

EUREF Symposium 2015



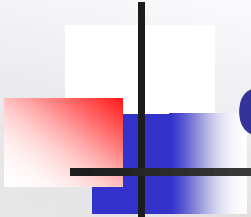
National report of Slovakia 2015

Branislav Droščák, Karol Smolík, Miroslav Roháček, Miroslav Steinhubel ¹⁾, Juraj Papčo, Marcel Mojzeš, Juraj Janák, Ľubomíra Gerhátová ²⁾

1) Geodetic and Cartographic Institute Bratislava

2) Slovak University of Technology in Bratislava, Faculty of Civil Engineering,
Department of theoretical Geodesy

EUREF 2015, annual symposium
3-5.June 2015, Leipzig, Germany



Outline

- Slovakian activities and contributions to EPN
- Status, activities and news from
 - **SKPOS** (Slovak real time positioning service)
 - national levelling network
 - national gravimetric network
- Research and development
 - Activities of Geodetic and cartographic institute
 - Activities of Slovak university of Technology
- Other news from Slovakia

Slovakian activities and contributions to EPN

EPN Operational centers



Geodetic and Cartographic Institute
Bratislava (GKÚ)



Slovak University of Technology in
Bratislava (SUT)



Slovakian activities and contributions to EPN

EPN Local analysis center



EUREF LOCAL ANALYSIS CENTRE	
Agency acronym	: SUT
Institution	: Slovak University of Technology
Mail Address	: Department of Theoretical Geodesy Faculty of Civil Engineering Radlinského 11, 813 68 Bratislava Slovakia
Primary Contact	
Contact Name	: Jan Hefty
Telephone	: + 421 2 5927 4533
Fax	: + 421 2 5292 5476
E-Mail	: jan.hefty@stuba.sk
Secondary Contact	
Contact Name	: Martina Míňariková
Telephone	: + 421 2 5249 8047
Fax	: + 421 2 5292 5476
E-Mail	: martina.minarikova@stuba.sk
Third Contact	
Contact Name	: Miroslava Haque Igondova
Telephone	: + 421 2 5249 8047
Fax	: + 421 2 5292 5476
E-Mail	: miroslava.igondova@stuba.sk
Software Used	: Bernese GPS Software, v. 4.2, BPE (until 1339 week) Bernese GPS Software, v. 5.0, BPE (since 1400 week)



Slovak University of
Technology in Bratislava
(SUT)

Slovakian activities and contributions to EPN Permanent stations contribution

EPN CB HOME

EUREF PERMANENT NETWORK

GNSS Res

ORGANISATION	NETWORK & DATA	PRODUCTS & SERVICES	DOCUMENTATION	NEWS
About group	Station list Maps Tracking status Data access Proposed stations Station log submission Station submission	Data analysis Positions & velocities Tropospheric delays ETRF/ITRF transformation Position time series Satellite orbit & clock correction streams	Formats Guidelines Equipment & calibration Papers FAQ	News FTP s

MOPI



MOP2



GANP



BBYS



Antenna manufacturer:
3S NAVIGATION
AOA
ASHTech

Map showing stations in Slovakia and surrounding regions (Poland, Czech Republic, Hungary). Red circles highlight stations: MOPI, MOP2, GANP, and BBYS.

Update map

Údaje map ©2015 GeoBasis-DE/BKG (©2009), Google 50 km Zmluvné podmienky

Slovakian activities and contributions to EPN Permanent stations contribution

GANP



EPN CB
HOME

EUREF PERMANENT NETWORK

ROB ★★★★★
GNSS RESEARCH GROUP

EUREF

ORGANISATION

About | Components | Working groups | Management | Contributors | Collaborations | Site map

NETWORK & DATA

Station list | Maps | Tracking status | Data access | Proposed stations | Station log submission | Station picture submission

PRODUCTS & SERVICES

Data analysis | Daily/weekly positions | Positions & velocities | Tropospheric delays | ETRF/ITRF transformation | Position time series | Satellite orbit & clock correction streams

DOCUMENTATION

Formats | Guidelines | Equipment & calibration | Papers | FAQ

NEWS, EVENTS & LINKS

News | Mails | Calendar | Workshops | FTP server | Web history | Links

NETWORK & DATA > STATION LIST

As of 21 May 2015, 266 permanent GNSS tracking stations (including 2 inactive) are part of the EUREF Permanent Network.

For a better understanding of the table, see the [legend](#).

Station Identification	Station Location	Data	Receiver Information	Antenna Information	Meteorological Instr.	Additional Information	Station Status
☐ Marker Name	☒ City	☒ Quality	☐ Type	☐ Type/Radome	☐ Meteo data	☐ Primary data centre	☐ Station status

Long Station Name	City	Country	DQ (%)		Availability				Last Data Available	Latency		Receiver								RINEX 3 data available	Remarks	
			0°	15°	Daily (%)		Hourly (%)			RT (%)	Hourly (s)	RT (s)	Sat. System									
					BKG	OLG	BKG	OLG					G	R	E	C	J	S				
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		
BBYS00SVK	Banska Bystrica	Slovak Republic	88	94	100	100	97	97	-	2015-05-20	97	96	-	✓	✓	✓	✓	✓	✓	3.02		
GANP00SVK	Ganovce	Slovak Republic	88	96	100	100	98	98	100	2015-05-20	-	96	0.5	✓	✓	✓	✓	✓	✓	3.02		
KIRU00SWE	Kiruna	Sweden	88	100	100	100	100	100	-	2015-05-20	100	99	-	✓	✓	✓	✓	✓	✓	3.02		
WROC00POL	Wroclaw	Poland	95	100	100	89	100	100	100	2015-05-20	100	99	0.4	✓	✓	✓	✓	✓	✓	3.02		
LPAL00ESP	Roque de los Muchachos	Spain	91	100	100	100	99	99	100	2015-05-20	98	96	0.8	✓	✓	-	-	✓	✓	-		
STAS00NOR	Stavanger	Norway	94	100	100	100	100	100	100	2015-05-20	0	0	0.8	✓	✓	✓	✓	✓	✓	-		
PRAT00ITA	Prato	Italy	81	99	100	100	100	100	-	2015-05-20	88	83	-	✓	✓	-	-	-	-	-		
QAQ100GRL	Qaqortoq / Julianehaab	Greenland	94	100	93	93	97	97	-	2015-05-20	95	92	-	✓	✓	-	-	-	-	-		

BBYS



Slovakian activities and contributions to EPN

EPN Real-time analysis WG

EPN CB HOME

EUREF PERMANENT NETWORK

GNSS Res

ORGANISATION
About | Components | Working groups | Management | Contributors | Collaborations | Site map

NETWORK & DATA
Station list | Maps | Tracking status | Data access | Proposed stations | Station log submission | Station picture submission

PRODUCTS & SERVICES
Data analysis | Daily/weekly positions | Positions & velocities | Tropospheric delays | ETRF/ITRF transformation | Position time series | Satellite orbit & clock correction streams

DOCUMENTATION
Formats | Guidelines | Equipment & calibration | Papers | FAQ

NEWS
News | FTP

NETWORK & DATA > **MAPS**

INTERACTIVE MAP

Legend
Station status (active, inactive, former)
Active Inactive Former

Locate station on map
Select a station -

Antenna manufacturer:
3S NAVIGATION
AOA
ASHTech

Multiple selection
Update

GANP


MOP2


Identification	Equipment	Tracking	Data flow
Marker Name:	GANP		
Marker Number:	11515M001		
Location:	Ganovce, Slovak Republic		
Status:	active		
Networks:	IGS	TOS	ECGN
	yes		no
More details:	station information		

Identification	Equipment	Tracking	Data flow
Marker Name:	MOP2		
Marker Number:	11507M002		
Location:	Modra-Piesok, Slovak Republic		
Status:	active		
Networks:	IGS	TOS	ECGN
	no	no	no
More details:	station information		

Slovakian activities and contributions to EPN

Monitoring of the official national ETRF coordinates on EPN web (“Elmars activity”)

EPN CB
HOME

EUREF PERMANENT NETWORK

GNSS Res

ORGANISATION

NETWORK & DATA

PRODUCTS & SERVICES

DOCUMENTATION

NEWS

5. POSITIONS PUBLISHED BY THE COUNTRY

The official ETRS89 coordinates used in Slovakia are maintained by **GKU**. This agency is fully responsible for the information kindly provided to the EPN:

Valid (from - to)	epoch t_0	Position (m)			Velocity (m/y)		
		X	Y	Z	V_X	V_Y	V_Z
111/2012 - now	184/2008	3929181.851	1455236.510	4793653.699	NA	NA	NA
310/2006 - 111/2012	233/2006	3929181.849	1455236.511	4793653.696	NA	NA	NA
310/2006 - 111/2012	184/2008	3929181.850	1455236.509	4793653.700	NA	NA	NA

Following a recent initiative of the EUREF Technical Working Group ([Monitoring of official national ETRF coordinates on EPN web](#)), the differences between the national coordinates and the latest cumulative EPN solutions (section 1) are regularly monitored. They are given in two maps: [horizontal differences] and [vertical differences].

