National report of Slovakia

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Geodetic and Cartographic Institute Bratislava

7th EUPOS Council and Technical Meeting

November 9-10 2021, Bucharest, Romania, Online

SKPOS stations infrastructure

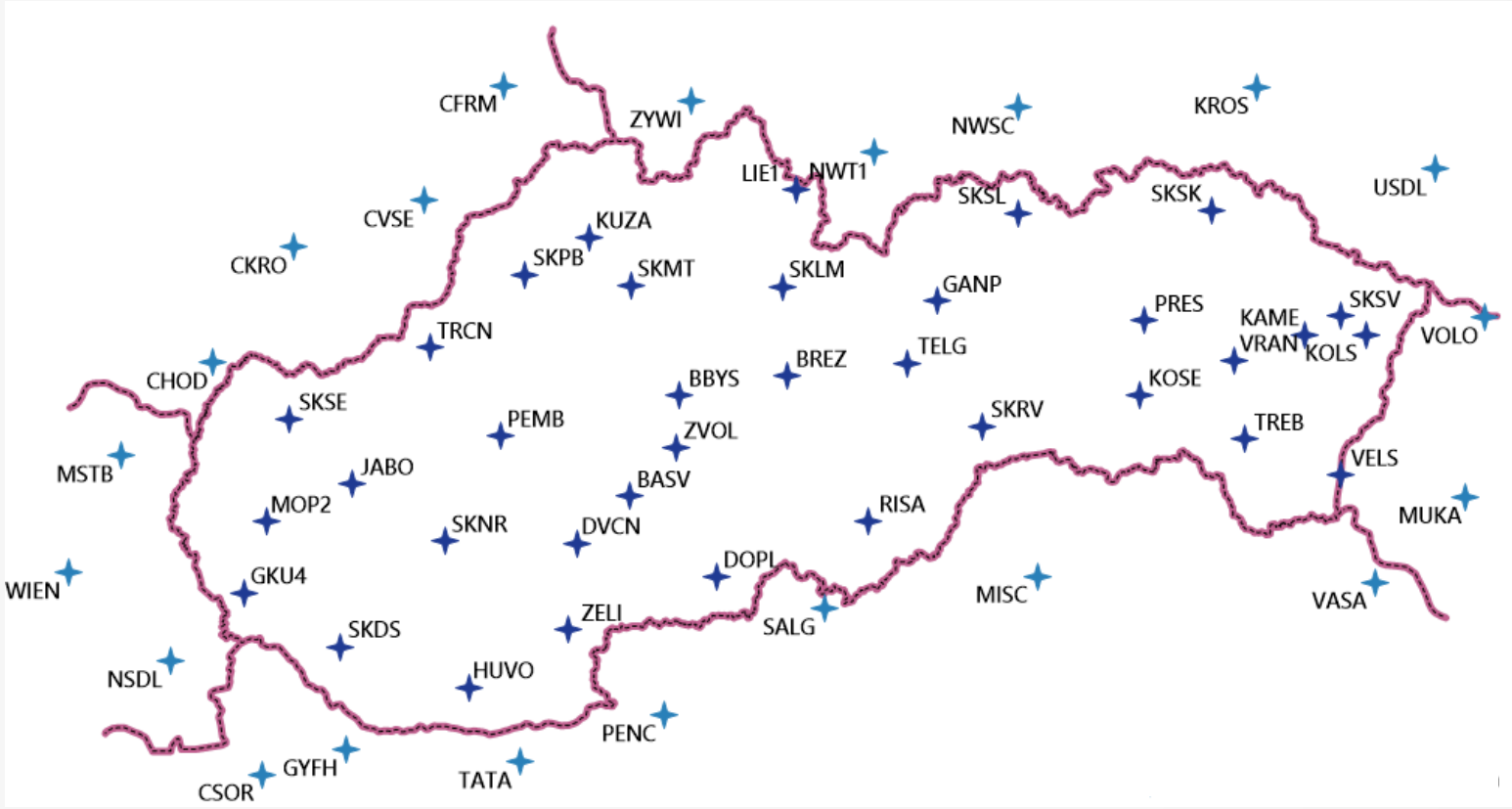
Status in November 2021

15 years
of continuous operation

2 200+
active users

35+21
reference stations

GPS, GLONASS,
Galileo, BeiDou



Trimble
NetR9

Trimble
Alloy

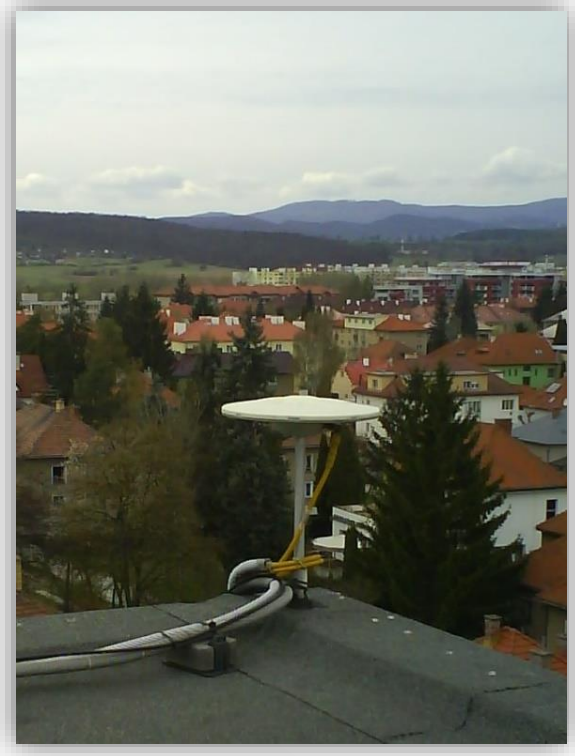
Zephyr Geodetic 2
Zephyr Geodetic 3

Choke Ring

SKPOS stations infrastructure

January 2021

- Station relocation
  - reinforced-concrete pillar instead of roof monumentation



SKZV

ZVOL

SKPOS stations infrastructure

February 2021

- Station relocation
  - reinforced-concrete pillar instead of roof monumentation

