National report of SLOVAKIA

Karol Smolík, Branislav Droščák

Geodetic and Cartographic Institute BRATISLAVA

karol.smolik@skgeodesy.sk
branislav.droscak@skgeodesy.sk

Communication Workshop of the Positioning Knowledge Exchange Network
April 26-27, 2018. Brussels, Belgium

Division of geodetic controls (in Slovakia)
(rem. Geodetic controls serves especially for surveyors)

- Active part (services)
  - Slovak real time positioning service (SKPOS)
  - Transformation service

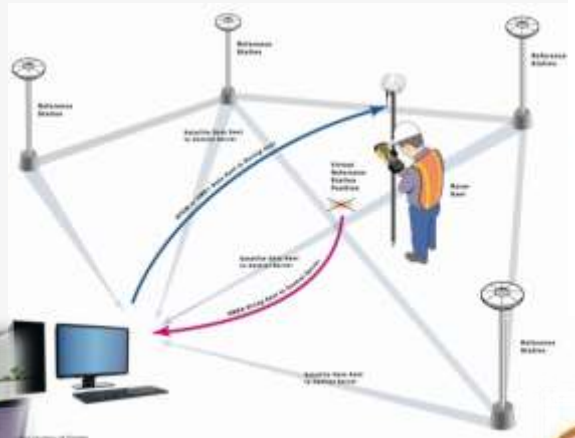
- Passive part
  - Geodetic networks points

SKPOS

Slovak real time determination system

- SK*POS*® is a multifunctional tool for precise object and phenomena positioning by global navigation satellite systems (GNSS)

- service enables users to work on-line or in post-processing way in mandatory geodetic reference systems ETRS89 and S-JTSK (JTSK03 frame)

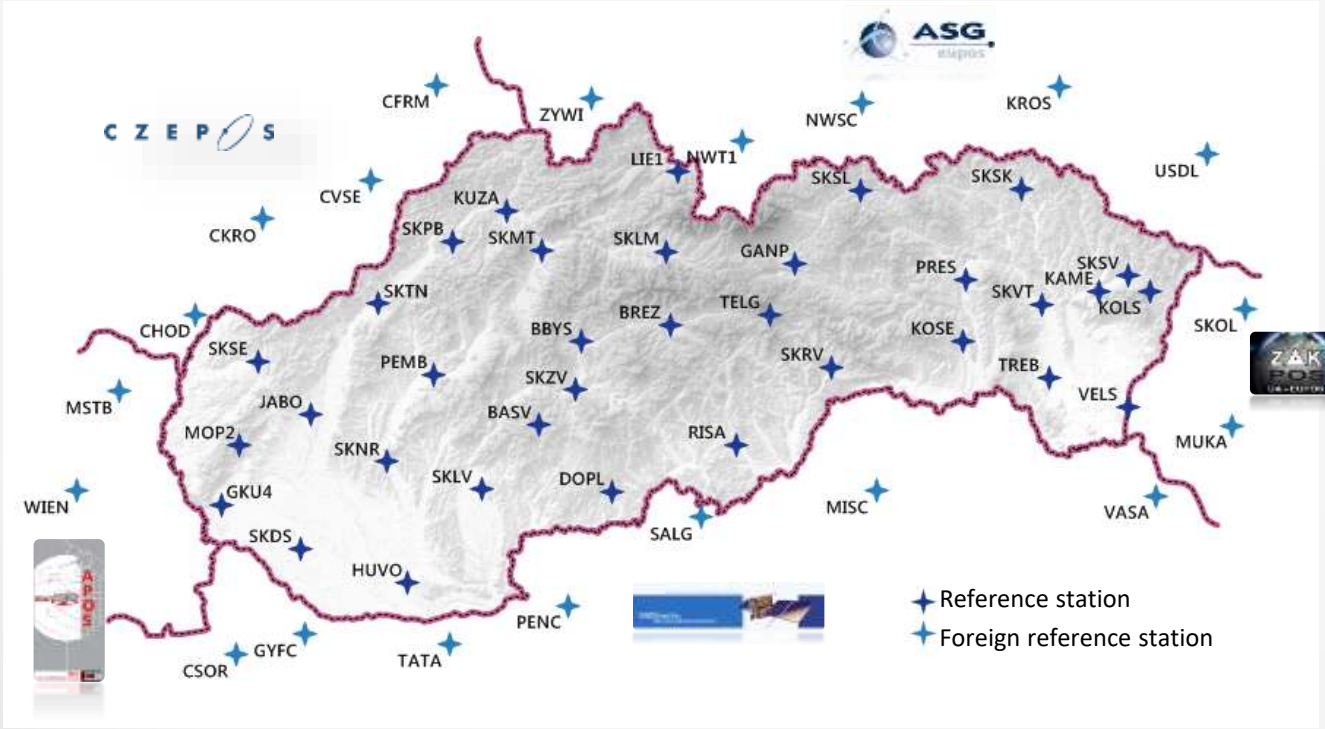


slovanet

SKPOS CORS infrastructure

Status in April 2018

- **34 Slovakian permanent stations**
  - All stations with TRIMBLE receivers and antennas
  - All stations observe GPS+GLONASS signals, 29 stations also observe Galielo and BeiDou
- **20 foreign permanent stations (APOS, gnssnet.hu, CZEPOS, ASG-EUPOS, ZAKPOS)**



