Service Quality Monitoring

Working group status

Ing. Karol Smolík

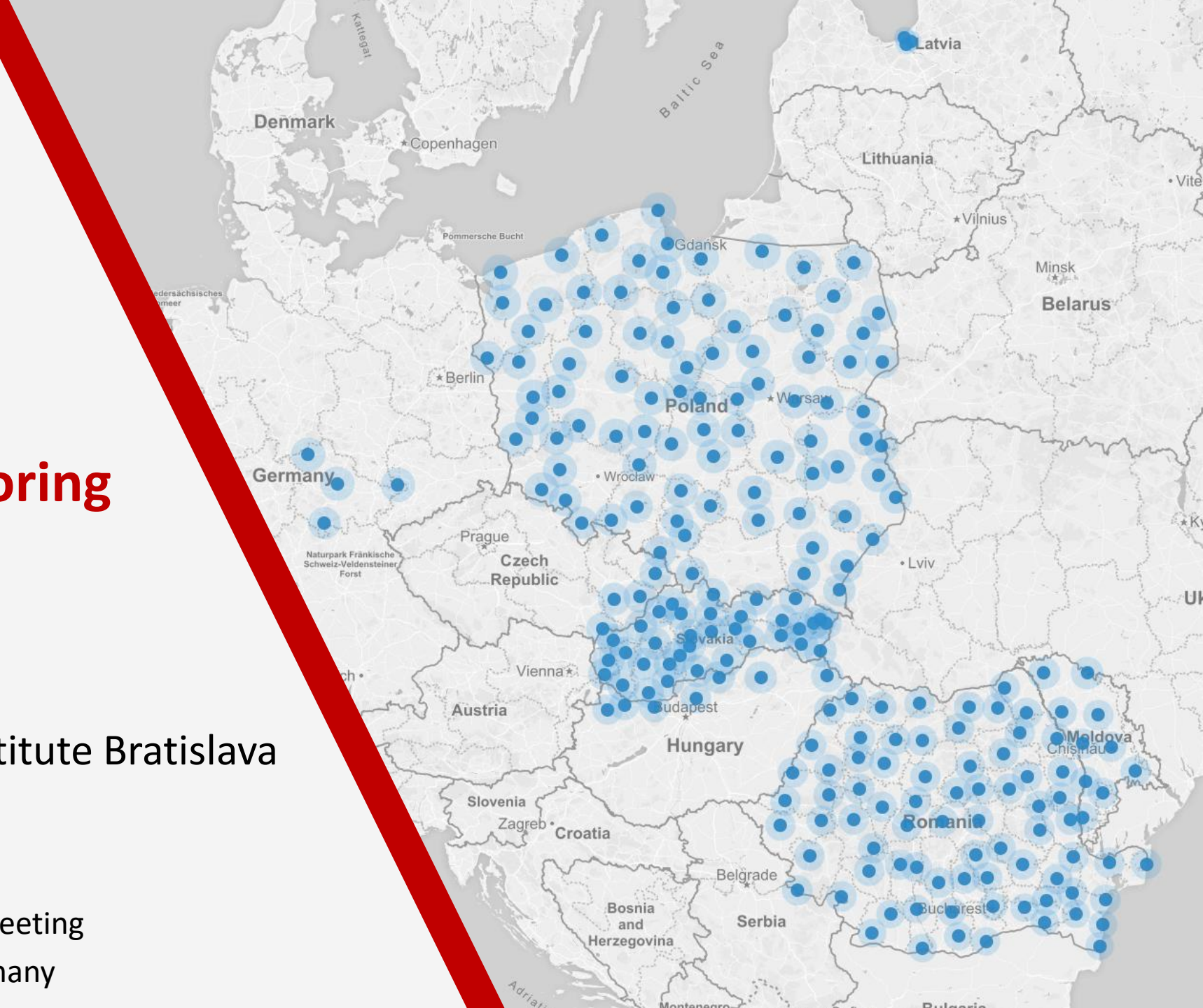
karol.smolik@skgeodesy.sk