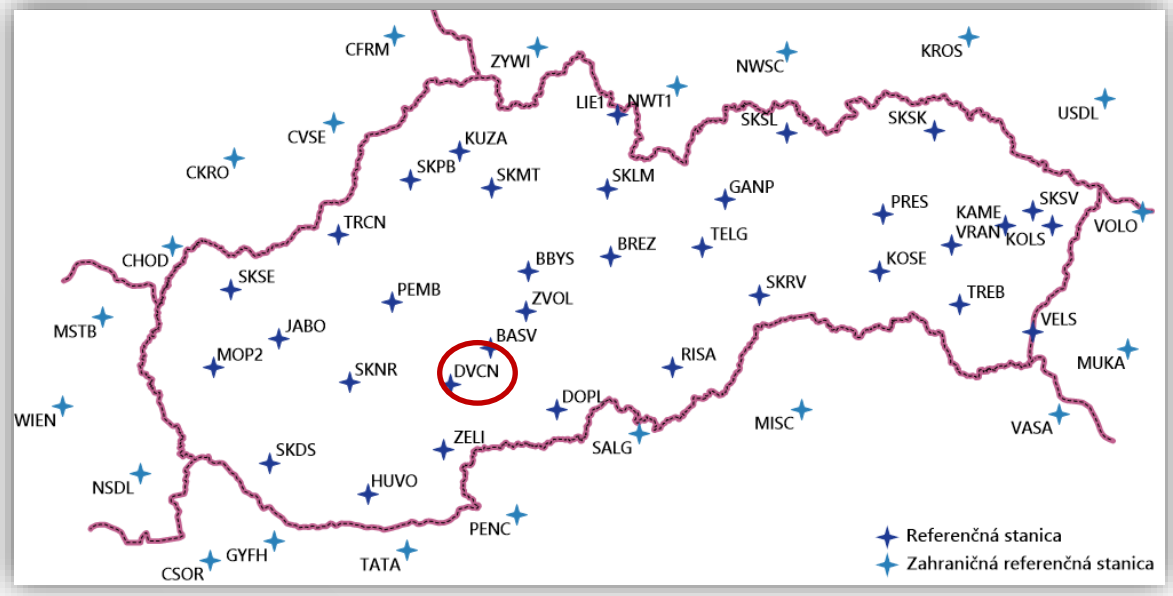
SKLV

ZELI

SKPOS stations infrastructure

June 2021

- New station in Devičany



DVCN

SKPOS stations infrastructure

September 2021

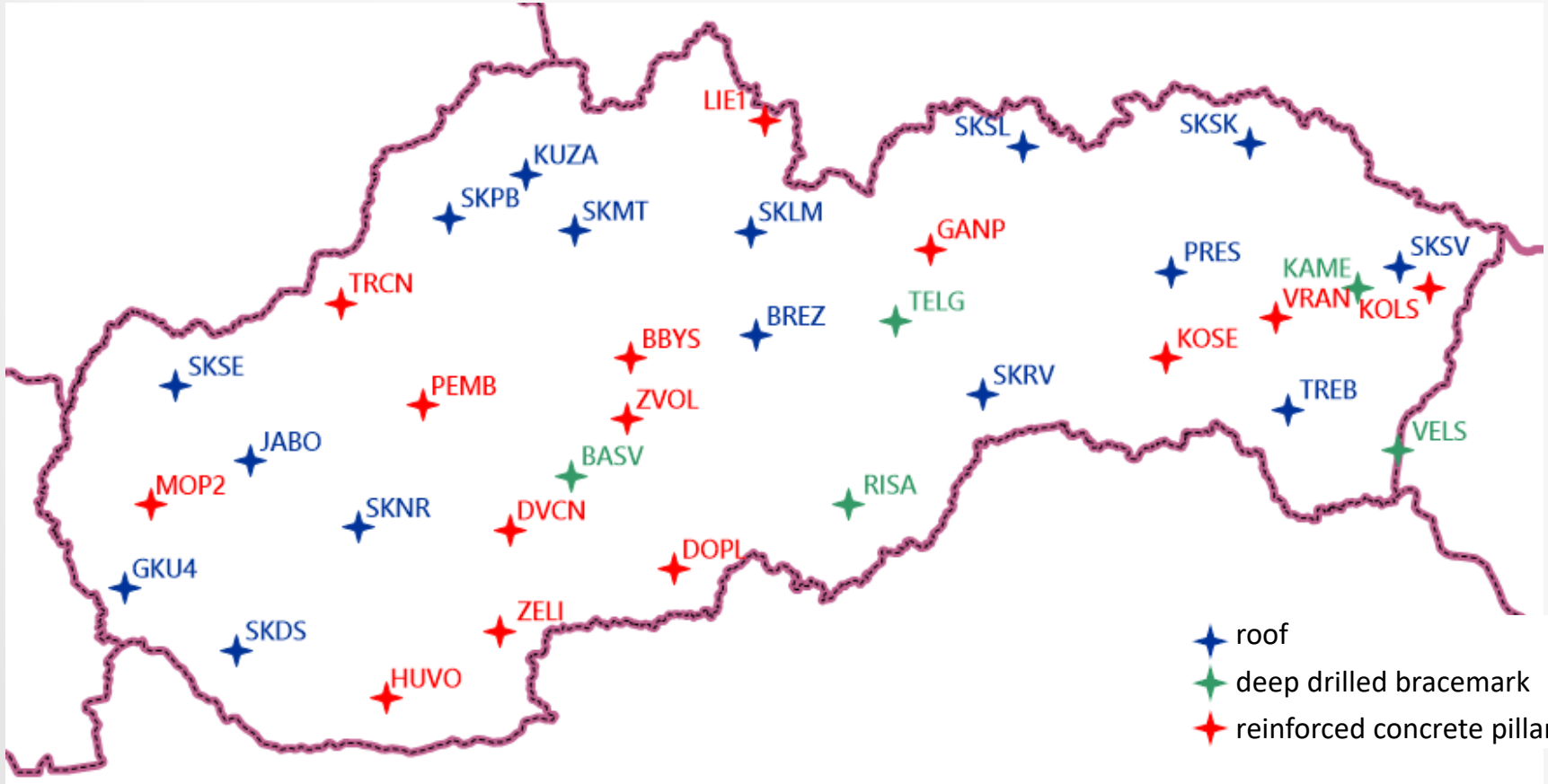
- Station relocation
  - reinforced-concrete pillar instead of roof monumentation