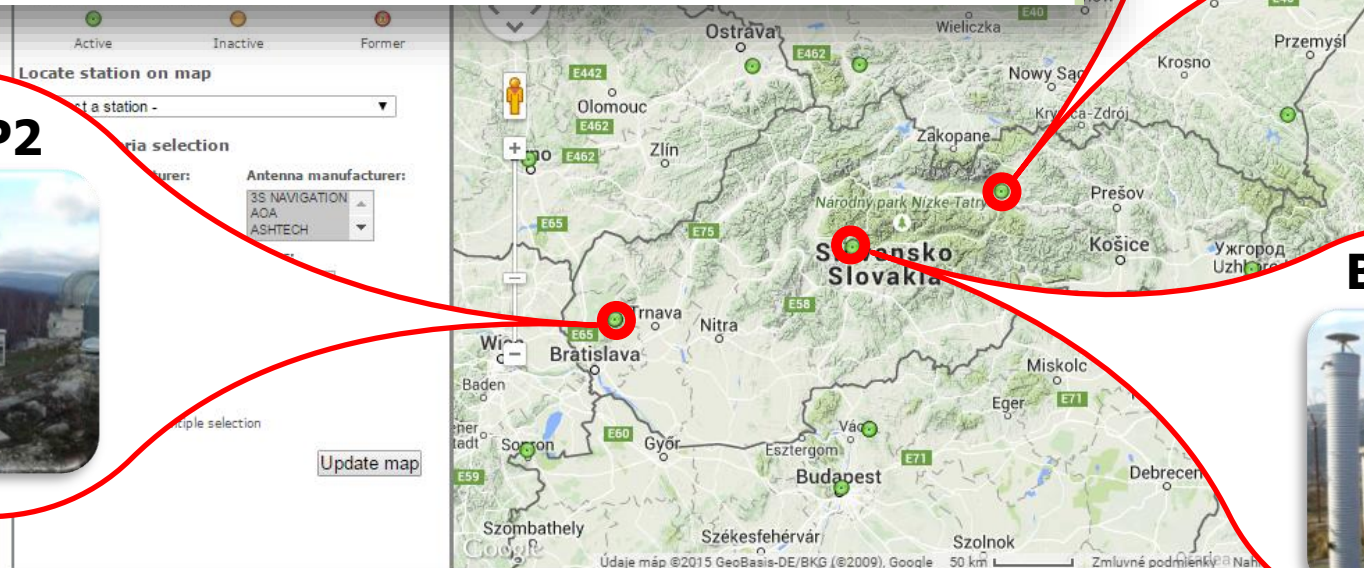
GANP

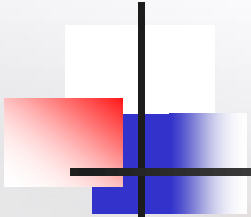


MOP2



BBYS

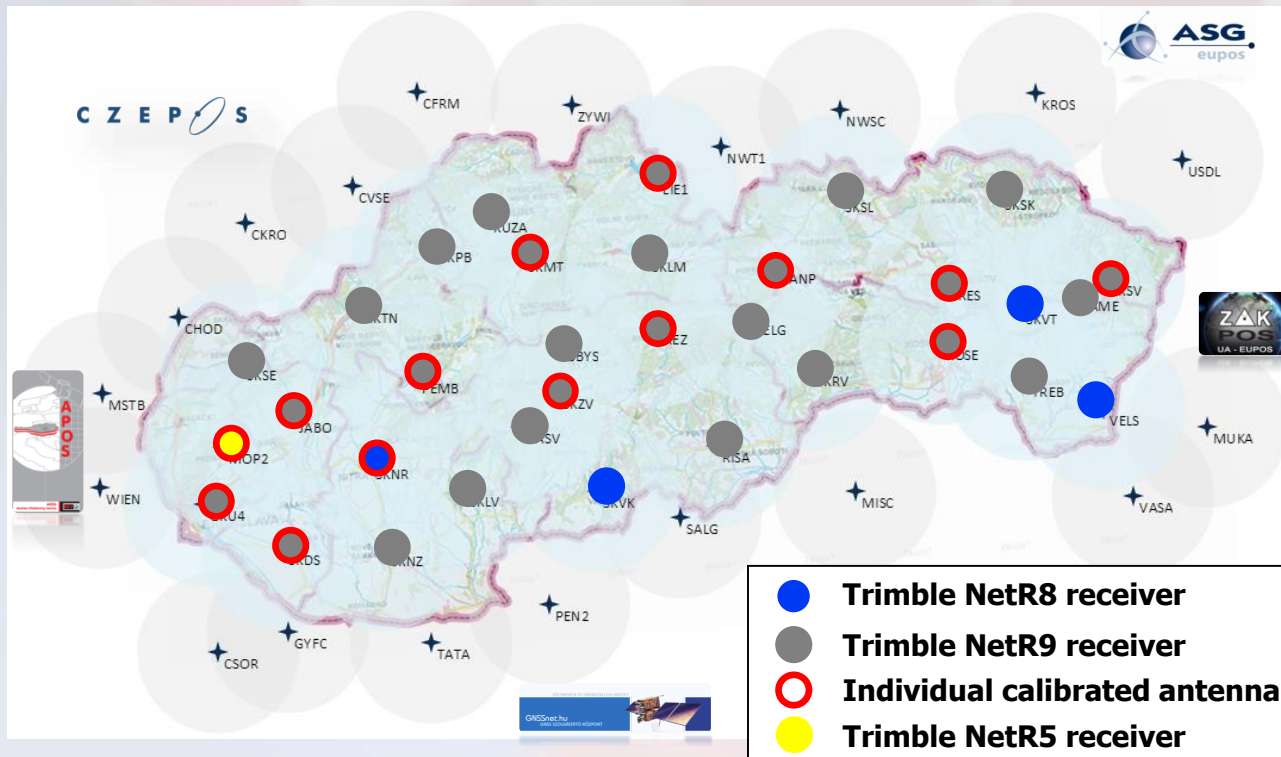




News from national spatial network (GNSS positioning)

Slovak real time positioning service - **SKPOS**® infrastructure (status in May 2015)

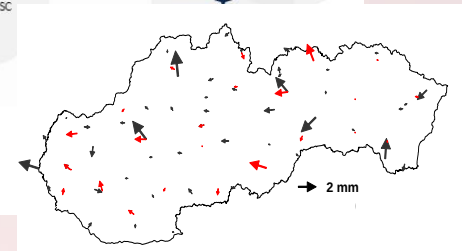
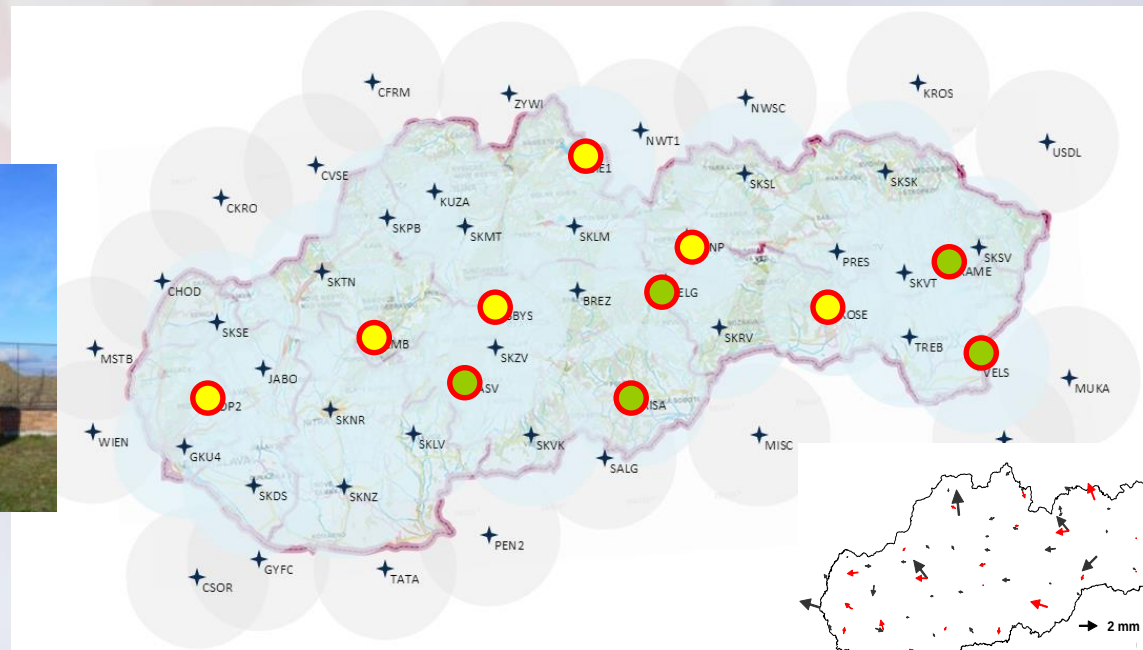
- **33 Slovakian permanent stations (14 individual calibrated)**
 - All stations with TRIMBLE receivers and antennas
 - All stations observe GPS+GLONASS signals (few Galileo)
- **19 foreign permanent stations (APOS, gnssnet.hu, CZEPOS, ASG-EUPOS, ZAKPOS)**



SKPOS®

infrastructure for geodynamics research

- 11 from 33 SKPOS® permanent stations have monumentation suitable for geodynamic research purposes
 - 6 stations reinforced-concrete pier monumentation
 - 5 stations deep drilled braced mark monumentation (5m deep) – 5 stations

