network solution (Network RTK in VRS concept) no Single RTK is provided!

Service (mountpoint)	Accuracy	Data format	Interval
SKPOS_MM 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+**	2 – 4 cm	RTCM 2.3 RTCM 3.1 CMRX CMR+	1 sec.
SKPOS_DM_SVK **SKPOS_DM_SVK_23**	0,3 – 1 m	RTCM 2.1 RTCM 2.3	1 sec.

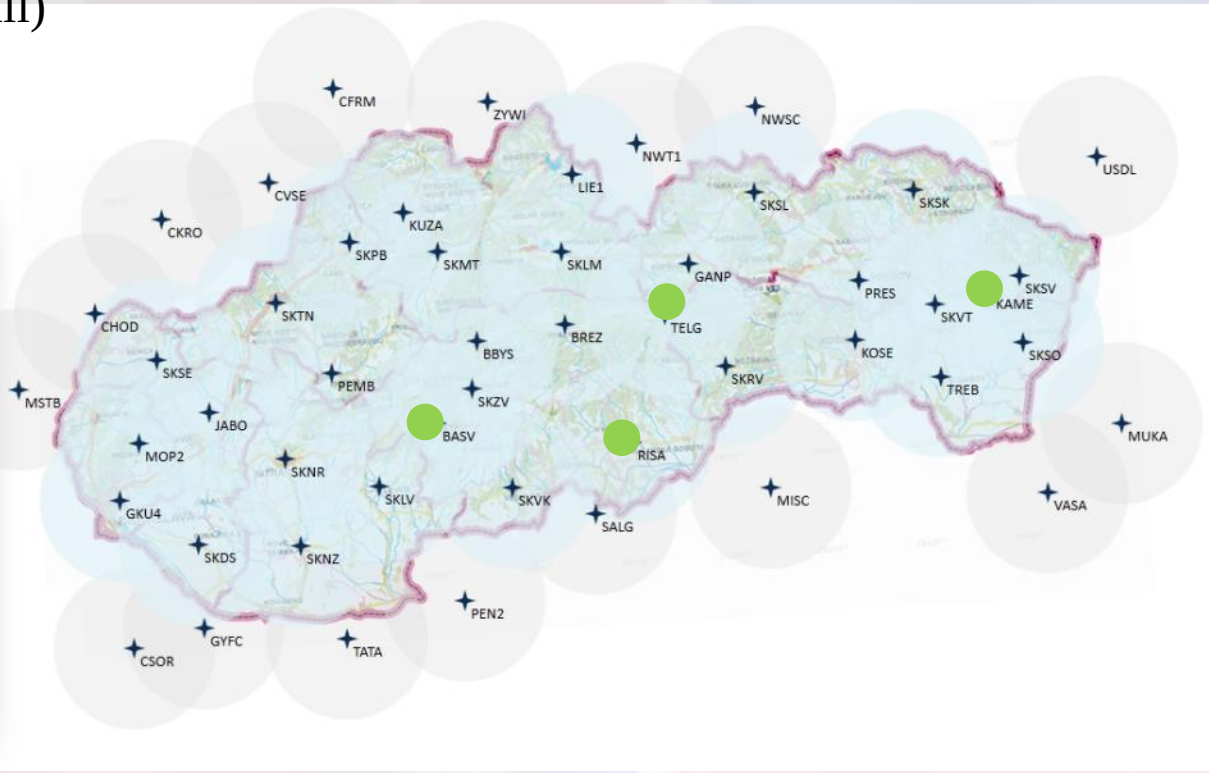
SKPOS®
number of registrations (users)

- over 935 registrations (April 2014)
- number is still increasing



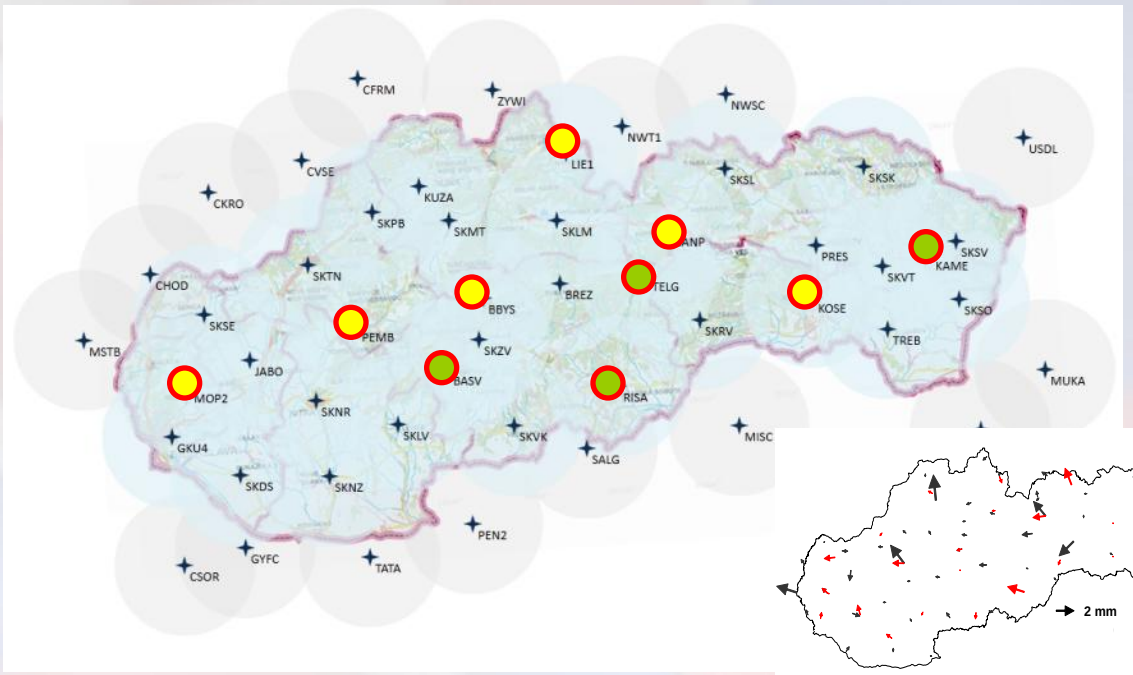
SK*POS*® infrastructure
New type of stations monumentation

- 2013 year - 4 new permanent stations entered into SK*POS*®
  - geodynamic monitoring purpose (Slovak University of Technology geodynamics project)
  - special type of monumentation (Unavco web page = deep drilled braced mark – more than 4m deep drill)



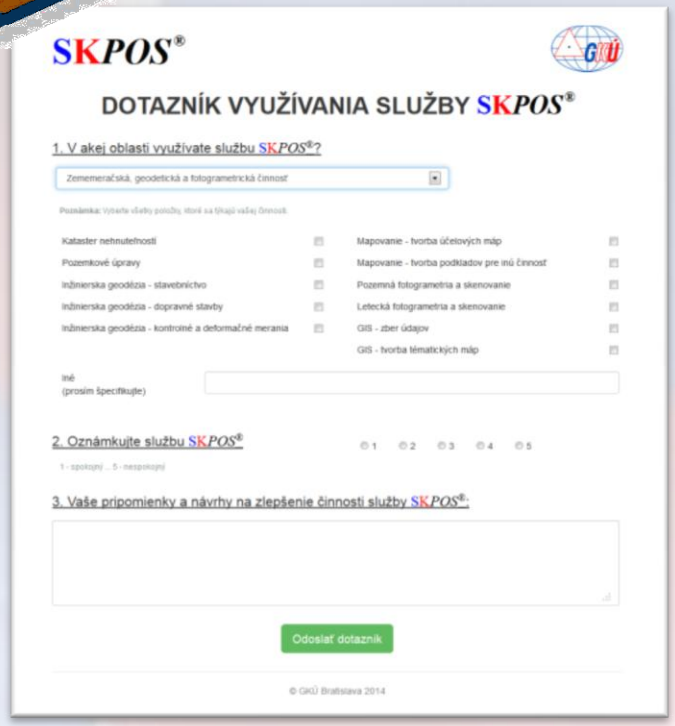
SKPOS® geodynamics infrastructure

Pilier/pier & deep drilled braced monumentation



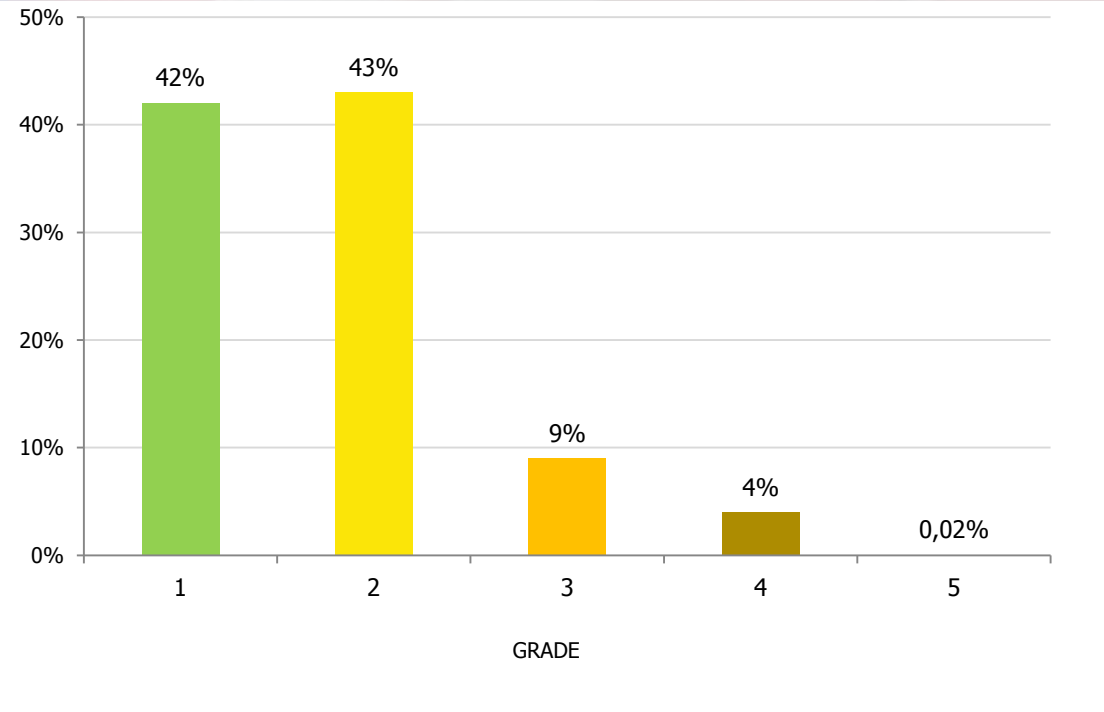
SK*POS*®
web survey about SK*POS*® usage

