

GNSS and InSAR collocation (experience from Slovakia)

Branislav Droščák¹, Juraj Papčo²

branislav.droscak@skgeodesy.sk, juraj.papco@stuba.sk

¹Geodetic and Cartographic Institute Bratislava

²Slovak university of Technology in Bratislava



9th EUPOS Technical meeting

22-23 November 2023, Riga, Latvia



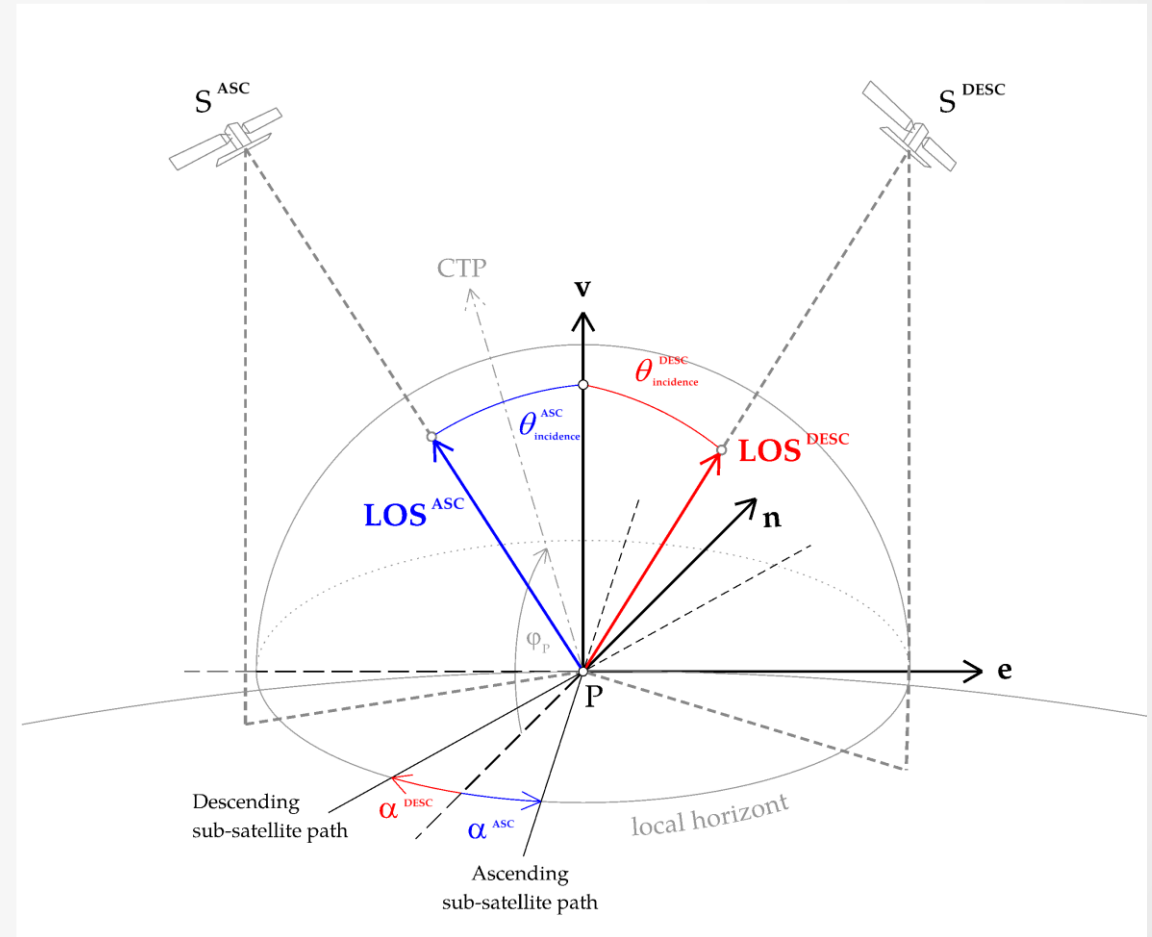
Establishment of „National InSAR reflector network“ to reference InSAR results

- **InSAR** (Interferometric Synthetic Aperture radar) vs „Conventional“ geodetic techniques:

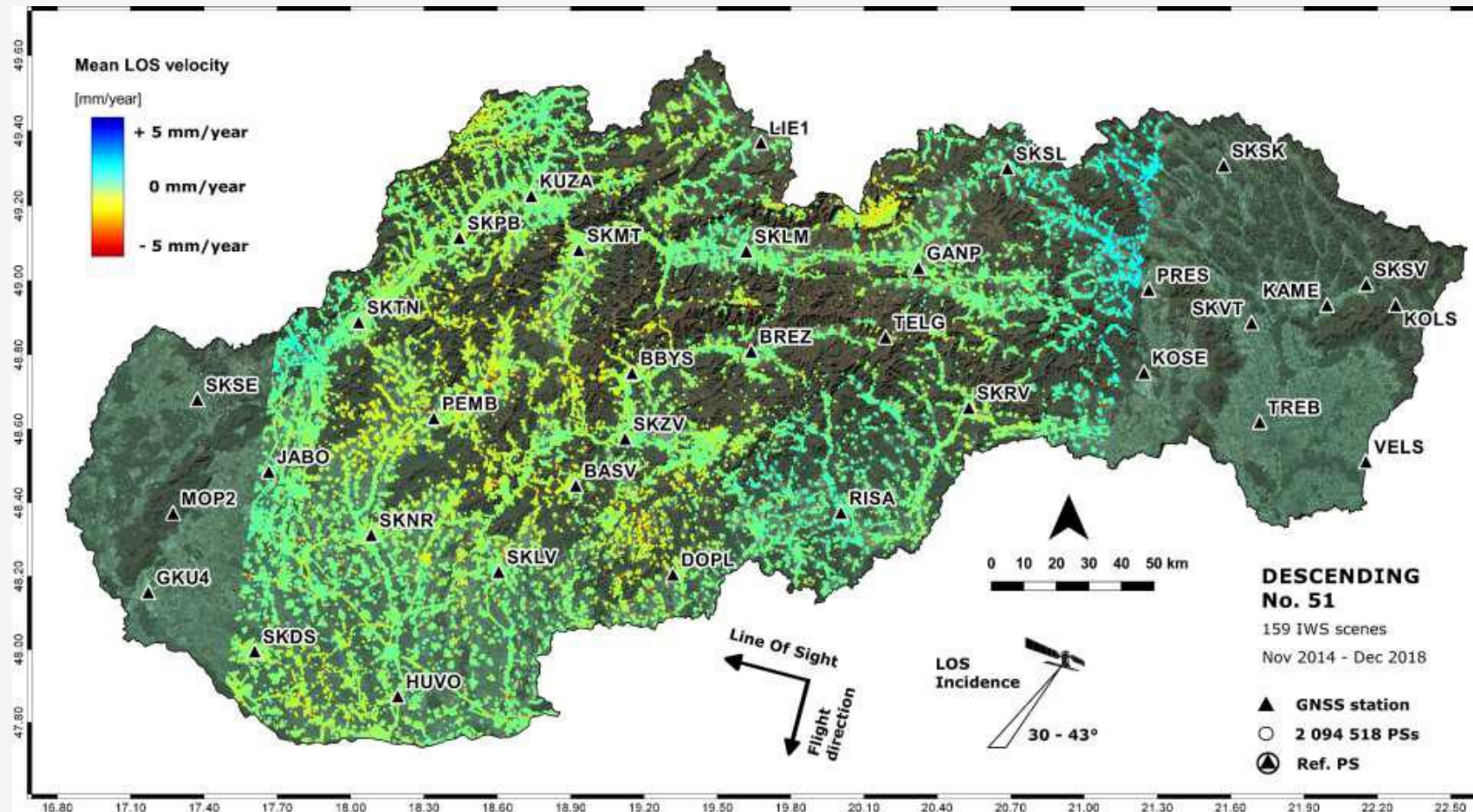
- **Different** datum (ref. frame)
- **Different** geometry
- **Different** benchmarks
- **Different** observation time