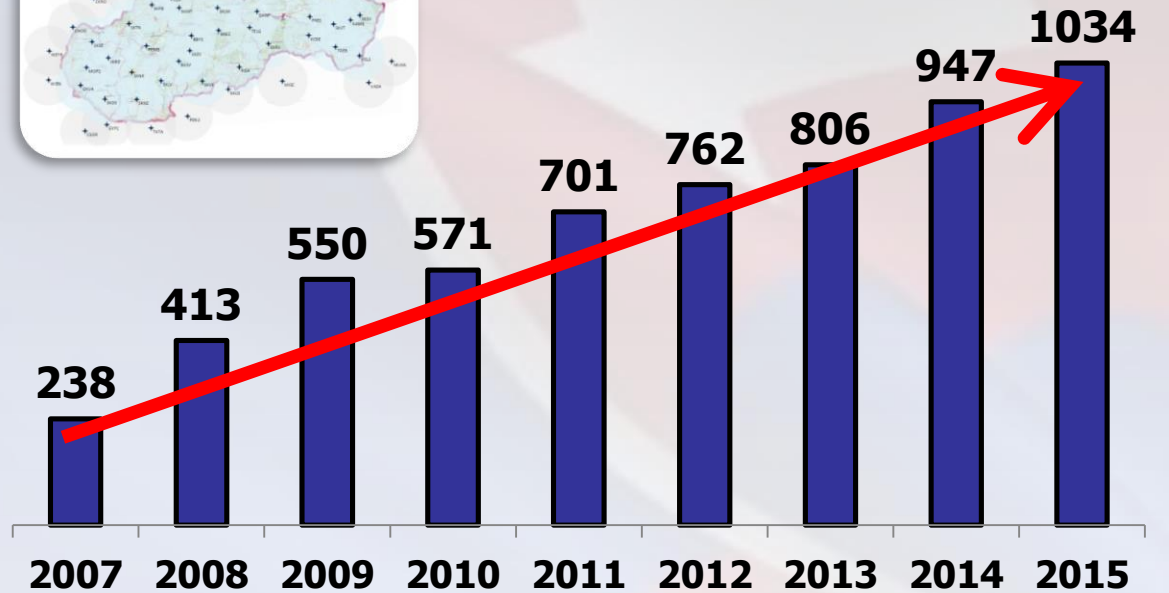


SKPOS®

number of users

- over 1000 registrations (May 2015)
- number is still increasing

SKPOS®

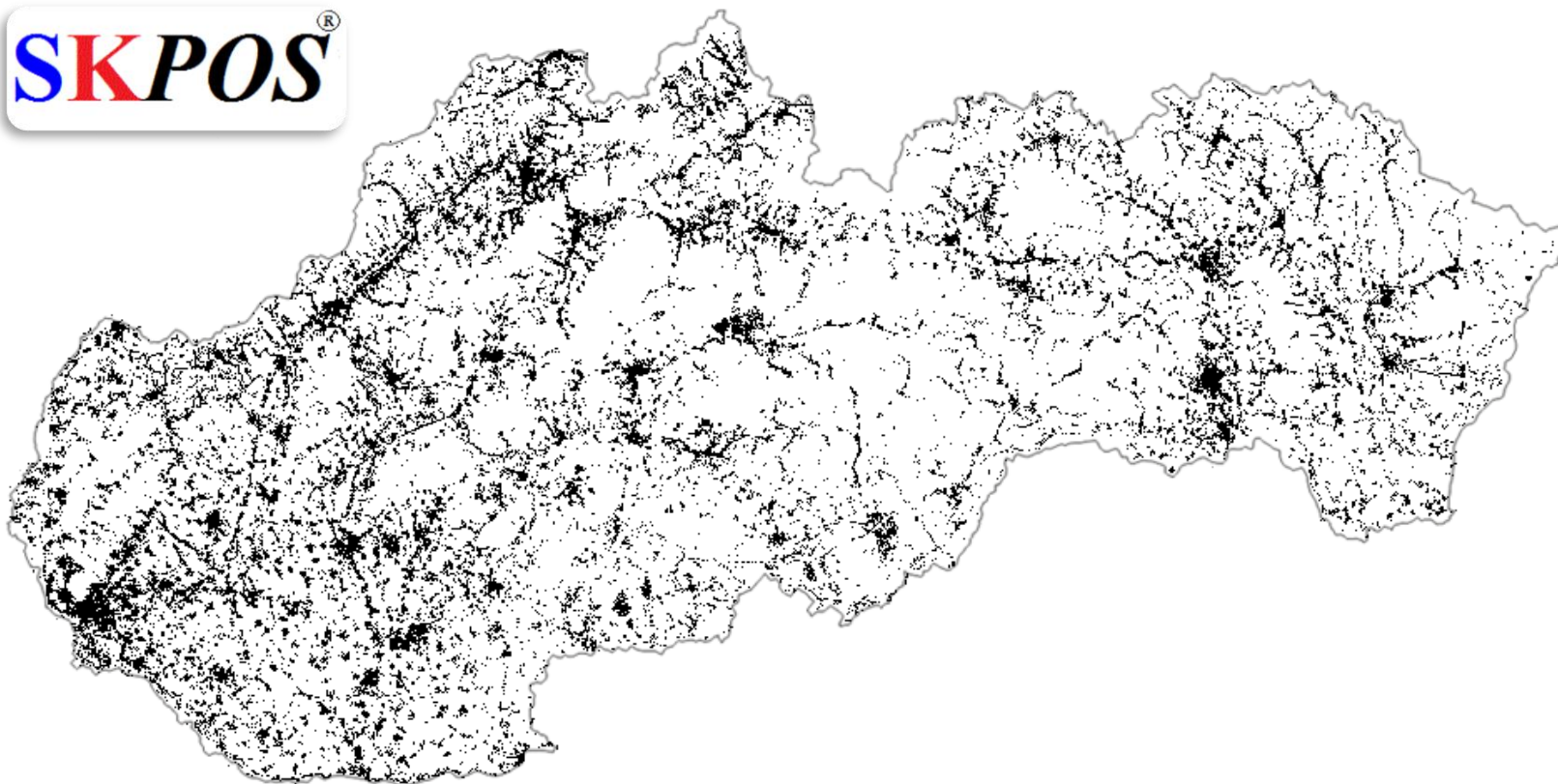


SKPOS[®]

service usage in 2014

- all users logins in 2014

SKPOS[®]

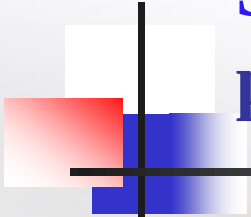


SKPOS®

type of users

- Surveying fields (cadastre, surveying, mapping, GIS) - **92%**
- Other fields - **8%**



**SKPOS®**

packages – data formats - charges

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

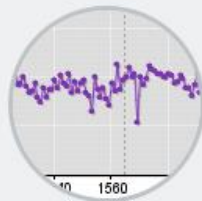
SKPOS®

Applications for analysis and administration



ASMARUP

Analýza inicializačných časov
používateľov SKPOS



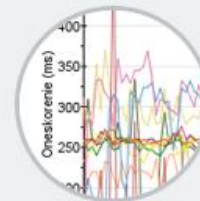
Časové rady

Časové rady referenčných staníc
SKPOS



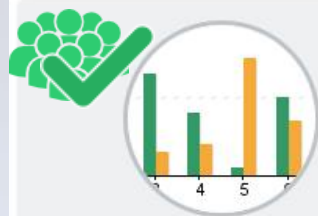
Monitoring používateľov

Počet pripojených používateľov



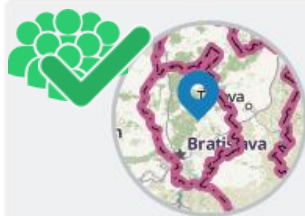
Oneskorenie staníc

Oneskorenie referenčných staníc
SKPOS



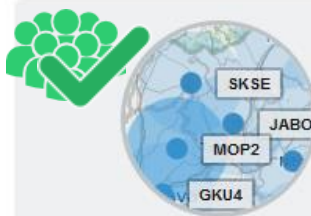
Monitoring sieťového riešenia Desktop

Desktop verzia - Monitoring
kvality sieťového riešenia



Monitoring sieťového riešenia Mobile

Mobilná verzia - Monitoring
kvality sieťového riešenia



EUPOS monitoring

EUPOS network RTK quality
monitoring



NMEA Analyzer

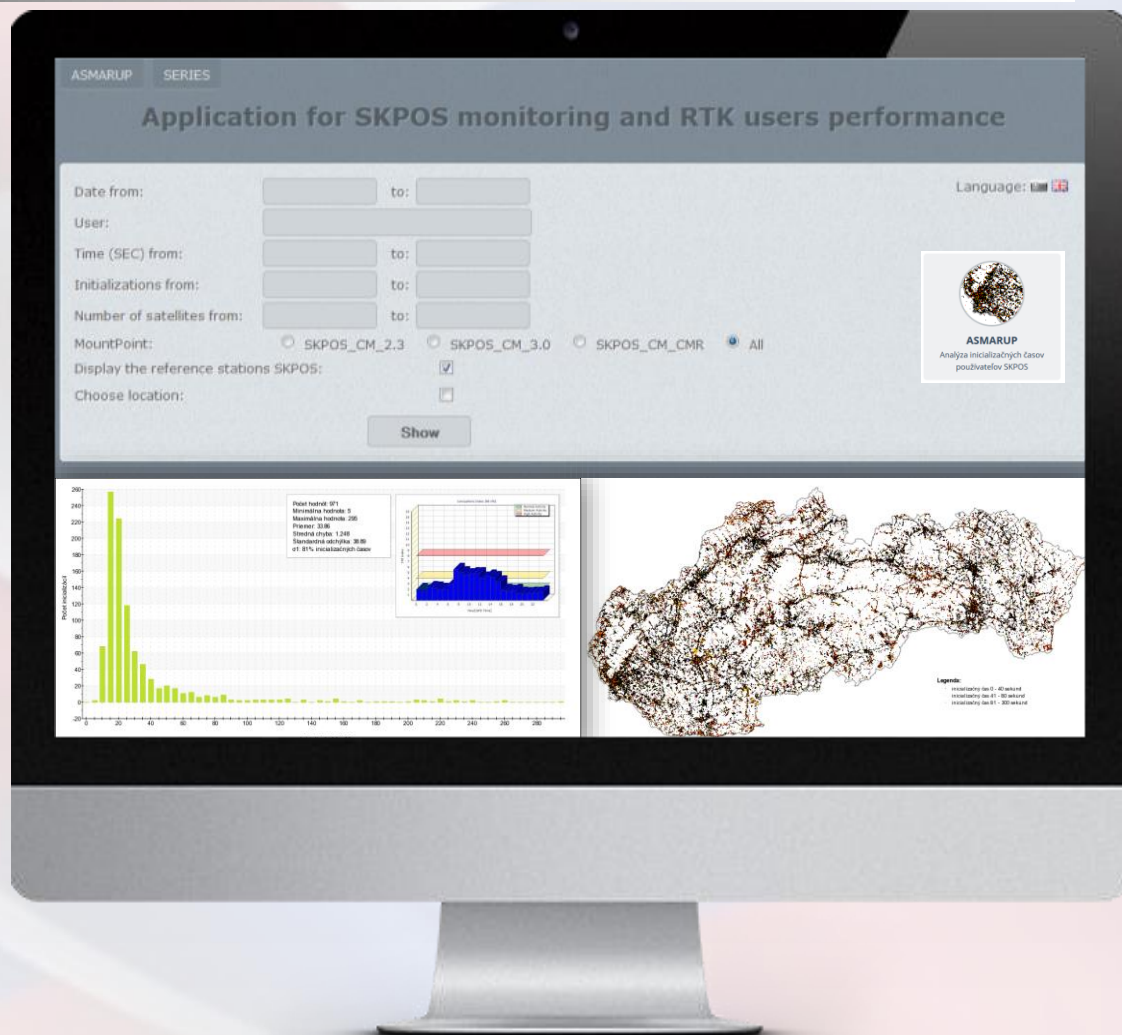
Analýza meraní používateľov z
NMEA správy



public available application

Application for SKPOS[®] Monitoring And RTK Users Performance (ASMARUP)

- application for users initialisation times analysis
- analysis enabled according to:
 - date and time,
 - particular user,
 - length of the initialisation time,
 - number of satellites,
 - mountpoint,
 - user position



Application for automatic visualization of **SKPOS**[®] permanent stations time series

- RAW time series input: SINEX from Bernese software
- CLEAN time series input: topocentric coordinates from MathCAD sw



