



**SKPOS®**

## National report of Slovakia

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Geodetic and Cartographic Institute Bratislava



8th EUPOS Council and Technical Meeting  
November 15-16 2022, Ljubljana, Slovenia



# SKPOS stations infrastructure

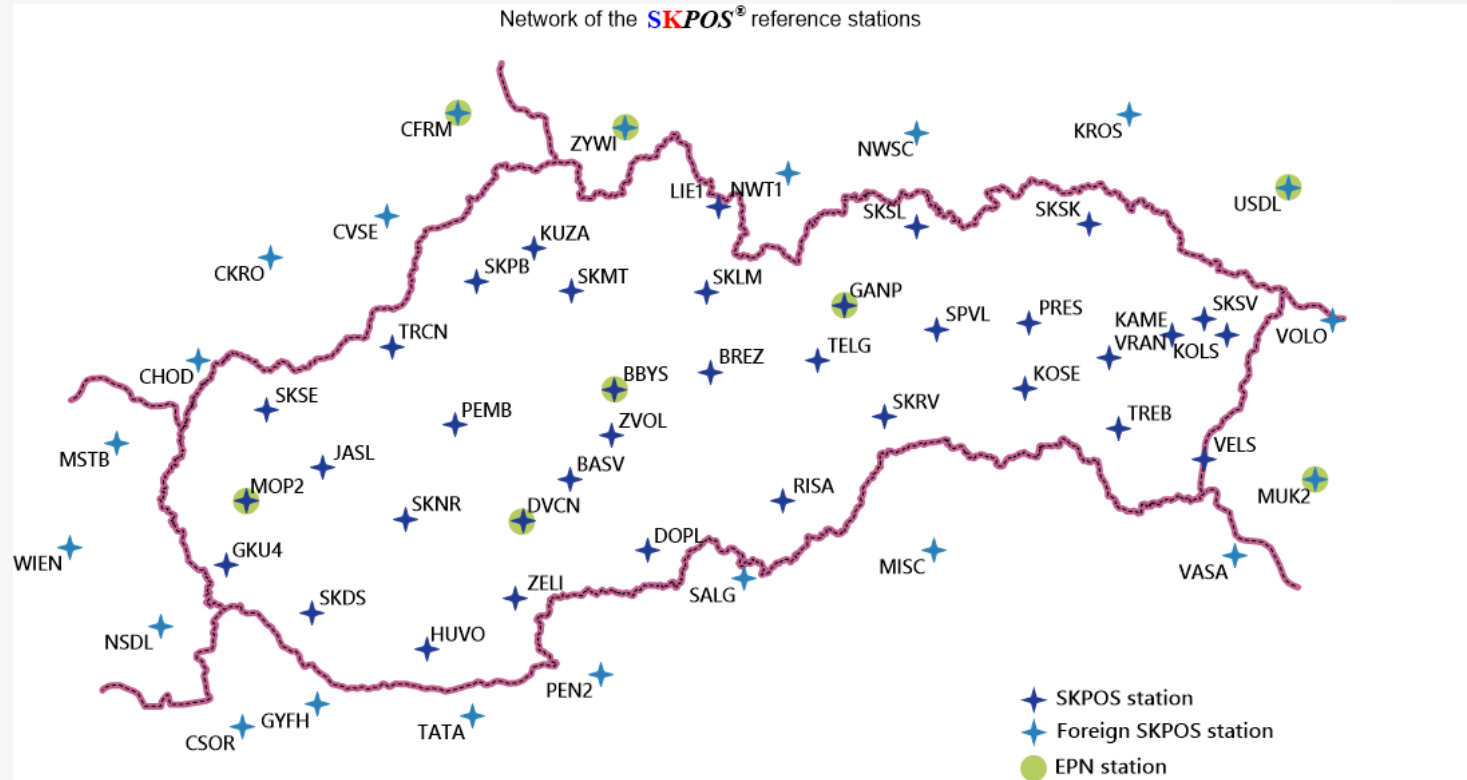
## Status in November 2022

16 years  
of continuous operation

2 500+  
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

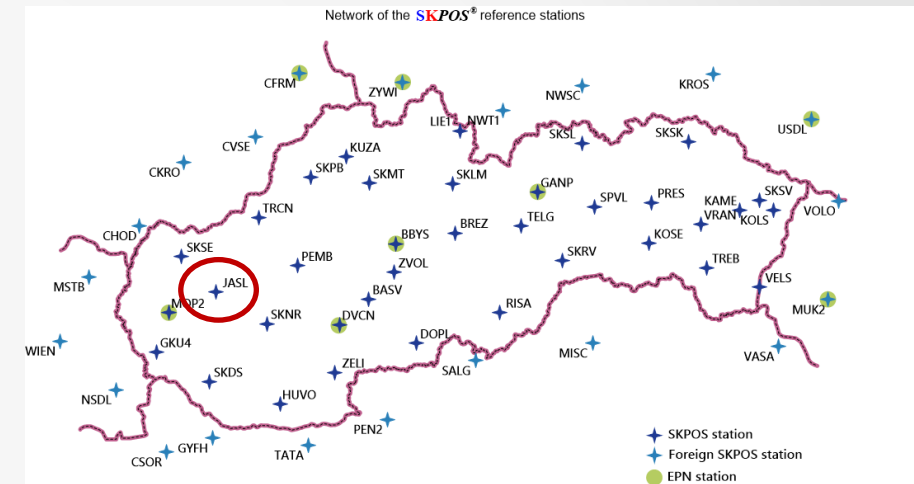
- DVCN - new EPN station from 2022-02-20
  - pillar monumentation + InSAR reflector
  - GPS+GLO+GAL+BDS+QZSS+SBAS
- EPOS contribution
  - stations GANP, BBYS