- questionnaire about SK*POS*® usage
- distributed during March 2014
- sent 727 emails
- received 383 responses (53%)
- 3 questions:
  - For what field of application do you use the SK*POS*® service?
  - How do you grade the service
    (1=best – 5=worst)
  - Your comments and suggestions related to service



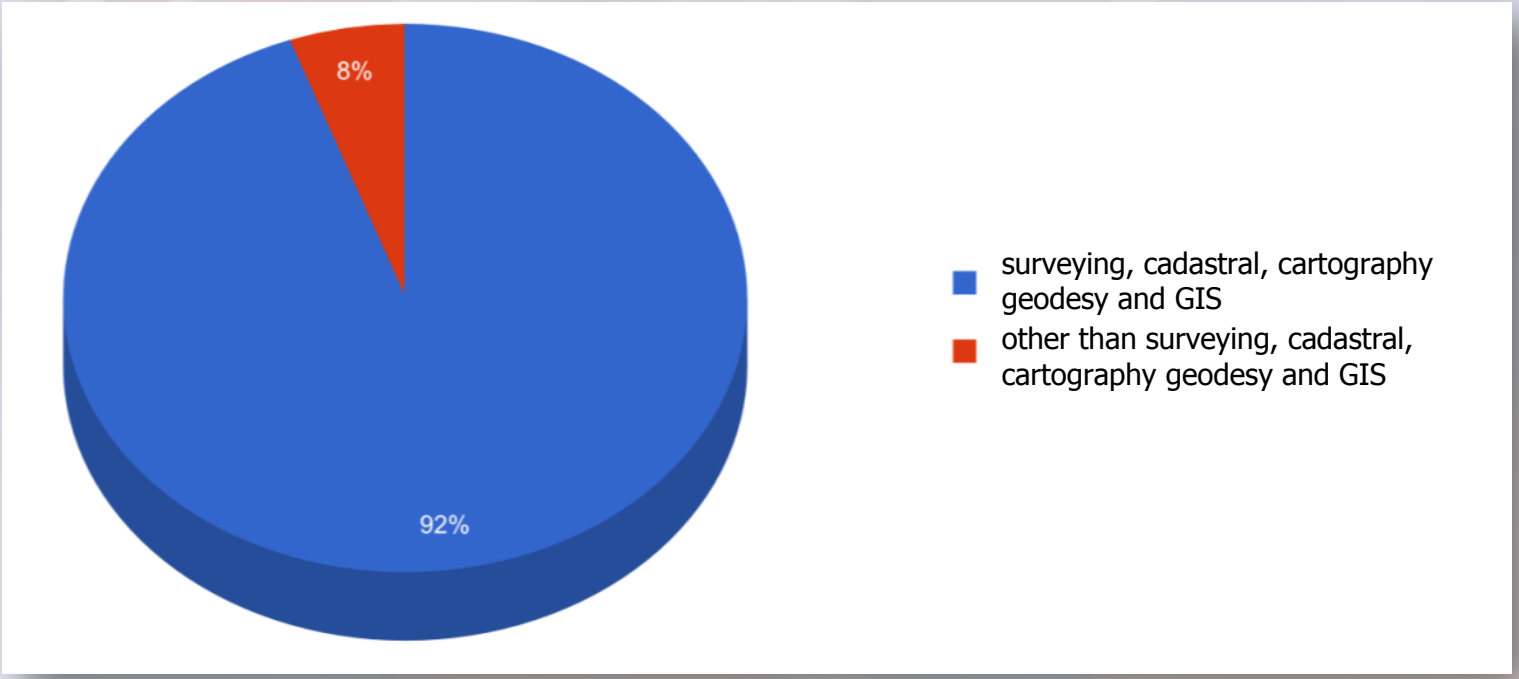
SKPOS®
survey results

- Q: How do you grade the service? (1=best – 5=worst)
- Result: Average grade **1.8 (A-)**



SK*POS*®
survey results

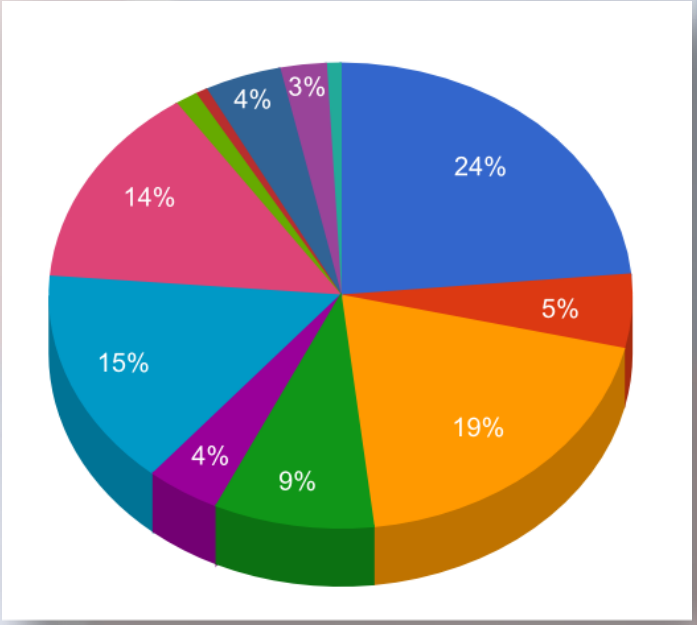
- Q: For what field of applications do you use the SK*POS*® service?
  - Surveying fields (cadastre, surveying, mapping, GIS) - **92%**
  - Other fields - **8%**



SK*POS*®
survey results

- Q: For what field of applications do you use the SK*POS*® service?
  - 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%

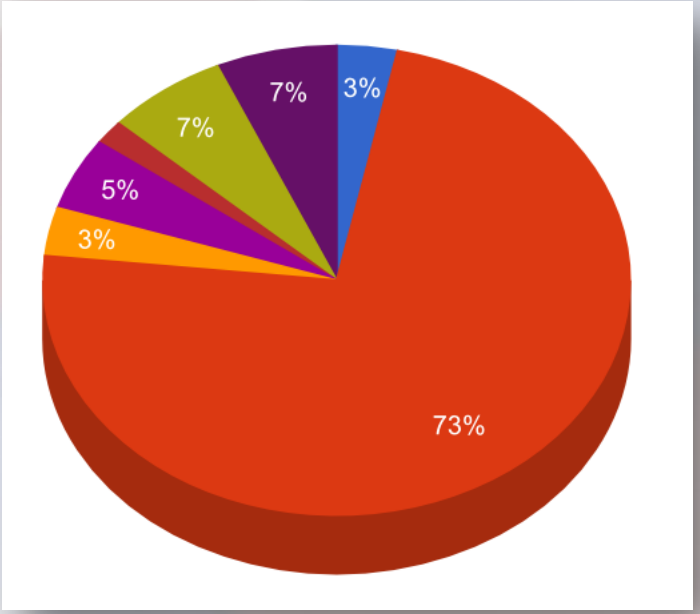


SK*POS*® survey results

- Q: For what field of applications do you use the SK*POS*® service?
  - 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%



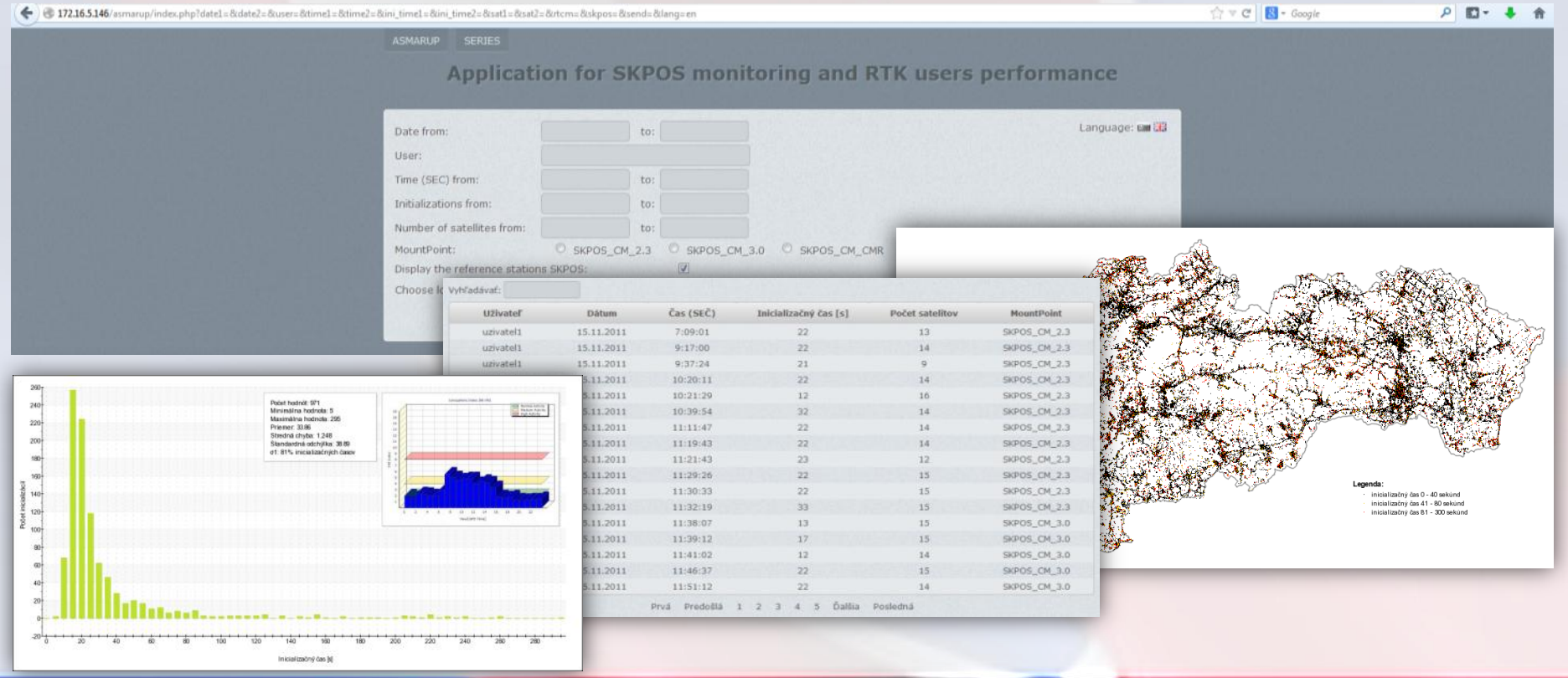
SKPOS®

Charges (flat rate pre 365 days)