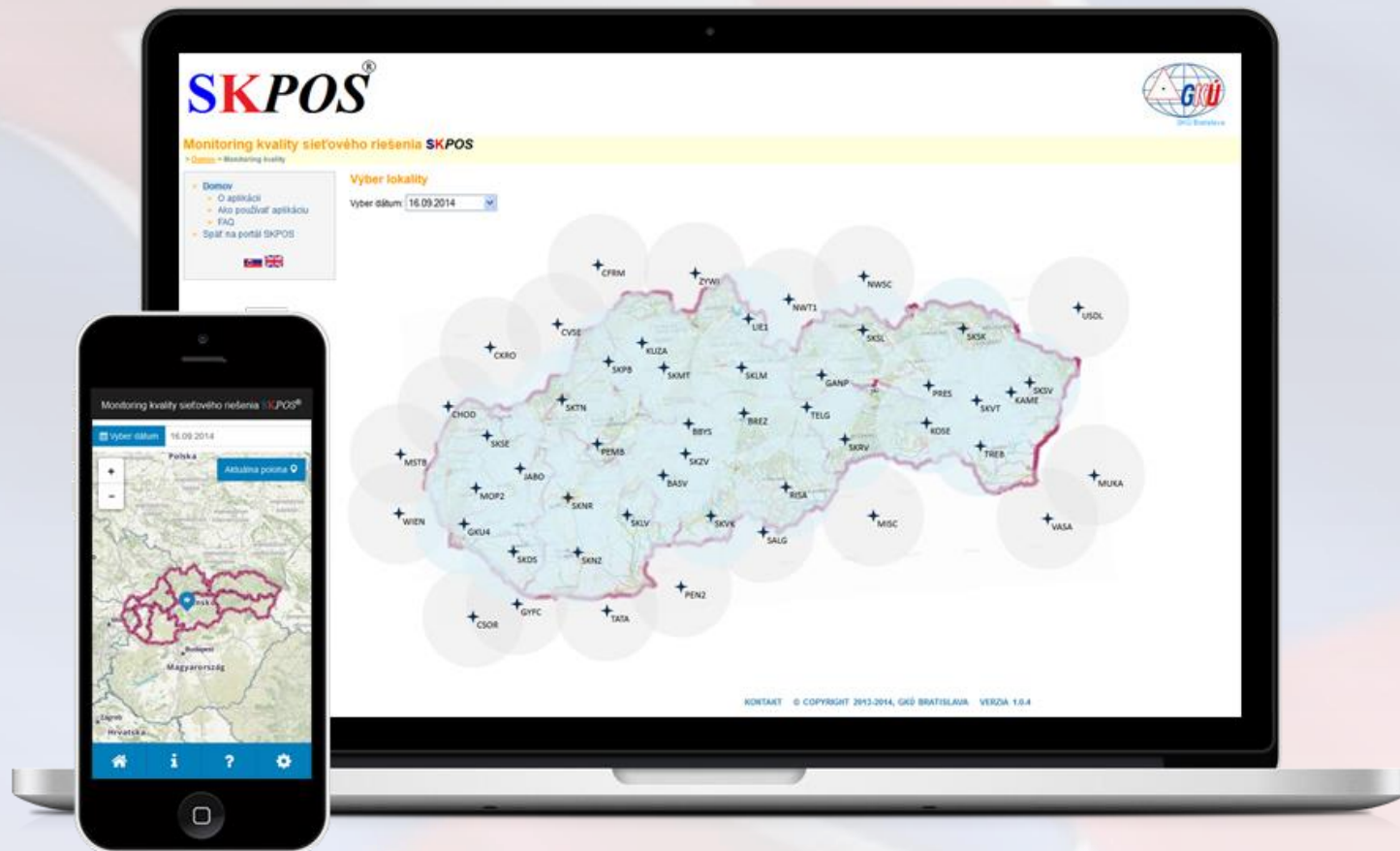
Application „SKPOS® network solution quality monitoring“



<http://monitoringSKPOS.gku.sk/m>

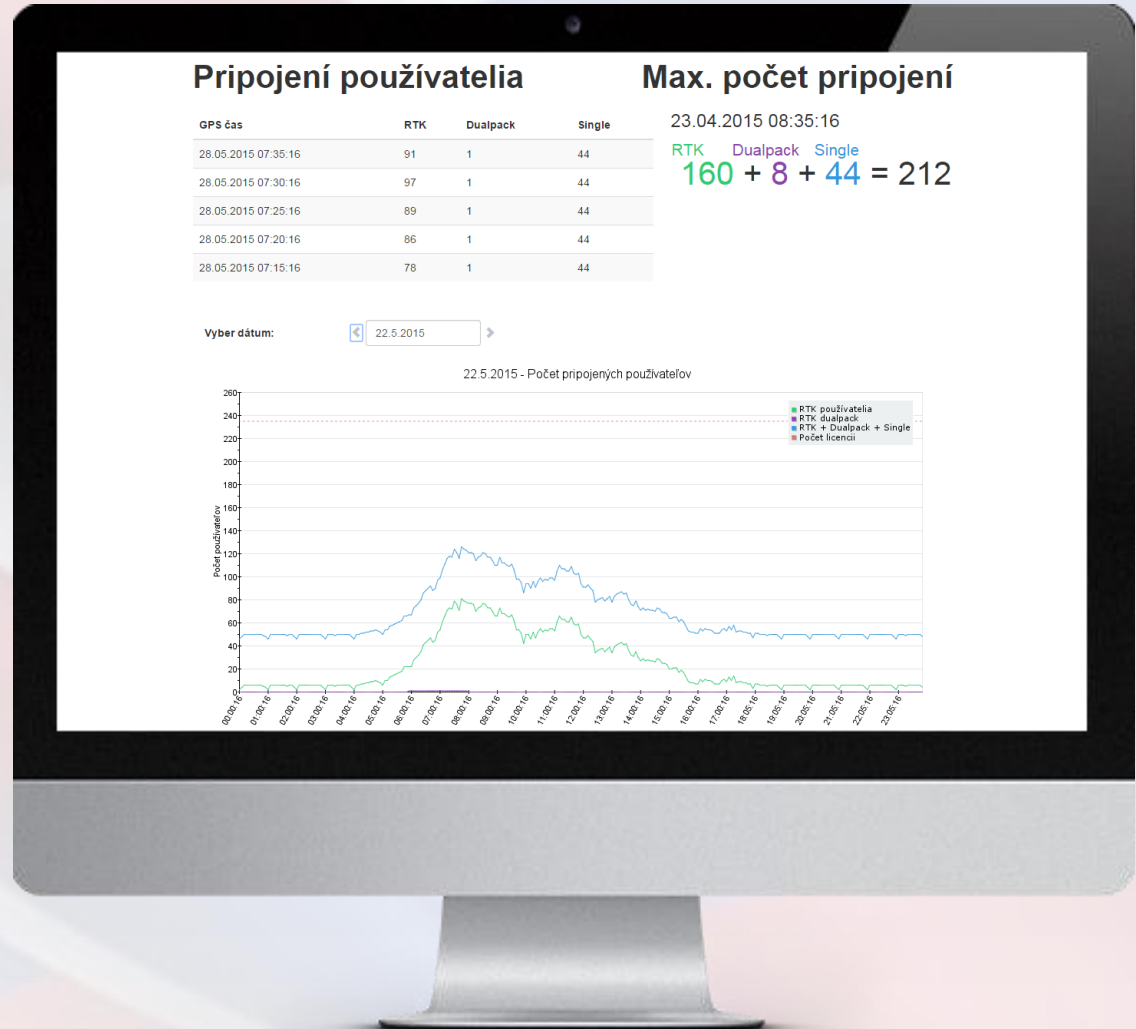


<http://monitoringSKPOS.gku.sk>



Application for Monitoring of number of on-line connected users

- Application visualizes and archives:
 - Number of on-line connected users in graph
 - Maximal number of connected users
 - Graphical history of users connections



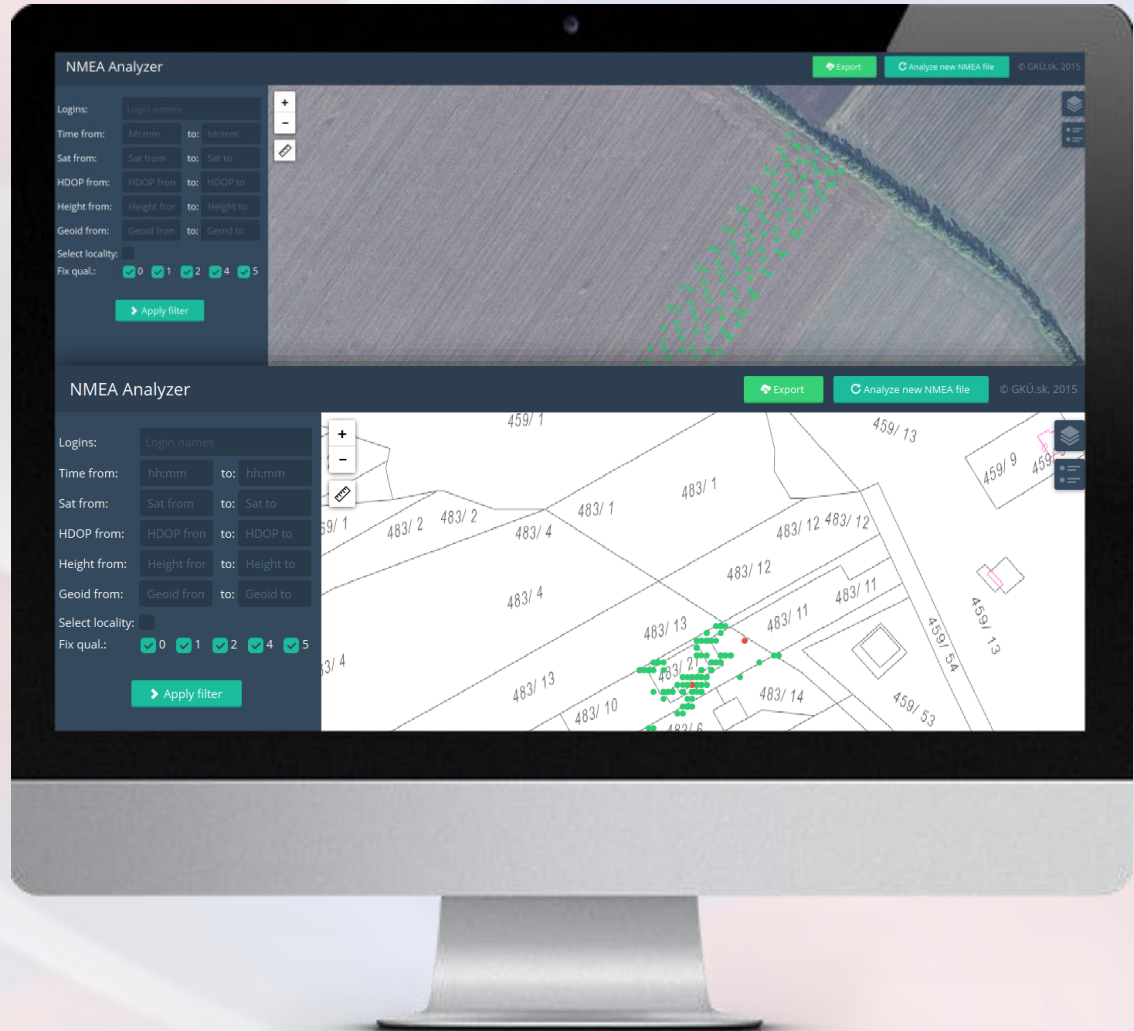
Application for Monitoring of SKPOS[®] permanent station data delay