SKVT

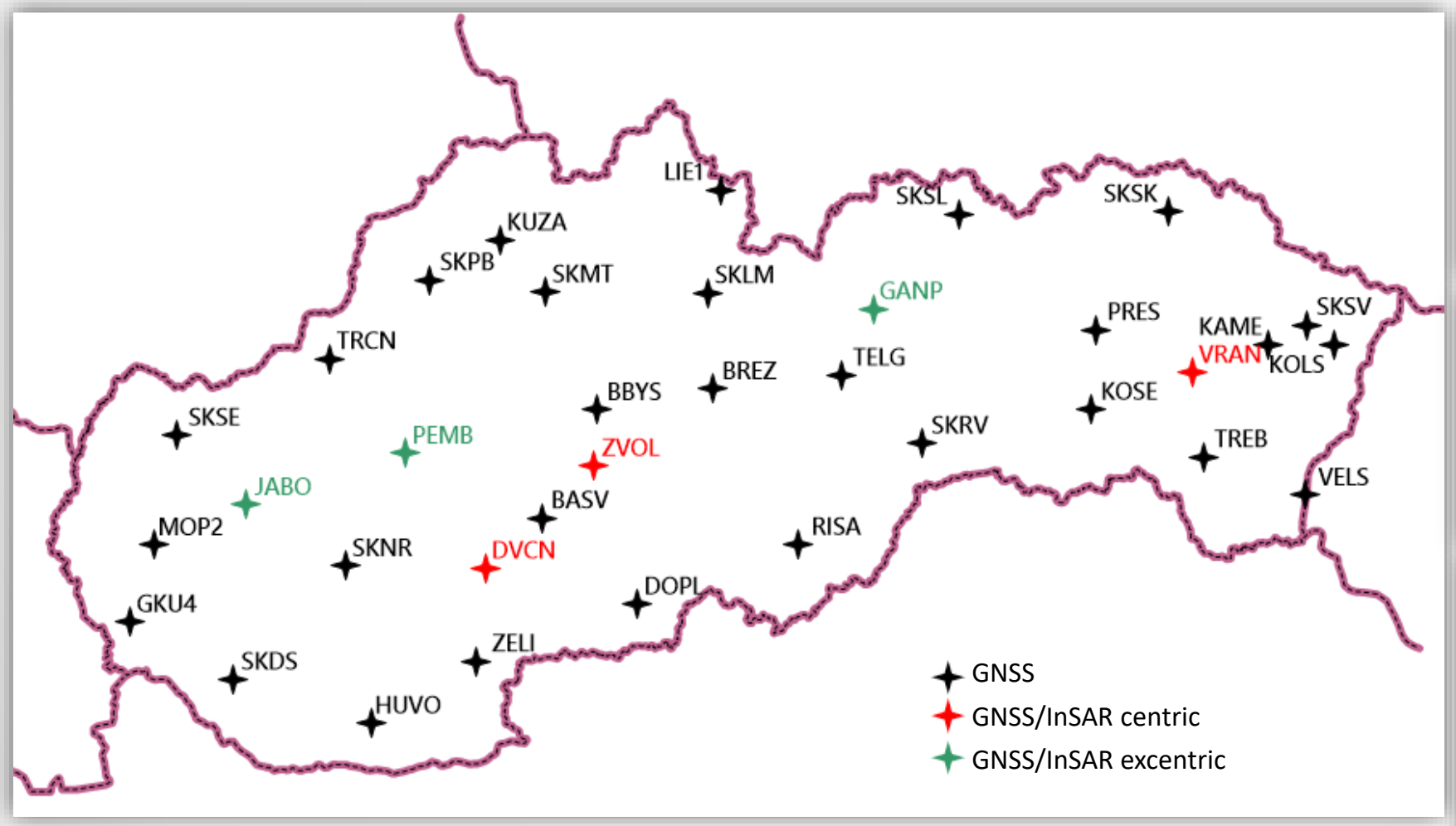
VRAN

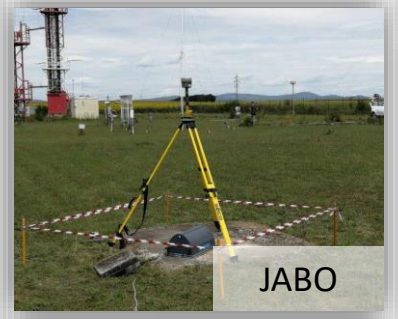
SKPOS stations infrastructure

- 19 of 35 slovakian permanent stations (54%) have monumentation suitable for geokinematics



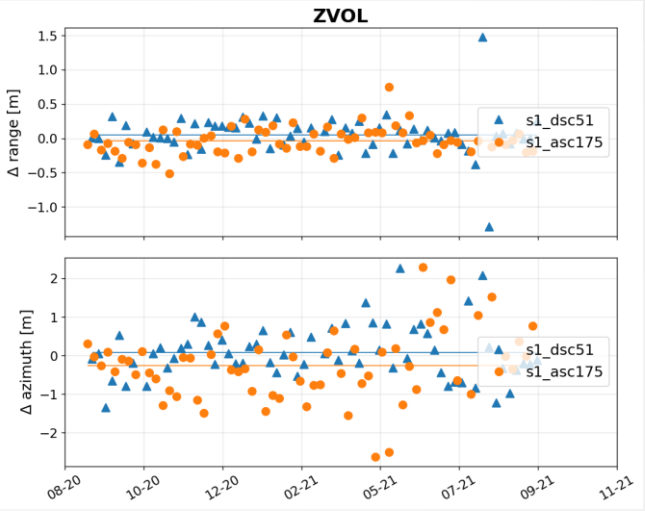
SKPOS GNSS/InSAR collocation

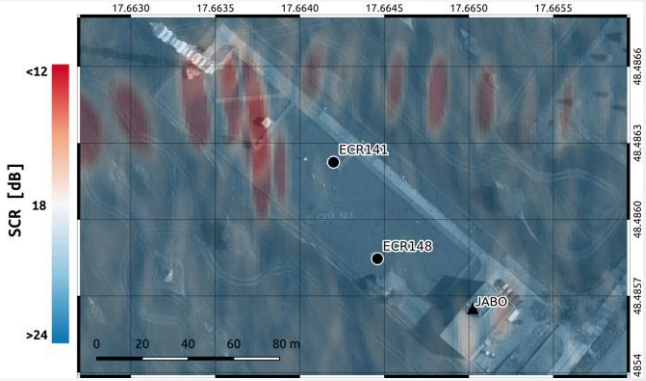




SKPOS GNSS/InSAR collocation

- Collocations helps us to monitor station surrondings stability
- InSAR = new geodetic technique
  - we plan to provide precise coordinates of InSAR reflector phase centers (like coordinates or heights of benchmarks)
  - InSAR reflector coordinates will enable to do correct absolute referencing of InSAR images to ETRS89
  - results from referenced InSAR image processing will be used e.g. for vertical monitoring of Slovakia etc.
- usage of InSAR technology is done in cooperation with Slovak University of Technology