New! **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+	~~90 € / 365 days (until 30.4.2014)~~ **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

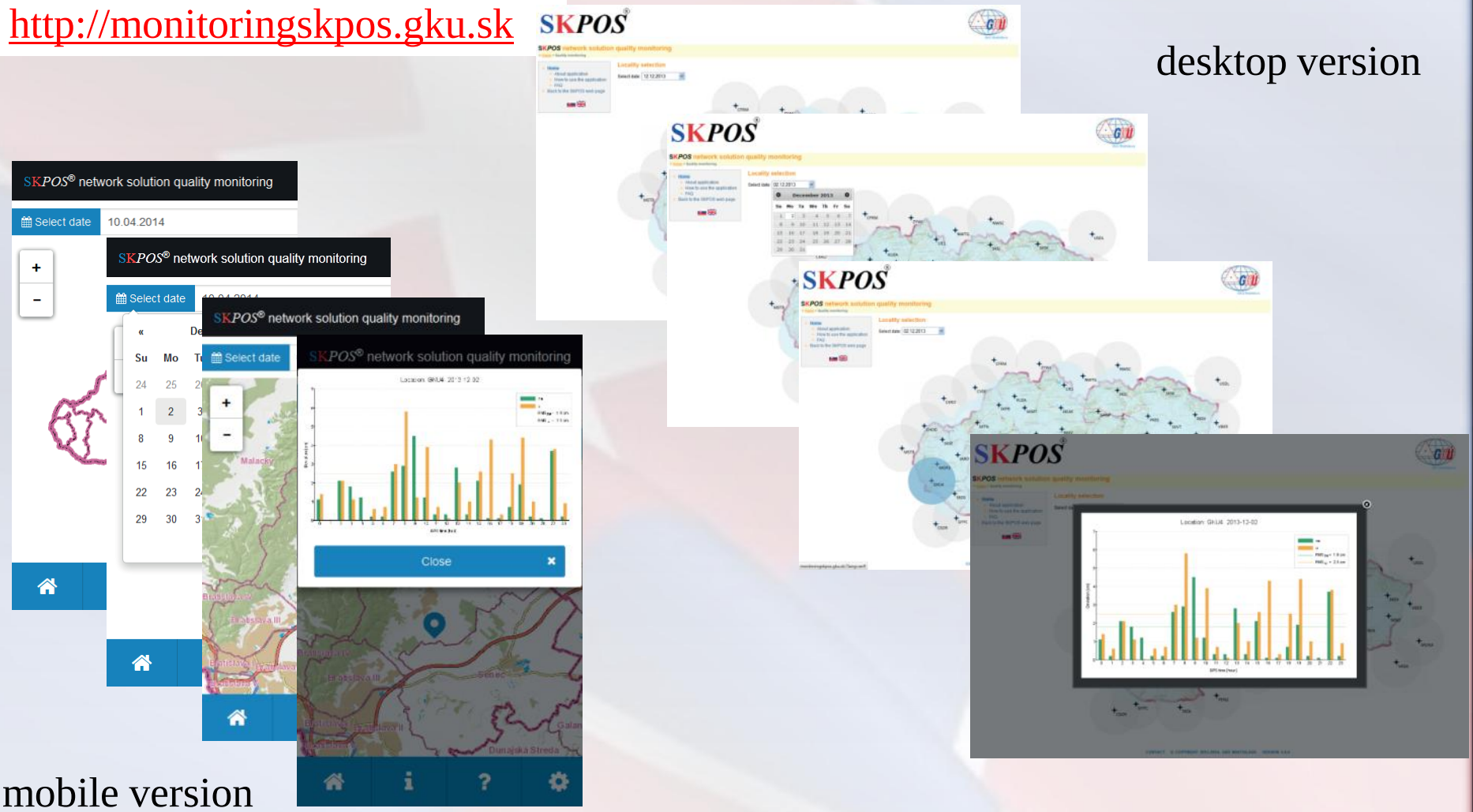
Application for SK*POS*® Monitoring And RTK Users Performance (ASMARUP)

- application for SK*POS*® user initialisation time analysis
- available only for administrators (GKU)
- Analysis acoording to: date and time, particular user, length of the initialisation time, number of satellites, used mountpoint, user position



Application „SKPOS® network solution quality monitoring“ (see poster)