- All stations monitored
 - Maximal delay values
 - Actual delay values
- Data archived
- Graph of data delays provided



Application „NMEA Analyzer“

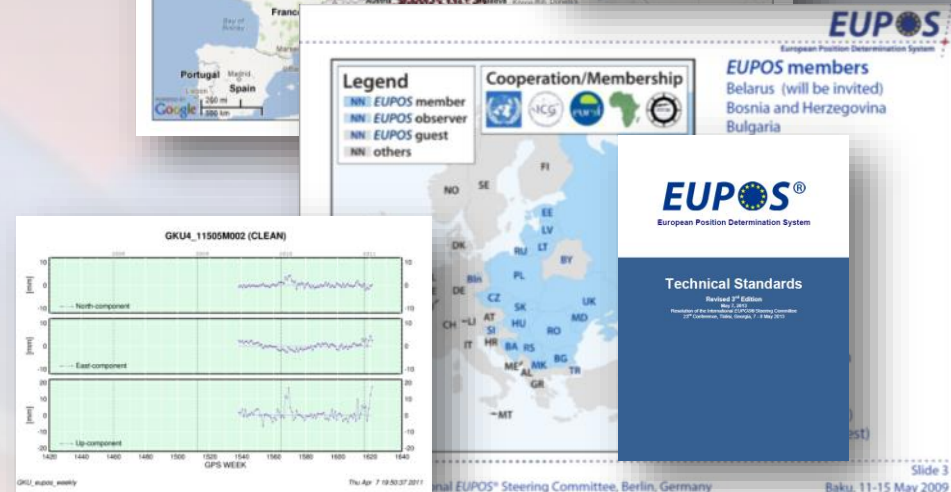
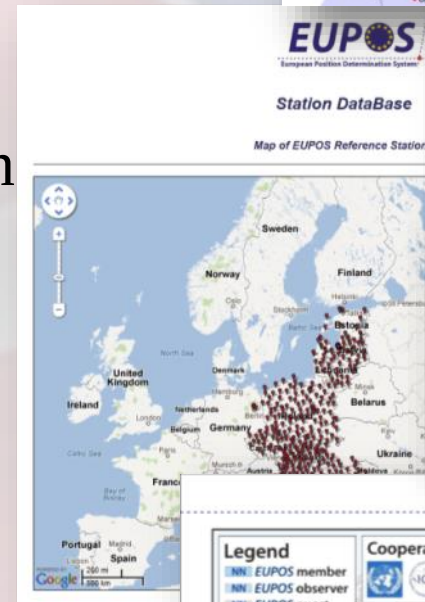
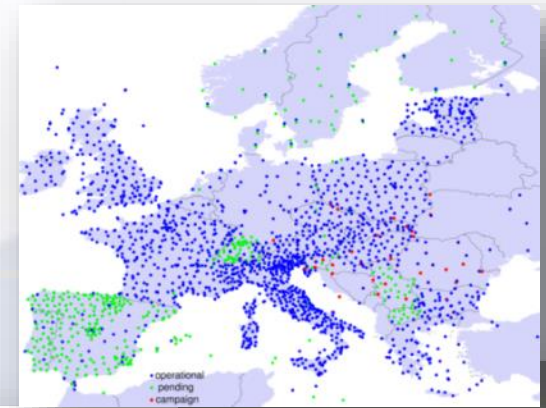
- Application for NMEA data handling
- Application enable:
 - Analyzing
 - Filtering
 - Exporting
 - Visualizing
- Underlay map
 - Terrain,
 - Satellite
 - Cadastral
 - **ZBGIS**®
- Color range output (according FIX)



SKPOS®

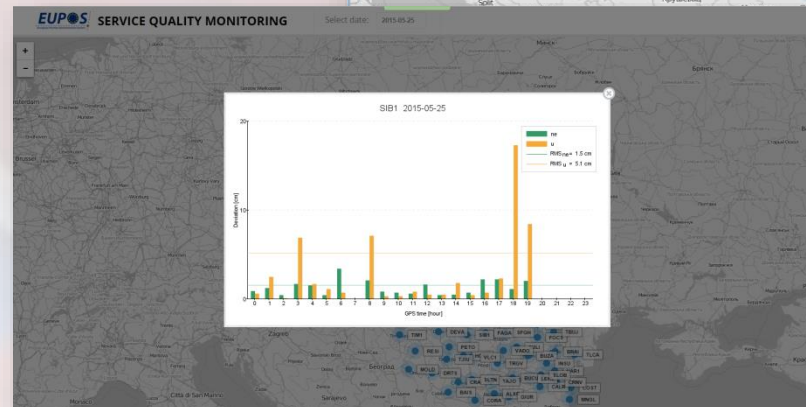
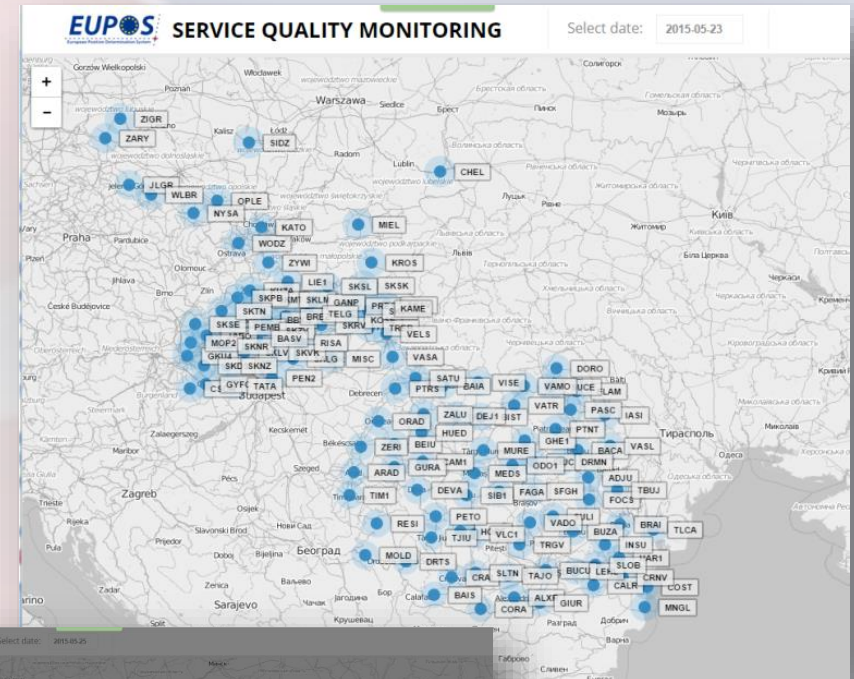
active part of *EUPOS*

- Follows *EUPOS* standards
- Keeps information in *EUPOS* station database
- Contributes to *EUPOS* combination centre (SINEX GKU)
- Leads *EUPOS* WG on Service Quality Monitoring



EUPOS WG on Service Quality Monitoring

- GKÚ Bratislava = administrator of **SKPOS**® and **EUPOS** Service Quality Monitoring
- **EUPOS** SQM
 - Application for monitoring of **EUPOS** countries network RTK quality
 - <http://monitoringeupos.gku.sk>



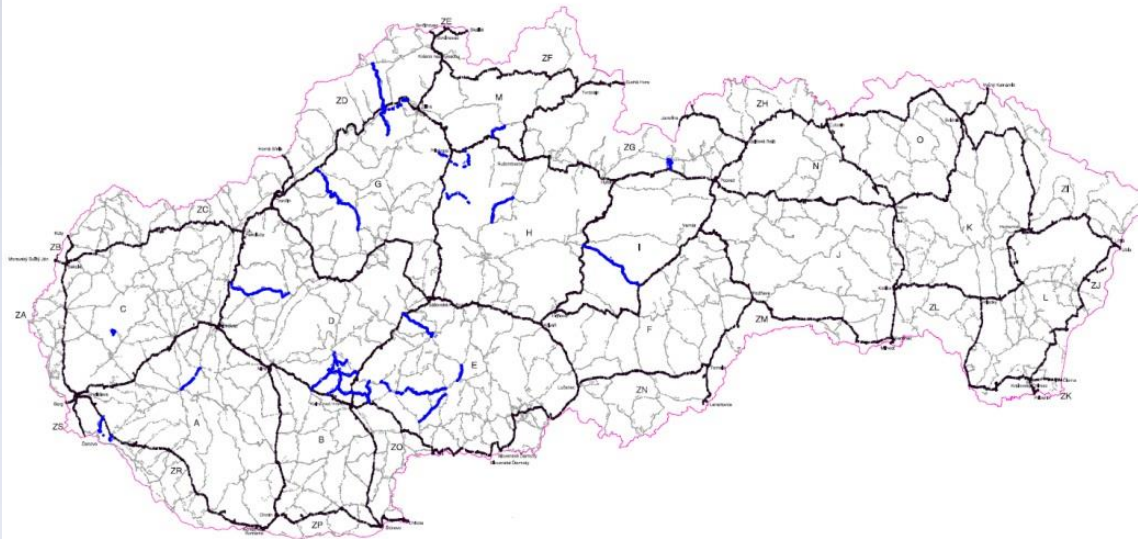
Status, activities and news from national
levelling network

National levelling network (ŠNS)

Measurements on the 2nd order levelling lines

- Measurements in 2014:
 - Totally measured: 601 km
 - 3 levelling groups
- New reprocessing of ŠNS is preparing (Data from 1987 - 2015)

