WG on
SERVICE QUALITY MONITORING
(status in November 2018)

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EUPOS WG on Service Quality Monitoring

- established in 2014 in Riga by the resolution 25.5 of the 25th Conference of the EUPOS Steering committee

- inspired by Czech and Slovakian solution of RTK network quality monitoring

- Aims:
  - creation of the uniform common network RTK quality monitoring tool based on virtual monitoring stations for all EUPOS member countries
  - set it up and do analysis on outputs
  - implementation it into EUPOS TS

RESOLUTION 25.5 OF THE 25TH CONFERENCE OF THE EUPOS STEERING COMMITTEE OF MAY 6-7, 2014 IN RIGA, LATVIA; AGENDA ITEM NO. 14.1: SKPOS (EUPOS) NETWORK SOLUTION MONITORING APPLICATION.

The EUPOS International Steering Committee (ISC),

noting the importance of the EUPOS service quality monitoring,

appreciating the development of an early tool for the quality monitoring of the EUPOS Network RTK service that could supplement the necessity to implement physical monitoring stations into the GNSS reference stations network,

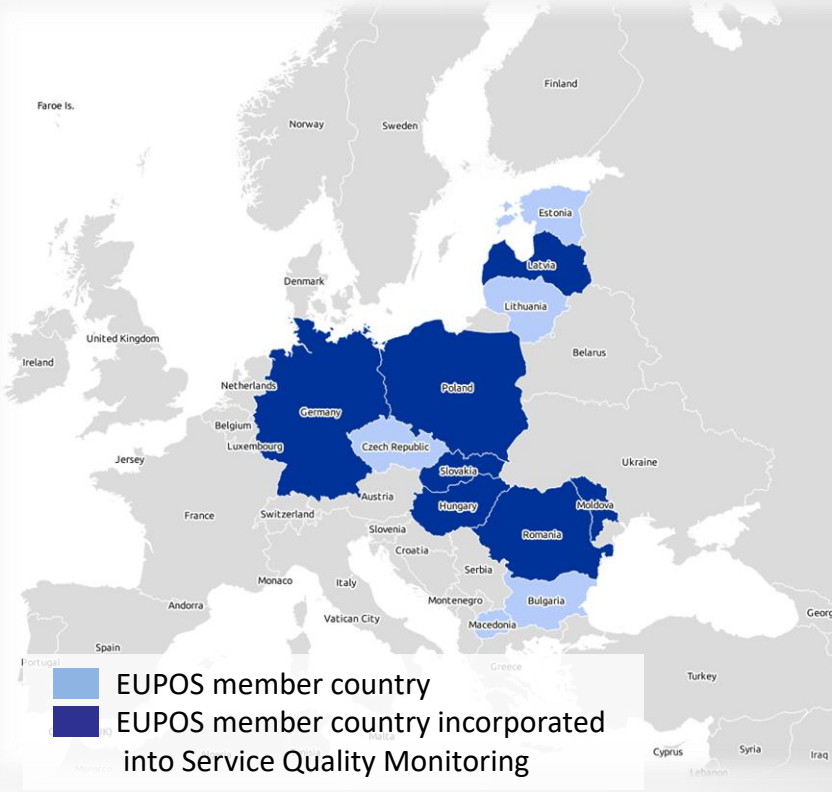
decides to create a EUPOS Working Group on Service Quality Monitoring and

requests Dr Branislav Droscak to chair this Working Group.