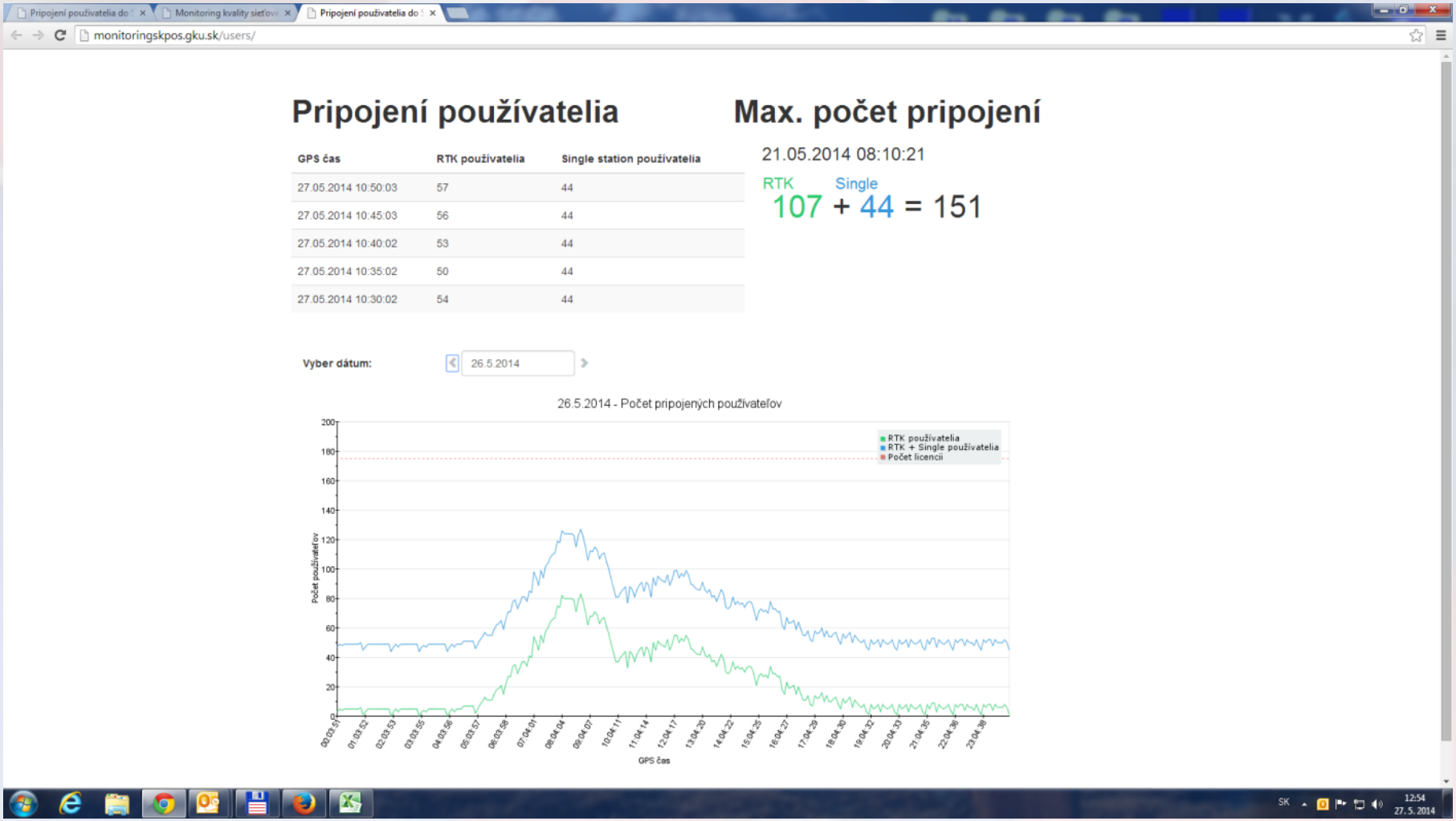
http://monitoringskpos.gku.sk



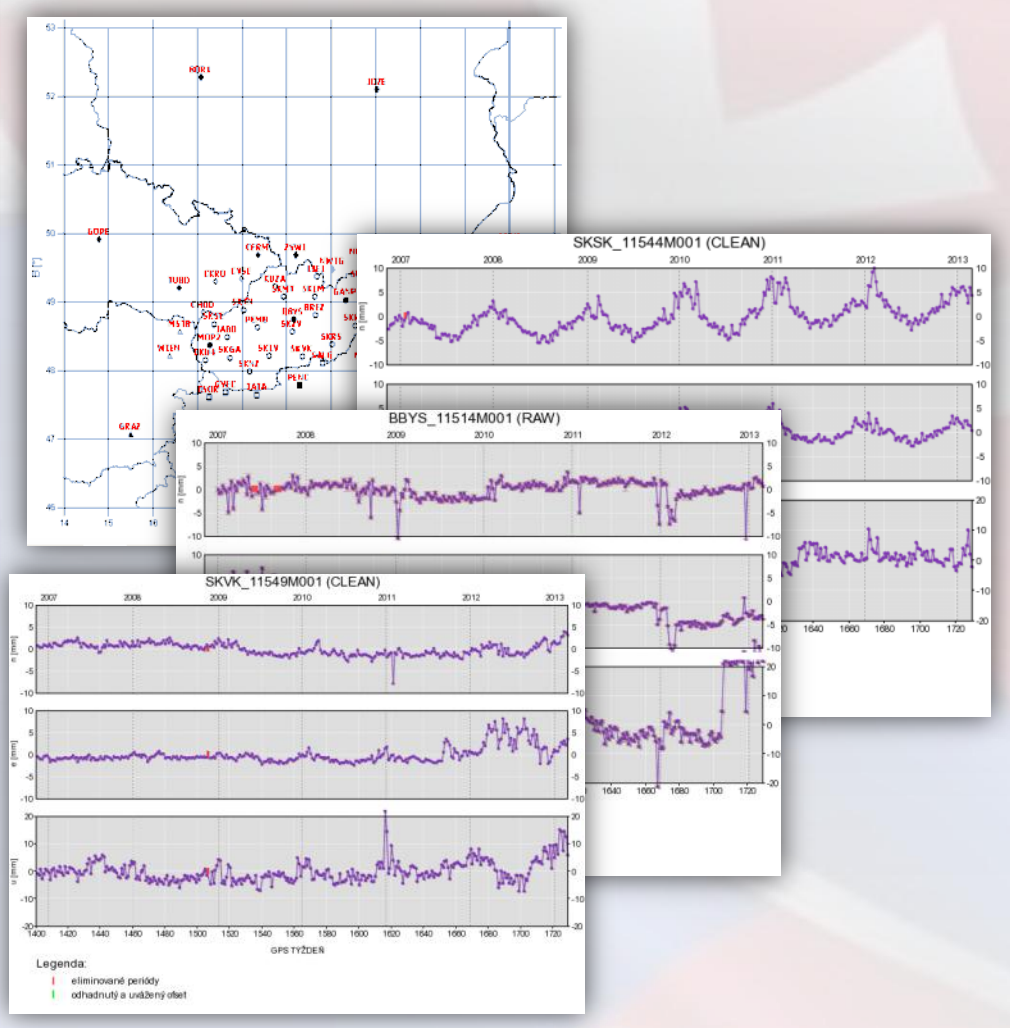
desktop version

mobile version

New application: **Number of online connected SK*POS*® users**



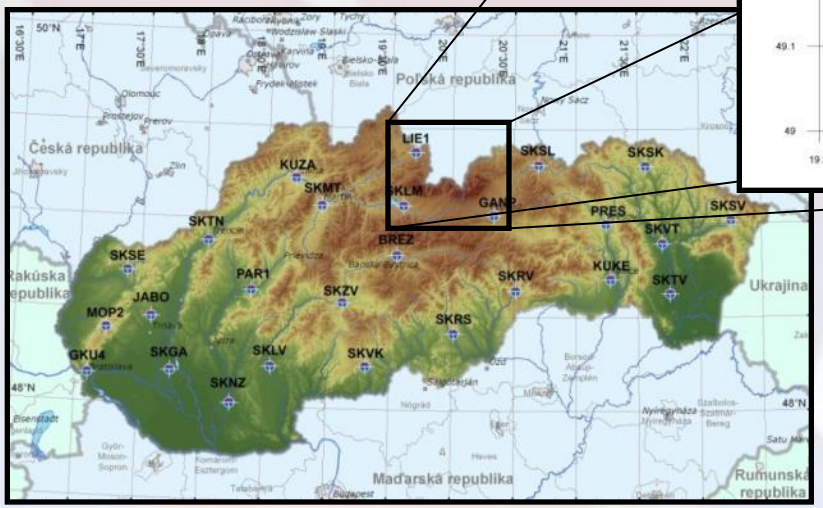
SKPOS®
time series analysis

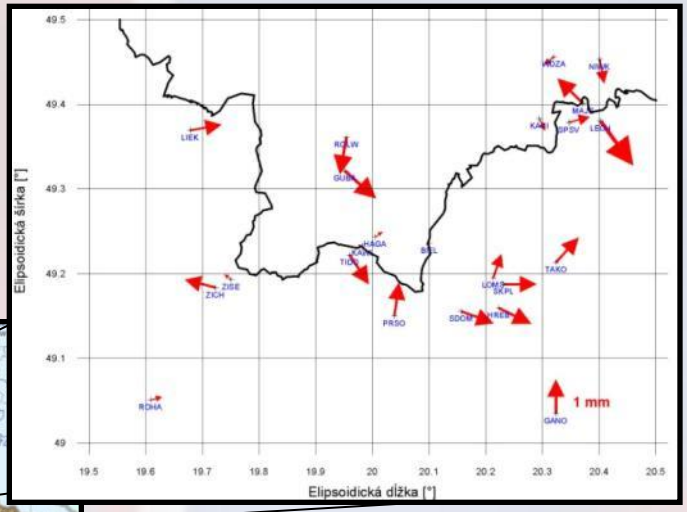


- Precise processing
  - Bernese software 5.0
    - January 2007 - February 2013
  - Bernese software 5.2
    - March 2013
- Times series analysis
  - jump determination
  - trend & season variation estimation
- Experience from analysis
  - jump estimation
  - unknown jumps estimation
  - seasonal variation
  - anomaly behaviour
  - stabile behaviour

Local geodynamics network Tatry
Geokinematics of Tatra mountines

- **5 days GNSS campaign (every year)**
- Cooperation with other slovakian institutions (TOPU, STU) and Poland
- 18 epoch points + permanent stations
- Processing in Bernese software