# SKPOS stations infrastructure

October 2022

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



JABO



JASL

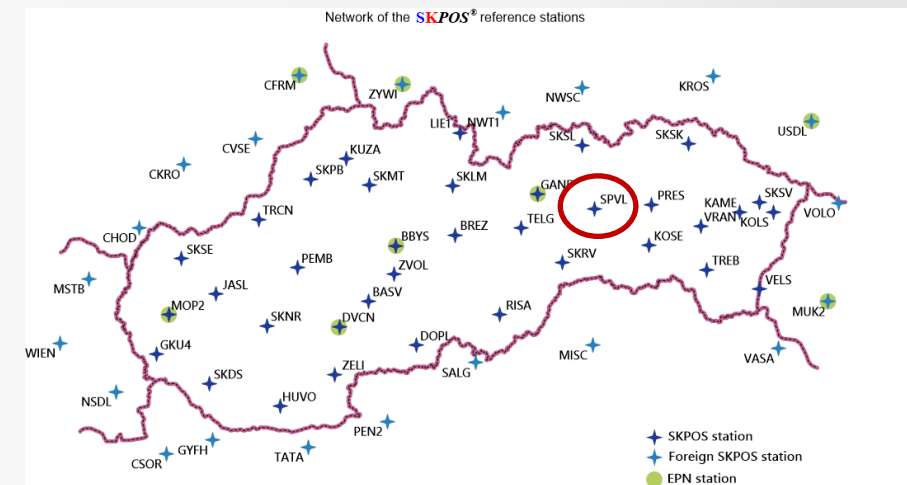
# SKPOS stations infrastructure

November 2022

- New station
  - reinforced-concrete pillar



SPVL

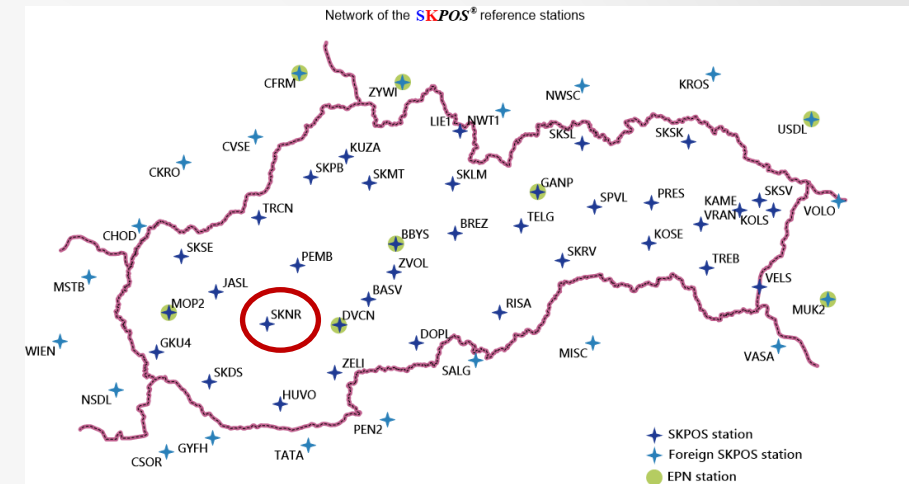




# SKPOS stations infrastructure

December 2022