EUPOS WG on Service Quality Monitoring (status in November 2018)

- Members
  - Branislav Droščák (Slovakia) – chair
  - Karol Smolík (Slovakia) - programmer

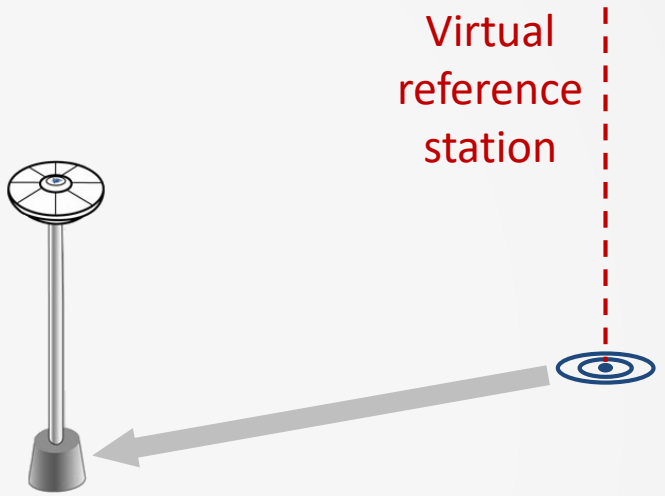
- Contributors
  - Karol Smolík (Slovakia) - SKPOS
  - Szymon Wajda (Poland) – ASG-EUPOS
  - István Galambos (Hungary) – gnssnet.hu
  - Vlad Sorta (Romania) – ROMPOS
  - Christian Trautvetter (Germany) – SAPOS
  - Ivars Degainis (Latvia) – EUPOS-RIGA
  - Pavel Ivancenco (Moldova) – MOLDPOS



- Contributors - recent negotiations
  - Jan Rezníček (Czech rep.) - CZEPOS
  - Besnic Como (Albania) - ALBPOS (in 2017 failed due to misunderstanding)

Monitoring of the network solution quality

EUPOS Service Quality Monitoring



Physical monitoring stations

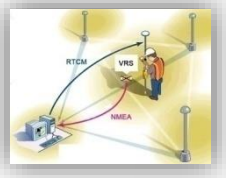
- real value of deviations
- high expenses
- impossibility to monitor entire network

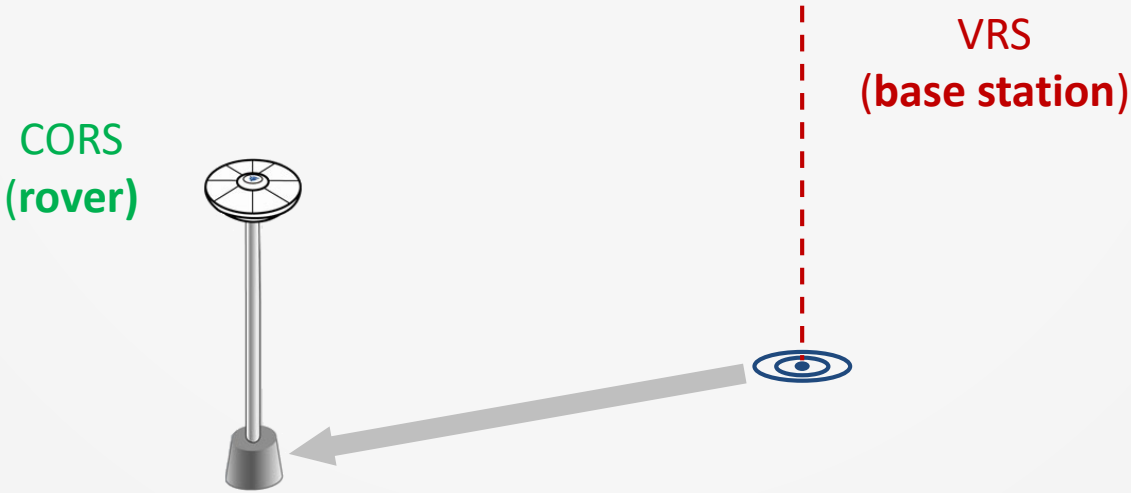
Virtual principle

- no physical monitoring stations
- low cost
- monitoring of the entire network
- virtual principle ≠ real deviation

EUPOS service quality monitoring Principle

- Concept copies the design of SK*POS*® network solution quality monitoring application
- Monitoring independent from the GNSS service provider control software
- Fully automatic solution
- Virtual solution (no physical monitoring stations)