Geodetic and Cartographic Institute Bratislava

EUPOS
European Position Determination System

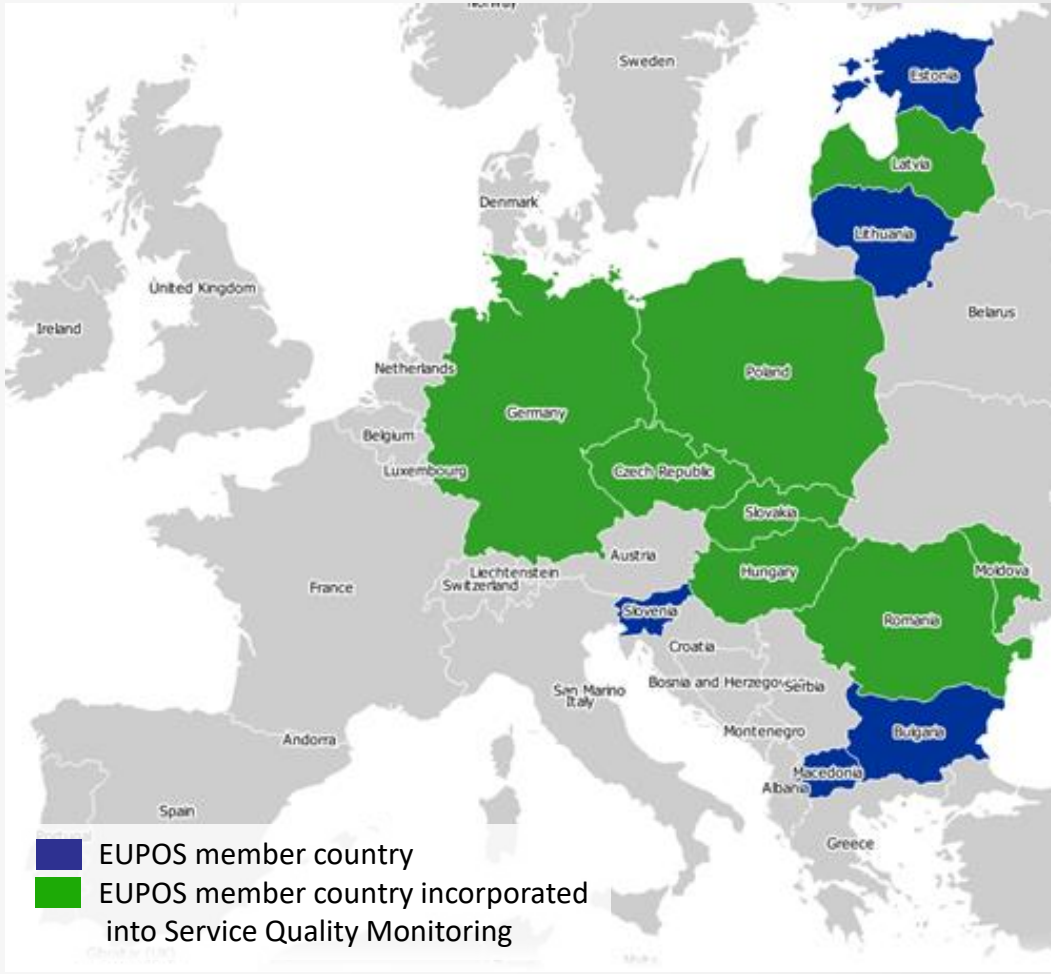
11th EUPOS Council and Technical Meeting