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



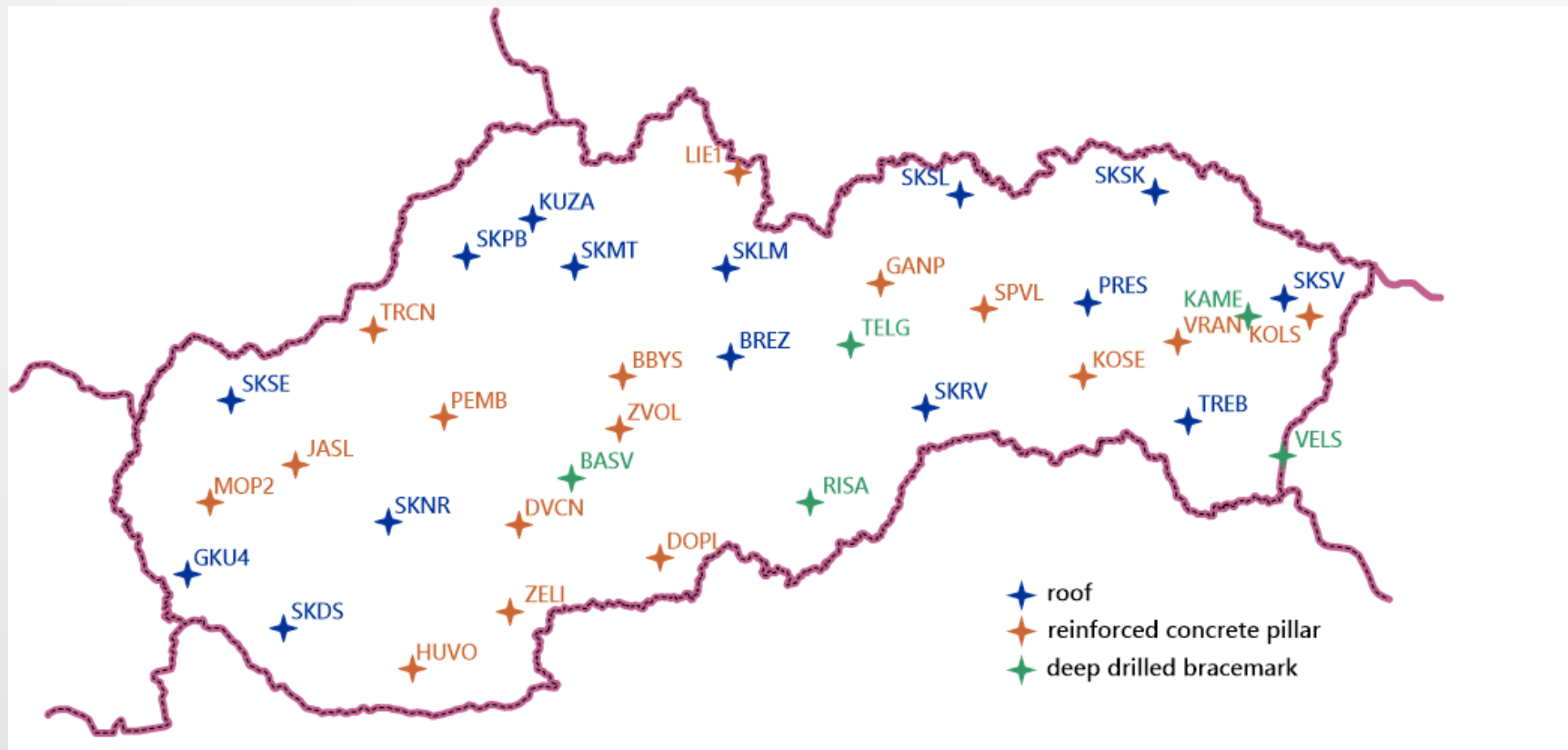
SKNR



NTRA

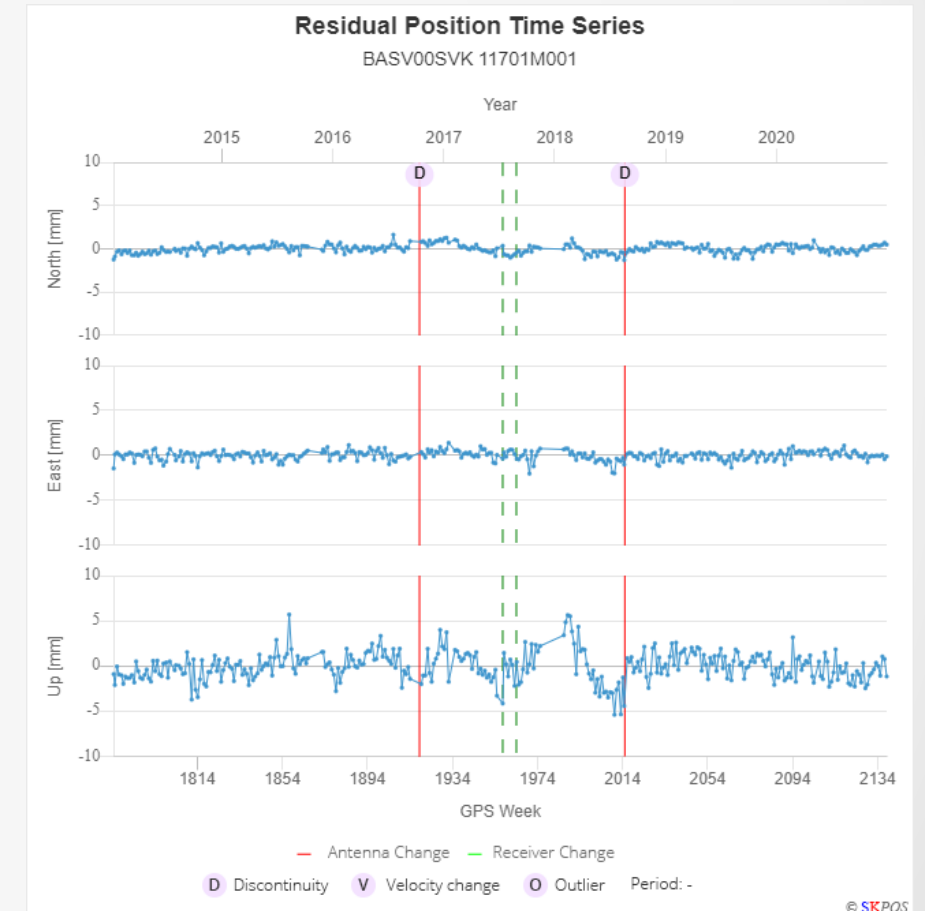
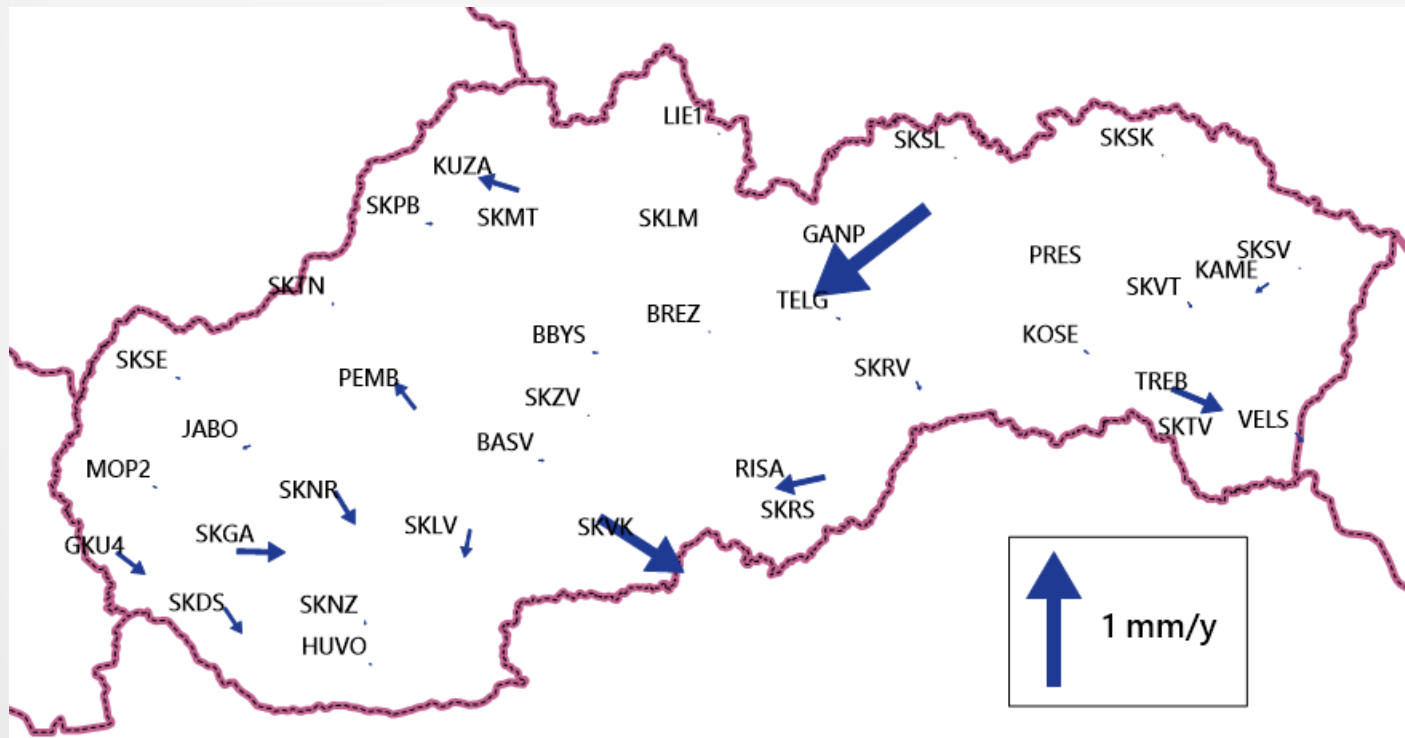
# SKPOS stations infrastructure

- 21 of 35 slovak permanent stations (60%) have monumentation suitable for geokinematics