SKPOS CORS infrastructure

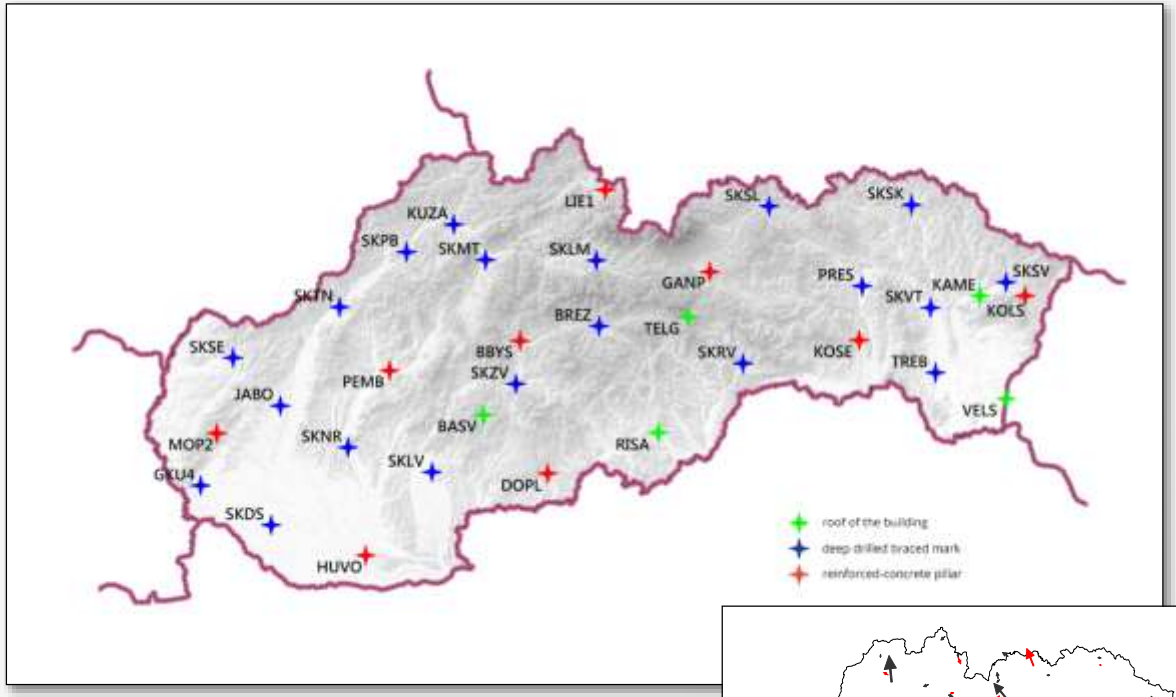
2 stations relocation in 2017 year

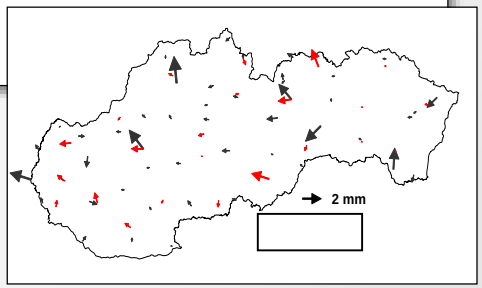
- Reinforced-concrete pillar instead of roof monumentation
- Contribution to geokinematics reseach (multipurpose usage of CORS = GKÚ philosphy)

SKPOS CORS infrastructure

geodynamics research monumentation

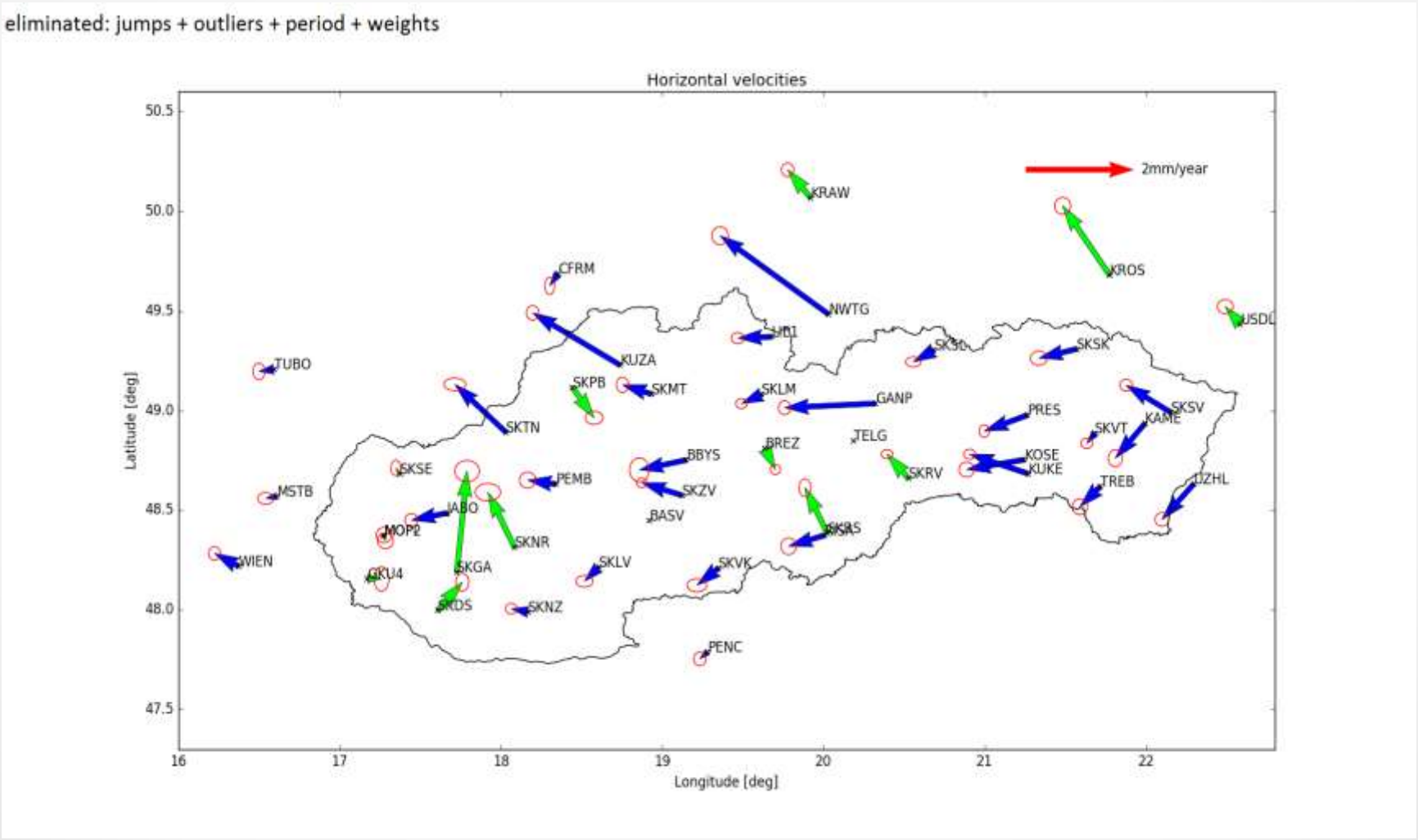
- together 14 of 34 slovakian SKPOS permanent stations (41%) have monumentation suitable for geodynamic research purposes





SKPOS CORS infrastructure

Geodynamics research results – HZ velocities (2007-2017)