ŠNS 2014



Status, activities and news from national
gravimetric network

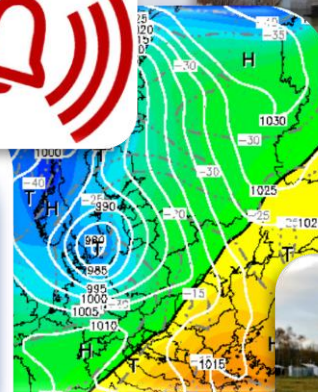


Research and development

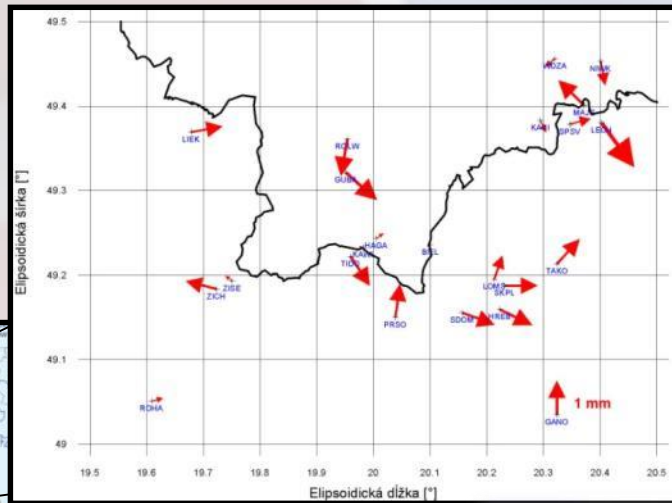
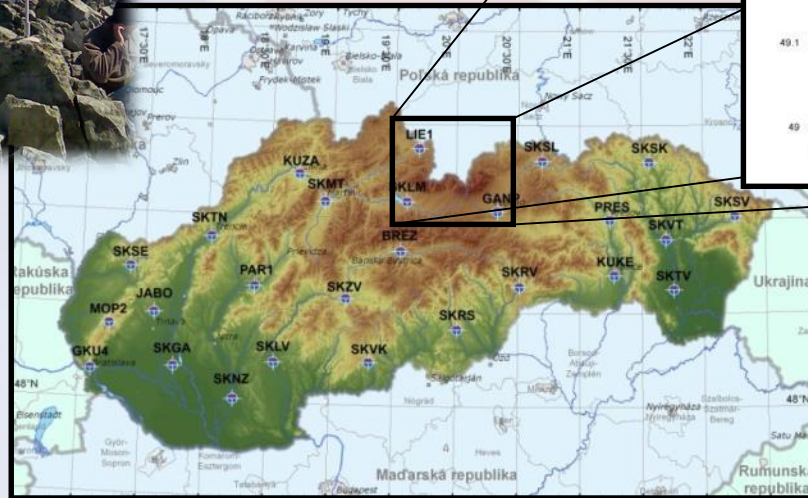
Collaboration with Vihorlat observatory

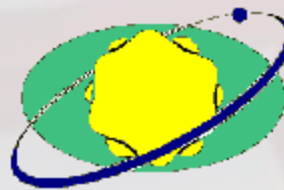
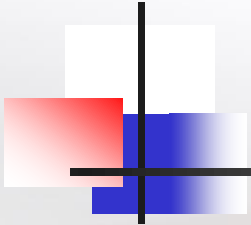
Space emergency system

- Multilateral project: Ukraine-Slovakia-Hungary-Romania
- Agreement signed in December 2015
- new KOLS permanent station will be part of **SKPOS**[®]
- goal: creation of Space emergency system
- www.meteognss.net



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Slovak University of Technology

Research and development activities

National center for diagnosing the earth surface deformations in Slovakia

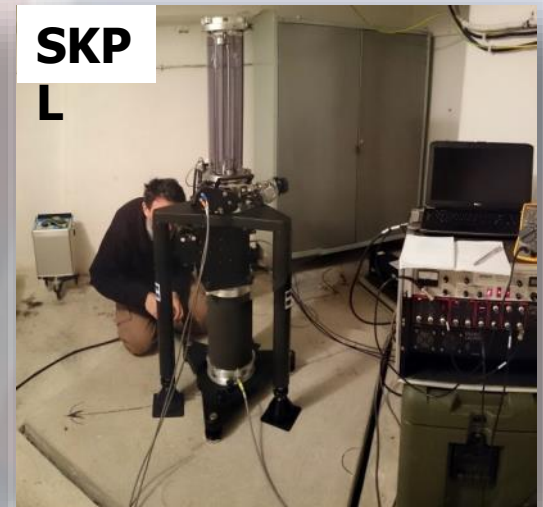
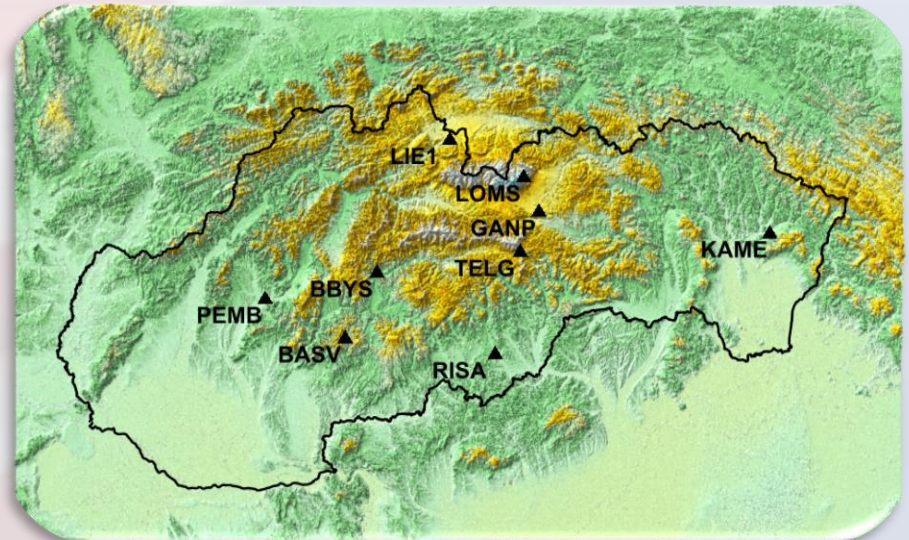
- ITMS research project (<http://www.geokinematika.sk>)
- Surface deformations monitored on 9 geodynamics points by
 - Permanent GNSS stations
 - Absolute gravity measurements

The screenshot shows the website of the National Center for Diagnosing the Earth Surface Deformations in Slovakia. The header includes navigation links (Súbor, Upraviť, Zobraziť, História, Záložky, Nástroje, Pomocník) and browser tabs. The main content area features the project title, ITMS number (26220220108), and project dates (1 December 2010 to 30 November 2013). A sidebar on the left lists sections: ABOUT THE PROJECT, MONITORED SITES NETWORK, SATELLITE AND GRAVIMETRIC MEASUREMENTS ANALYSIS, PROJECT OUTPUT, and CONTACT. The main text describes the project's aim to identify Earth surface deformations using satellite, gravimetric, and tropospheric measurements. It also mentions the output of a permanently updated database and the use of GNSS receivers for tracking position variations.

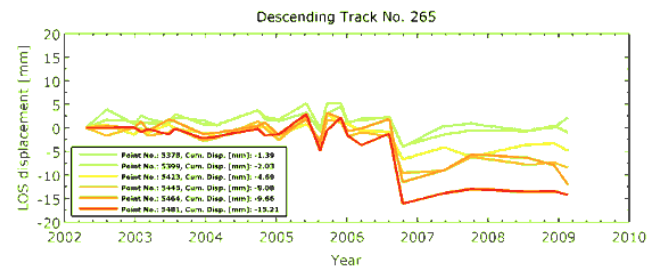
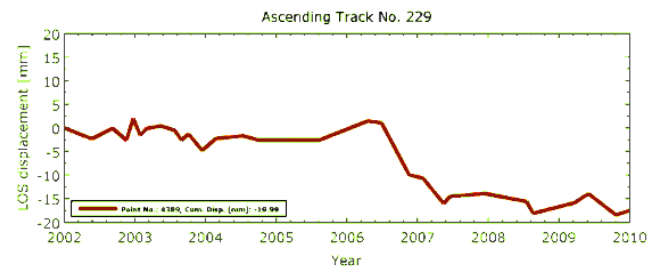
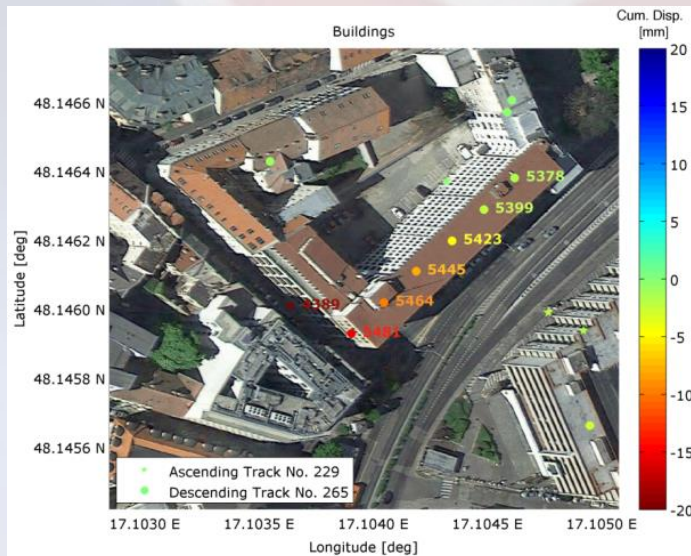
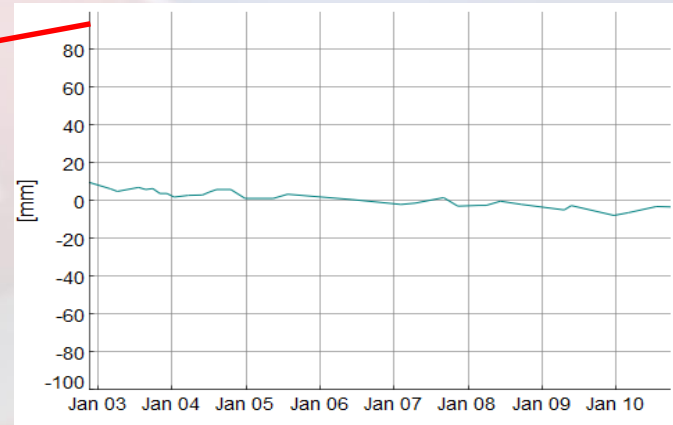