- **National InSAR reflector network**

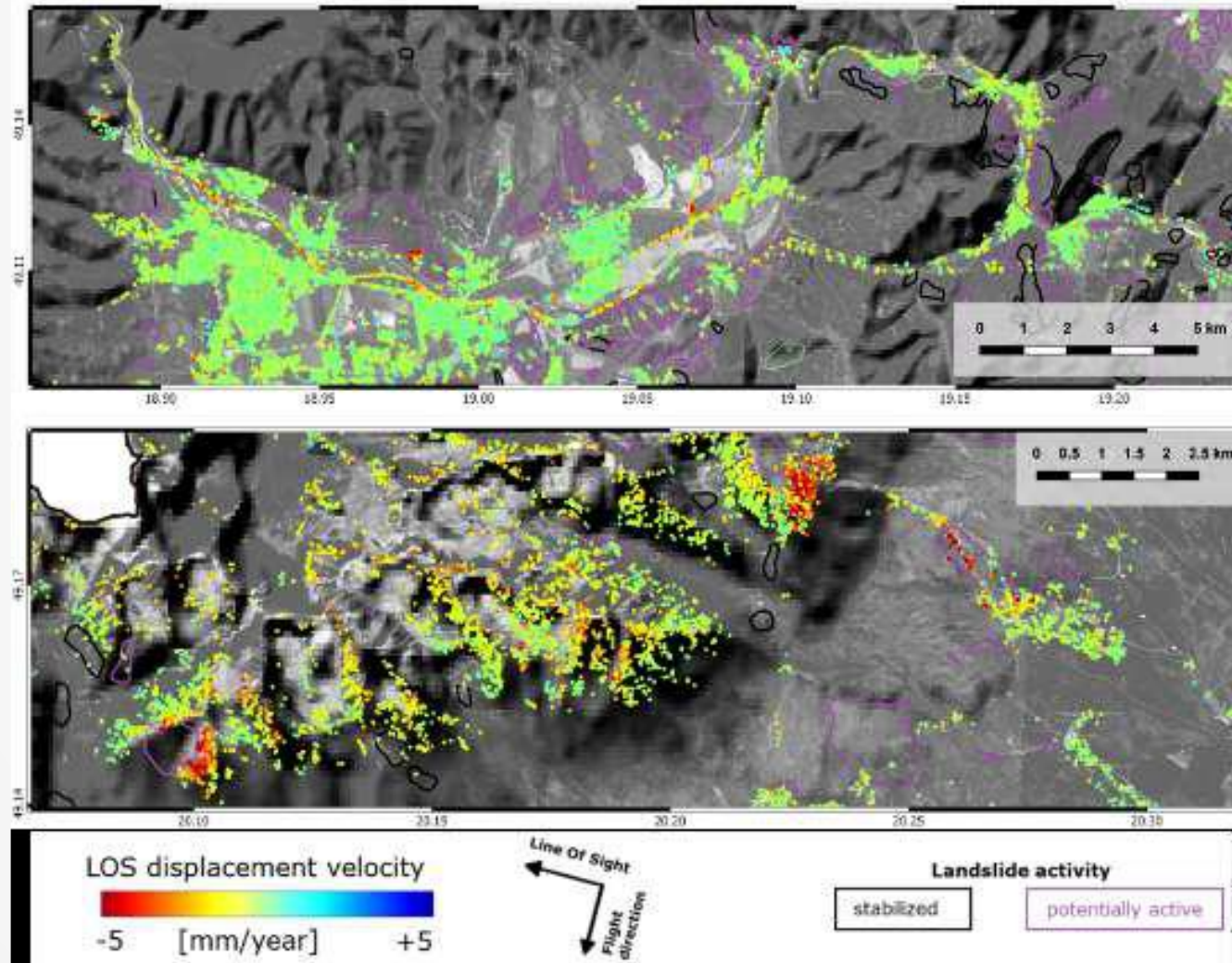
- consist of set of artificial reflectors with precise ETRS89 coordinates of its phase centers



„National InSAR reflector network“ will serve for state wide vertical monitoring = doing levelling only where it will be needed



„National InSAR reflector network“ will serve for regional monitoring
= suitable e.g. for geologists