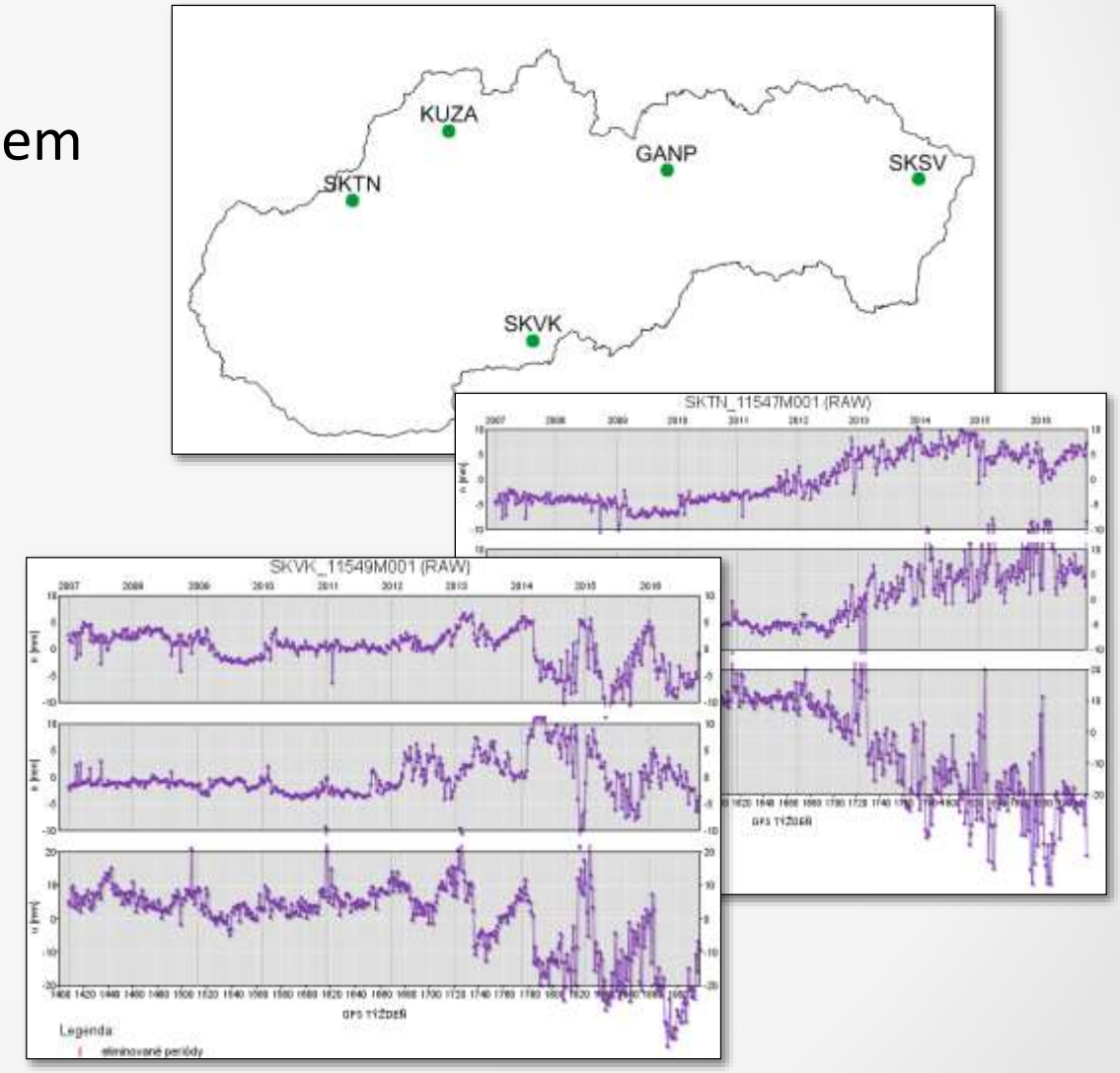


SKPOS CORS infrastructure

anomalous behavior on 5 CORS

- 5 different stations
- Different time of problem
- Different behavior

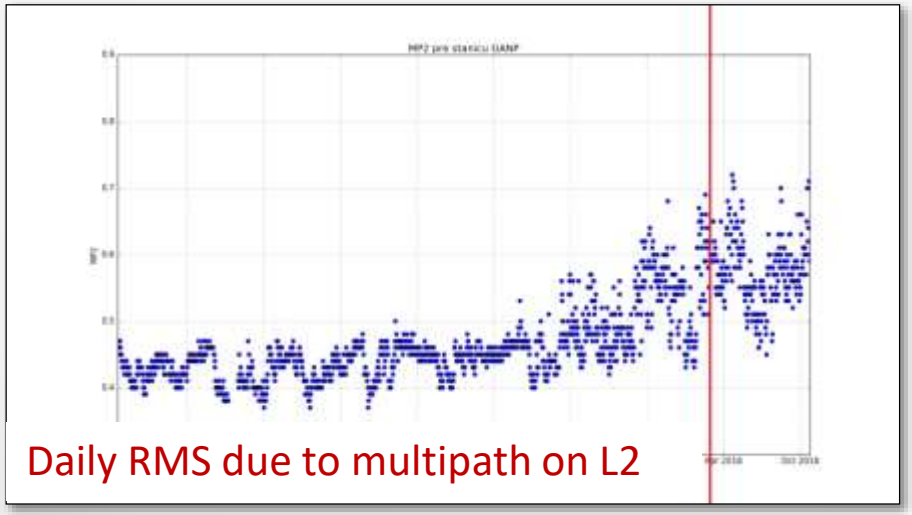
- Potential issues
  - Receiver
  - Antenna
  - Monumentation



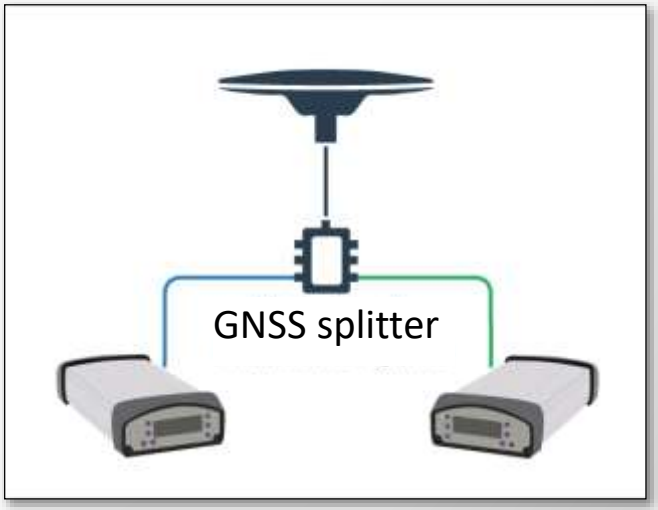
SKPOS CORS infrastructure

anomalous behavior on 5 CORS

- Made a several tests and analysis
  - Additional antenna
  - Second receiver connected via splitter
  - Multipath comparison
  - Coordinates differences