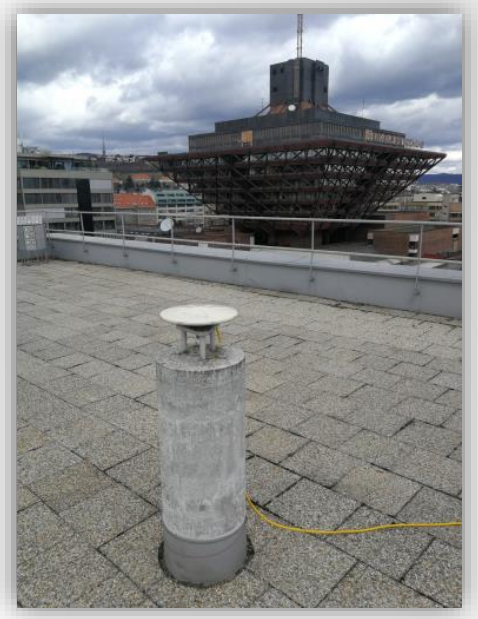
Physical monitoring station

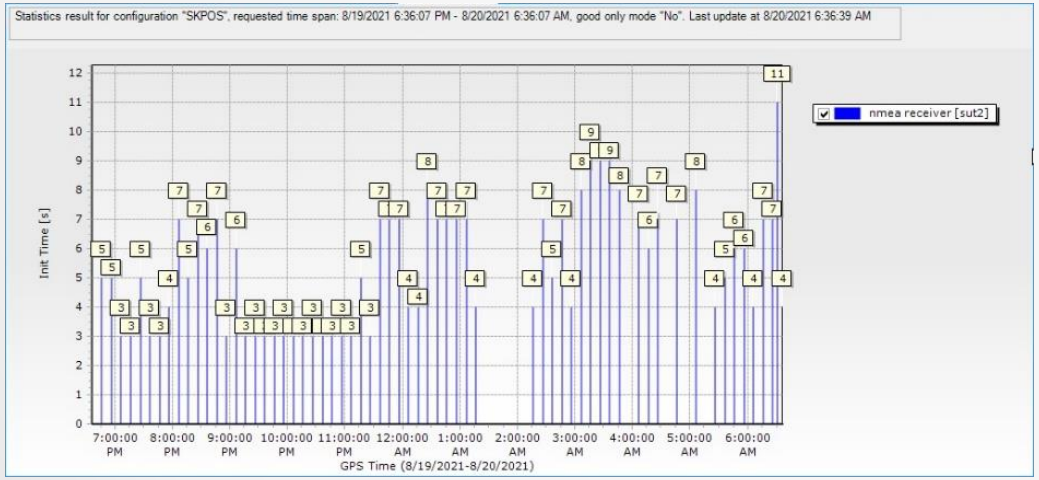
2013

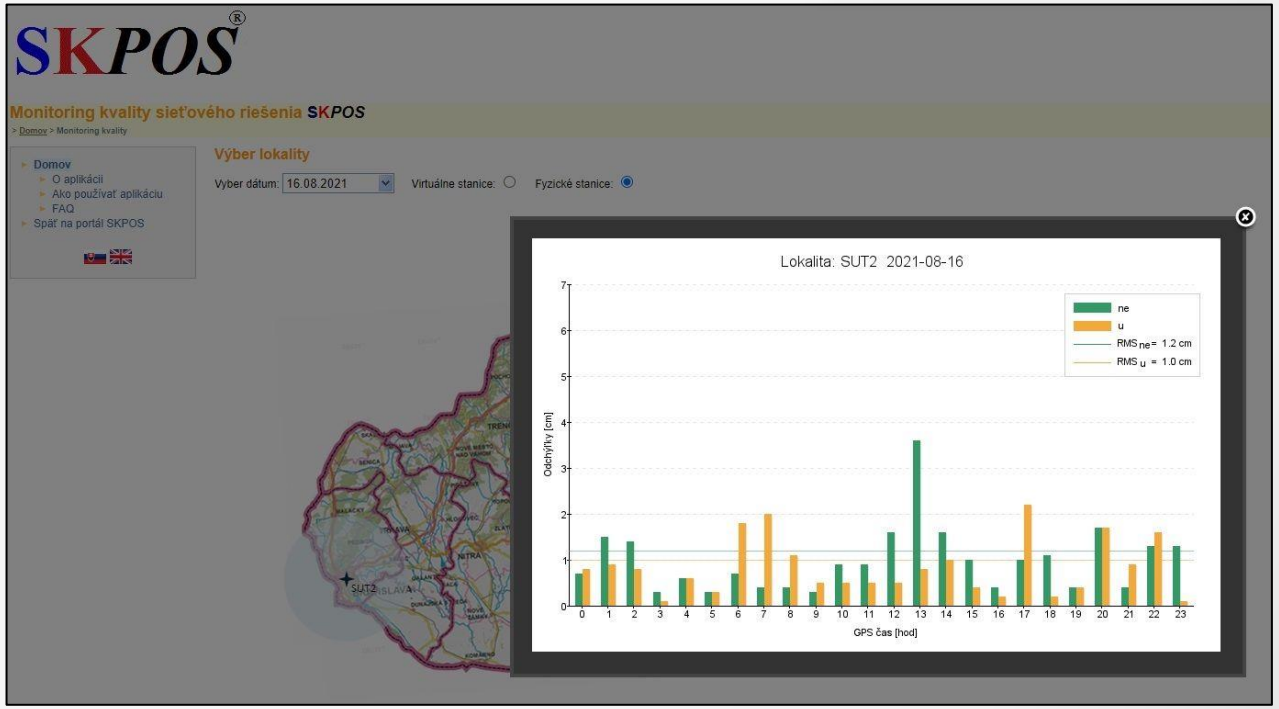
Quality monitoring based on virtual stations

2020

New physical monitoring station SUT2







SKPOS Infrastructure

- Control software:

  Trimble Pivot Platform

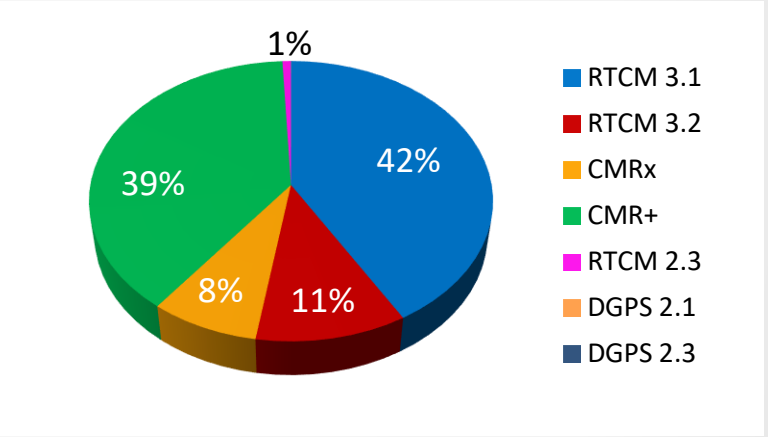
  - Version 4.3 (Production server)
  - Version 4.5 (Backup server)

- Receivers firmware
  - Alloy: 6.12
  - NetR9: 5.52

SKPOS – Galileo and BeiDou
Full capability Galileo and BeiDou

SKPOS	Component	GPS + GLONASS + Galileo + BeiDou
Hardware	Antennas	✓ 35
	Receivers	✓ 35
Software Trimble Pivot	RINEX CORS, VRS	✓
	RTK VRS **2018-10-16**	✓

11% of users use Galileo and BeiDou



SKPOS portfolio
Data formats – content - charges

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

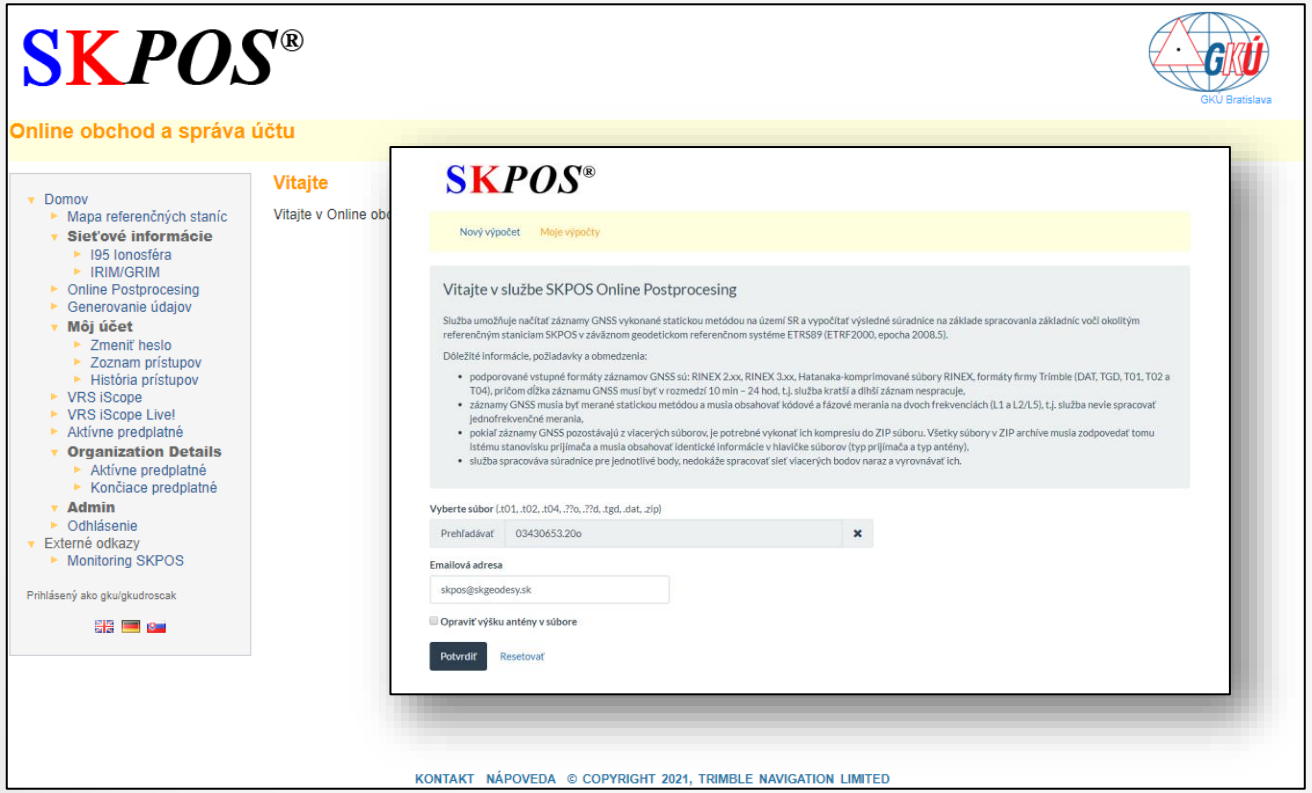
Package	Content	Duration	Format	Flat rate
SKPOS_mm	RINEX 1000 h	year	RINEX 2.x, 3.x	50 €
SKPOS_cm (year)	RTK unlimited + 50 h RINEX	year	RTCM 2.3, 3.1, RTCM 3.2, CMRx, CMR+	50 €
SKPOS_cm (month)	RTK unlimited	month	RTCM 2.3, 3.1 RTCM 3.2, CMRx, CMR+	19 €
SKPOS_dm	DGNSS unlimited	year	RTCM 2.1, 2.3	20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