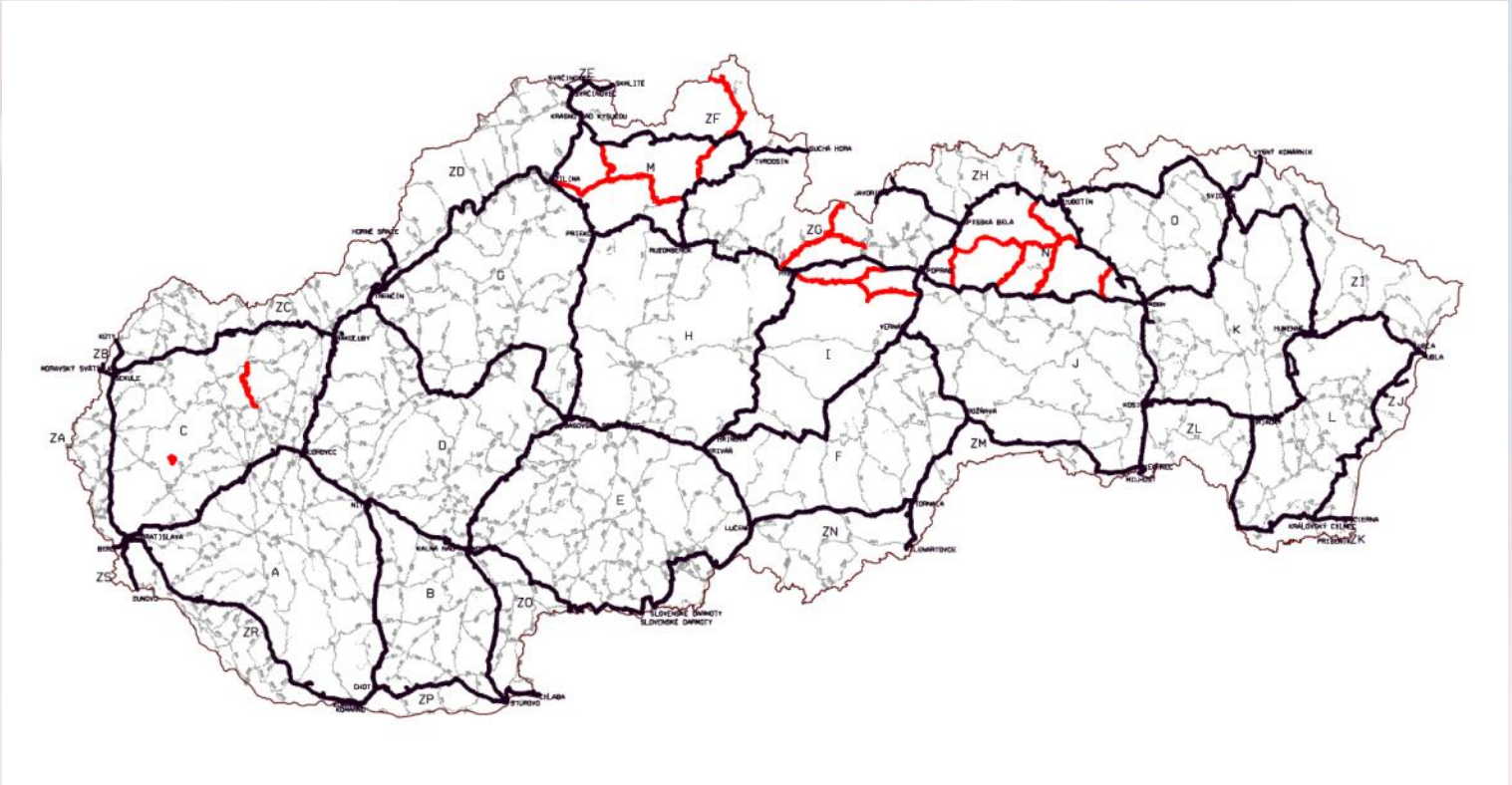




Status, activities and news from national levelling network

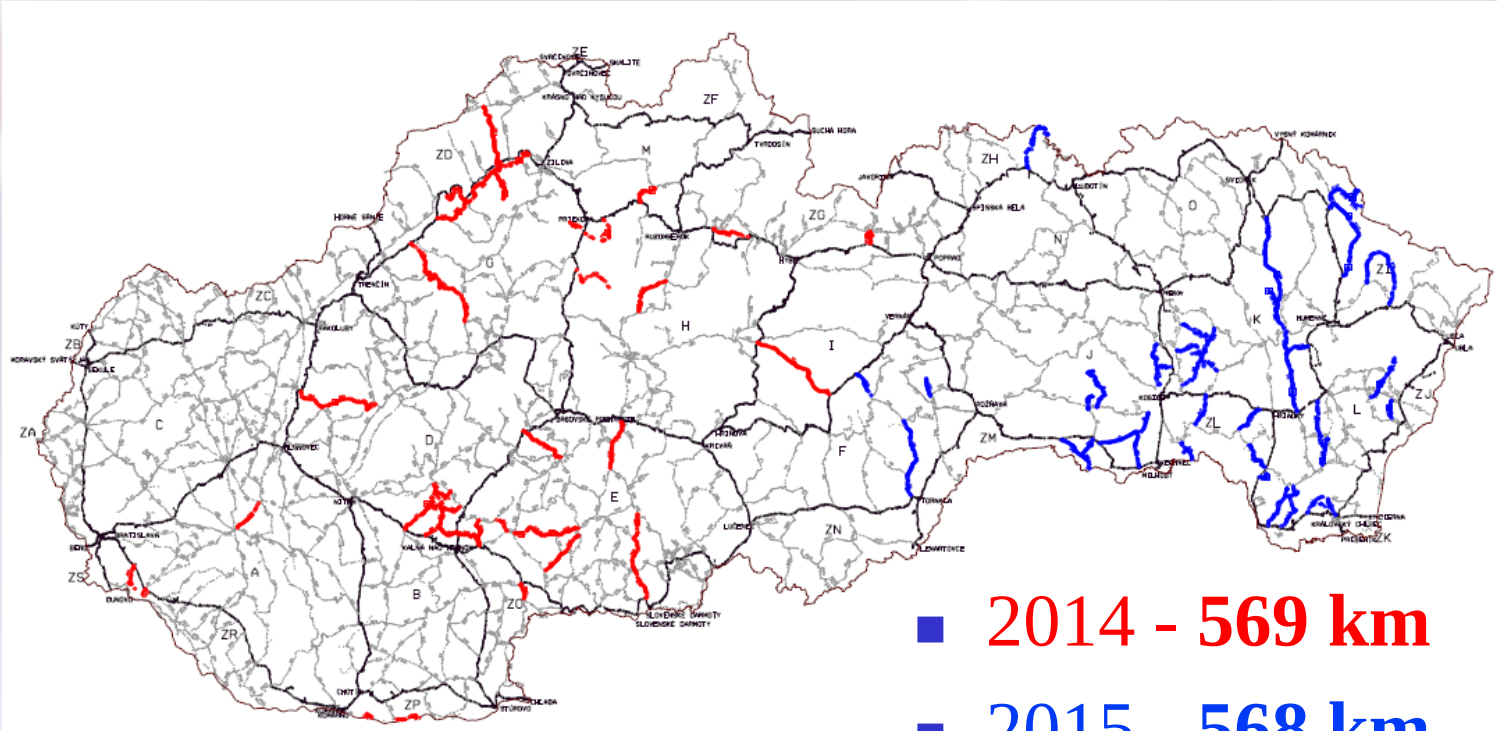
National levelling netvork (ŠNS)
Measurements in 2013

- Measurements performed on 2nd order levelling lines
- Totally 560 km
- 3 measuring groups



National levelling network (ŠNS)
Measurements plan for 2014 - 2015

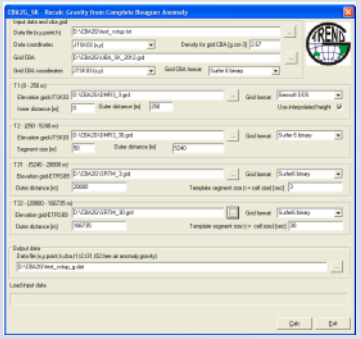
- Plan to finnish measurements on the 2nd order levelling lines
- 3 measuring groups



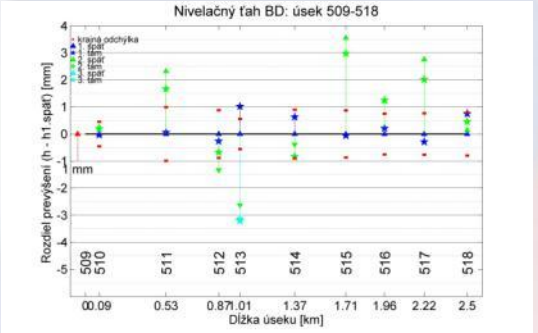
- 2014 - **569 km**
- 2015 - **568 km**

National levelling netvork (ŠNS)
Reprocessing – Aim and strategy

- Aim:
  - New national **Balt after adjustment** realisation (Bpv_{yy})
  - New $SKVRF_{yy}$ = **EVRF2007 national realisation**
  - New **quasigeoids** from ETRS89-h to Bpv and EVRF2007



- Inputs:
  - 1st order levelling lines measurements (1997-2005)
  - 2nd order levelling lines measurement (1987-2015)

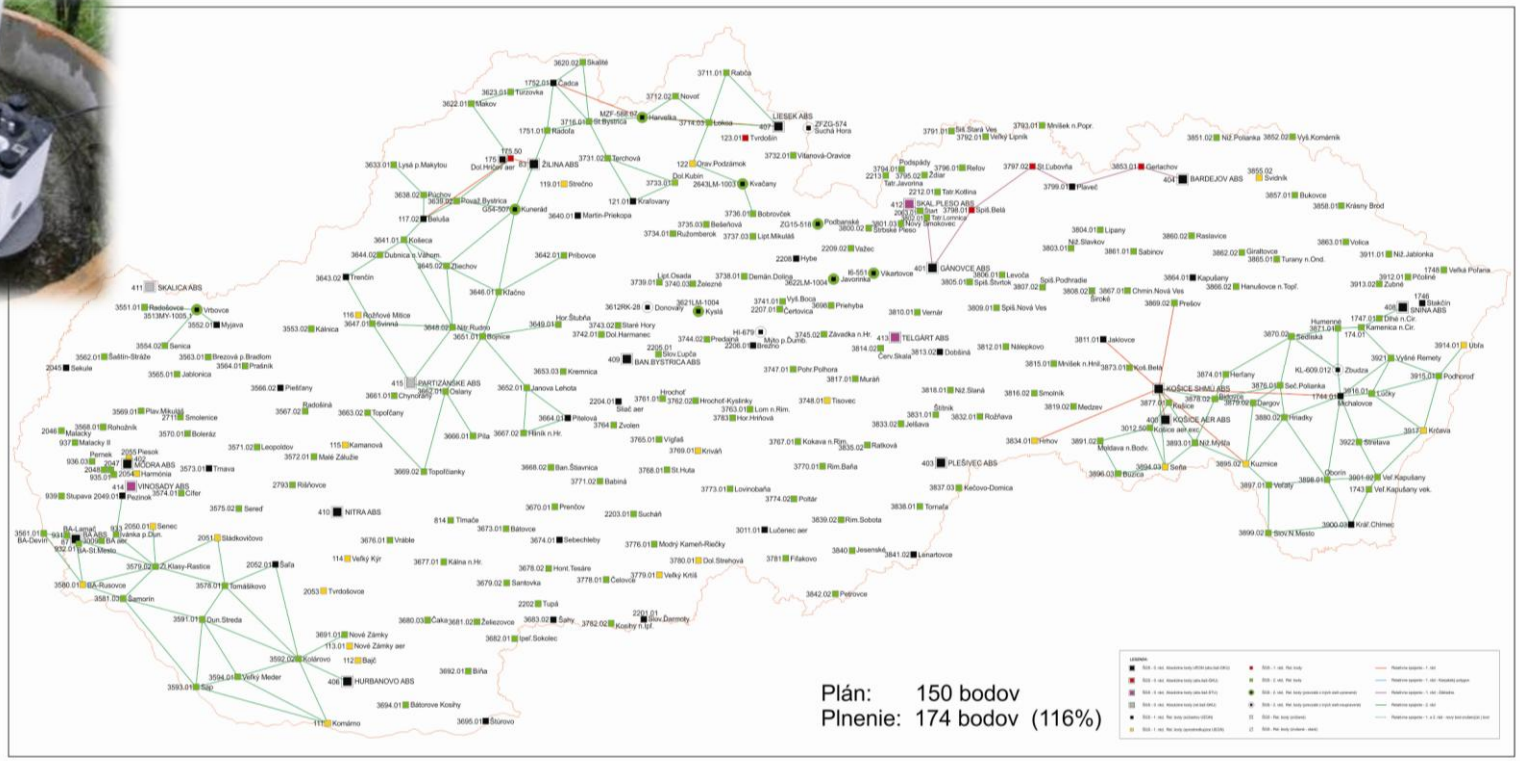


- 2 step strategy
  - Reprocessing of 1st order levelling lines
    - New map of Bouguer anomalies (software CBA2G_SK)
    - 1st order levelling lines control measurements
  - 2nd order levelling lines adjustment onto 1st order polygons

Status, activities and news from national gravimetric network

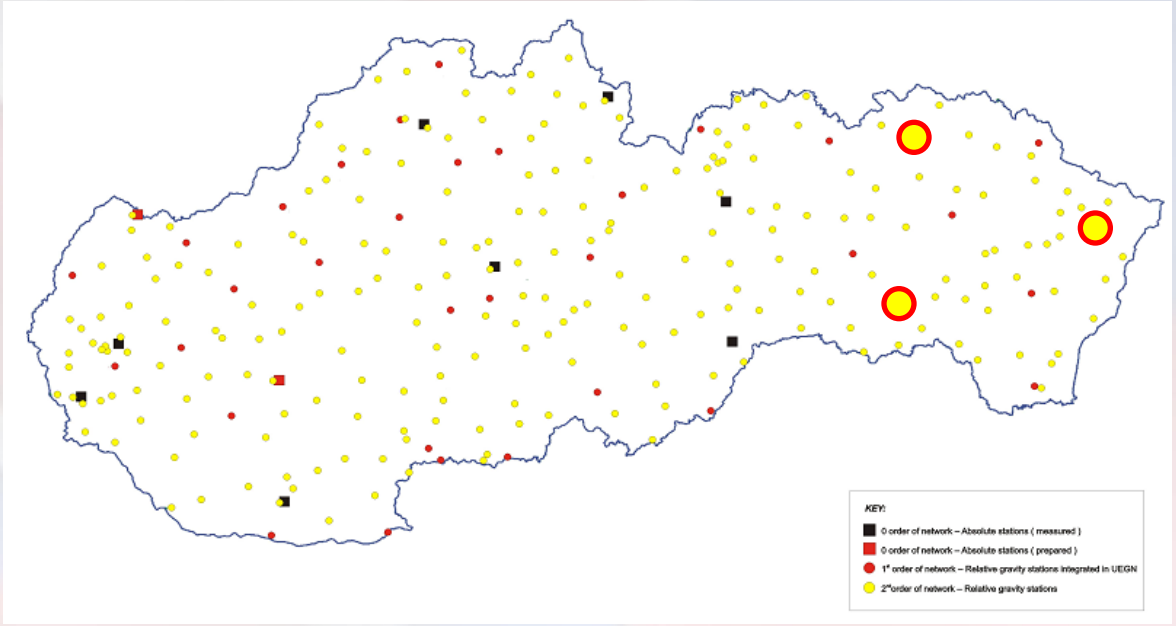
National gravimetric network (ŠGS)
Measurements in 2013