Daily RMS due to multipath on L2



SKPOS CORS infrastructure

antennas upgrade

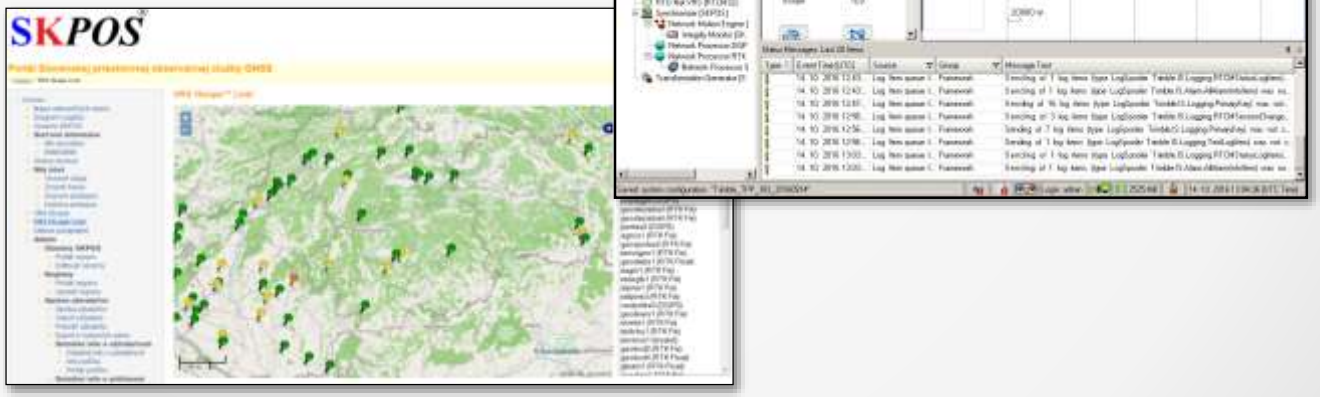
- The problem was
  - more than 10 years old antennas Trimble Zephyr Geodetic 2
  - all problematic antennas are from one series

- Antennas will be replaced by new Trimble Zephyr Geodetic 3 in 2018
  - with absolute robotic calibration

SKPOS

control software

- Trimble® Pivot™ Platform GNSS Infrastructure Software
  - Main software: version 3.10.3
  - Back-up software: version 3.10.3
- Receivers firmware
  - Trimble NetR9 receivers: version 5.30
  - Trimble NetR8 receivers: version 4.81



SKPOS web page

- Responsive design
- Full of interesting information (SVK/ENG):
  - News
  - Infrastructure
  - Packages and prices
  - Quality monitoring
  - Registration

http://skpos.gku.sk

SKPOS web page

new items

- published list of reference station
- coordinates
- antenna calibration file

Reference stations

#	Reference station	Location	Coordinates Change format ETRS89 (ETRF2000) epoch 2008.5			Antenna	Receiver
			X (m)	Y (m)	Z (m)		
1	BASV	Banská Štiavnica	4009952.2193	1374556.6500	4750511.3543	TRM55971.00 NONE	TRIMBLE NETR9
2	BBYS	Banská Bystrica	3980359.1445	1382291.8716	4772771.7709	TRM59800.00 NONE	TRIMBLE NETR9
3	BREZ	Brezno	3963889.0095	1414440.8746	4777131.8796	TRM55971.00 NONE	TRIMBLE NETR9
4	DOPL	Dolné Plachtince	4019049.1891	1408890.6541	4732383.5840	TRM55971.00 NONE	TRIMBLE NETR9
5	GANP	Gánovce	3929181.8684	1455236.5018	4793653.7059	TRM59800.00 SCIS	TRIMBLE NETR9

SKPOS portfolio

SKPOS®

SKPOS_dm

differential corrections for code measurements

SKPOS_cm

differential corrections for phase measurements

SKPOS_mm

postprocessing and phase measurements

SKPOS portfolio

data formats – content - charges

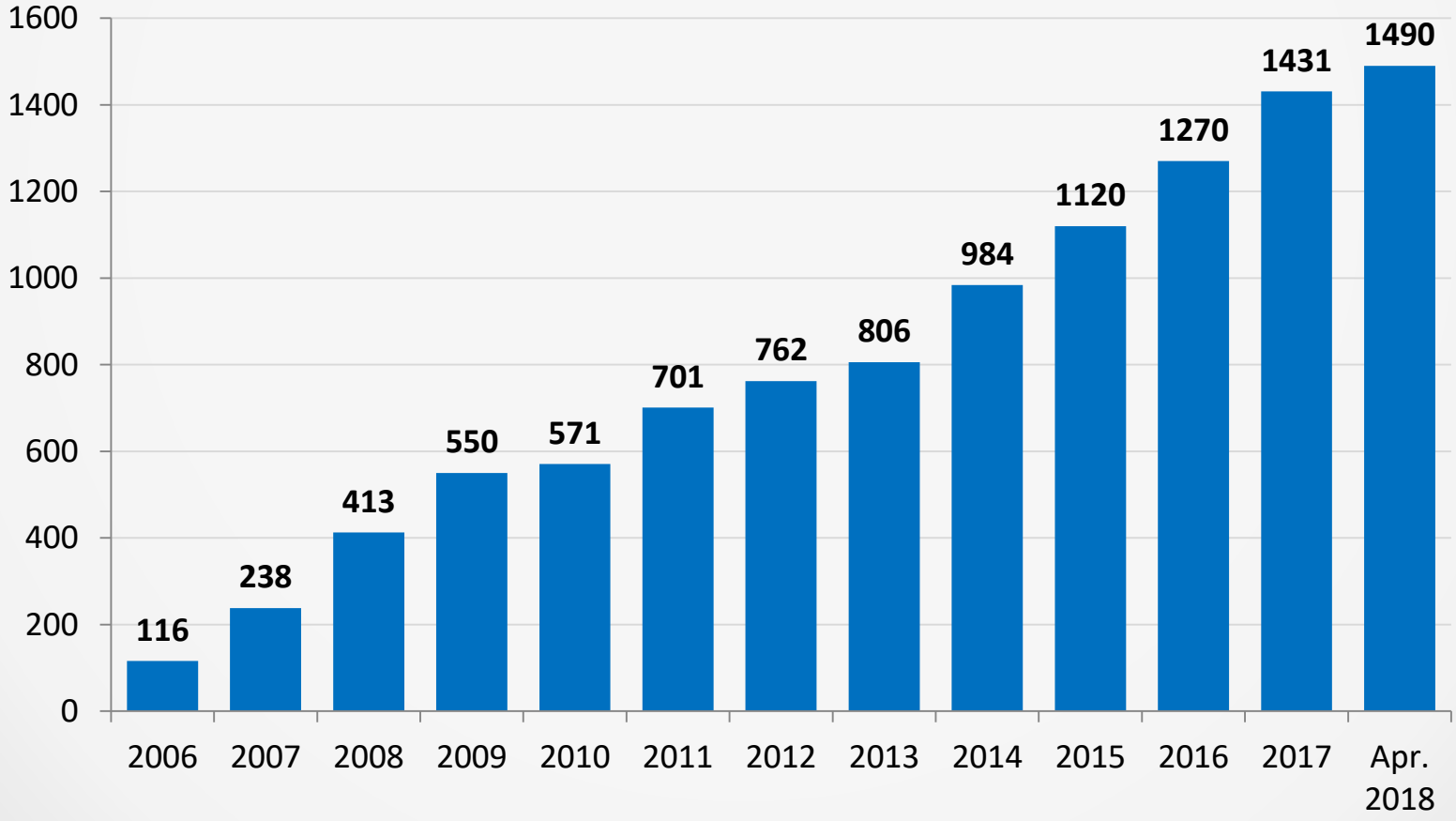
Only network solution (Network RTK in VRS concept) is provided.
No single RTK!