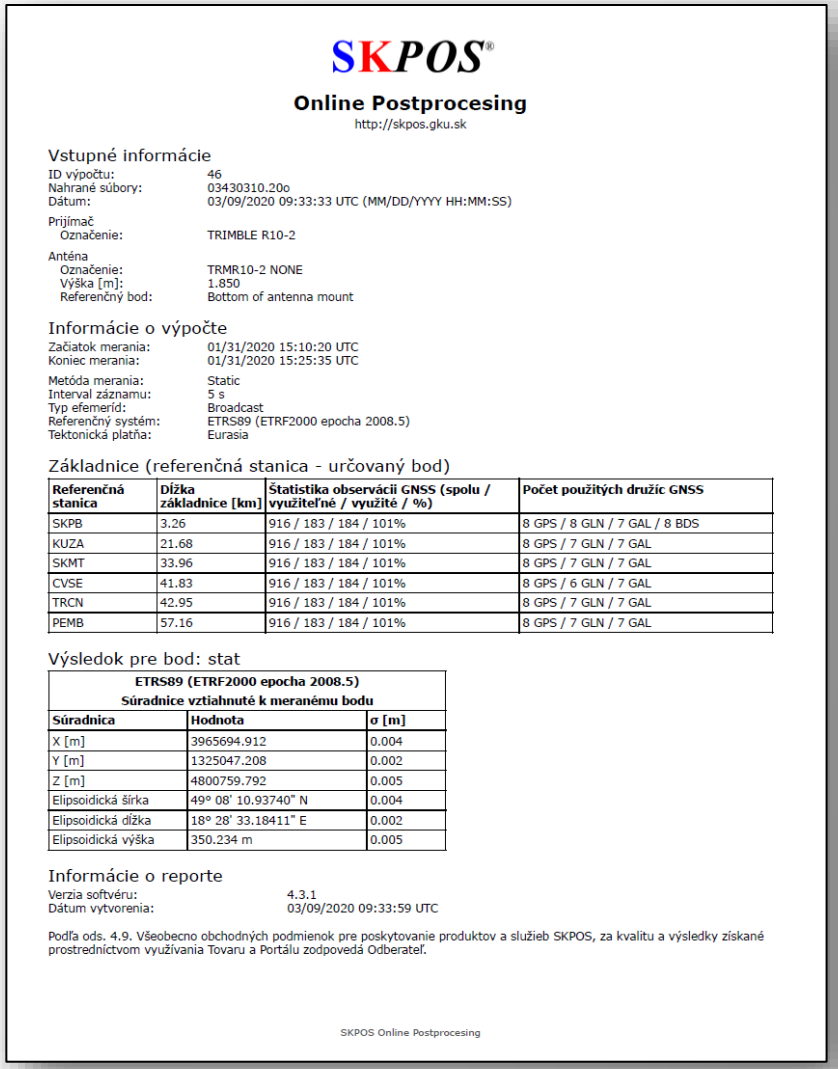
SKPOS portfolio
Data formats

Mountpoint	Data format	GNSS	Data rate
SKPOS_DM_SVK	RTCM 2.1	GPS	0.1 kB/s
SKPOS_DM_SVK_23	RTCM 2.3	GPS, GLO	0.2 kB/s
SKPOS_CM_23	RTCM 2.3	GPS, GLO	0.8 kB/s
SKPOS_CM_31	RTCM 3.1	GPS, GLO	0.3 kB/s
SKPOS_CM_32	RTCM 3.2 MSM5	GPS, GLO, GAL, BDS	1.0 kB/s
SKPOS_CM_32_MSM7	RTCM 3.2 MSM7	GPS, GLO, GAL, BDS	1.1 kB/s
SKPOS_CM_CMRx	CMRx	GPS, GLO, GAL, BDS	0.4 kB/s
SKPOS_CM_CMRplus	CMR+	GPS, GLO	0.3 kB/s

SKPOS Online Postprocesing

- Application for calculating static measurement
- Based on Trimble Pivot Platform




SKPOS®

Online Postprocesing

http://skpos.gku.sk

Vstupné informácie

ID výpočtu: 46
Nahrané súbory: 03430310.20o
Dátum: 03/09/2020 09:33:33 UTC (MM/DD/YYYY HH:MM:SS)

Prijímač
Označenie: TRIMBLE R10-2

Anténa
Označenie: TRMR10-2 NONE
Výška [m]: 1.850
Referenčný bod: Bottom of antenna mount

Informácie o výpočte

Začiatok merania: 01/31/2020 15:10:20 UTC
Koniec merania: 01/31/2020 15:25:35 UTC

Metóda merania: Static
Interval záznamu: 5 s
Typ efemerid: Broadcast
Referenčný systém: ETRS89 (ETRF2000 epocha 2008.5)
Tektonická platňa: Eurasia

Základnice (referenčná stanica - určovaný bod)

Referenčná stanica	Dĺžka základnice [km]	Štatistika observácii GNSS (spolu / využiteľné / využité / %)	Počet použitých družíc GNSS
SKPB	3.26	916 / 183 / 184 / 101%	8 GPS / 8 GLN / 7 GAL / 8 BDS
KUZA	21.68	916 / 183 / 184 / 101%	8 GPS / 7 GLN / 7 GAL
SKMT	33.96	916 / 183 / 184 / 101%	8 GPS / 7 GLN / 7 GAL
CVSE	41.83	916 / 183 / 184 / 101%	8 GPS / 6 GLN / 7 GAL
TRCN	42.95	916 / 183 / 184 / 101%	8 GPS / 7 GLN / 7 GAL
PEMB	57.16	916 / 183 / 184 / 101%	8 GPS / 7 GLN / 7 GAL