October 21-22, 2025, Berlin, Germany



EUPOS WG on Service Quality Monitoring

- established in 2014
- inspired by Czech and Slovakian solution
- aims:
  - creation of the uniform common network RTK quality monitoring tool based on virtual monitoring stations for all EUPOS member countries
- working group members
  - Karol Smolík (Slovakia) - chair
  - Branislav Droščák (Slovakia)
- WG cooperators
  - Szymon Wajda (Poland) – ASG-EUPOS
  - István Galambos (Hungary) – gnssnet.hu
  - Vlad Sorta, Miluta Flueras, Victor Crasnopolschi (Romania) – ROMPOS
  - Christian Trautvetter (Germany) – SAPOS
  - Rolands Pinta (Latvia) – EUPOS-RIGA
  - Alexandr Mihailov (Moldova) – MOLDPOS
  - Jan Řezníček (Czech Republic) – CZEPOS



End of 2024



- migrated to a new server
- new version of
  - Windows Server
  - Apache web server
  - PHP
  - MariaDB

Windows Server 2022

APACHE

php

MariaDB

Cyber attack on January 5/2025

- massive cyber attack in Slovakia
- affected:
  - Land registry
  - Cadaster offices
  - Websites
  - SKPOS
  - GIS web services
  - **Including EUPOS SQM**



Current status



Ready

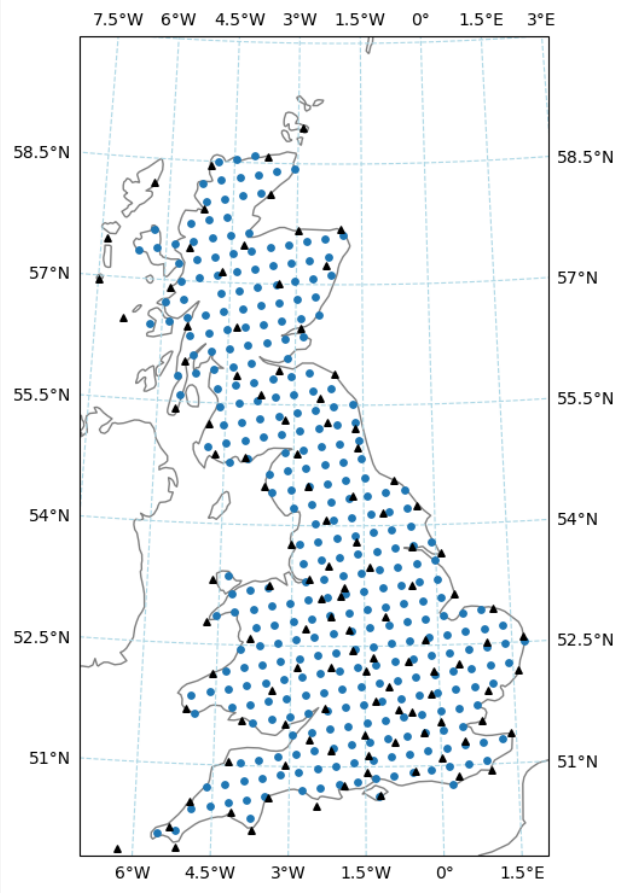
- SKPOS monitoring
- servers
- recovered source codes
- recovered database
- installed web server and database