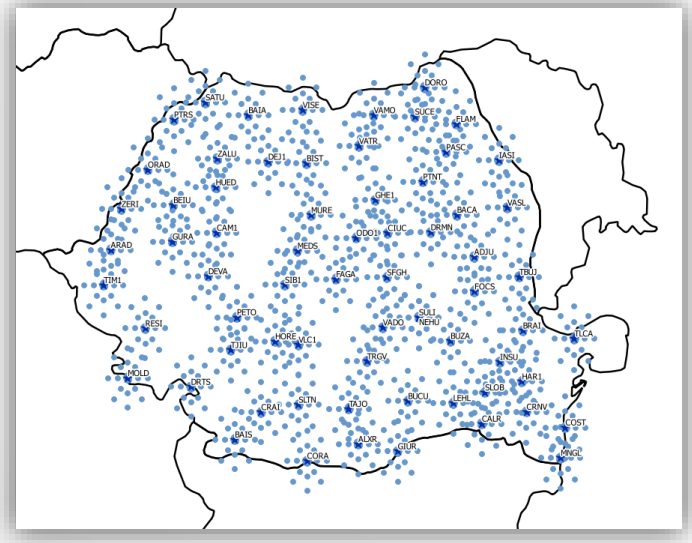


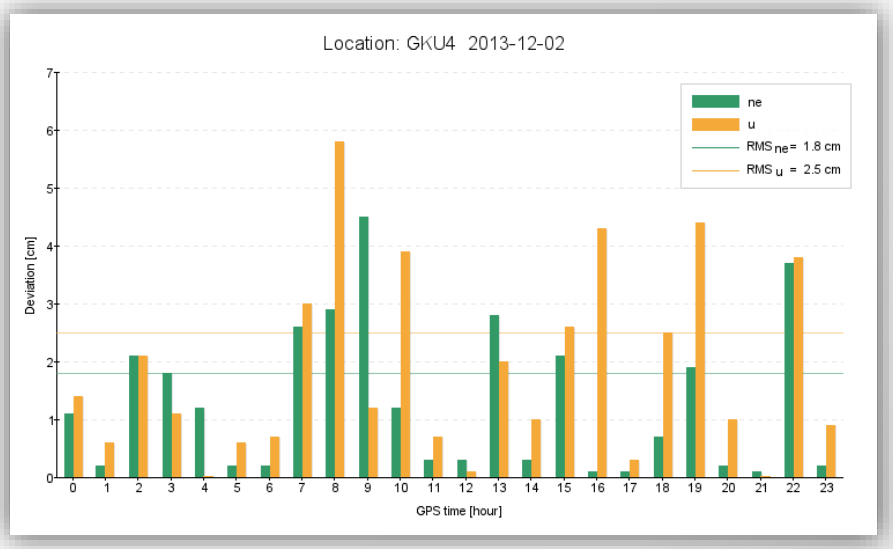
EUPOS service quality monitoring Principle

- Monitoring of the whole territory of countries
- Random generation of (virtual) test points
- Baseline processing by open source RTKNAVI software