Výsledok pre bod: stat

ETRS89 (ETRF2000 epocha 2008.5) Súradnice vztiahnuté k meranému bodu		
Súradnica	**Hodnota**	**σ [m]**
X [m]	3965694.912	0.004
Y [m]	1325047.208	0.002
Z [m]	4800759.792	0.005
Elipsoidická šírka	49° 08' 10.93740" N	0.004
Elipsoidická dĺžka	18° 28' 33.18411" E	0.002
Elipsoidická výška	350.234 m	0.005

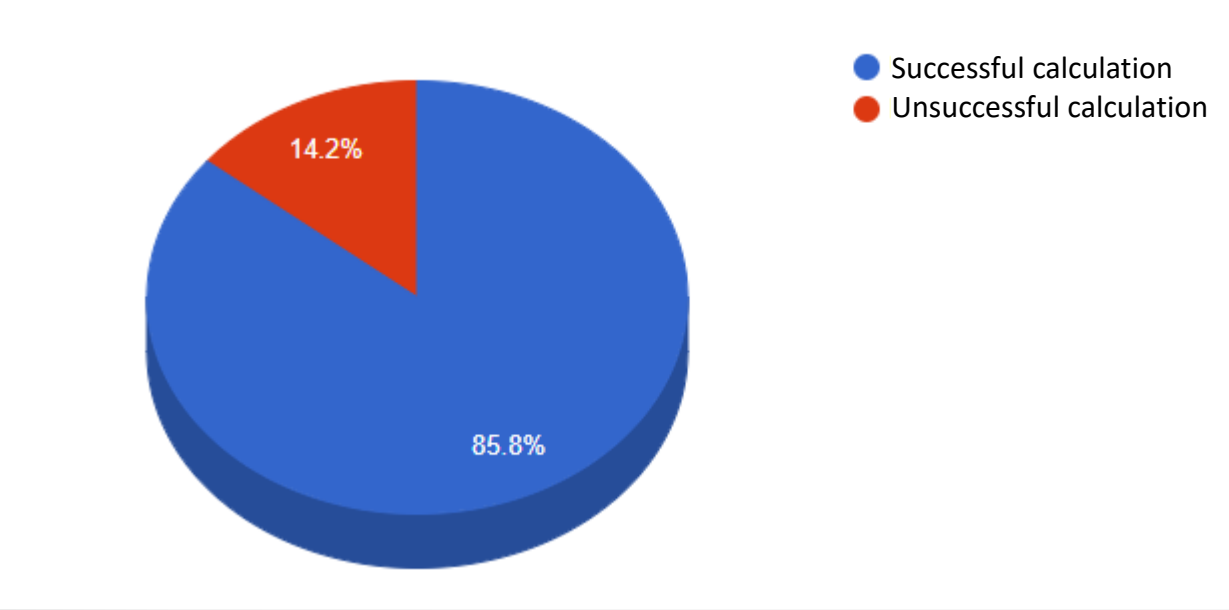
Informácie o reporte

Verzia softvéru: 4.3.1
Dátum vytvorenia: 03/09/2020 09:33:59 UTC

Podľa ods. 4.9. Všeobecno obchodných podmienok pre poskytovanie produktov a služieb SKPOS, za kvalitu a výsledky získané prostredníctvom využívania Tovaru a Portálu zodpovedá Odberateľ.

SKPOS Online Postprocesing

- 1120 calculations per year
- Customized report
  - standard deviation checker
- 14% unsuccessfully calculation



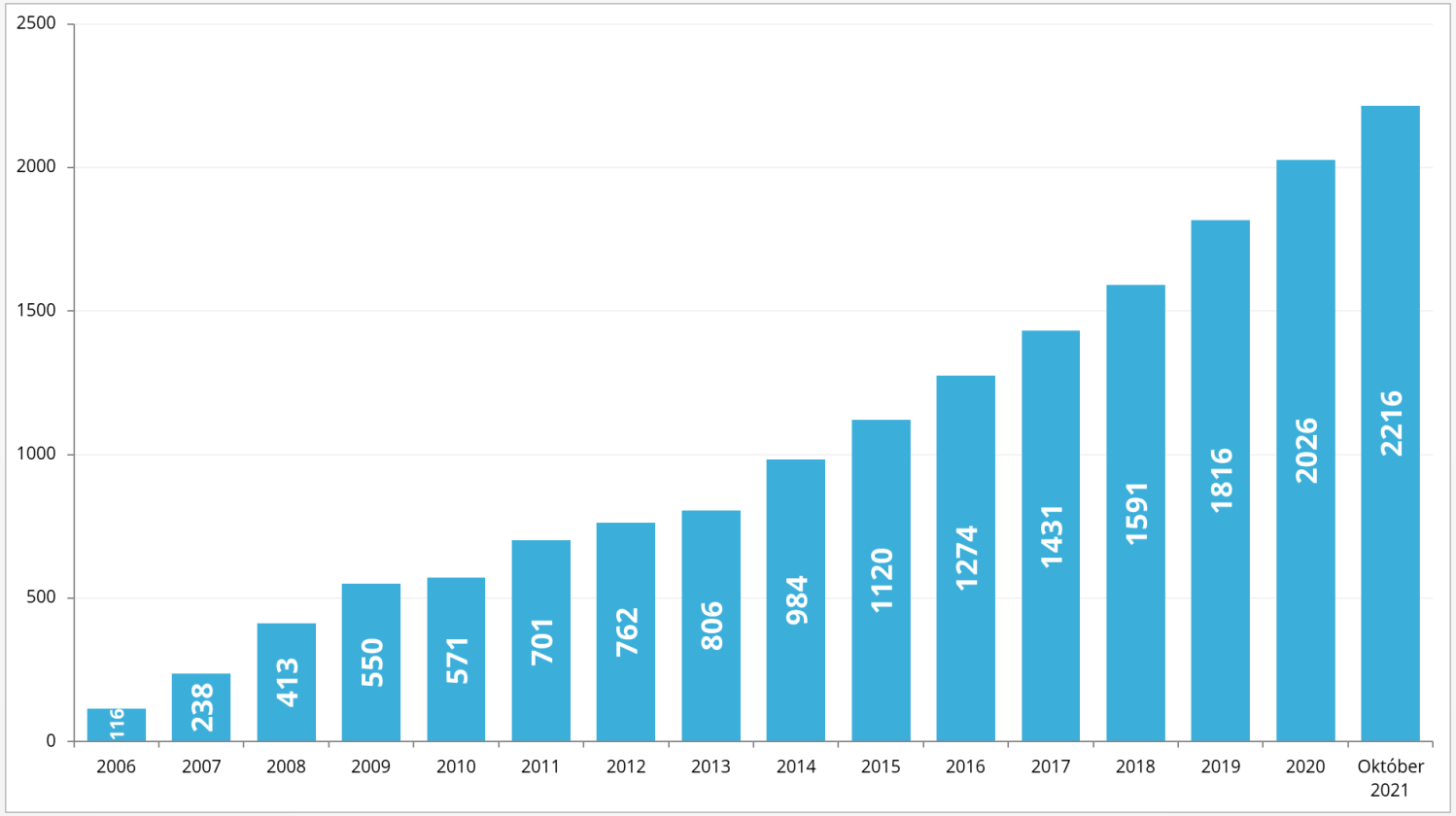
Výsledok pre bod: XVII

ETRS89 (ETRF2000 epocha 2008.5) Súradnice vztiahnuté k meranému bodu		
Súradnica	**Hodnota**	**σ [m]**
X [m]	3936650.070	0.140
Y [m]	1560095.526	0.063
Z [m]	4753871.679	0.151
Elipsoidická šírka	48° 29' 52.76563" N	0.033
Elipsoidická dĺžka	21° 37' 6.37226" E	0.023
Elipsoidická výška	163.066 m	0.212