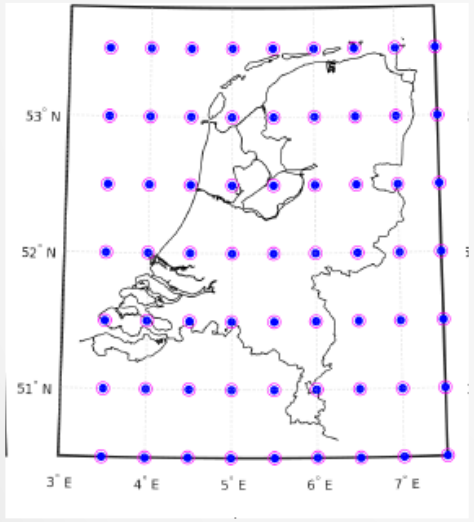
Still waiting

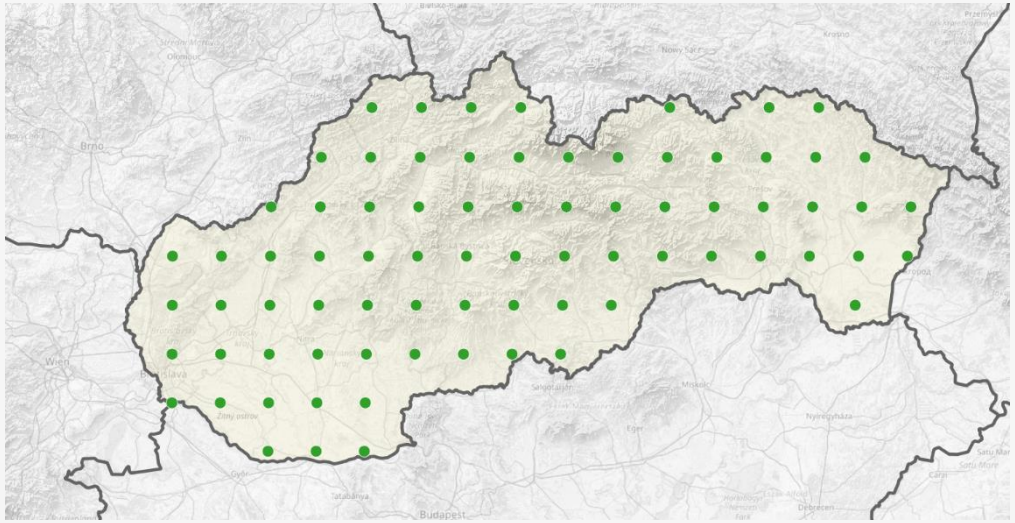
- permission for all external casters
- exceptions in firewall and proxy
- installation of source codes and app testing
- hardening
- purchase and installation of a TLS certificate
- vulnerability and penetration tests
- publication at https://monitoringEupos.gku.sk

Reference frame validation of a network RTK service using the Grid check approach

- approach was invented by Lennard Huisman (NSGI – Kadaster, Netherlands)
- validation of end product not the input data
- tested in the Netherlands, Great Britain, Slovakia
- grid check approach
  - reguest VRS data for grid of locations
  - compute coordinates for VRS using Bernese according EUREF guidelines for densification
  - compare computed coordinates with coordinates of requested locations