- **relative gravimetric measurements on ŠGS network points (175 points)**
- 1 measuring group



National gravimetric network (ŠGS)
Measurements in 2013

- **Absolute gravimetric measurements on ŠGS 0.order points (3 points)**
- Measurement orderd and performed by VUGTK (research institute – Czech republic)



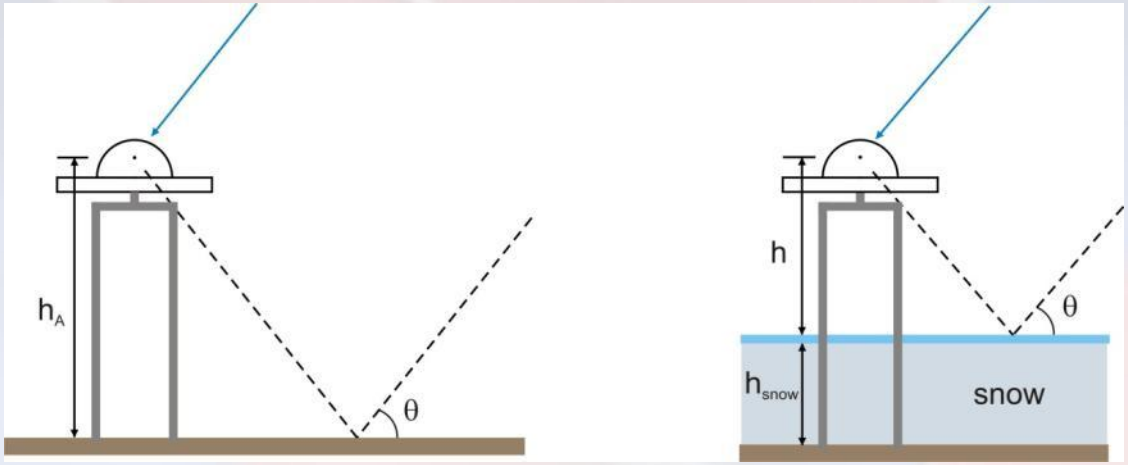
Slovak University of Technology activities

Snow depth sensing using GPS multipath

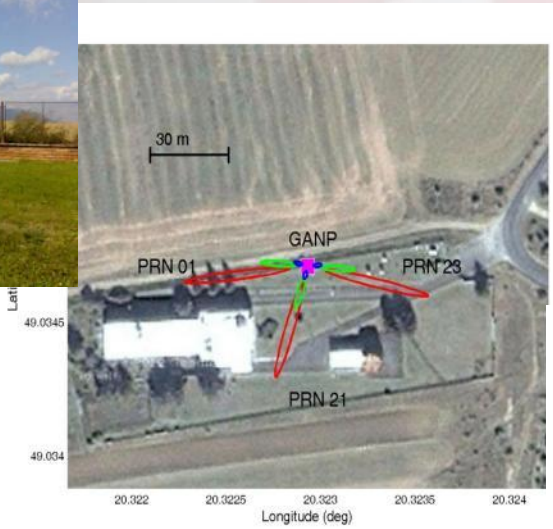
- Analysis of GPS multipath allows to detect actual the antenna height h above the reflecting surface and enables to monitor the time variability of the depth of the reflector.
- Snow cover in the vicinity of GPS antenna causes decrease of effective h relatively to antenna height h_A above the terrain related to surface without snow. The time variability of h is then interpreted as variability of snow depth (Larson, Billich, Ozeki, Heki and others).

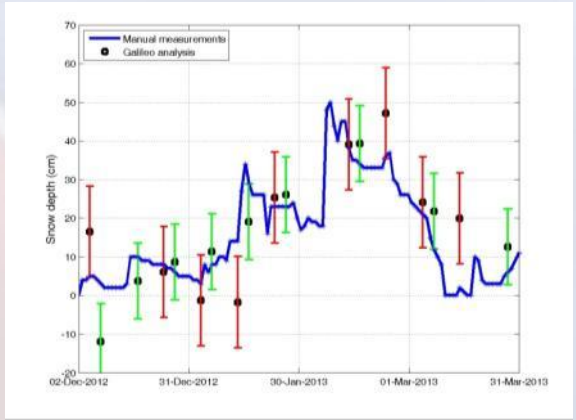
$$h_{SNOW} = h_A - h$$

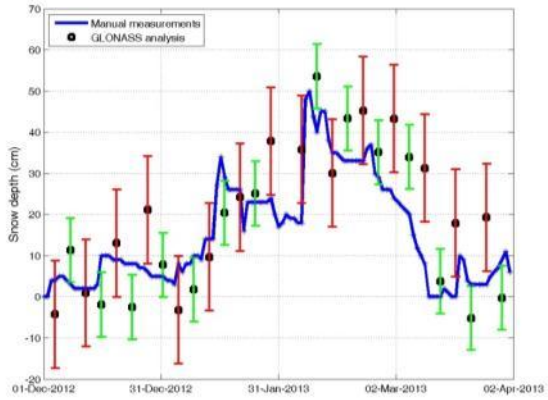
Variation of height h of reflection surface due to height h_{SNOW} of the actual snow cover