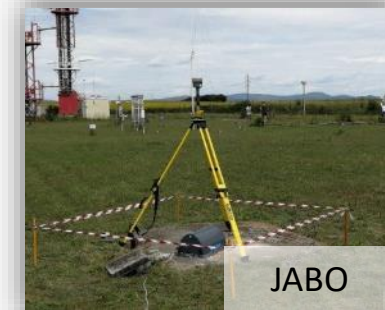
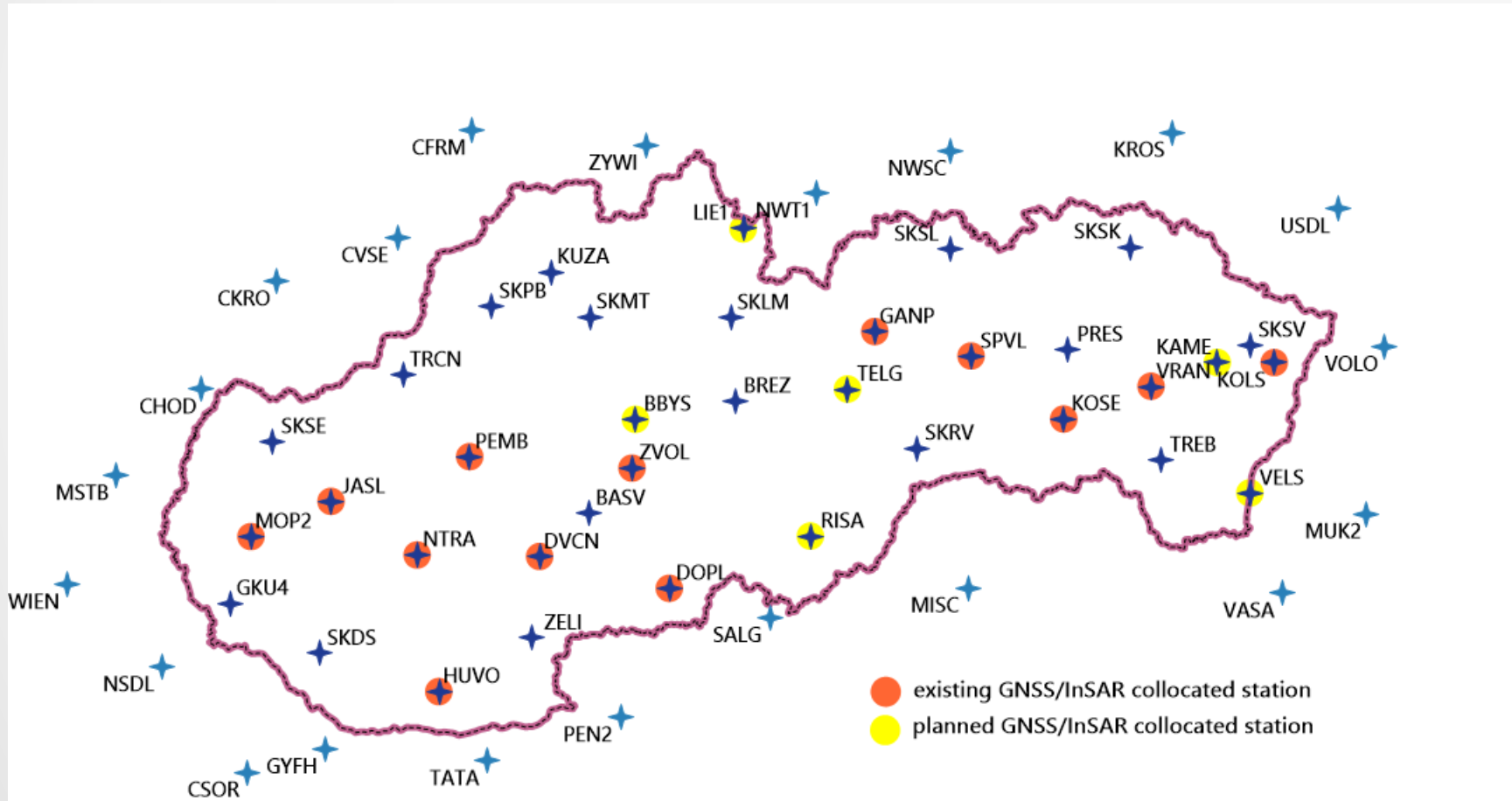


Collocation with GNSS on SKPOS CORS

- via artificial SAR reflector (known phase center)
 - Passive: corner reflector
 - Active: radar transponder
- collocation ensure:
 - linking of InSAR networks from individual Sentinel-1 satellite tracks
 - InSAR measurements to the national realization of ETRS89
 - absolute deformation time series
 - calibration of systematic effects