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 MSM, CMRx, CMR+	50 €
SKPOS_cm (month)	RTK unlimited	month	RTCM 2.3, 3.1 RTCM 3.2 MSM, CMRx, CMR+	19 €
SKPOS_dm	DGNSS unlimited	year	RTCM 2.1, 2.3	20 €

SKPOS

number of users

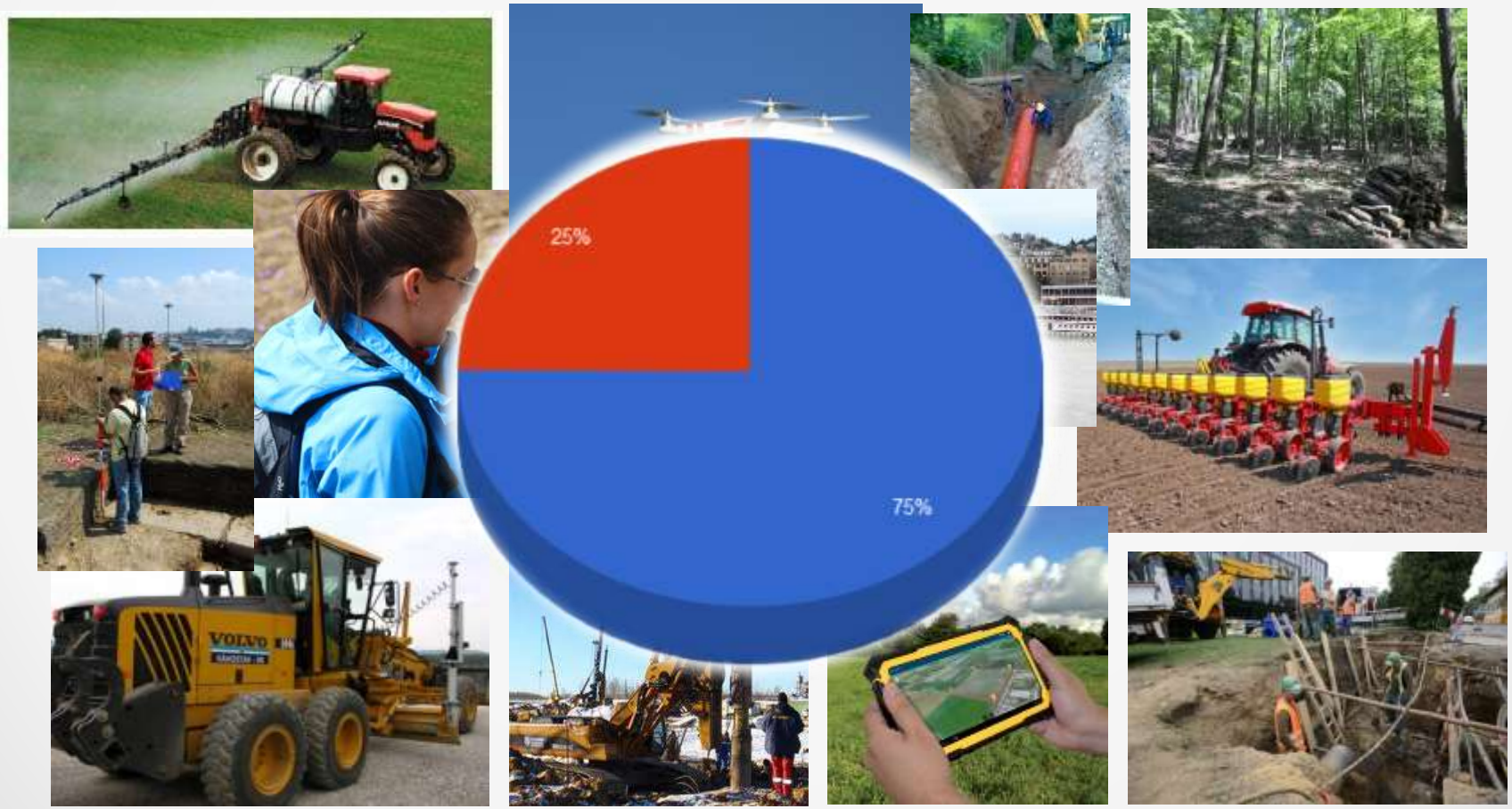
- over 1490 registrations (Apr. 2018)



SKPOS

Type of users (precise values from registration forms)

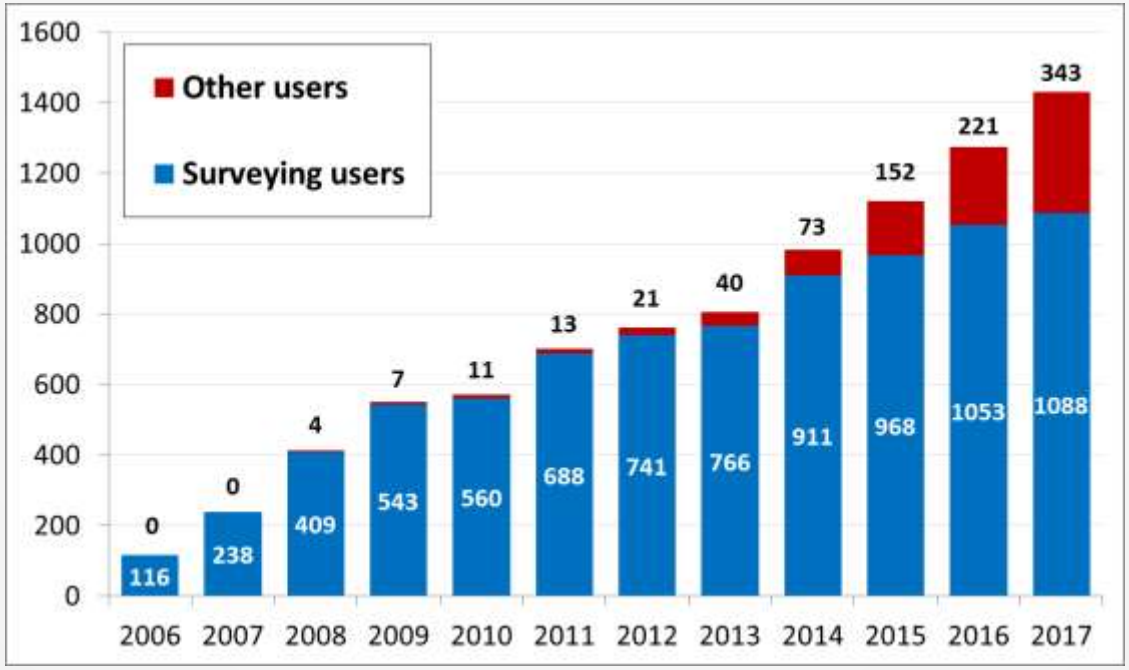
- Surveying fields (cadastre, surveying, mapping, GIS) – **75 %**
- Other fields (precise agriculture, machine guarding) – **25 %**