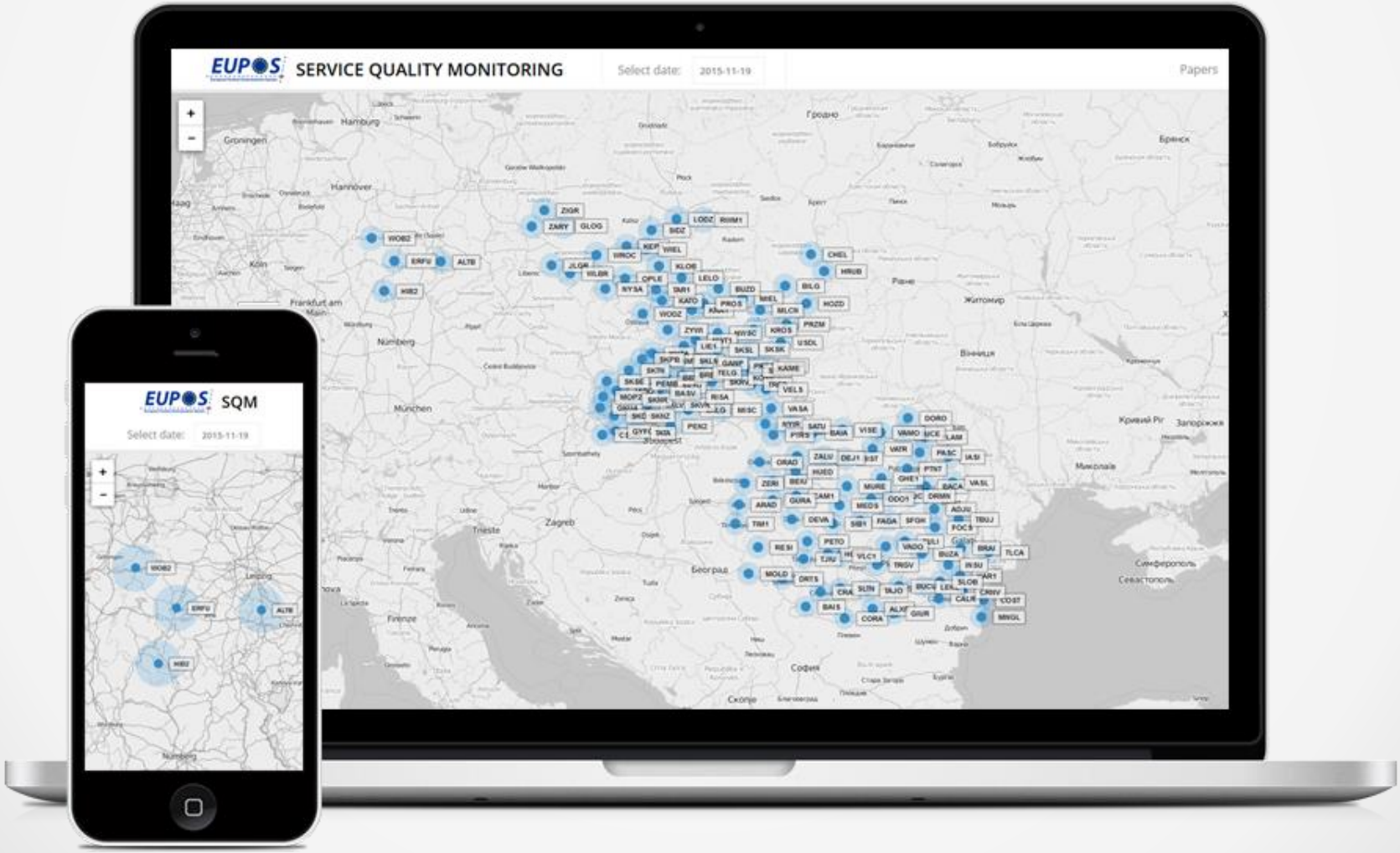
RTKNAVI
www.rtklib.com

- Results (deviations and RMS) available via web/mobile application

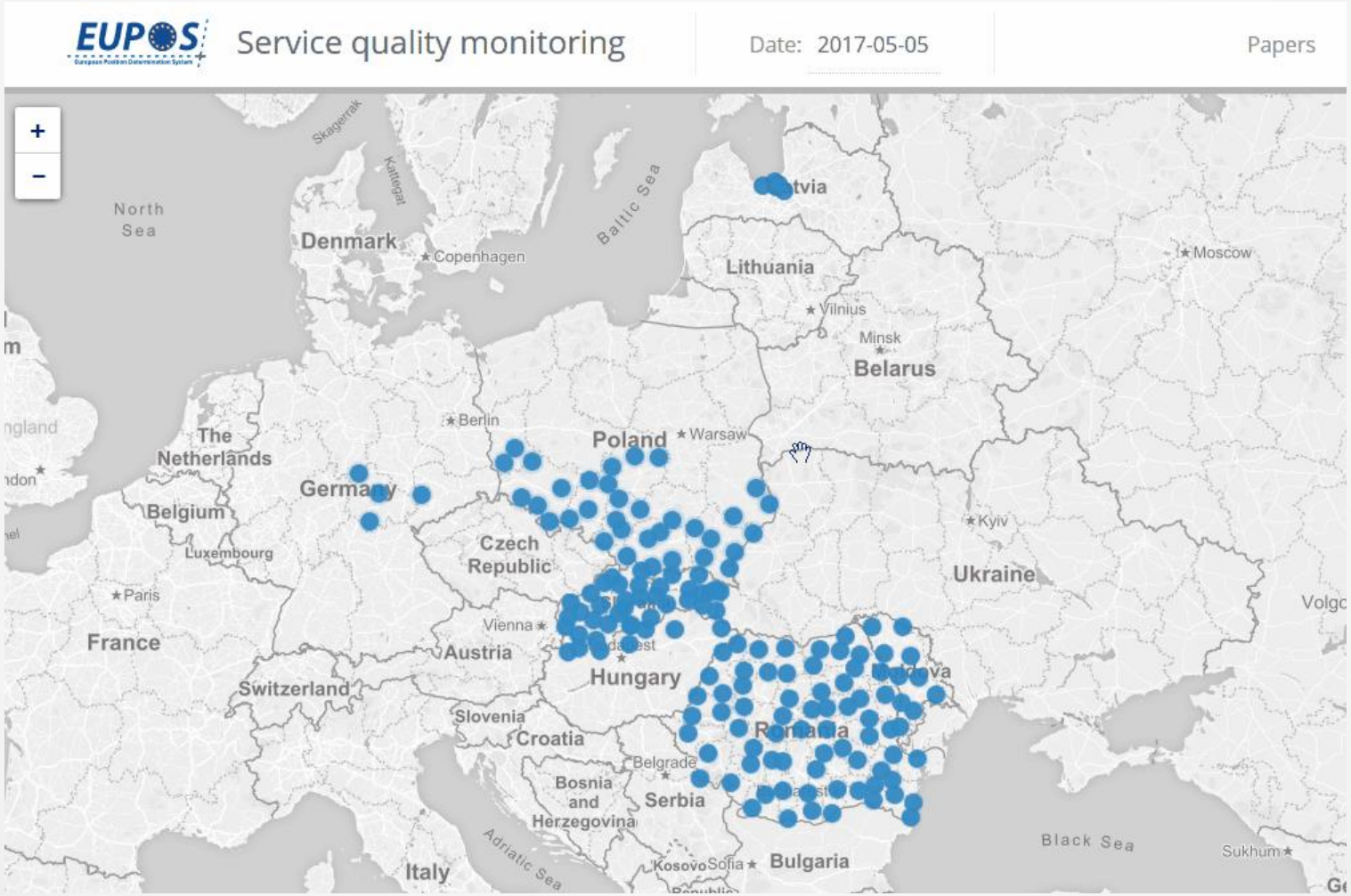




User interface

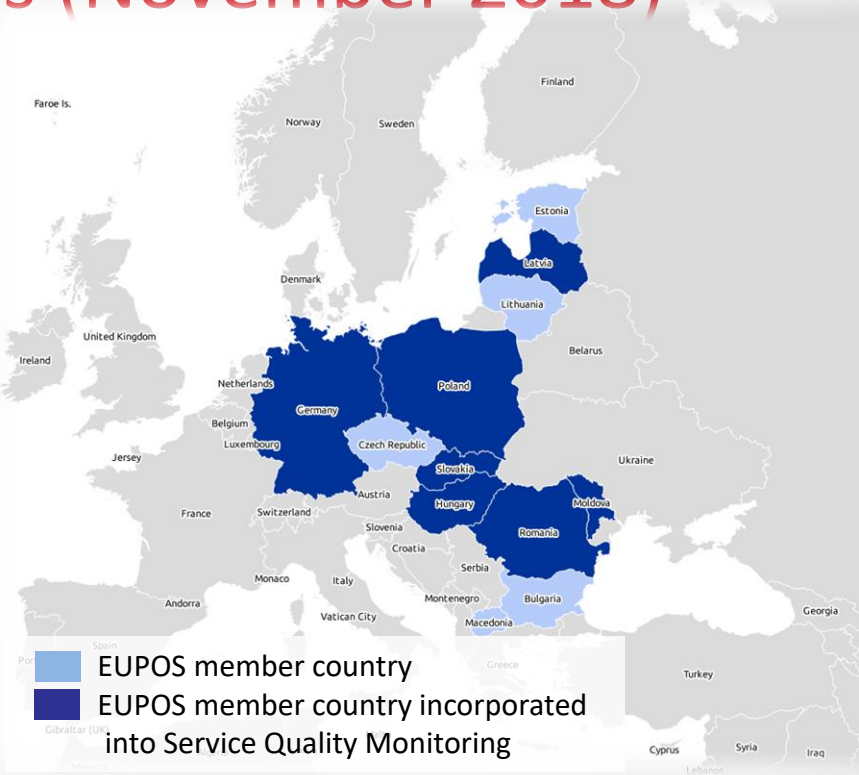


Video demonstration



EUPOS service quality monitoring
Stations and software status (November 2018)

SKPOS	34 stations
ASG eupos	32 stations
GNSSnet.hu GNSS SZOLGÁLTATÓ KÖZPONT	7 stations
ROMPOS Romanian Position Determination System	68 stations
SAPOS	4 stations