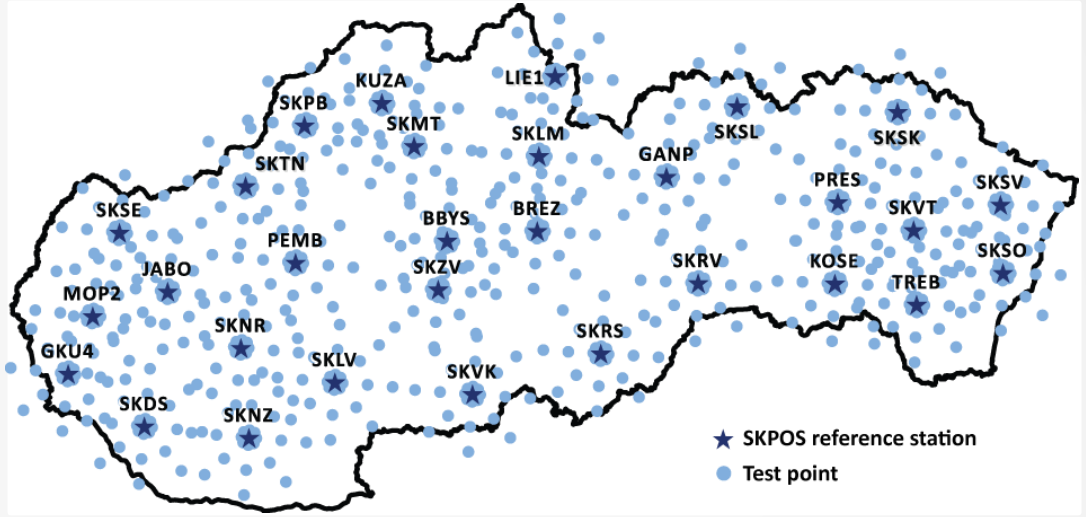
EUPOS SQM vs Grid check

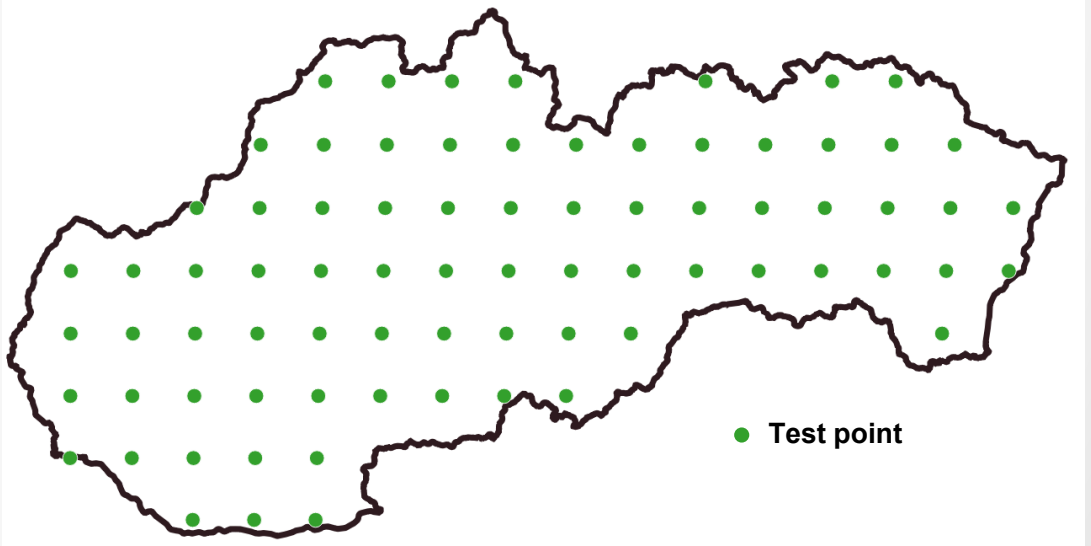
	EUPOS SQM	Grid Check
Concept	VRS	VRS
Method	RTK	Static
Computation software	RTKNAVI	Bernese
Results	Real-time	Postprocessing
Density of results	hourly	daily
Monitored area	up to 20 km from the station	whole area depends on the grid density
Focus	RTK service monitoring	reference frame validation