SKPOS

Type of users (precise values from registration forms)

- In 2017 more new SKPOS users were from non geodetic field
- SKPOS = geodetic controls primary – GKÚ have to react on this situation

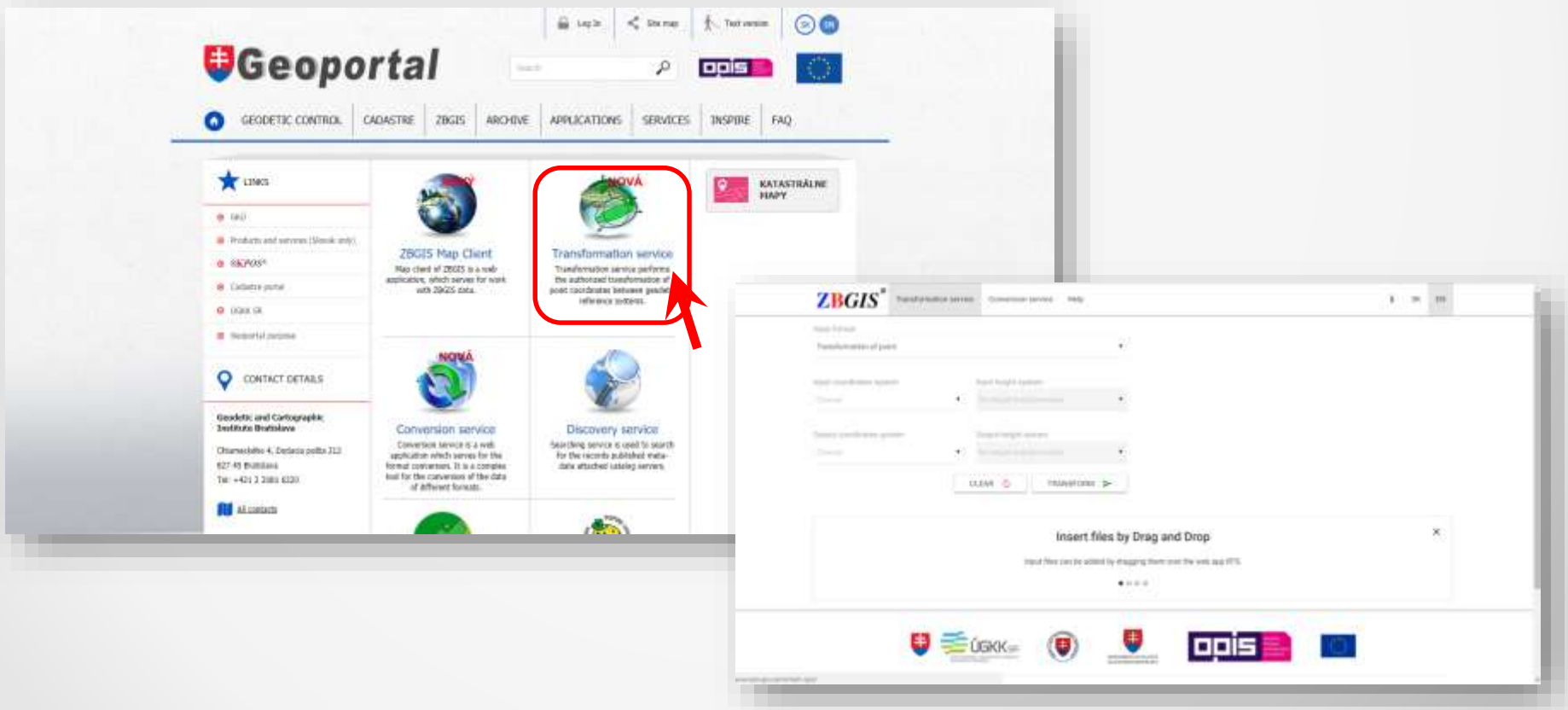


SKPOS and Galileo

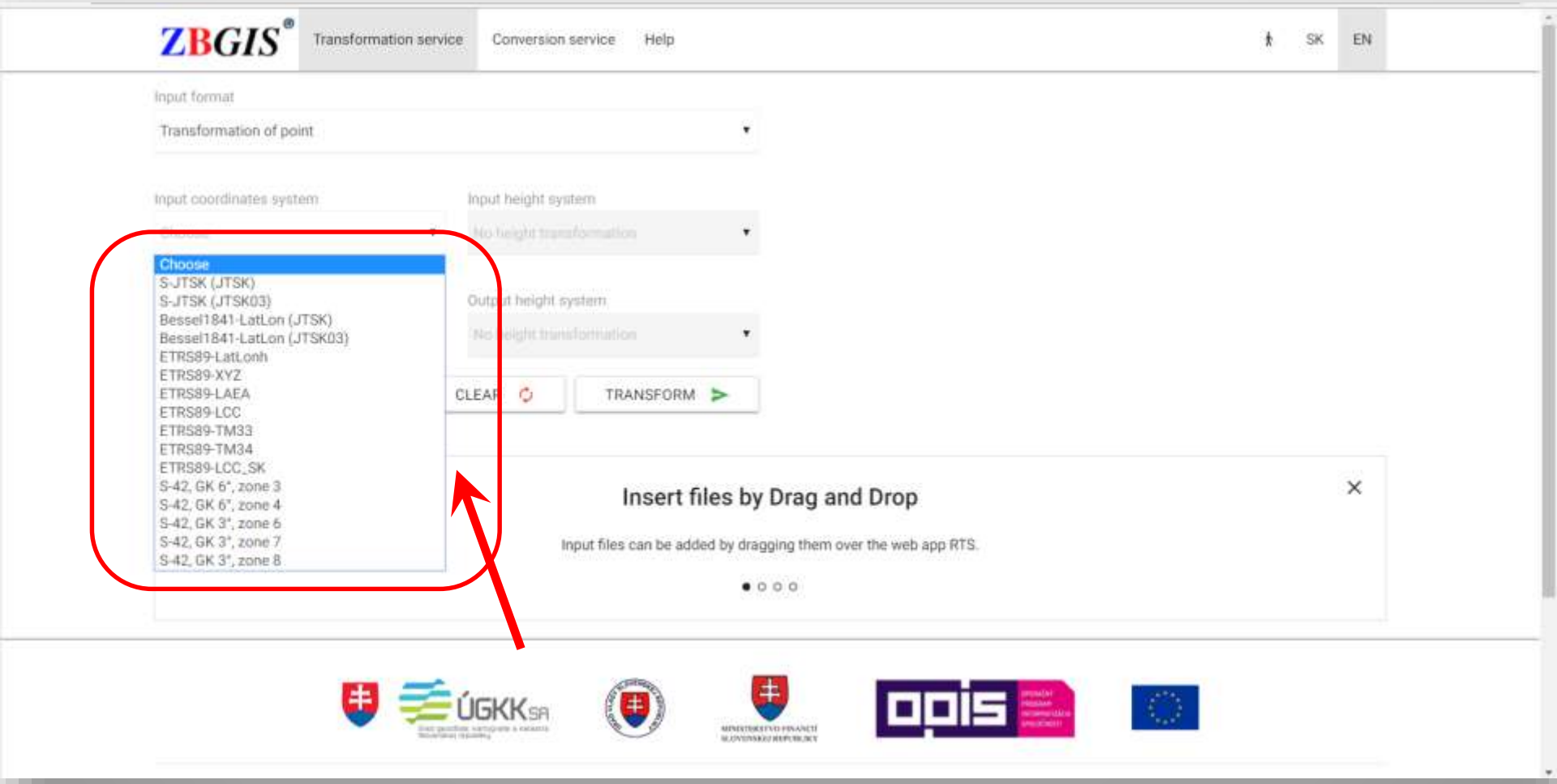
SKPOS	Component	GPS + GLONASS + Galileo + BeiDou
Hardware	Antennas	34 (34)
	Receivers	31 (34)
Software Trimble Pivot	RINEX CORS	
	RINEX VRS	plan for 2018 year
	RTCM 3.2 MSM (GPS+GLONASS)	
	RTCM 3.2 MSM (GPS+GLONASS+GALILEO)	plan for 2018 year