# Multi-year solution 2007 – 2020

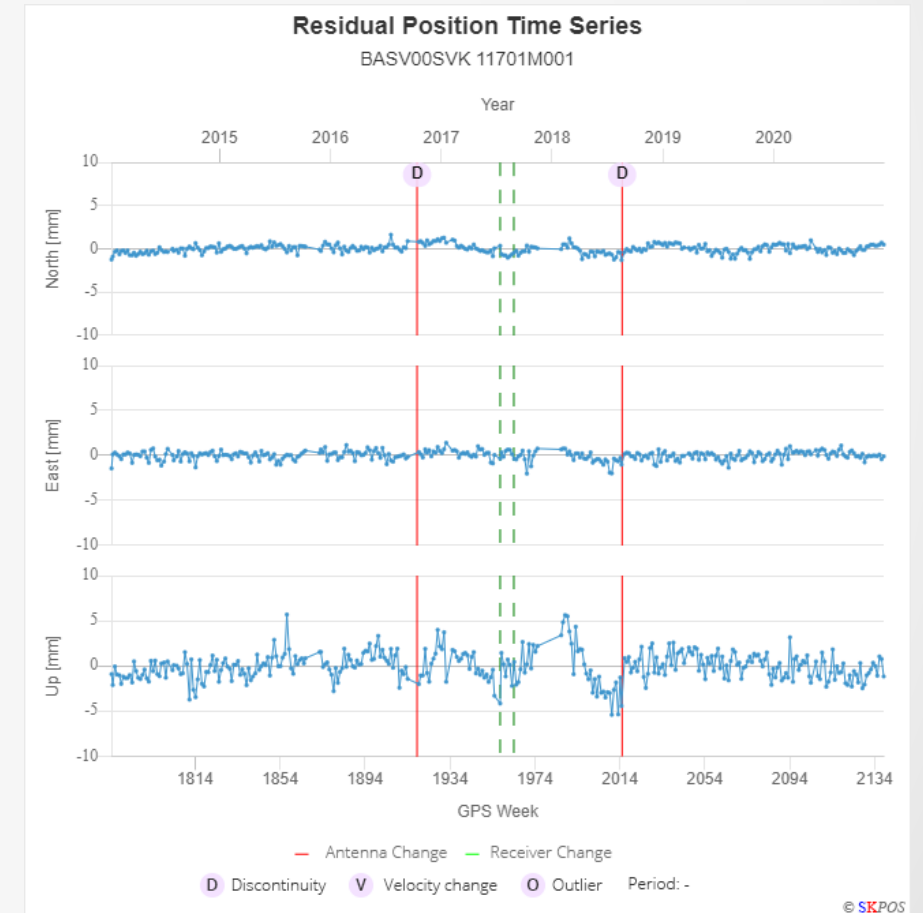
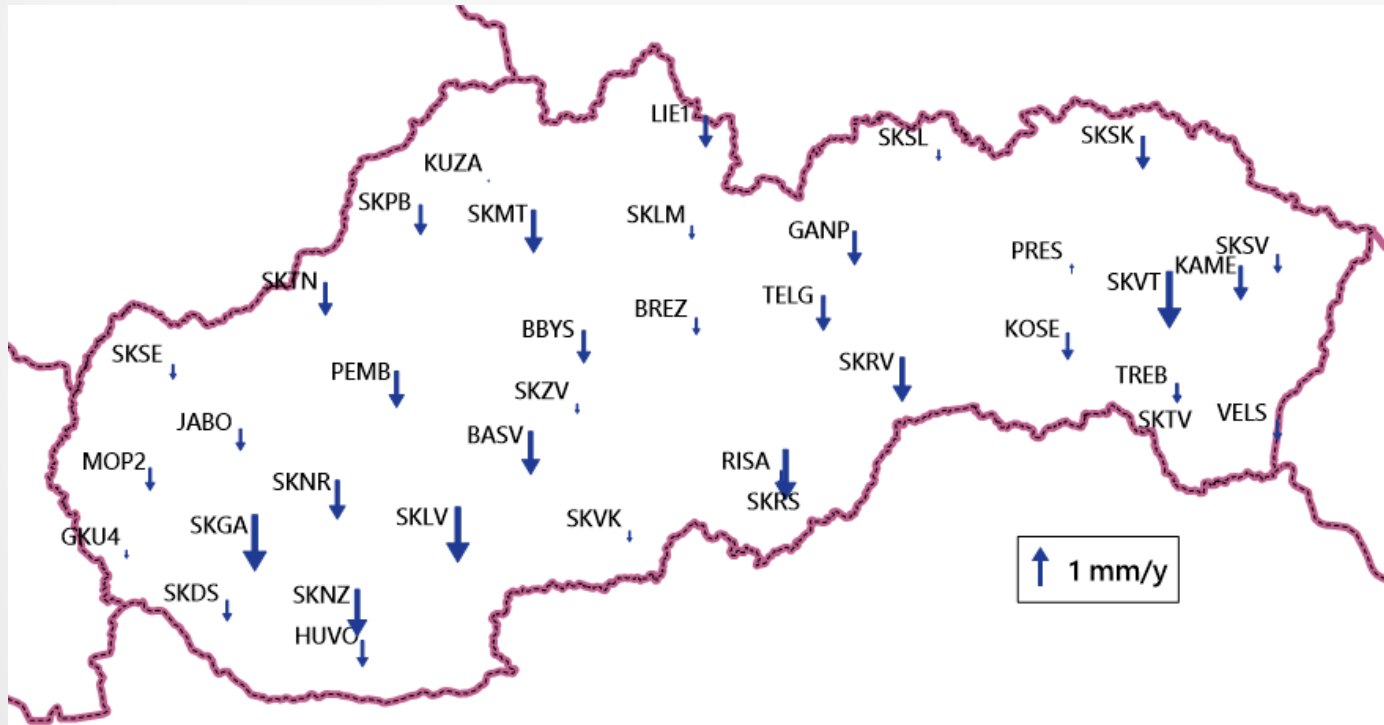
## Horizontal velocities