RIGA EUPOS	5 stations
MOLDPOS	10 stations
	160 stations



GNSS receiver manufacturers

- Trimble
- Leica
- Topcon
- Javad
- Astech

Softwares:

- Trimble Pivot Platform
- Geo++ GNSMART
- Leica Spider

EUPOS networks deviations comparison
Result statistics (November 2018)

RTK network		SKPOS	ASG eupos	GNSSnet.hu GNSS SZOLGÁLTATÓ KÖZPONT	ROMPOS Romanian Position Determination System	SAPOS	RIGA EUPOS	MOLDPOS	EUPOS European Position Determination System
Software		Trimble Pivot Platform	Trimble Pivot Platform	Geo++ GNSMART	Leica Spider	Trimble Pivot Platform	Geo++ GNSMART	Leica Spider	Σ
Time period		5 years	4 years	4 years	4 years	3 years	3 years	1 year	
Number of monitored stations		34	34	7	68	4	5	10	**160**
Maximal	ne	49.9 cm	45.4 cm	48.7 cm	49.7 cm	49.9 cm	35.3 cm	34.8 cm	
	u	49.8 cm	49.2 cm	49.9 cm	49.9 cm	41.2 cm	49.3 cm	41.1 cm	
Average	ne	1.1 cm	0.9 cm	1.2 cm	1.2 cm	0.9 cm	1.0 cm	1.0 cm	**1.0 cm**
	u	2.4 cm	1.2 cm	1.3 cm	2.6 cm	1.4 cm	1.8 cm	1.3 cm	**1.7 cm**
No fix		14%	7%	15%	18%	9%	25%	28%	**17%**