Transformation service (official)
Basic information

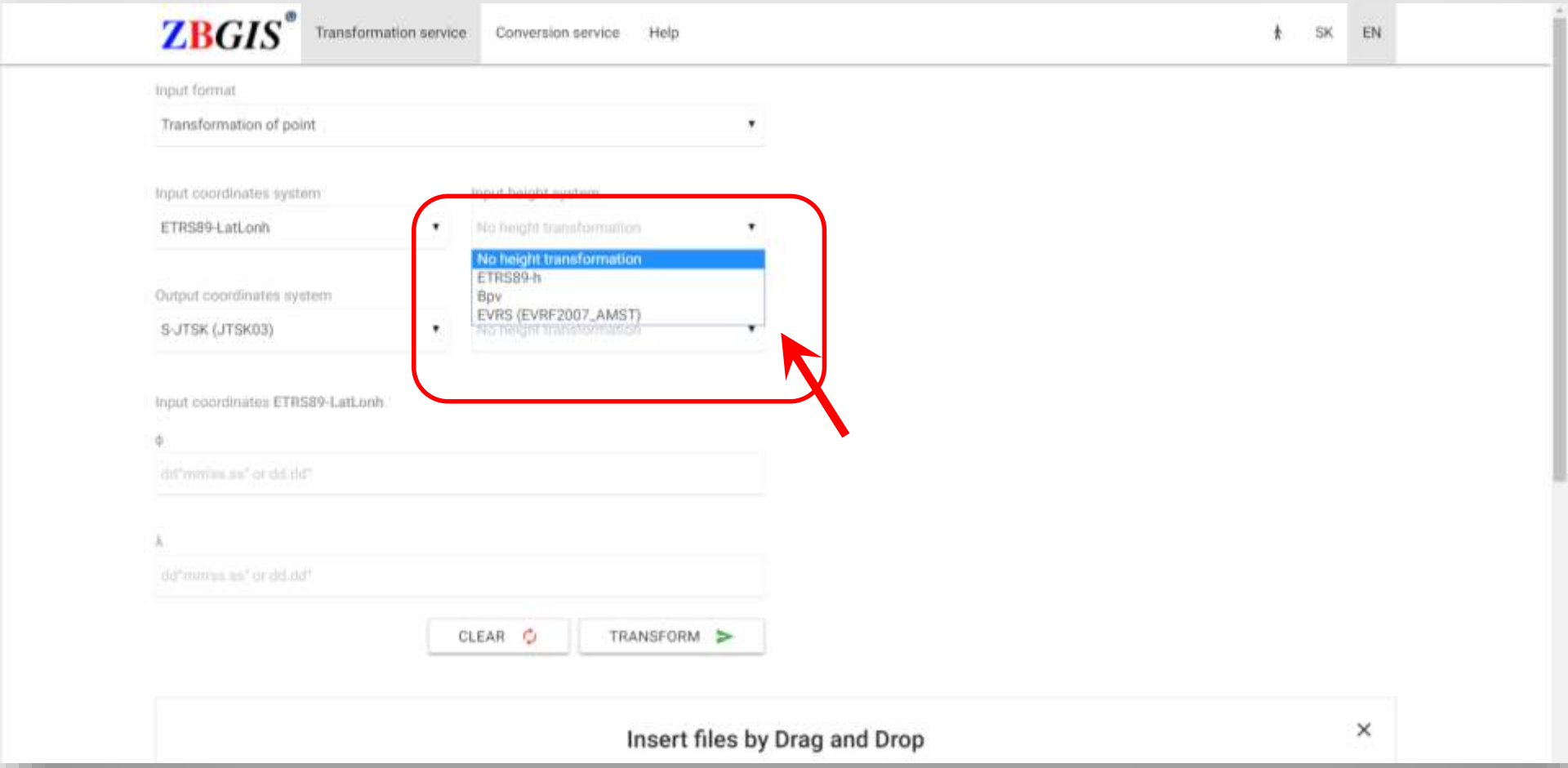
- performs the authorized transformation of point coordinates between geodetic reference systems
- available via geoportal from 30.01.2013