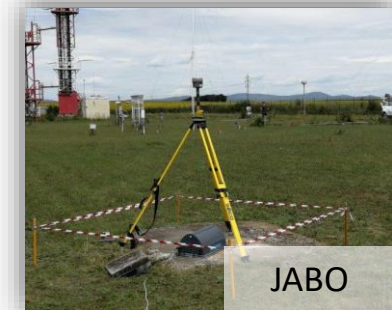
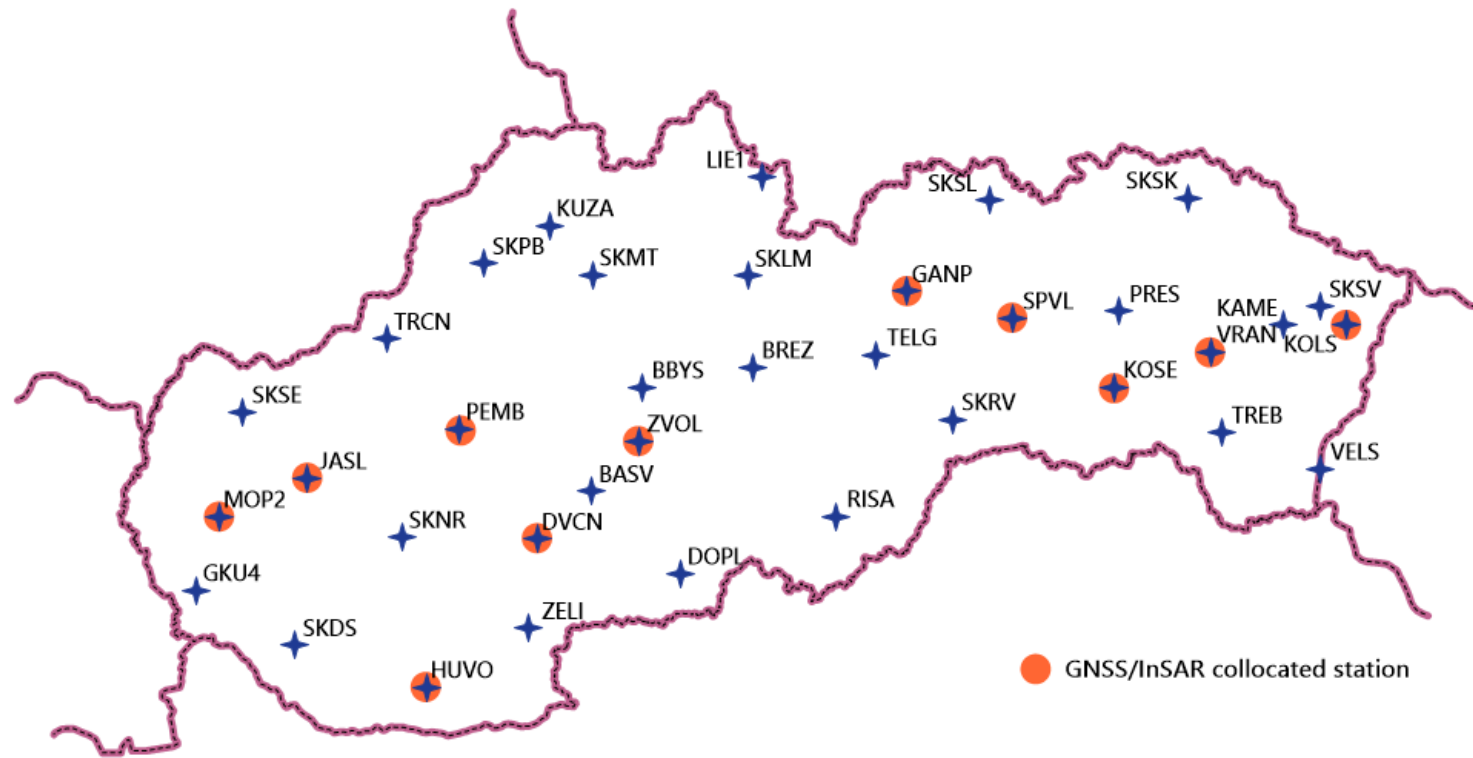


# Multi-year solution 2007 – 2020

## Vertical velocities

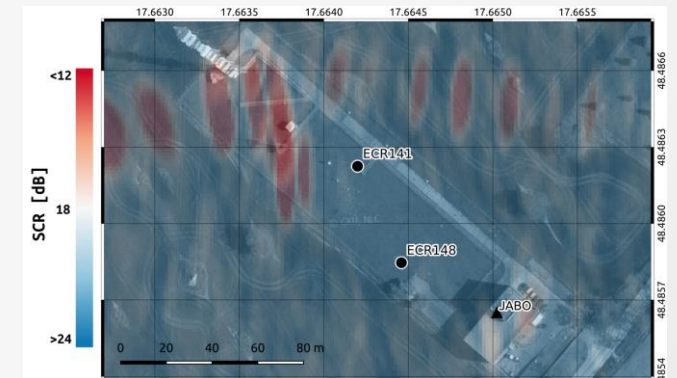
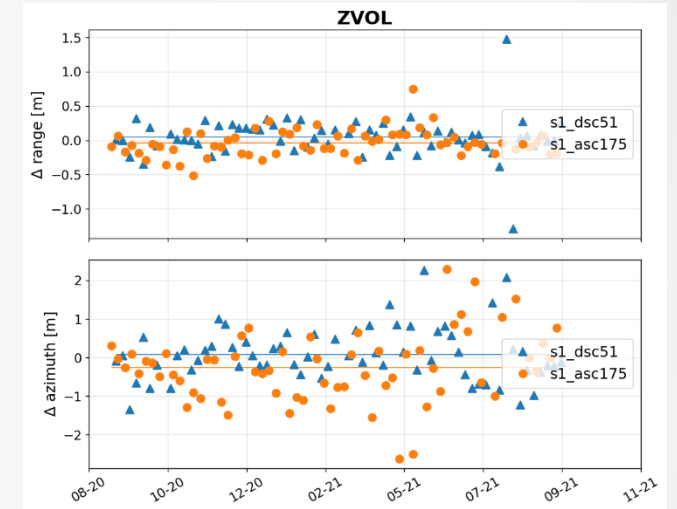


# SKPOS GNSS/InSAR collocation



# SKPOS GNSS/InSAR collocation

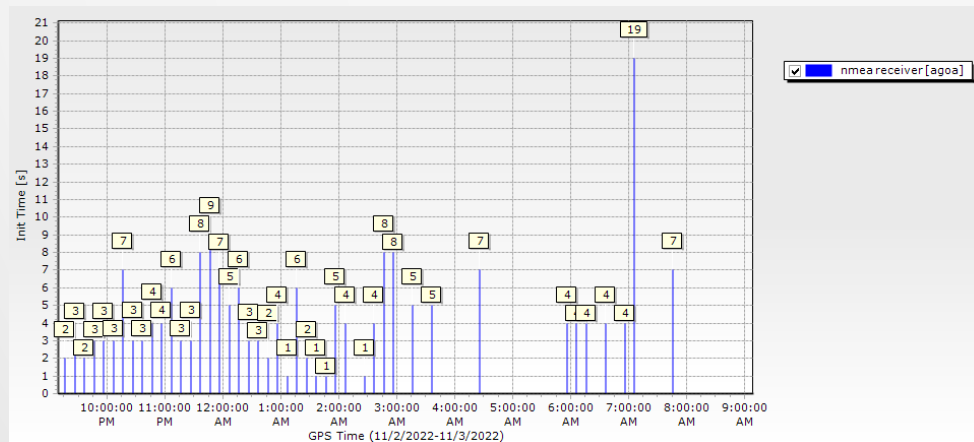
- Collocations helps us to monitor station surroundings stability
- InSAR = new geodetic technique
  - we plan to provide precise coordinates of InSAR reflector phase centers (like coordinates or heights of benchmarks)
  - InSAR reflector coordinates will enable to do correct absolute referencing of 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
- 2022  
Relocation of monitoring station SUT2 → AGOA



# SKPOS Infrastructure

- Control software:



- Version 4.72

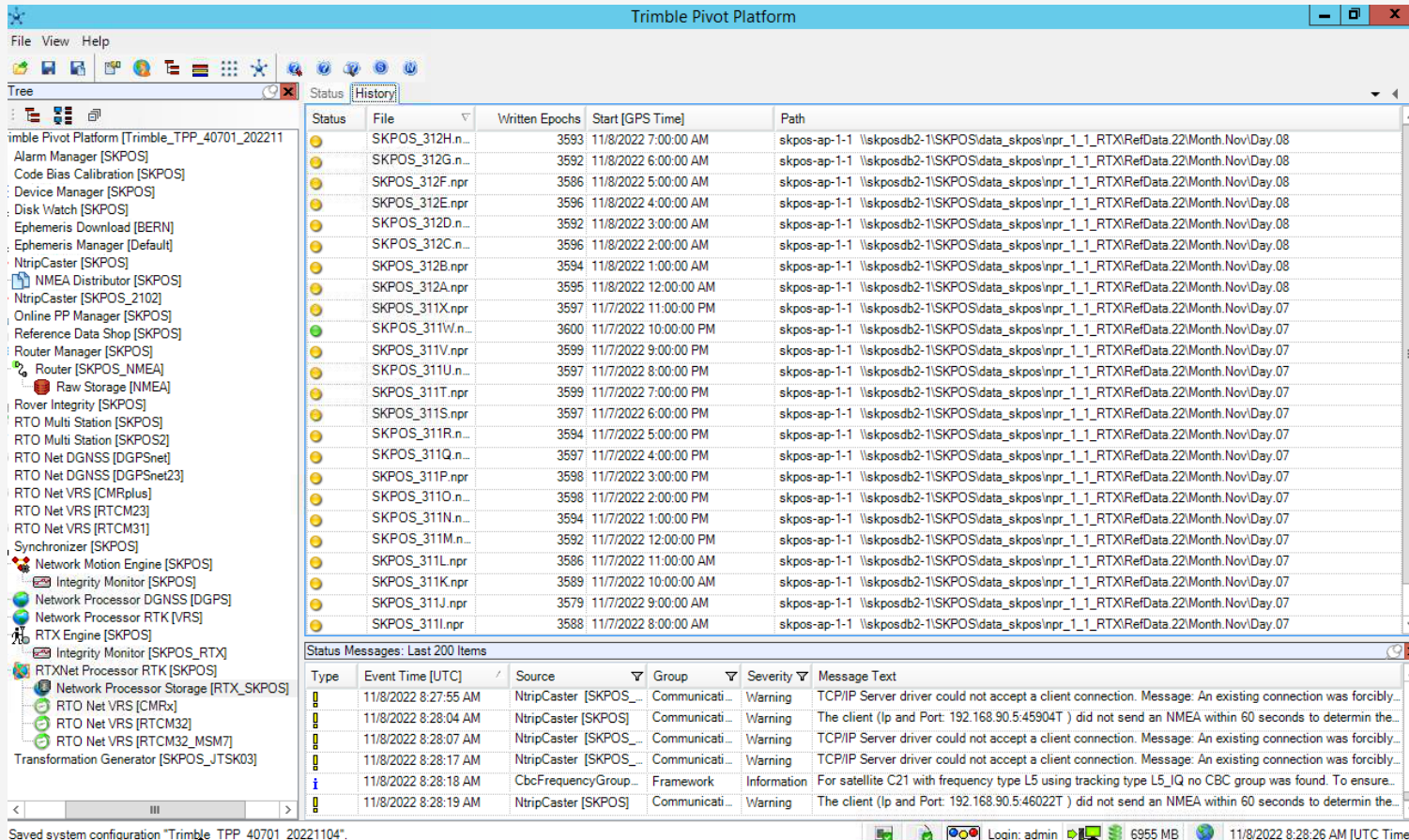
- Receivers firmware

- Alloy: 6.15
- NetR9: 5.55



# SKPOS Infrastructure

- Control software  Trimble Pivot Platform
  - Problem with missing epochs in npr files



The screenshot displays the Trimble Pivot Platform software interface. The main window is titled "Trimble Pivot Platform" and contains a "Tree" view on the left and a "Status" window on the right. The "Status" window shows a table of files with columns for Status, File, Written Epochs, Start [GPS Time], and Path. Below the table, there is a "Status Messages: Last 200 Items" section showing a list of messages with columns for Type, Event Time [UTC], Source, Group, Severity, and Message Text.

Status	File	Written Epochs	Start [GPS Time]	Path
●	SKPOS_312H.npr	3593	11/8/2022 7:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_312G.npr	3592	11/8/2022 6:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_312F.npr	3586	11/8/2022 5:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_312E.npr	3596	11/8/2022 4:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_312D.npr	3592	11/8/2022 3:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_312C.npr	3596	11/8/2022 2:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_312B.npr	3594	11/8/2022 1:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_312A.npr	3595	11/8/2022 12:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.08
●	SKPOS_311X.npr	3597	11/7/2022 11:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311W.npr	3600	11/7/2022 10:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311V.npr	3599	11/7/2022 9:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311U.npr	3597	11/7/2022 8:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311T.npr	3599	11/7/2022 7:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311S.npr	3597	11/7/2022 6:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311R.npr	3594	11/7/2022 5:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311Q.npr	3597	11/7/2022 4:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311P.npr	3598	11/7/2022 3:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311O.npr	3598	11/7/2022 2:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311N.npr	3594	11/7/2022 1:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311M.npr	3592	11/7/2022 12:00:00 PM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311L.npr	3586	11/7/2022 11:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311K.npr	3589	11/7/2022 10:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311J.npr	3579	11/7/2022 9:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07
●	SKPOS_311I.npr	3588	11/7/2022 8:00:00 AM	skpos-ap-1-1 \skposdb2-1\SKPOS\data_skpos\mpr_1_1_RTX\RefData.22\Month.Nov\Day.07

Type	Event Time [UTC]	Source	Group	Severity	Message Text
!	11/8/2022 8:27:55 AM	NtripCaster [SKPOS_...]	Communicati...	Warning	TCP/IP Server driver could not accept a client connection. Message: An existing connection was forcibly...
!	11/8/2022 8:28:04 AM	NtripCaster [SKPOS]	Communicati...	Warning	The client (Ip and Port: 192.168.90.5:45904T ) did not send an NMEA within 60 seconds to determine the...
!	11/8/2022 8:28:07 AM	NtripCaster [SKPOS_...]	Communicati...	Warning	TCP/IP Server driver could not accept a client connection. Message: An existing connection was forcibly...
!	11/8/2022 8:28:17 AM	NtripCaster [SKPOS_...]	Communicati...	Warning	TCP/IP Server driver could not accept a client connection. Message: An existing connection was forcibly...
i	11/8/2022 8:28:18 AM	CbcFrequencyGroup...	Framework	Information	For satellite C21 with frequency type L5 using tracking type L5_IQ no CBC group was found. To ensure...
!	11/8/2022 8:28:19 AM	NtripCaster [SKPOS]	Communicati...	Warning	The client (Ip and Port: 192.168.90.5:46022T ) did not send an NMEA within 60 seconds to determine the...

Saved system configuration "Trimble\_TPP\_40701\_20221104".