National center for diagnosing the earth surface deformations in Slovakia

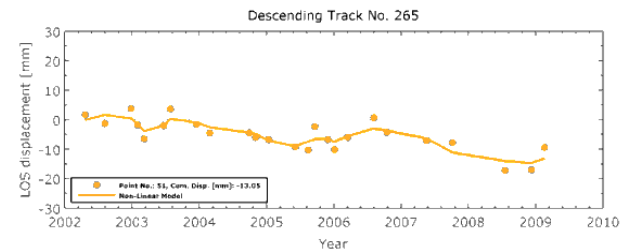
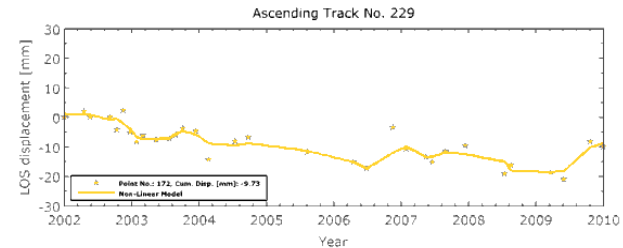
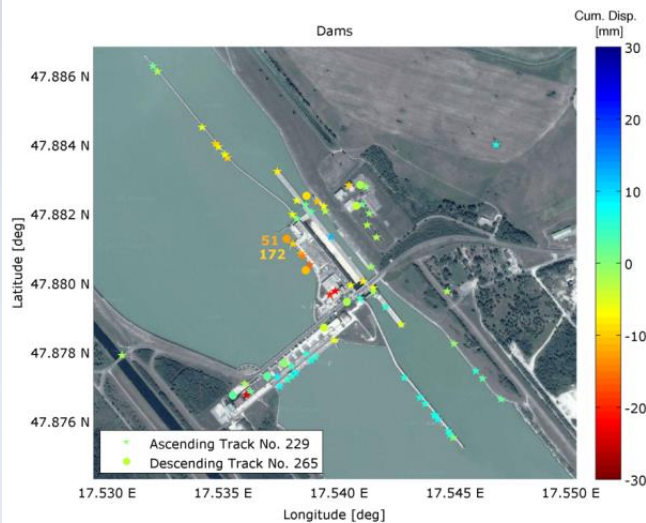
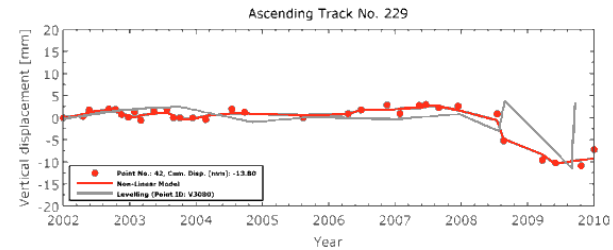
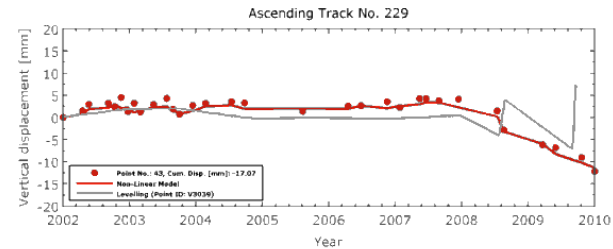
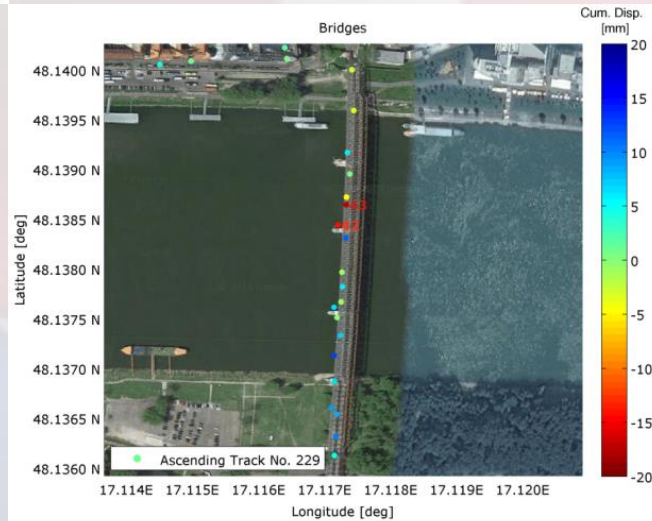
- Repeated absolute gravity measurements
- absolute gravimeter FG5X-247
- 3 campaigns performed:
 - June 2014 - October 2014 - April 2015



Ps InSAR monitoring - urban targets



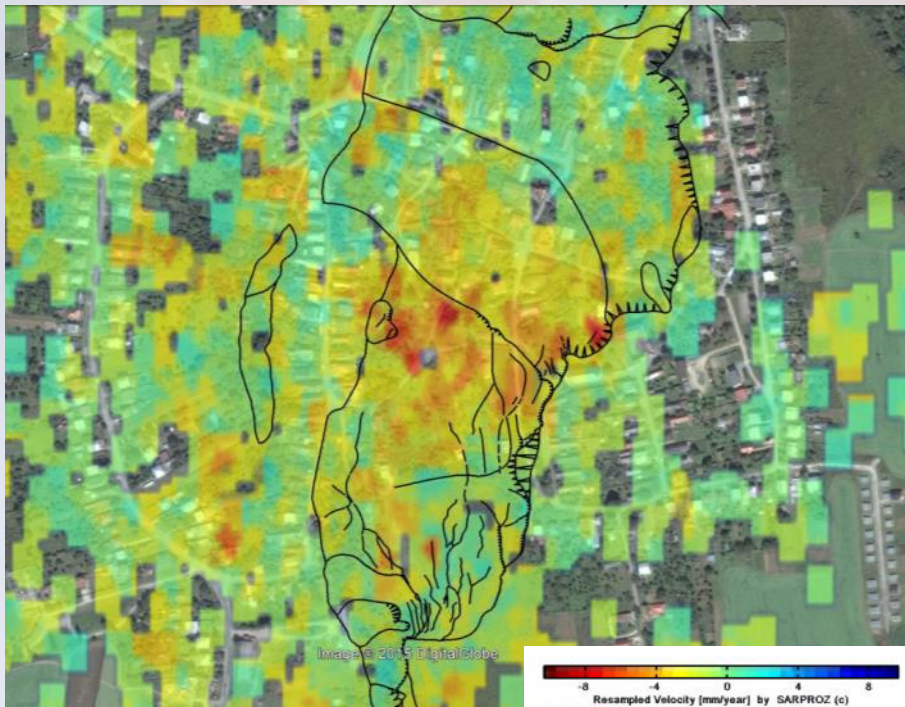
Ps InSAR monitoring - urban targets



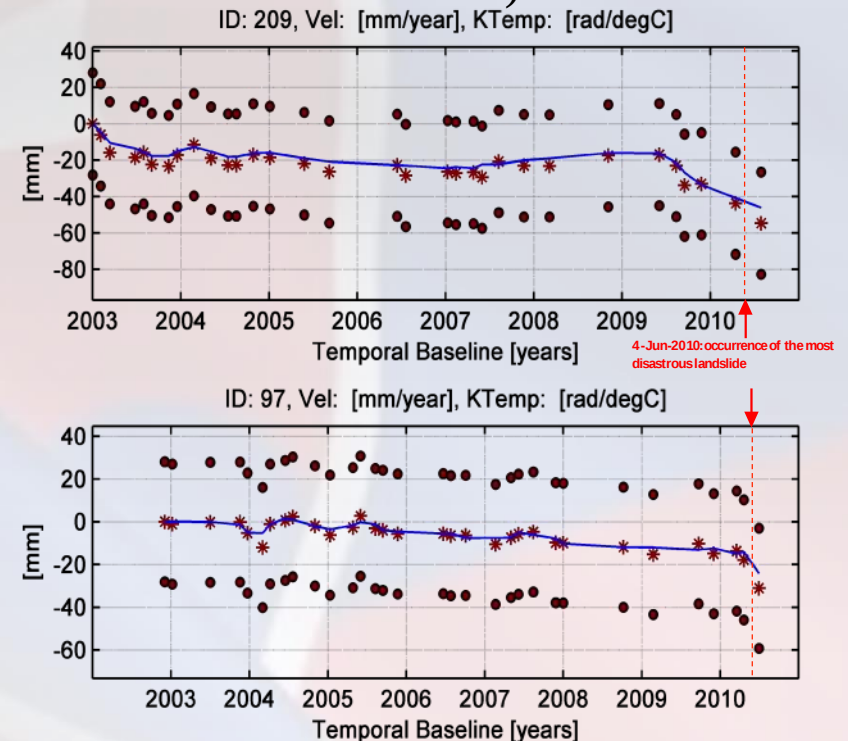
Ps InSAR monitoring - landslides

Devastating landslide in Nižná Myšľa (SE Slovakia) - 4th of June, 2010
Monitoring of possible prerequisites – ERS & ENVISAT – period 1992 - 2010

QUASI-PS INSAR approach ERS (1992-1999)



PS INSAR approach ENVISAT (2002-2010)



GrafLab (GRAvity Field LABoratory) software

Spherical harmonic synthesis (SHS)

Geopotential model and reference system selection

Global geopotential model of the Earth

Browse... ☒ Use maximum degree of GGM

GM of GGM (m³.s⁻²) R of GGM (m) nmin nmax Ellipsoid

3986004.415E+8 6378136.3 0 GRS80

Point type selection

Type of the input coordinates: ☒ Ellipsoidal ☐ Spherical

☐ Grid ☐ Load data Browse... ☐ Point-wise

Lat. min (°) Lat. step (°) Lat. max (°) Latitude (°)

Lon. min (°) Lon. step (°) Lon. max (°) Longitude (°)

Height above the reference surface (m) Ellipsoidal height/Spherical radius (m)

Calculated parameters and output selection

☐ Commission error ☒ Export data

Computation of fnALFs ☒ Export report

Display data settings ☐ Export data in *.mat

Output folder and file

OK Close

- **GrafLab (GRAvity Field LABoratory)**
 - SHS up to ultra-high degrees (tens of thousands or even higher)
 - Point-wise and grid modes
 - Computes 38 frequently used gravity field quantities: e.g. geoid, height anomaly, gravity anomaly/disturbance, tensors, ...
- **isGrafLab (Irregular Surface GRAvity Field LABoratory)**
 - A modified version of GrafLab
 - Fast SHS on grids at irregular surfaces (e.g. the Earth's surface)
 - Based on the lumped coefficients approach and Taylor series expansion