Upozornenie: červenou hodnotou sú zvýraznené smerodajné odchýlky prekračujúce resp. 0,05m pri elipsoidickej výške. Zvážte prosím vhodnosť výsledkov pre Vašu prá

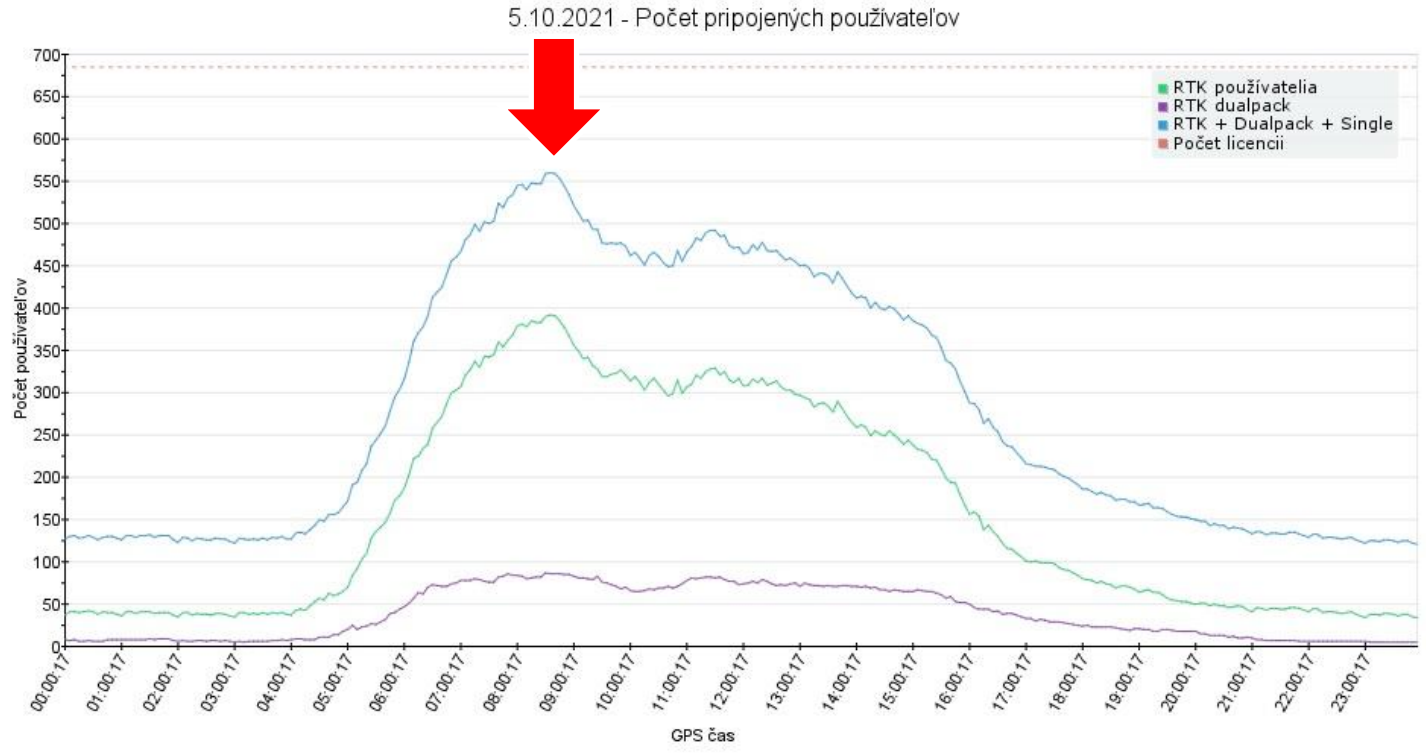
Number of users

- Number of users: 2216 (Nov. 2021)



Maximum simultaeous login

- Maximum 560 simultaneous logins (2021-10-05)