Login: admin 6955 MB 11/8/2022 8:28:26 AM [UTC Time]



# SKPOS portfolio

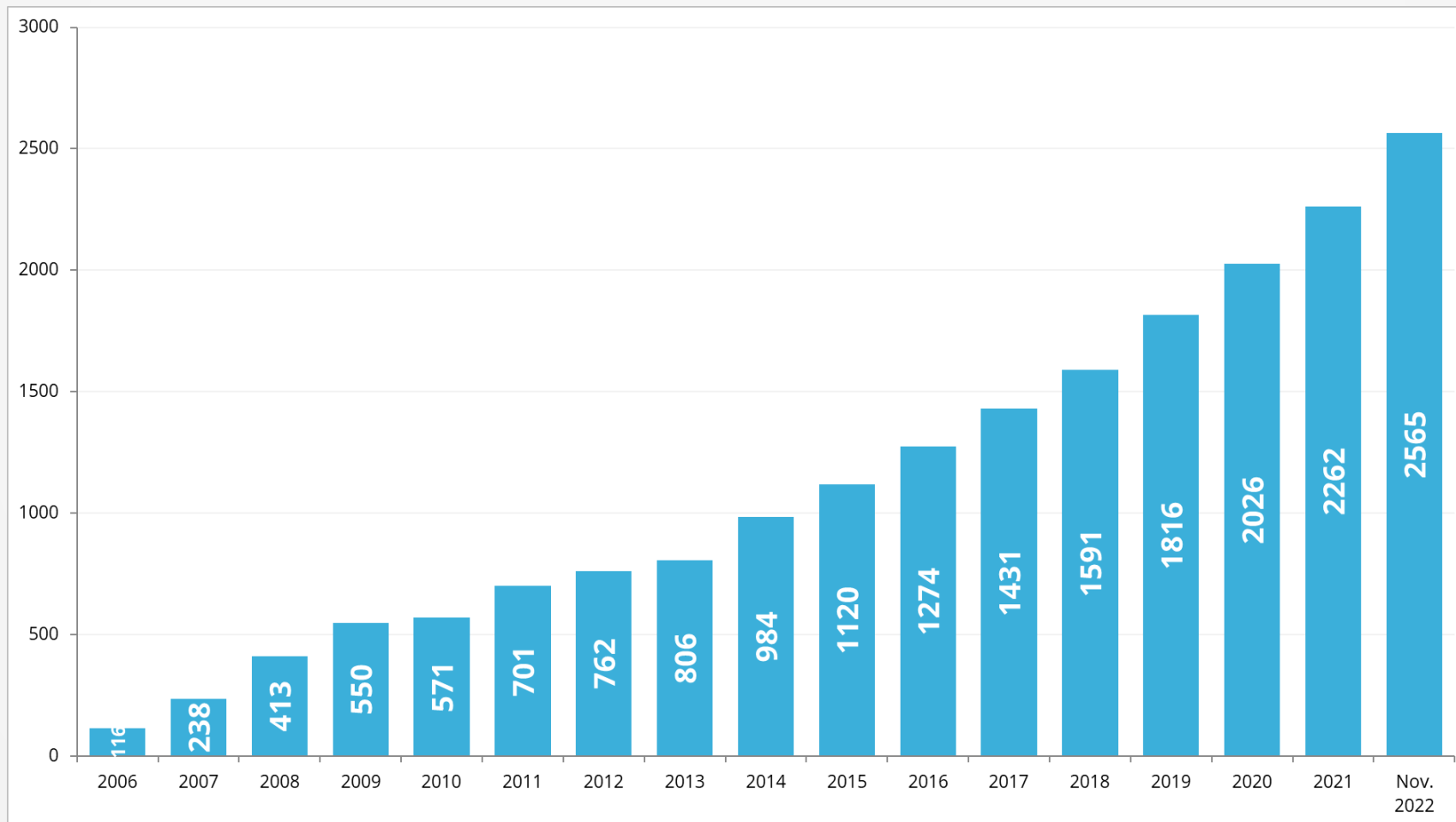
## Data formats – content - charges

**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 €

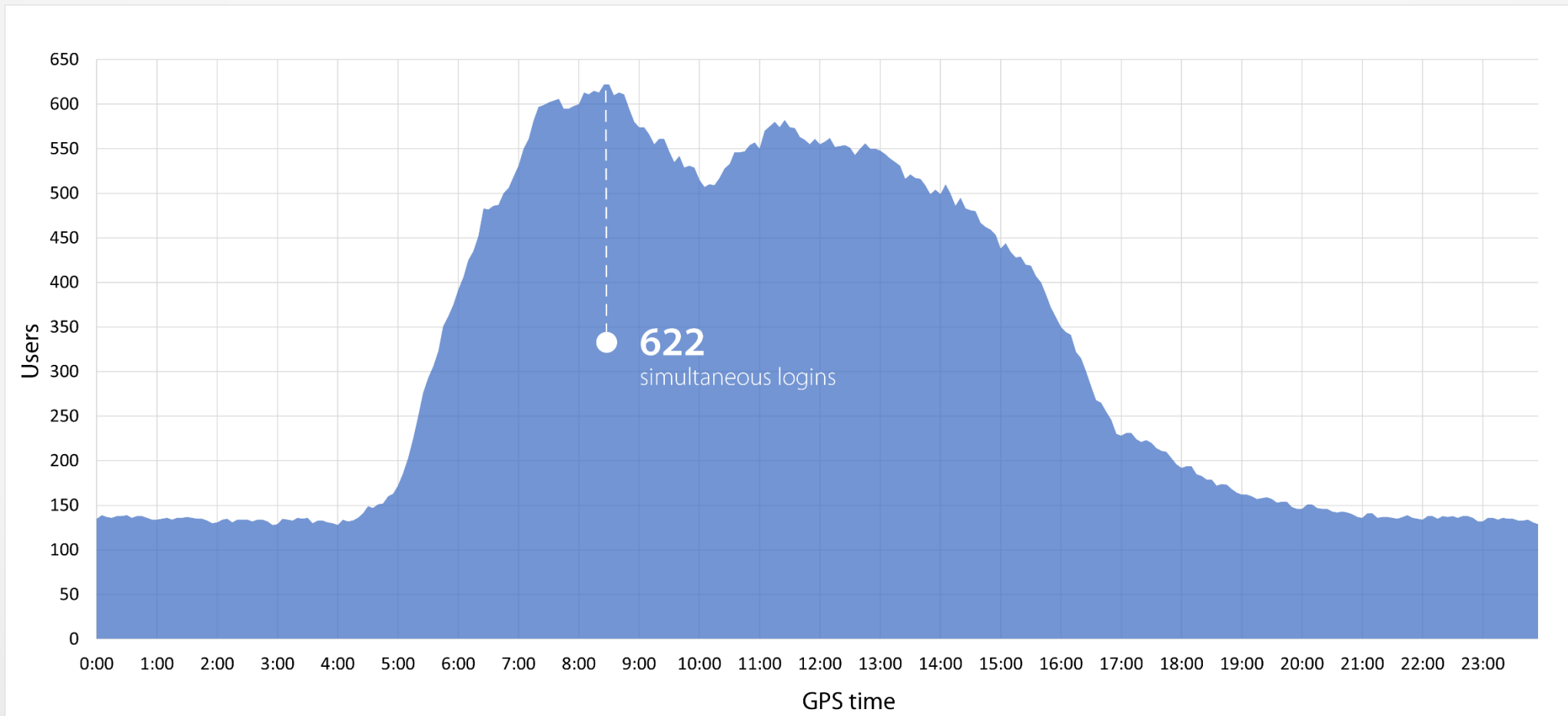
# Number of users

- Number of users: 2565 (Nov. 2022)