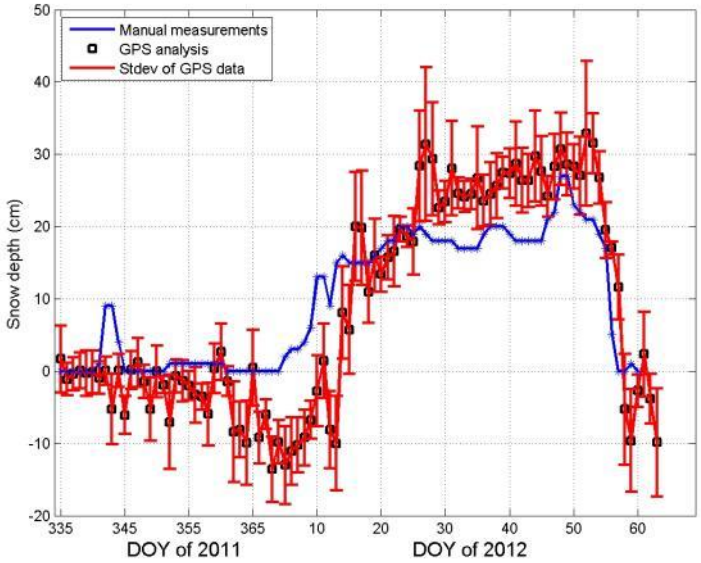


Variations of effective depth of reflector at IGS and EPN permanent station GANP

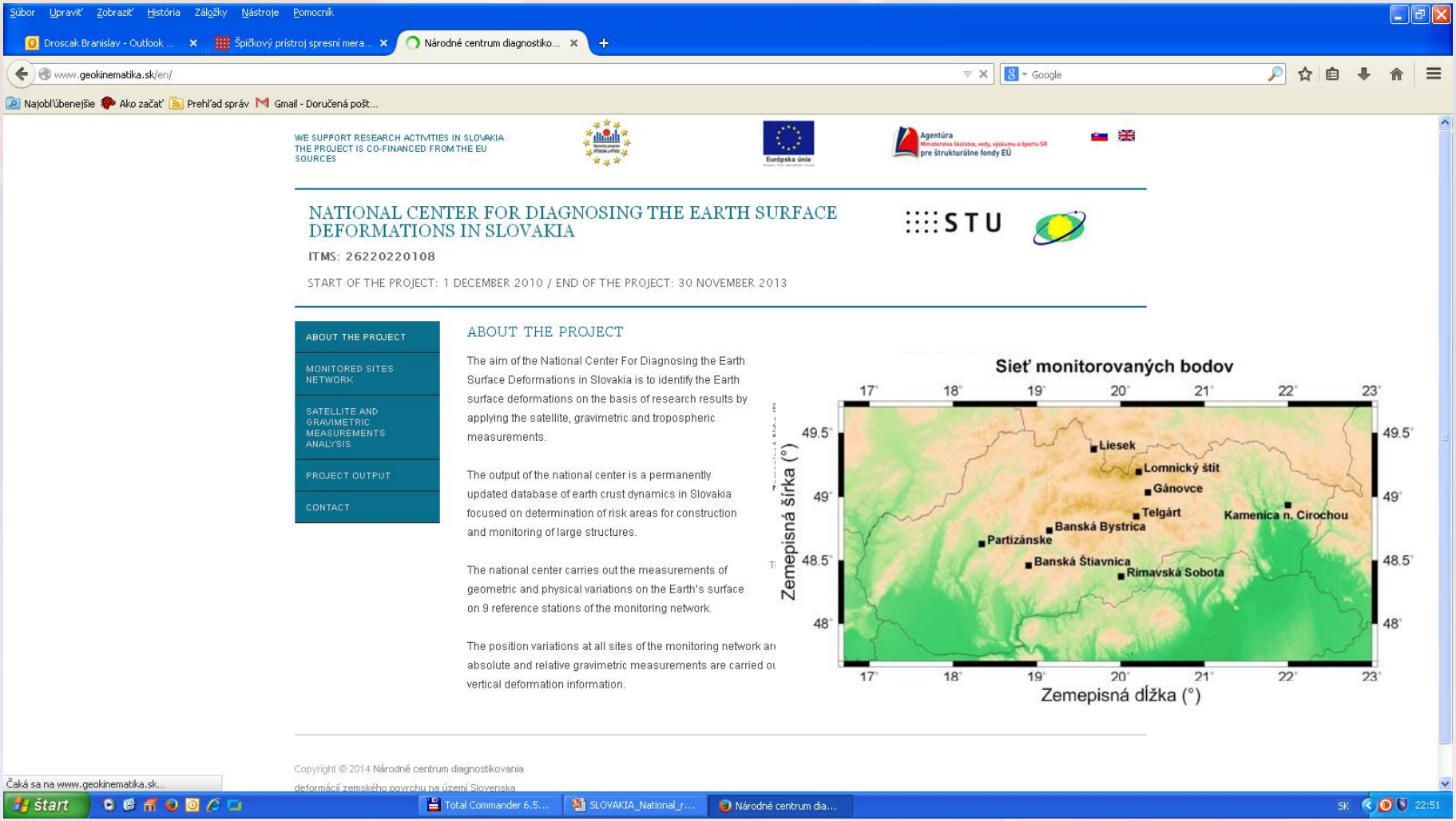








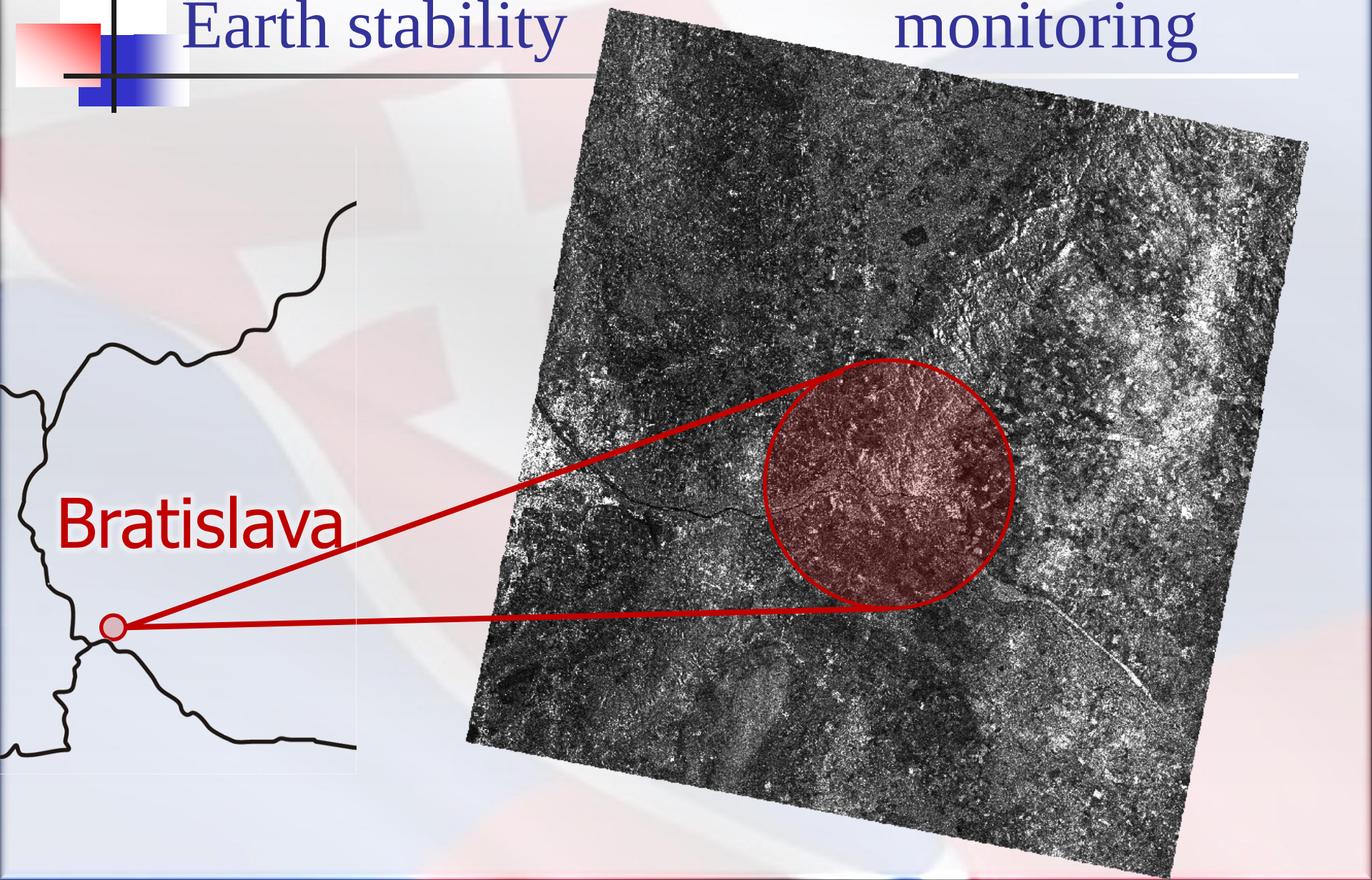
National center for diagnosting the earth surface deformations in Slovakia



National center for diagnosting the earth surface deformations in Slovakia

- New absolute gravimeter FG5X-247 was purchased for project

PS InSAR technology tests
Earth stability monitoring



Other news

www.geoportal.sk

Prihlásenie | Mapa stránok

Vyhľadávanie

ZBGIS A ŠMD | ARCHÍV | APLIK

Map client ZBGIS

Metadata editor

Metaúdajový editor (MDE) je webová aplikácia, ktorá slúži na vytváranie nových alebo na editáciu existujúcich metaúdajových záznamov.

Vstúpiť

Transformation service

služba

ov medzi

témami.

Inspire

ÚGKK SR zabezpečuje sprístupnenie referenčných údajov a informácií rezortu aj pomocou elektronických služieb, ktoré spĺňajú požiadavky smernice INSPIRE.

Vstúpiť

Conversion service

Konverzná služba slúži na konverziu formátov. Je to komplexný nástroj pre konverziu údajov rôznych formátov.

Vstúpiť

klient ZBGIS

Mapový klient ZBGIS je webová aplikácia, ktorá slúži na prácu s údajmi ZBGIS, zobrazovanie, vyhľadávanie a analýzu priestorových údajov.