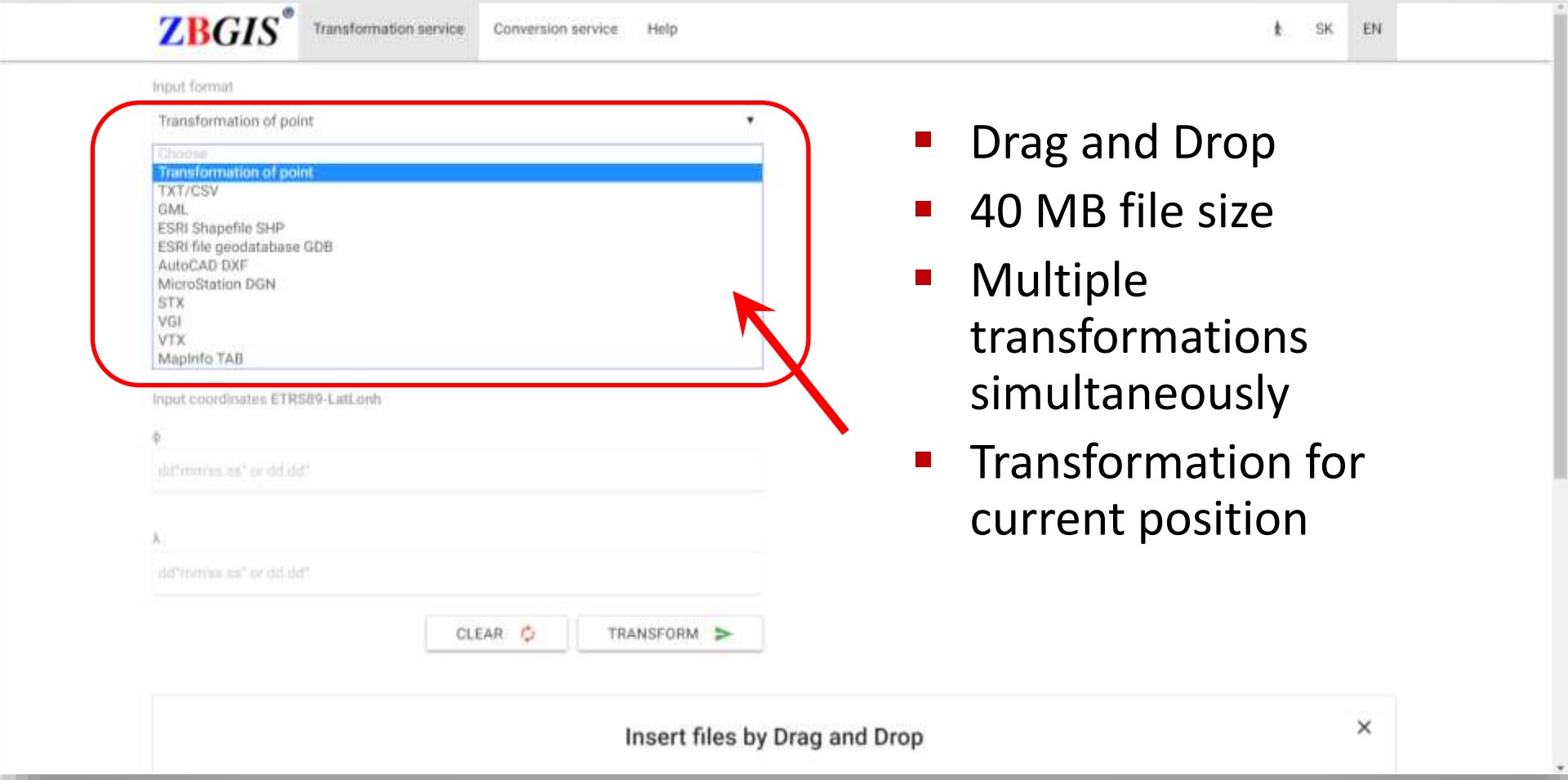
Supported coordinate reference systems
S-42 was added



Supported vertical reference systems



Supported file formats



- Drag and Drop
- 40 MB file size
- Multiple transformations simultaneously
- Transformation for current position

EPSG Registry

Standardization for Slovakian reference systems

- The **EPSG** Geodetic Parameter Dataset is a structured dataset of Coordinate Reference Systems and Coordinate Transformations
- All valid slovakian geodetic reference system are standardized = have EPSG codes from february 2018

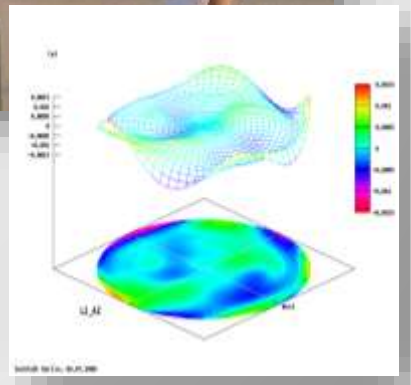
International Association of Oil & Gas Producers

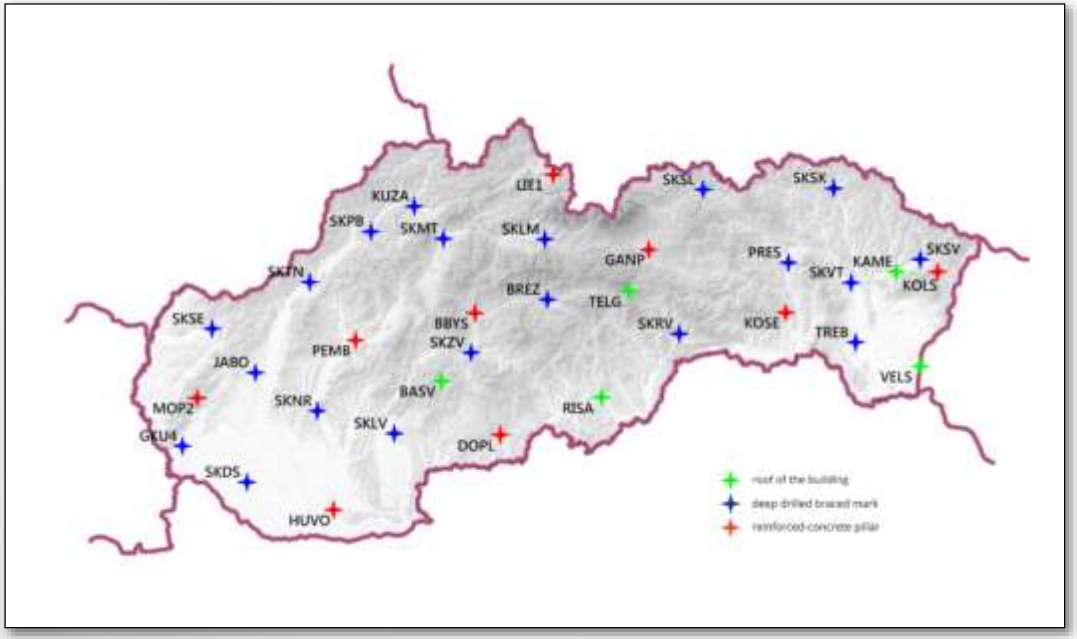
Reference system	EPSG Code
S-JTSK (JTSK) East-North	EPSG:5514
S-JTSK (JTSK) South-West	EPSG:5513
S-JTSK (JTSK03) East-North	EPSG:8353
S-JTSK (JTSK03) South-West	EPSG:8352
...	

GNSS metrology in Slovakia

SKPOS reference station level

- Number of SKPOS reference stations: 34
- Number of calibrated antennas: 16
- Type of calibration: individual robotic GPS+GLO
- Aim for future: robotic GPS+GLO+GAL for every new antenna





GNSS metrology in Slovakia

GNSS rover (users) level

- Legislative:
  - only general act for metrology
  - no calibration order or other official particular legislative document for “GNSS” metrology
- no calibration baseline for GNSS rovers
- If calibration protocol needed
  - dealers of main GNSS manufactures provide “calibration certificate”
  - users go to Czech republic or Hungary where GNSS calibration workplace is
- plans for next few years
  - foundation of GNSS baseline for GNSS rover+antenna calibration (Czech model)
  - maybe purchasing of robot for GNSS antenna calibration

Thank you for your attention

Karol Smolík
Geodetic and Cartographic Institute BRATISLAVA
karol.smolik@skgeodesy.sk