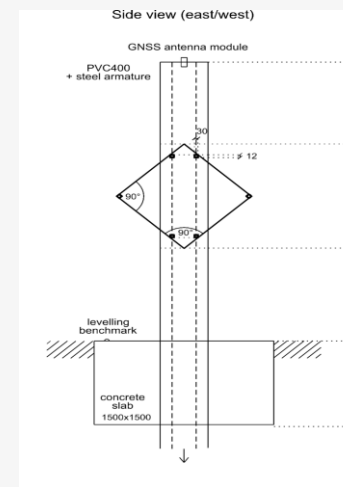
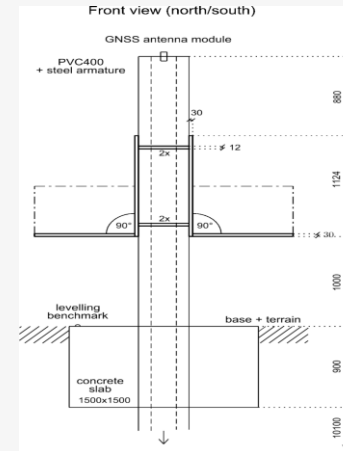
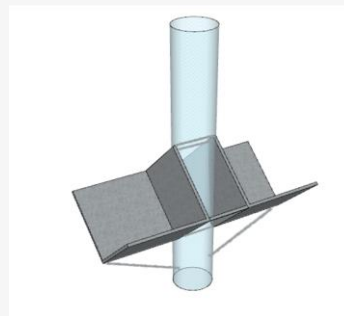


SKPOS GNSS/InSAR collocation sites (status in November 2023 = 13 sites)



GNSS/InSAR collocation site with passive reflector – slovakian design

- InSAR:
 - no secondary reflection
 - > 1 m over terrain
 - > 20 dB SCR
- GNSS
 - no effect multipath
 - > 1.3 m over InSAR reflector
- robust construction
- phase center – measured precise



GNSS/InSAR collocation site with passive reflector Installation on the new SKPOS CORS (new pillar)



GNSS/InSAR collocation site with passive reflector Installation on the existing SKPOS pillar



Active transponder (electricity needed)

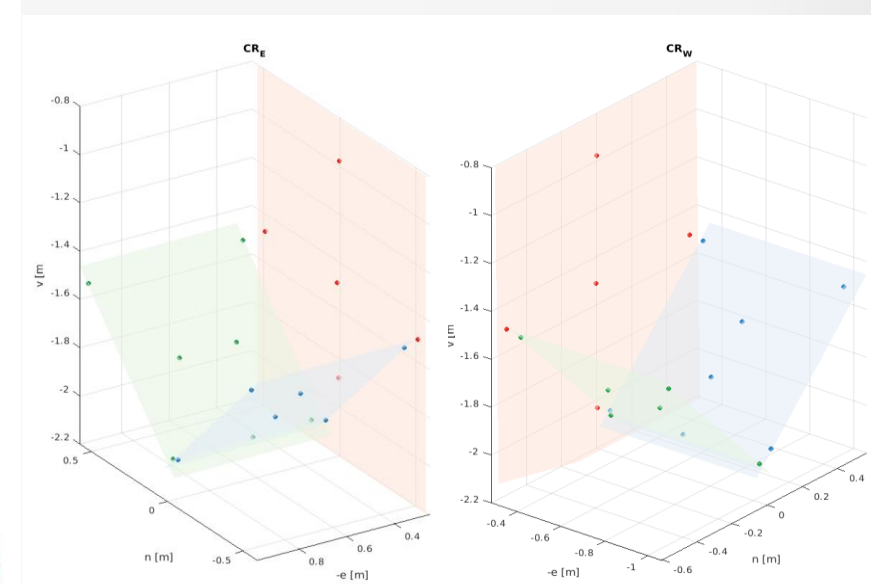
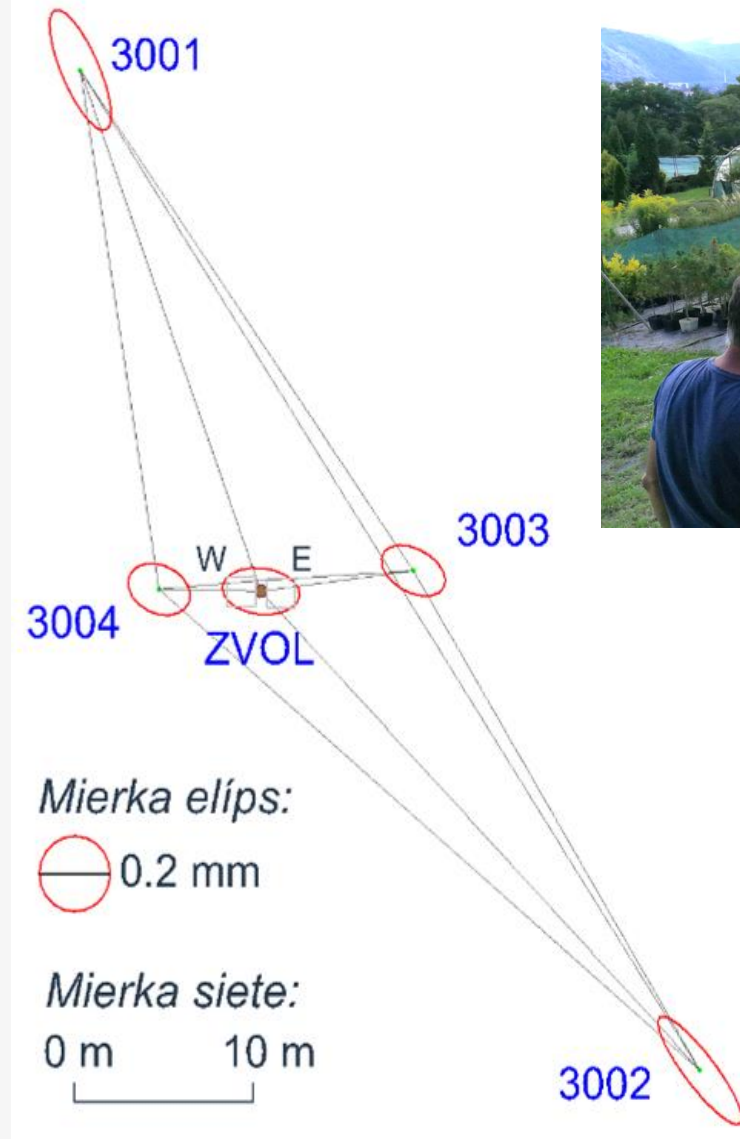
Eccentric placement = not very comparable with GNSS