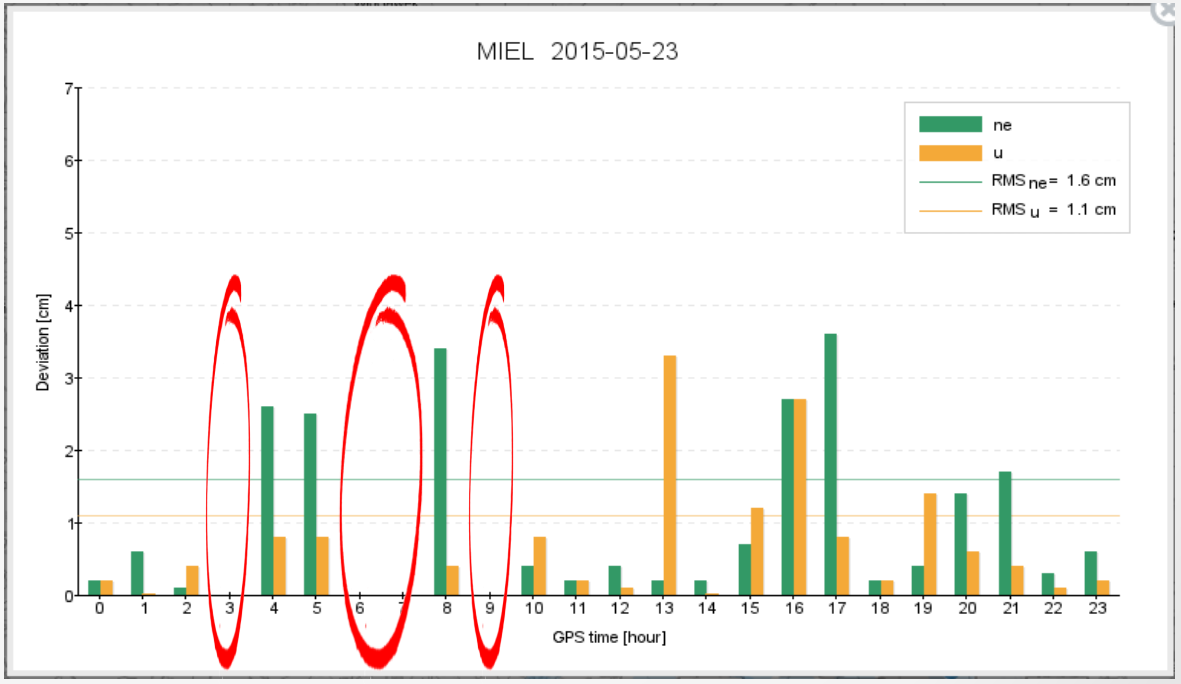
EUPOS networks deviations comparison
Table comparison 2017 vs 2018

RTK network		SKPOS	ASG eupos	GNSSnet.hu GNSS SZOLGÁLTATÓ KÖZPONT	ROMPOS Romanian Position Determination System	SAPOS	RIGA EUPOS	MOLDPOS	EUPOS European Position Determination System
Software		Trimble Pivot Platform	Trimble Pivot Platform	Geo++ GNSMART	Leica Spider	Trimble Pivot Platform	Geo++ GNSMART	Leica Spider	Σ
Number of monitored stations		34	34	7	68	4	5	10	**160**
Maximal 2017 vs 2018	ne	49.9 cm	44.6 cm	48.6 cm	49.7 cm	49.9 cm	35.3 cm	12.8 cm	
	ne	49.9 cm	45.4 cm	48.7 cm	49.7 cm	49.9 cm	35.3 cm	34.8 cm	
Maximal 2017 vs 2018	u	49.8 cm	49.2 cm	49.9 cm	49.9 cm	37.5 cm	49.3 cm	19.1 cm	
	u	49.8 cm	49.2 cm	49.9 cm	49.9 cm	41.2 cm	49.3 cm	41.1 cm	
Average	ne	1.1 cm	0.9 cm	1.2 cm	1.2 cm	0.9 cm	1.0 cm	1.0 cm	**1.0 cm**
	u	2.4 cm	1.2 cm	1.3 cm	2.6 cm	1.4 cm	1.8 cm	1.3 cm	**1.7 cm**
No fix		14%	7%	15%	18%	9%	25%	28%	**17%**

„No fix“ item

RTK network	SKPOS	ASG eupos	GNSSnet.hu	ROMPOS	SAPOS	RIGA EUPOS	MOLDPOS	EUPOS
Software	Trimble Pivot Platform	Trimble Pivot Platform	Geo++ GNSMART	Leica Spider	Trimble Pivot Platform	Geo++ GNSMART	Leica Spider	Σ
No fix	14%	7%	15%	18%	9%	25%	28%	**17%**

- „No fix“ = no value in graphics
  - ambiguity processing failure
    - high ionosphere
    - long baseline/short time
    - …
  - service out of order
  - not know