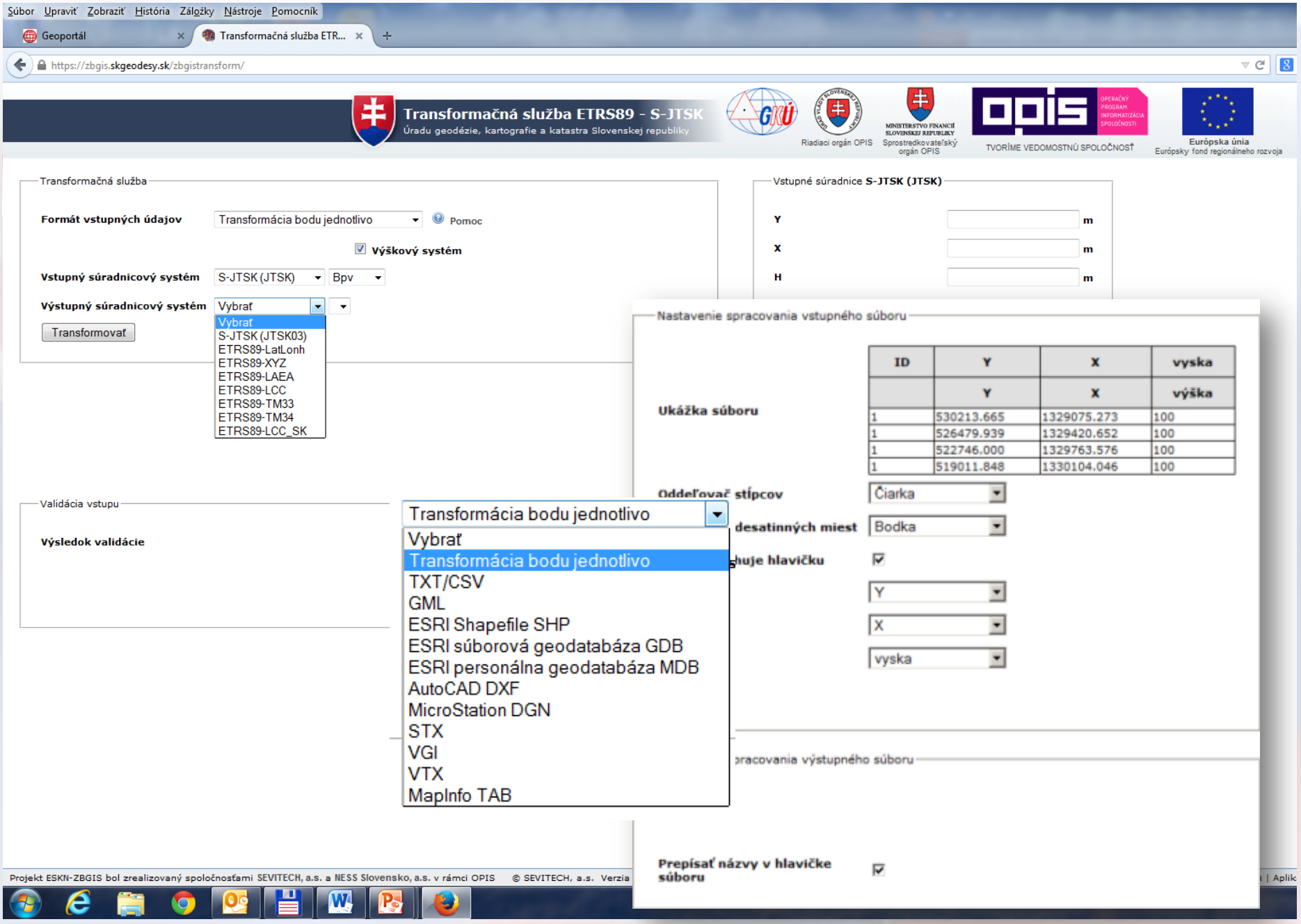
Transformačn

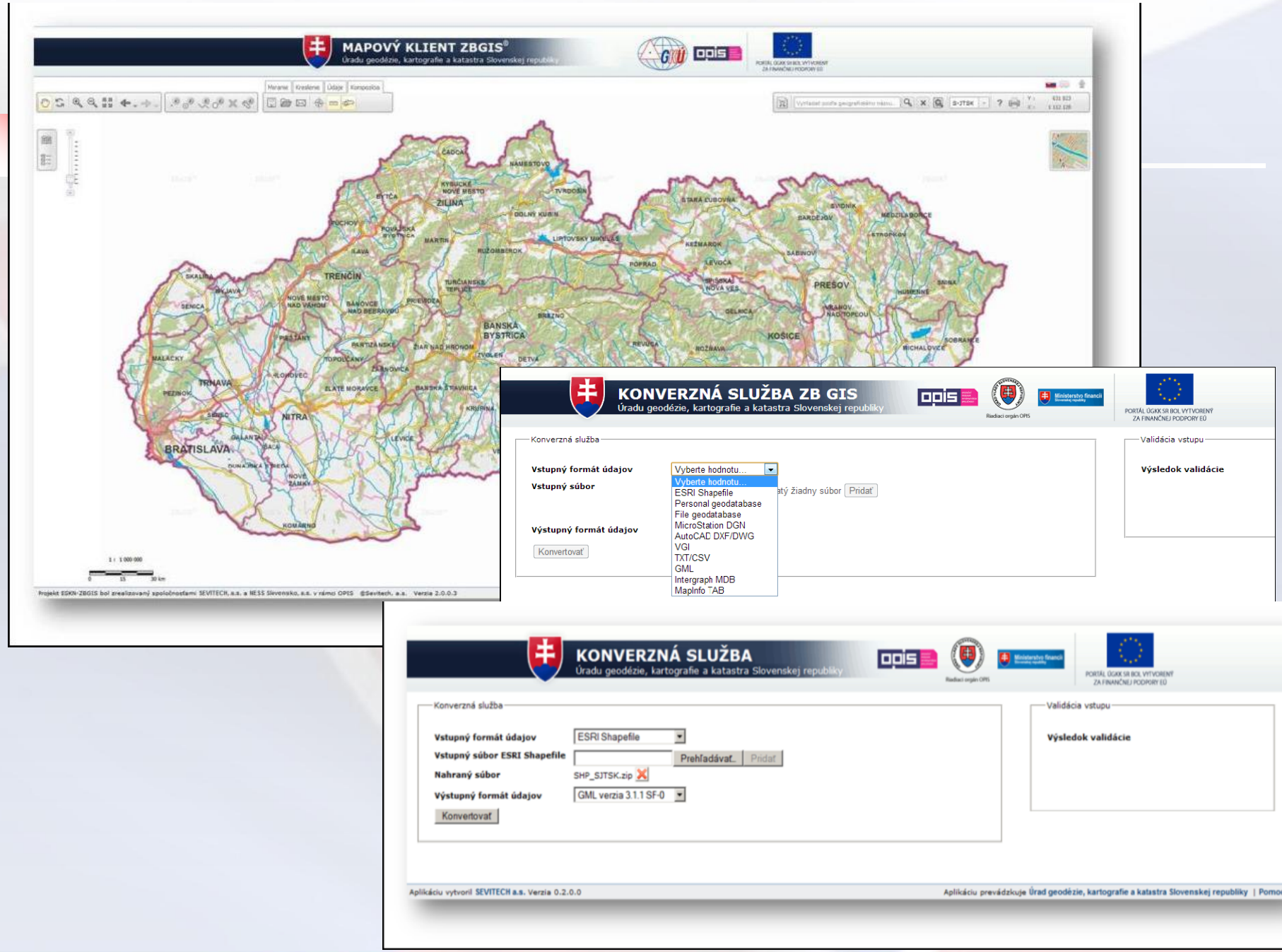
Aplikácia Transformačná služba vykonáva autorizovanú transformáciu súradníc bodov medzi záväznými geodetickými systémami.

Searching service

Slúži na vyhľadávanie metaúdajových záznamov publikovaných pripojeným katalógovým serverom.

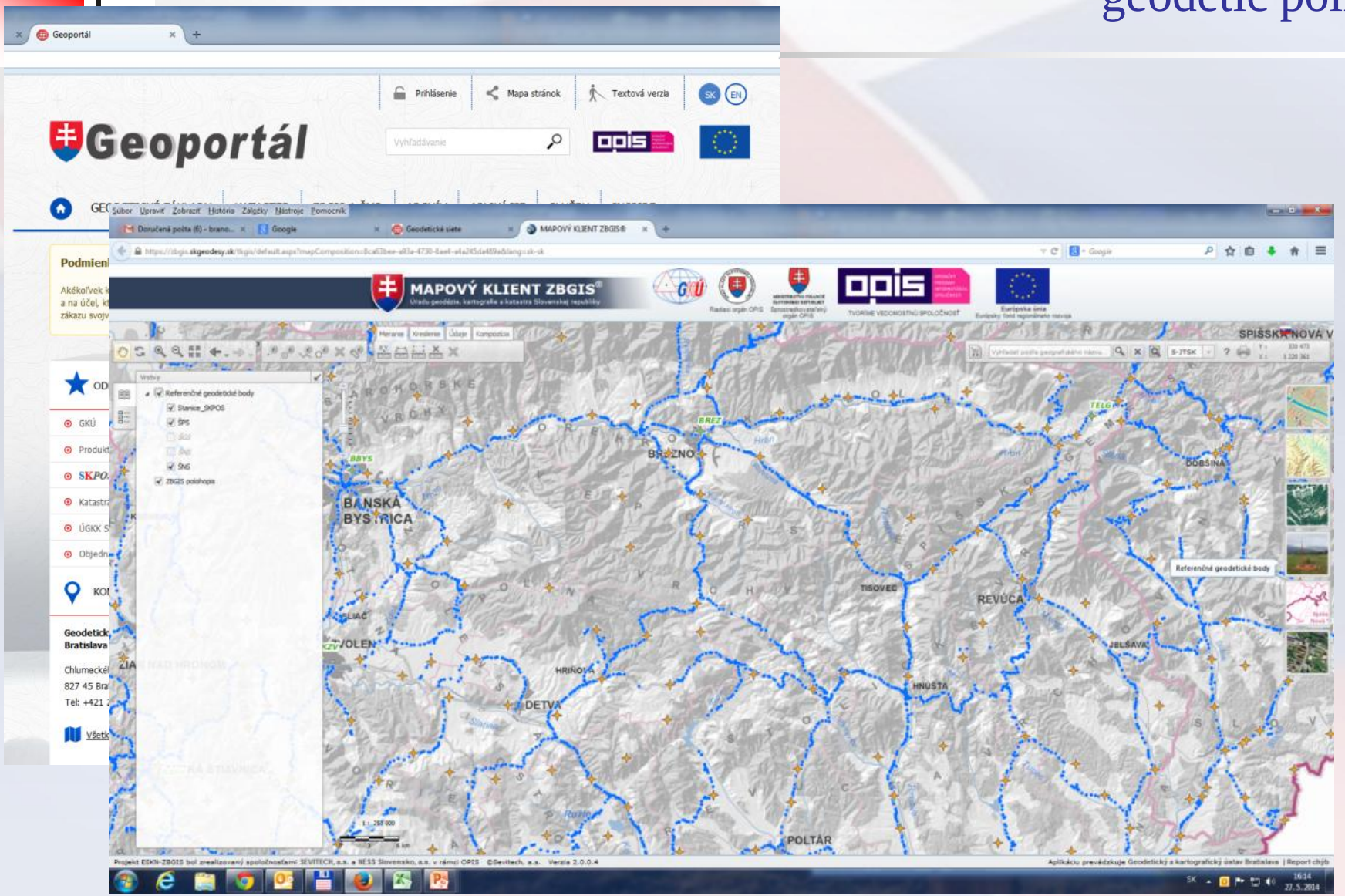
Vstúpiť


Súbor Upraviť Zobraziť História Záložky Nástroje Pomocník
Geoportál
Transformačná služba ETR...
https://zbgis.skgeodesy.sk/zbgistransform/
Transformačná služba ETRS89 - S-JTSK
Úradu geodézie, kartografie a katastra Slovenskej republiky
Riadiaci orgán OPIS
Sprostredkovateľský orgán OPIS
TVORÍME VEDOMOSTNÚ SPOLOČNOSŤ
Európska únia
Európsky fond regionálneho rozvoja
Transformačná služba
Formát vstupných údajov
Transformácia bodu jednotlivo
Pomoc
Výškový systém
Vstupný súradnicový systém
S-JTSK (JTSK)
Bpv
Výstupný súradnicový systém
Vybrať
S-JTSK (JTSK03)
ETRS89-LatLonh
ETRS89-XYZ
ETRS89-LAEA
ETRS89-LCC
ETRS89-TM33
ETRS89-TM34
ETRS89-LCC_SK
Transformovať
Vstupné súradnice S-JTSK (JTSK)
Y
X
H
m
Nastavenie spracovania vstupného súboru
ID
Y
X
vyska
Y
X
výška
Ukážka súboru
1 530213.665 1329075.273 100
1 526479.939 1329420.652 100
1 522746.000 1329763.576 100
1 519011.848 1330104.046 100
Oddeľovač stĺpcov
Čiarka
desatinných miest
Bodka
Y
X
vyska
Validácia vstupu
Výsledok validácie
Transformácia bodu jednotlivo
Vybrať
Transformácia bodu jednotlivo
TXT/CSV
GML
ESRI Shapefile SHP
ESRI súborová geodatabáza GDB
ESRI personálna geodatabáza MDB
AutoCAD DXF
MicroStation DGN
STX
VGI
VTX
MapInfo TAB
Prepísať názvy v hlavičke súboru
Projekt ESKN-ZBGIS bol zrealizovaný spoločnosťami SEVITECH, a.s. a NESS Slovensko, a.s. v rámci OPIS
© SEVITECH, a.s. Verzia


MAPOVÝ KLIENT ZBGIS®
Úradu geodézie, kartografie a katastra Slovenskej republiky
KONVERZNÁ SLUŽBA ZB GIS
Úradu geodézie, kartografie a katastra Slovenskej republiky
Konverzná služba
Vstupný formát údajov
Vyberte hodnotu...
ESRI Shapefile
Personal geodatabase
File geodatabase
MicroStation DGN
AutoCAD DXF/DWG
VGI
TXT/CSV
GML
Intergraph MDB
MapInfo TAB
Vstupný súbor
Výstupný formát údajov
Konvertovať
Validácia vstupu
Výsledok validácie
KONVERZNÁ SLUŽBA
Úradu geodézie, kartografie a katastra Slovenskej republiky
Konverzná služba
Vstupný formát údajov
ESRI Shapefile
Vstupný súbor ESRI Shapefile
Prehľadávať...
Pridať
Nahraný súbor
SHP_SJTSK.zip
Výstupný formát údajov
GML verzia 3.1.1 SF-0
Konvertovať
Validácia vstupu
Výsledok validácie
Aplikáciu vytvoril SEVITECH a.s. Verzia 0.2.0.0
Aplikáciu prevádzkuje Úrad geodézie, kartografie a katastra Slovenskej republiky | Pomoc

Geodetic basics points browser

www.geoportal.sk / Map client ZBGIS / Layer Reference geodetic points



Thank you
for your attention