National report of Slovakia

Ing. Karol Smolík

karol.smolik@skgeodesy.sk

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
SKPOS stations infrastructure

February 2021

- Station relocation
  - reinforced-concrete pillar instead of roof monumentation
SKPOS stations infrastructure

June 2021

- New station in Devičany
SKPOS stations infrastructure

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

SKVT  VRAN

September 2021
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 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
SKPOS Infrastructure

- **Control software:**
  - 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**

<table>
<thead>
<tr>
<th>SKPOS</th>
<th>Component</th>
<th>GPS + GLONASS + Galileo + BeiDou</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antennas</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Receivers</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td><strong>Trimble Pivot</strong></td>
<td></td>
</tr>
<tr>
<td>RINEX CORS, VRS</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>RTK VRS</td>
<td><strong>2018-10-16</strong></td>
<td>✔️</td>
</tr>
</tbody>
</table>

11% of users use Galileo and BeiDou

- **RTCM 3.1**
- **RTCM 3.2**
- **CMRx**
- **CMR+**
- **RTCM 2.3**
- **DGPS 2.1**
- **DGPS 2.3**
SKPOS portfolio
Data formats – content - charges

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

<table>
<thead>
<tr>
<th>Package</th>
<th>Content</th>
<th>Duration</th>
<th>Format</th>
<th>Flat rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKPOS_mm</td>
<td>RINEX 1000 h</td>
<td>year</td>
<td>RINEX 2.x, 3.x</td>
<td>50 €</td>
</tr>
<tr>
<td>SKPOS_cm (year)</td>
<td>RTK unlimited + 50 h RINEX</td>
<td>year</td>
<td>RTCM 2.3, 3.1, RTCM 3.2, CMRx, CMR+</td>
<td>50 €</td>
</tr>
<tr>
<td>SKPOS_cm (month)</td>
<td>RTK unlimited</td>
<td>month</td>
<td>RTCM 2.3, 3.1, RTCM 3.2, CMRx, CMR+</td>
<td>19 €</td>
</tr>
<tr>
<td>SKPOS_dm</td>
<td>DGNSS unlimited</td>
<td>year</td>
<td>RTCM 2.1, 2.3</td>
<td>20 €</td>
</tr>
</tbody>
</table>
## SKPOS portfolio

### Data formats

<table>
<thead>
<tr>
<th>Mountpoint</th>
<th>Data format</th>
<th>GNSS</th>
<th>Data rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKPOS_DM_SVK</td>
<td>RTCM 2.1</td>
<td>GPS</td>
<td>0.1 kB/s</td>
</tr>
<tr>
<td>SKPOS_DM_SVK_23</td>
<td>RTCM 2.3</td>
<td>GPS, GLO</td>
<td>0.2 kB/s</td>
</tr>
<tr>
<td>SKPOS_CM_23</td>
<td>RTCM 2.3</td>
<td>GPS, GLO</td>
<td>0.8 kB/s</td>
</tr>
<tr>
<td>SKPOS_CM_31</td>
<td>RTCM 3.1</td>
<td>GPS, GLO</td>
<td>0.3 kB/s</td>
</tr>
<tr>
<td>SKPOS_CM_32</td>
<td>RTCM 3.2 MSM5</td>
<td>GPS, GLO, GAL, BDS</td>
<td>1.0 kB/s</td>
</tr>
<tr>
<td>SKPOS_CM_32_MSM7</td>
<td>RTCM 3.2 MSM7</td>
<td>GPS, GLO, GAL, BDS</td>
<td>1.1 kB/s</td>
</tr>
<tr>
<td>SKPOS_CM_CMRx</td>
<td>CMRx</td>
<td>GPS, GLO, GAL, BDS</td>
<td>0.4 kB/s</td>
</tr>
<tr>
<td>SKPOS_CM_CMRxplus</td>
<td>CMRx+</td>
<td>GPS, GLO</td>
<td>0.3 kB/s</td>
</tr>
</tbody>
</table>
SKPOS Online Postprocessing

- Application for calculating static measurement
- Based on Trimble Pivot Platform
SKPOS Online Postprocessing

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

Výsledok pre bod: XVII

<table>
<thead>
<tr>
<th>Súradnice vztiahnuté k meranému bodu</th>
<th>Hodnota</th>
<th>σ [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>X [m]</td>
<td>393650.070</td>
<td>0.140</td>
</tr>
<tr>
<td>Y [m]</td>
<td>156095.526</td>
<td>0.063</td>
</tr>
<tr>
<td>Z [m]</td>
<td>475381.679</td>
<td>0.151</td>
</tr>
<tr>
<td>Elipsoidická šírka</td>
<td>48° 29’ 52.76563” N</td>
<td>0.033</td>
</tr>
<tr>
<td>Elipsoidická dĺžka</td>
<td>21° 37’ 6.37226” E</td>
<td>0.023</td>
</tr>
<tr>
<td>Elipsoidická výška</td>
<td>163.066 m</td>
<td>0.212</td>
</tr>
</tbody>
</table>

Uvážme preto: Červenou barvou sú znázornené smerodajné odchylky prekrájujúce resp. 0,05m pri elipsoidickej výške. Zvažte prosím vhodnosť výsledkov pre Vašu prácu.
Number of users

- Number of users: 2216 (Nov. 2021)
Maximum simultaneous login

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

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

- Slovak geodesy, cartography and cadastral authority plan to Open this topic and change the law
Thank you for your attention

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