Some analyzes

Analyzes of deviations according to RTK network control software

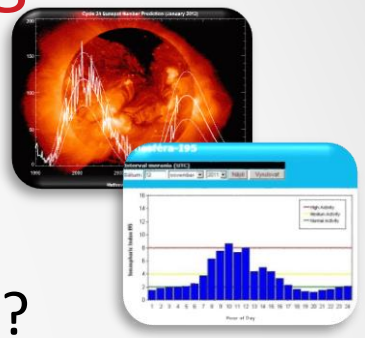
RTK network		SKPOS 14% ASG eupos 7% SAPOS 9%	GNSSnet.hu 15% RIGA EUPOS 25%	ROMPOS 18% MOLDPOS 28%
Software		**Trimble Pivot Platform**	**Geo++ GNSMART**	**Leica Spider**
Number of monitored stations		70	12	78
Maximal	ne	49.9 cm	48.7 cm	49.7 cm
	u	49.8 cm	49.9 cm	49.9 cm
Average	ne	**1.0 cm**	**1.1 cm**	**1.0 cm**
	u	**1.7 cm**	**1.6 cm**	**2.0 cm**
No fix		**10%**	**21%**	**23%**

Analyzes of deviations according to reference stations density

- Density values in km^2 were computed as fraction: country area/number of CORS

RTK network		RIGA EUPOS	SKPOS, SAPOS	ASG eupos, GNSSnet.hu, ROMPOS, MOLDPOS
Density		**< 1000 km^2**	**1000 km^2 – 2000 km^2**	**> 2000 km^2**
Number of monitored stations		5	38	114
Average	ne	1.0 cm	1.0 cm	1.1 cm
	u	1.8 cm	1.9 cm	1.6 cm
No fix		25%	12%	17%

Analyzes of „No fix“ values according to dependency on high ionosphere = Day/night



- Test assumption: Ionosphere is during night lower!
- Q: Are „no fix“ values from monitoring lower at nights?

		SKPOS	ASG eupos	GNSSnet.hu GNSS SZOLGÁLTATÓ KÖZPONT	ROMPOS Romanian Position Determination System	SAPOS	RIGA EUPOS	MOLDPOS	EUPOS European Position Determination System
Average value „day“	ne	1.3	1.2	1.6	1.6	1.1	1.3	1.4	1.4
	u	2.4	1.3	1.3	1.4	1.4	1.9	1.6	1.6
Average value „night“	ne	0.9	0.7	1.2	1.0	0.7	0.8	0.9	0.9
	u	2.4	1.2	1.3	1.3	1.2	1.8	1.5	1.5
No fix „day“		17%	8%	19%	20%	12%	30%	30%	19%
No fix „night“		11%	6%	11%	16%	6%	20%	25%	14%

Analyzes of „No fix“ values according to dependency on high ionosphere
Control software day/night comparison

RTK network		SKPOS, ASG eupos, SAPOS	GNSSnet.hu, RIGA EUPOS	ROMPOS, MOLDPOS
Software		**Trimble Pivot Platform**	**Geo++ GNSMART**	**Leica Spider**
Average value „day“	ne	1.2	1.5	1.6
	u	1.7	1.7	1.3
Average value „night“	ne	0.8	0.9	1.2
	u	1.6	1.6	1.3
No fix „day“		15%	26%	20%
No fix „night“		8%	16%	16%

Summary and conclusions

- monitoring tool available on http://monitoringEUPOS.gku.sk on EUPOS web page www.eupos.org
- results from the monitoring confirm „cm“ quality of EUPOS countries network RTK
- performed analysis
  - confirm:
    - „no fix“ values dependency on high ionosphere
  - do not confirm deviations dependency on:
    - network RTK control software
    - reference stations network density
    - brand of the receiver
- more analysis in future is needed
  - No fix differences
  - average ne/u components differences

Would like to join EUPOS WG serivce quality monitoring?

Contact us:
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Thank you for your attention

Branislav Droscak