EUPOS SQM vs Grid check

Comparison in the SKPOS network

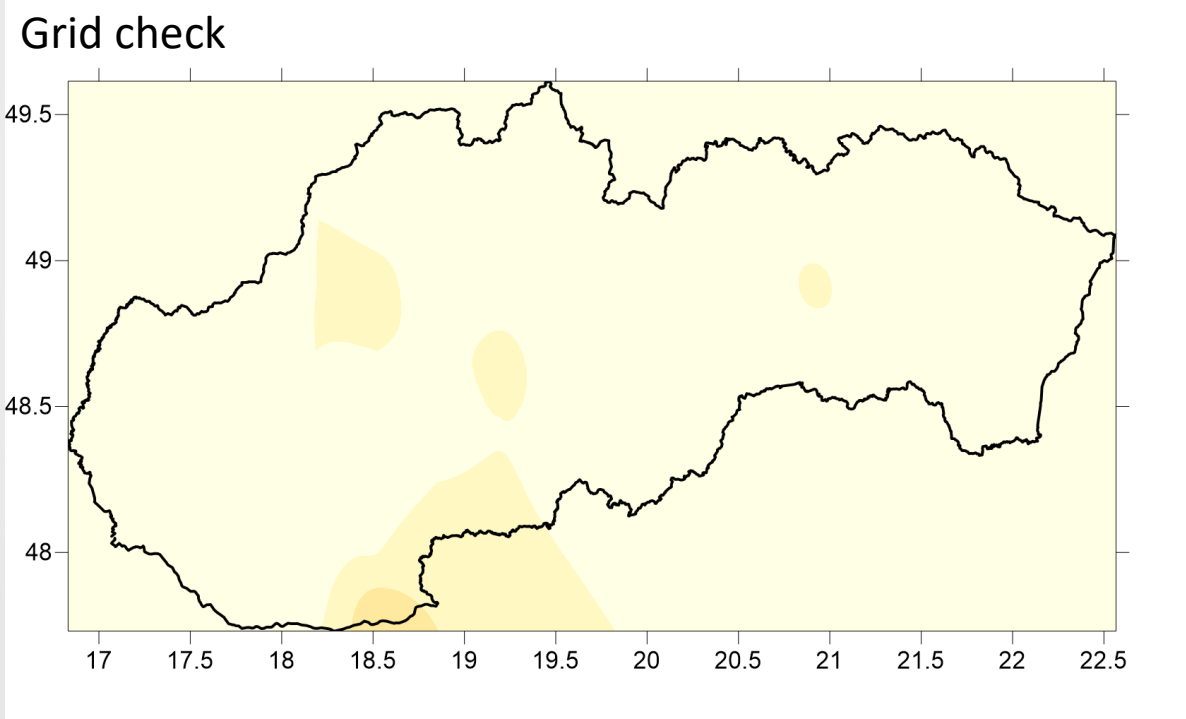
- EUPOS SQM
  - 24 different VRS around each stations per day = 840 VRS
  - 2-minute RTK
  - computation in RTKNAVI
  - GPS, GLO, GAL, BDS
- grid check
  - 25 x 25 km grid = 77 VRS
  - 24-hour rinex files
  - computation in Bernese
  - GPS, GLO, GAL