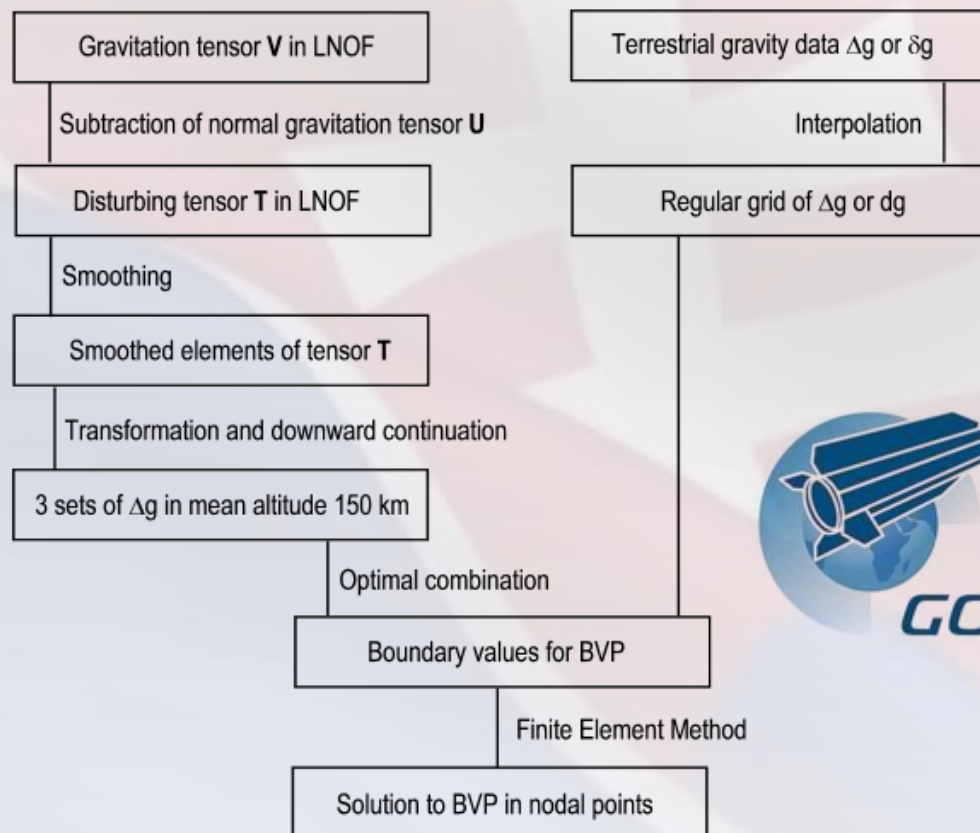
References:

- Bucha, B., Janák, J., 2013. A MATLAB-based graphical user interface program for computing functionals of the geopotential up to ultra-high degrees and orders. DOI: <http://dx.doi.org/10.1016/j.cageo.2013.03.012>.
- Bucha, B., Janák, J., 2014. A MATLAB-based graphical user interface program for computing functionals of the geopotential up to ultra-high degrees and orders: Efficient computation at irregular surfaces. DOI: <http://dx.doi.org/10.1016/j.cageo.2014.02.005>.

Available at:

- www.svf.stuba.sk/en/departments/departments-of-theoretical-geodesy/science-and-research/downloads.html?page_id=4996

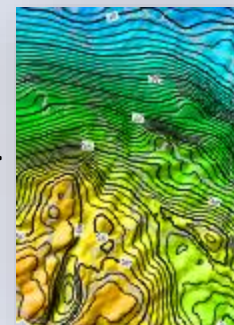
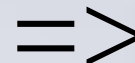
Determination of regional quasigeoid from combination of GOCE and terrestrial measurements



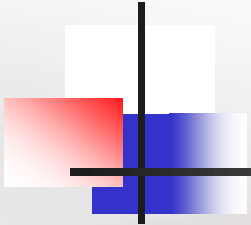
Development of effective combination of satellite gravity gradiometry (SGG) from GOCE and terrestrial data gravity anomalies or gravity disturbances.



Gravity anomalies or gravity disturbances



Reference: Janák J., Pitoňák, M., Minarechová Z.: Regional quasigeoid from GOCE and terrestrial measurements. Stud. Geophys. Geod., 58, pp. 626-649



Other news

Geodesy, cartography and cadastre authority of Slovak republic – geoportal (www.geoportal.sk)

Alberding Quality Control x Prekladac Google x gravity anomaly measure x Doručené (4) - brano.dro x EUREF Permanent GNSS x downloads - Faculty of C x Geoportál x

www.geoportal.sk/geoportal.html

Príhlásenie Mapa stránok Textová verzia SK EN

Vyhľadavanie

ODIS

Geoportál

GEODETICKÉ ZÁKLADY KATASTER ZBGIS A ŠMD ARCHÍV APLIKÁCIE SLUŽBY INSPIRE FAQ

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Súhlasím

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- GKÚ
- Produkty a služby
- SKPOS®
- Katastrálny portál
- ÚGKK SR
- Objednávky
- VÚC/mesto/obec

KONTAKTNÉ ÚDAJE

Geodetický a kartografický ústav Bratislava

Chlumeckého 4, Dodacia pošta 212
827 45 Bratislava
Tel.: 02 / 2081 6000

Všetky kontakty

Mapový klient ZBGIS

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

Transformačná služba

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

Mapy

OZNAMY A AKTUALITY

DVRM
01.03.2015
Digitálny výškový referenčný model je voľne dostupný na stiahnutie

Aktualizácia technickej správy
19.02.2015
Zverejnenie aktualizovanej technickej správy definícií vzťah medzi S-JTSK a ETRS89 (verzia 2.0)

Technická správa
10. október 2014 Zverejnenie technickej správy definícií vzťah medzi S-JTSK a ETRS89

Transformačná služba
14. august 2014 Implementácia EVRS do Rezortnej transformačnej služby

Všetky aktuality

14:59
28. 5. 2015

ETRS89 – S-JTSK relation

Official technical report published on Geoportal

The screenshot shows a web browser window with the URL www.geoportal.sk/sk/geodeticke-zaklady/na-stiahnutie/. The page features the Geoportál logo and a navigation menu with links: Úvod, SKPOS, Geodetické body GZ, Na stiahnutie, and Objednať. The 'Na stiahnutie' link is highlighted with a red box. Below the navigation menu, the page title is 'GEODETIKÉ ZÁKLADY' and the subtitle is 'Prevodová interpolačná tabuľka JTSK03 <=> JTSK'. The main content area contains a technical report titled 'SÚRADNICOVÝ SYSTÉM JEDNOTNEJ TRIGONOMETRICKEJ SIETE KATASTRÁLNEJ A JEHO VZŤAH K EURÓPSKEMU TERESTRICKÉMU REFERENČNÉMU SYSTÉMU 1989 (Verzia 2.0)'. The report is authored by Ing. Droščák Branislav, PhD. The page also includes a sidebar with links to various services and a footer with the date 28. 5. 2015.

Geoportál

Príhlásenie Mapa stránok Textová verzia SK EN

Vyhľadávanie

OPIS

EUROPEAN UNION

GEODETIKÉ ZÁKLADY KATASTER ZBGIS A ŠMD ARCHÍV APLIKÁCIE SLUŽBY INSPIRE FAQ

Úvod

Pod SKPOS

Geodetické body GZ

Na stiahnutie

Objednať

Domov > Geodetické základy > Na stiahnutie

GEODETIKÉ ZÁKLADY

Úvod

SKPOS

Geodetické body GZ a štátna hranica

Na stiahnutie

Objednať

ODKAZY

GKÚ

Produkty a služby

SKPOS

Katastrálny portál

ÚGKK SR

Objednávky

VÚC/mesto/obec

Prevodová interpolačná tabuľka JTSK03 <=> JTSK

Technická správa: Súradnicový systém jednotnej trigonometrickej siete katastrálnej a jeho vzťah k Európskemu terestrickému referenčnému systému 1989 (verzia 2.0)

Digitálny výškový referenčný model - DVRM05

Model je určený na prevod elipsoidických výšok určených GNSS v systéme ETRS89 do súradnicových výšok Bpv.

Geodetický a kartografický ústav Bratislava
Chlumeckého 4, 827 45 Bratislava

Technická správa

SÚRADNICOVÝ SYSTÉM JEDNOTNEJ TRIGONOMETRICKEJ SIETE KATASTRÁLNEJ A JEHO VZŤAH K EURÓPSKEMU TERESTRICKÉMU REFERENČNÉMU SYSTÉMU 1989 (Verzia 2.0)

Ing. Droščák Branislav, PhD.

28. 5. 2015

Transformation service EVRS (EVRF2007) implemented

Súbor Upraviť Zobrazit' História Záložky Nástroje Pomocník

Prihláste sa – Účty Google Slovenská technická univer... Referáty 2015 Google Translate

https://zbgis.skgeodesy.sk/zbgistransform/

 **Transformačná služba ETRS89 - S-JTSK**
Úradu geodézie, kartografie a katastra Slovenskej republiky

Transformačná služba

Formát vstupných údajov Transformácia bodu jednotlivo Pomoc

☒ Výškový systém

Vstupný súradnicový systém ETRS89-LatLonh Vybrať

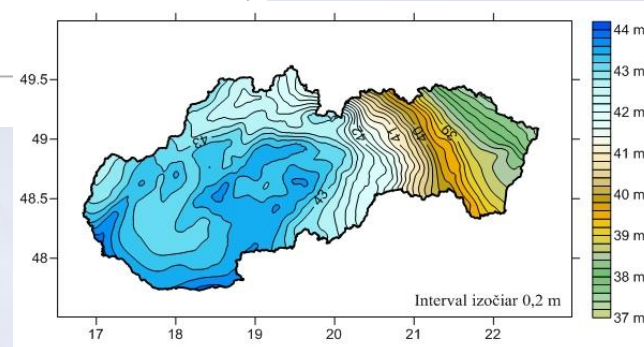
Výstupný súradnicový systém Vybrať

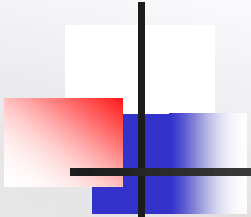
Transformovať

NEW

EVRS (EVRF2007_AMST)

DMQSK2014-E = Digital model of quasigeoid
ETRS89-h (ETRF2000) ↔ EVRS (EVRF2007)





**Thank you
for your attention**