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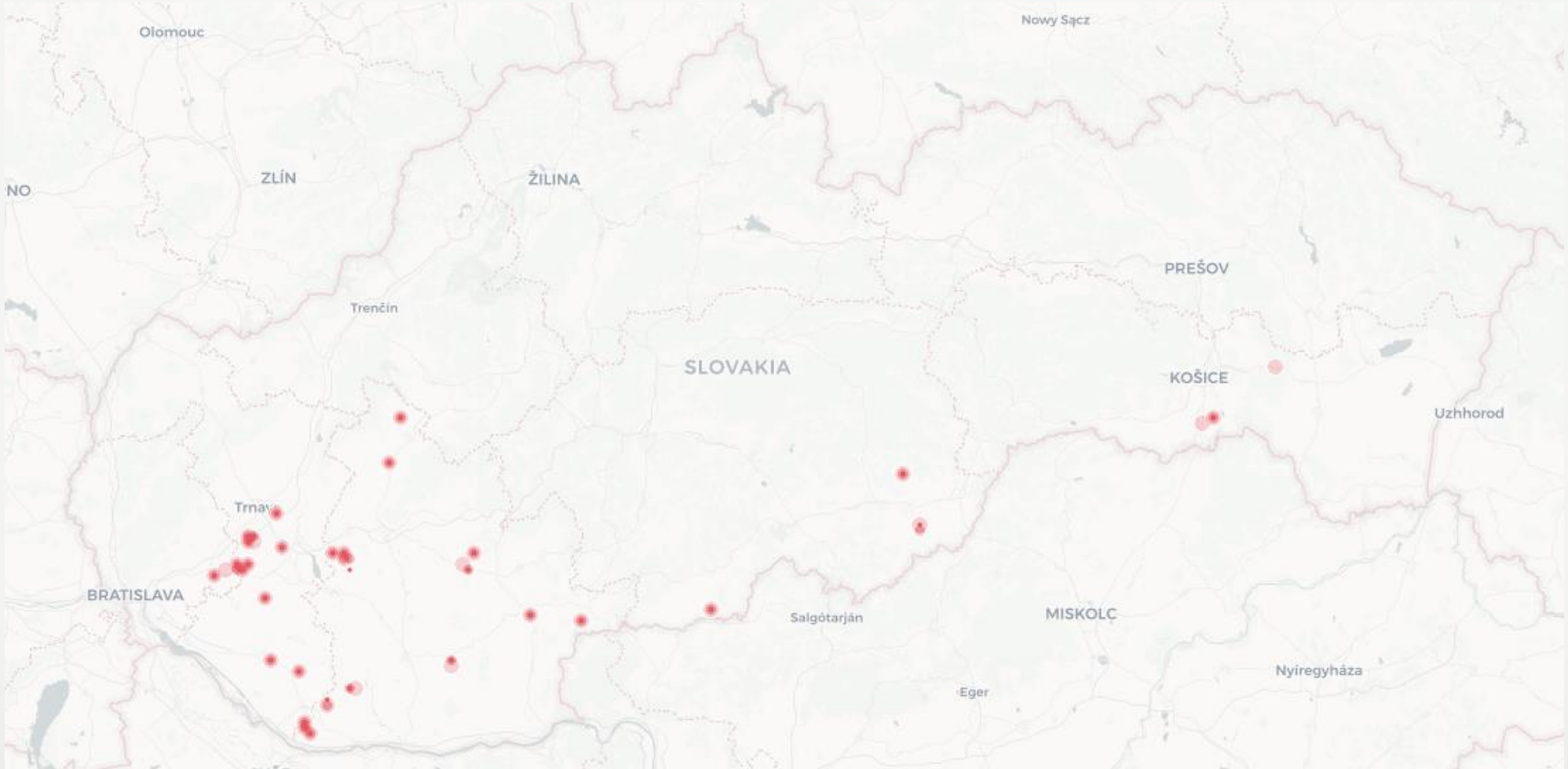
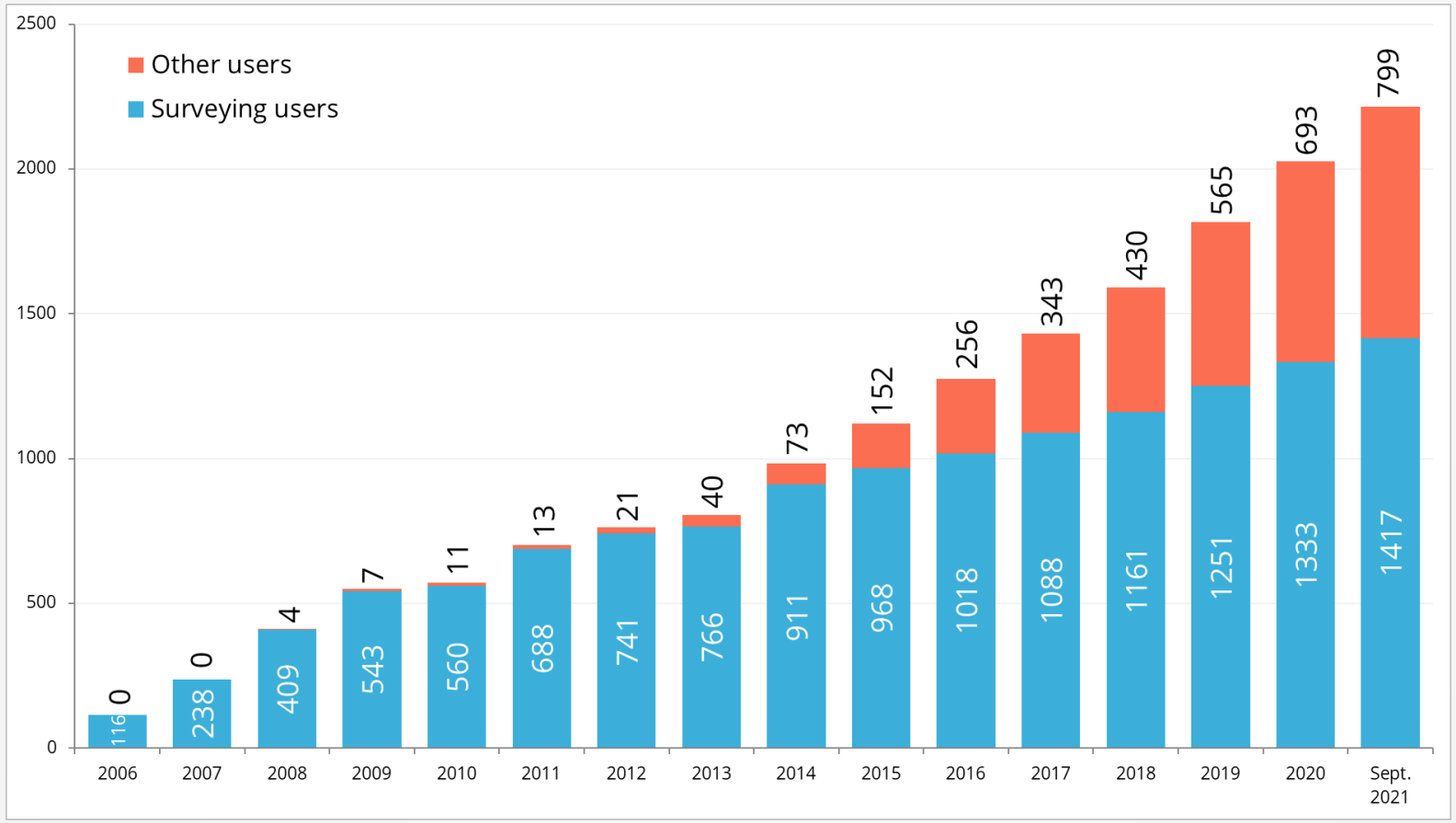


Type of users

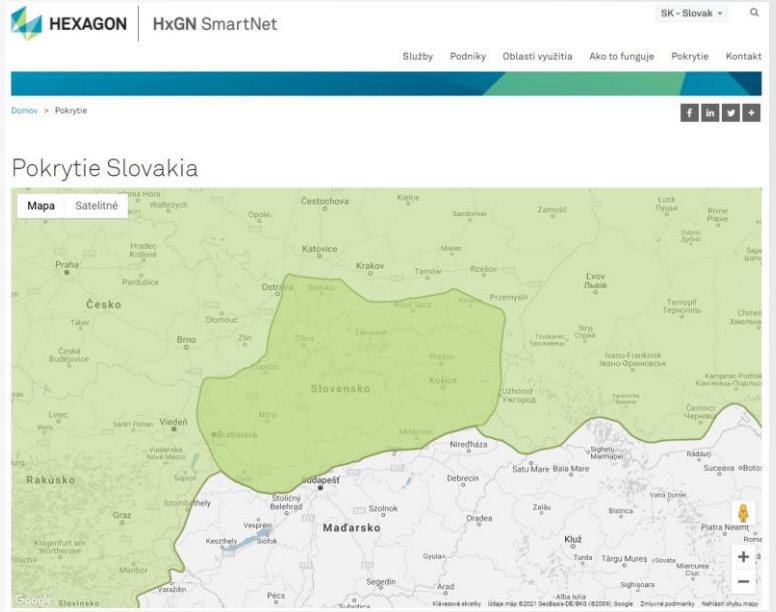
- Since 2017 more new SKPOS users were from non geodetic field



15 years of SKPOS
Conference for users

- 2021-10-13 - for geodetic, cartographic and cadastral authorities
- 2021-10-20 - for all users and invited guests
- Together 317 participants (offline, online)
- Presentations and videos are available at SKPOS web

Private GNSS networks in Slovakia



- Only 1 private GNSS network in Slovakia: HxGN SmartNet
- Surveying law in Slovakia:
  - all surveyors must connect to:
    - active geodetic controls (SKPOS)
    - passive geodetic controls (geodetic benchmarks)
- HxGN SmartNet use „hole“ in the law and declare their Permanent reference stations as stations set up on passive geodetic points
- In reality:
  - Mismatch because HxGN SmartNet provide network solution (MAX, VRS, ...)
  - HxGN SmartNet is not monitored, coordinates are not checked and not valided
- Slovak geodesy, cartography and cadastral authority plan to Open this topic and change the law

Thank you for your attention

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