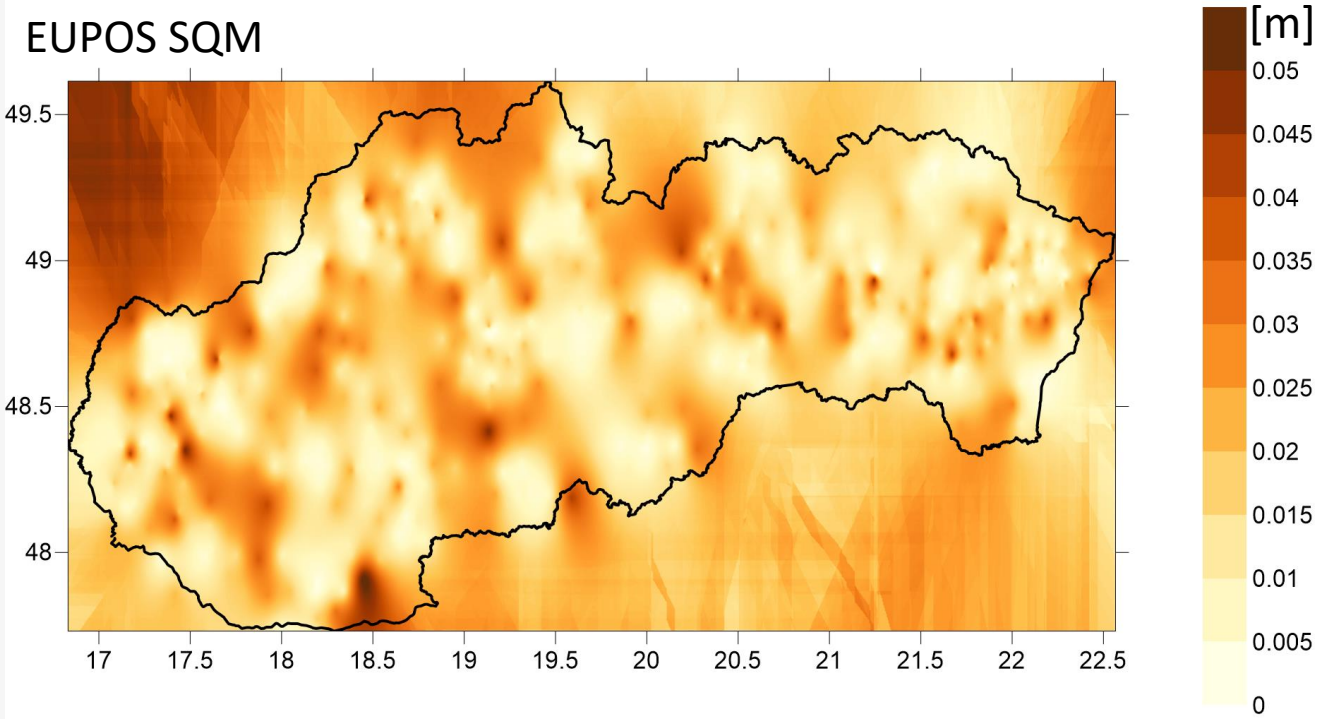


EUPOS SQM vs Grid check

Comparison in the SKPOS network – horizontal difference



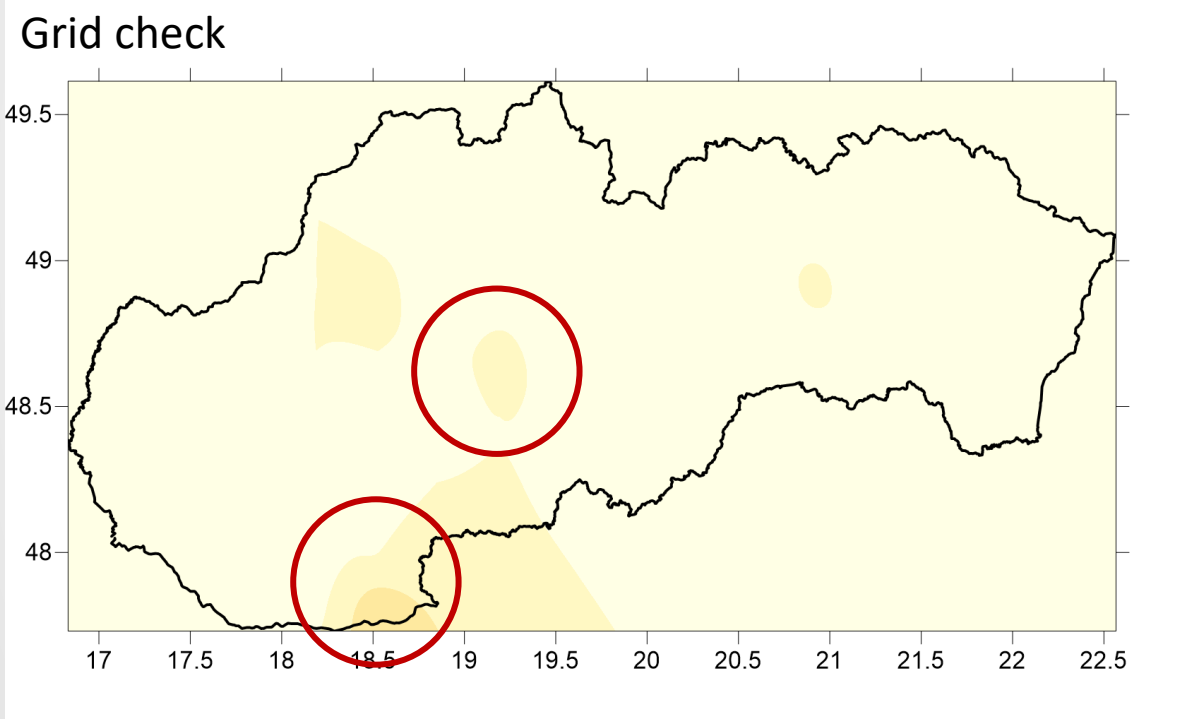
Max: 0.014 m
Avg: 0.002 m



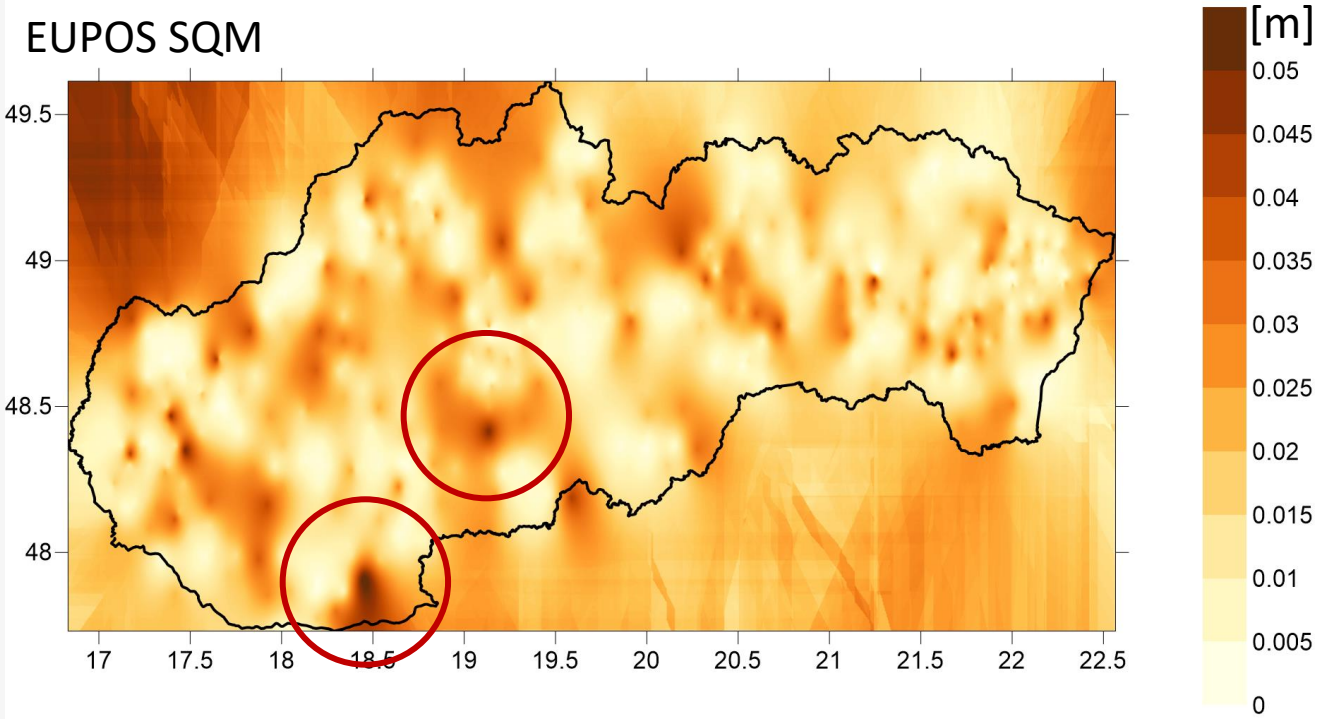
Max: 0.047 m
Avg: 0.011 m

EUPOS SQM vs Grid check

Comparison in the SKPOS network – horizontal difference



Max: 0.014 m
Avg: 0.002 m



Max: 0.047 m
Avg: 0.011 m

Plans

- full restoration of SQM monitoring
- comparison of the virtual principle with the new physical stations in Slovakia
- deeper analysis of the differences between EUPOS SQM and Grid check

Thank you for your attention

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