# Maximum simultaneous logins

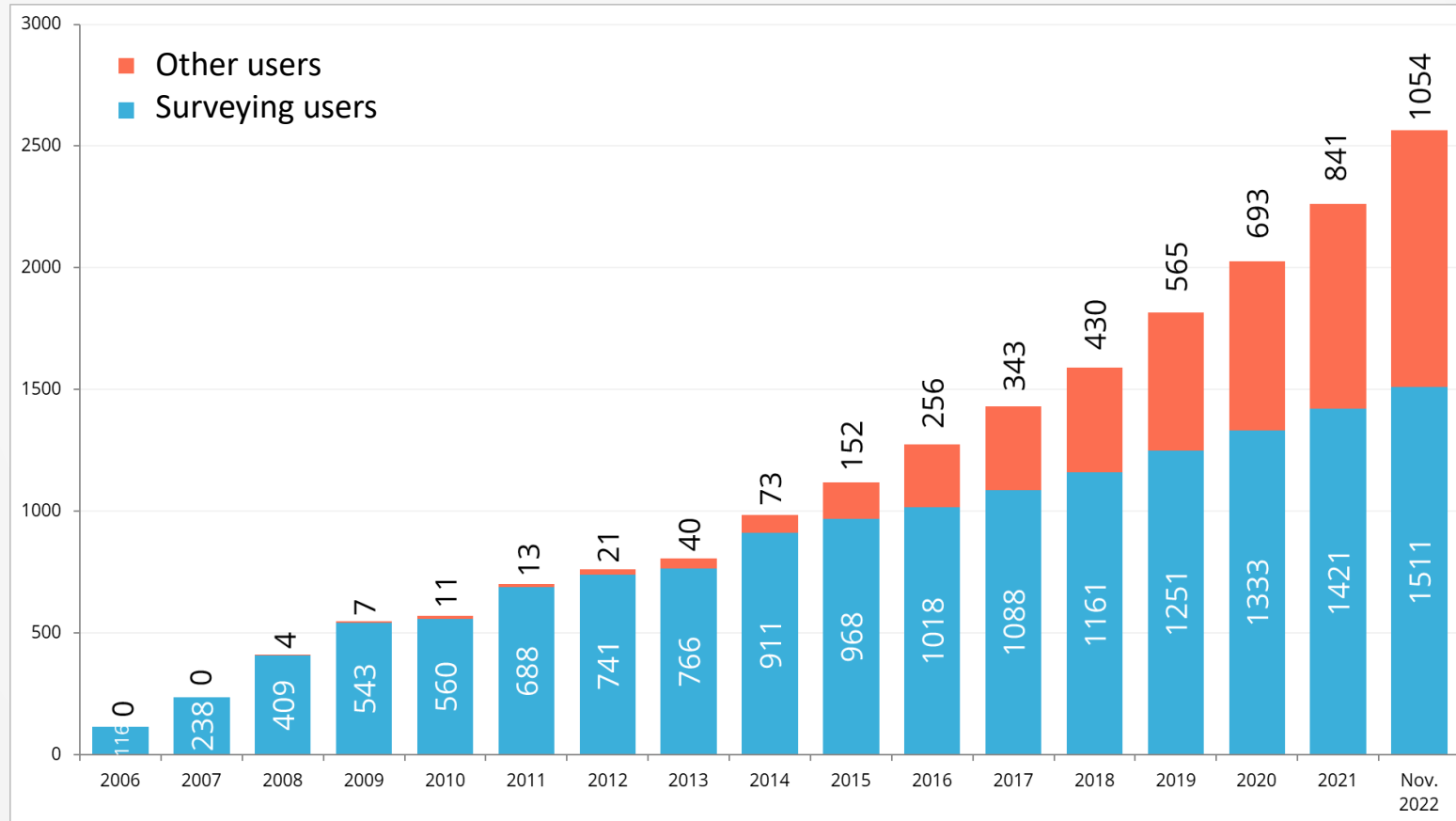
- Maximum 622 simultaneous logins (2022-10-12)





# Type of users

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



# Coordinate reference frame

- ETRS89 (ETRF2000) epoch 2008.5
- 7 Helmert transformation parameters to national system S-JTSK (JTSK03)
- Shift-grid transformation from S-JTSK (JTSK03) to S-JTSK (JTSK) – Nadcon, NTv2
- All valid geodetic reference system are standardized = have EPSG codes from February 2018

Reference system	EPSG Code
S-JTSK (JTSK) East-North	EPSG:5514
S-JTSK (JTSK) South-West	EPSG:5513
S-JTSK (JTSK03) East-North	EPSG:8353
S-JTSK (JTSK03) South-West	EPSG:8352
...	

# CORS coordinates keeping up to date

- 2021 – 2nd SKPOS multi-year solution (2007-2020) computed
  - accepted by EUREF GB at EUREF 2022 Symposium in Zagreb as a new Class A – EUREF Densification for Slovakia
  - reference frame and epoch remain the same to keep transformation parameters to S-JTSK consistent

**ETRS89 (ETRF2000) at epoch 2008.5**



Geodetic and Cartographic Institute Bratislava

**REPORT OF COMPUTATION  
OF THE SKPOS MULTI-YEAR SOLUTION  
AS EUREF DENSIFICATION FOR SLOVAKIA**

For the validation to the EUREF Governing Board

Authors: Martin Ferianc, Branislav Droscak, Karol Smolik,  
Miroslav Rohacek, Miroslav Steinhübel

Bratislava  
2021



# Tenders

- New 4 Trimble Alloy receivers
  - Plan to replace 4 Trimble NetR9 for Trimble Alloy each year
- Tender for provider of network connection for reference stations
  - next year we probably change the provider
  - tender must be done every 4 years





**SKPOS®**

**Thank you for your attention**

**Branislav Droščák**

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