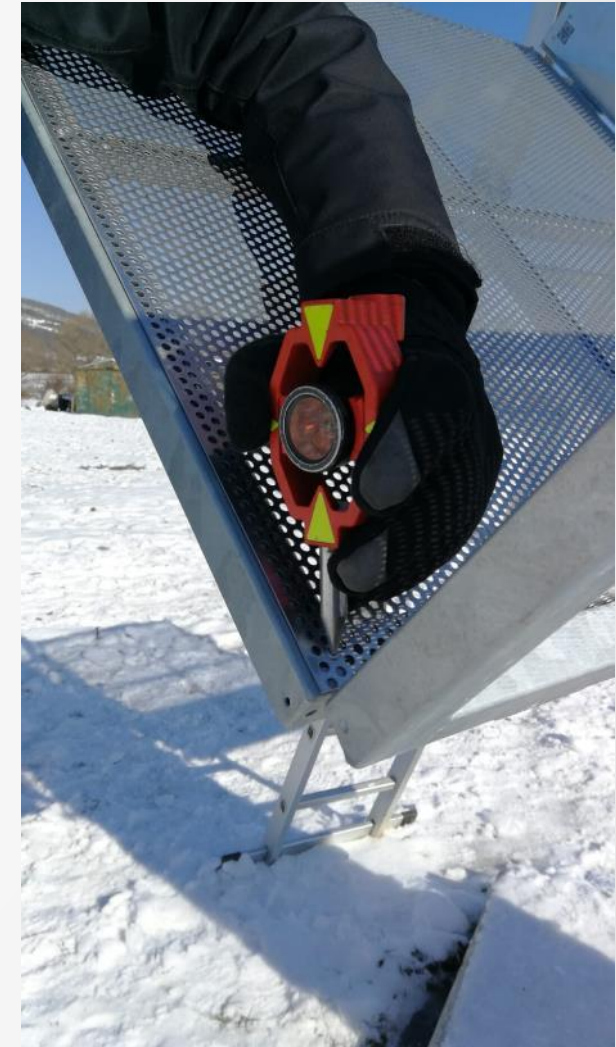
Determination of passive InSAR reflector phase center coordinates is very important



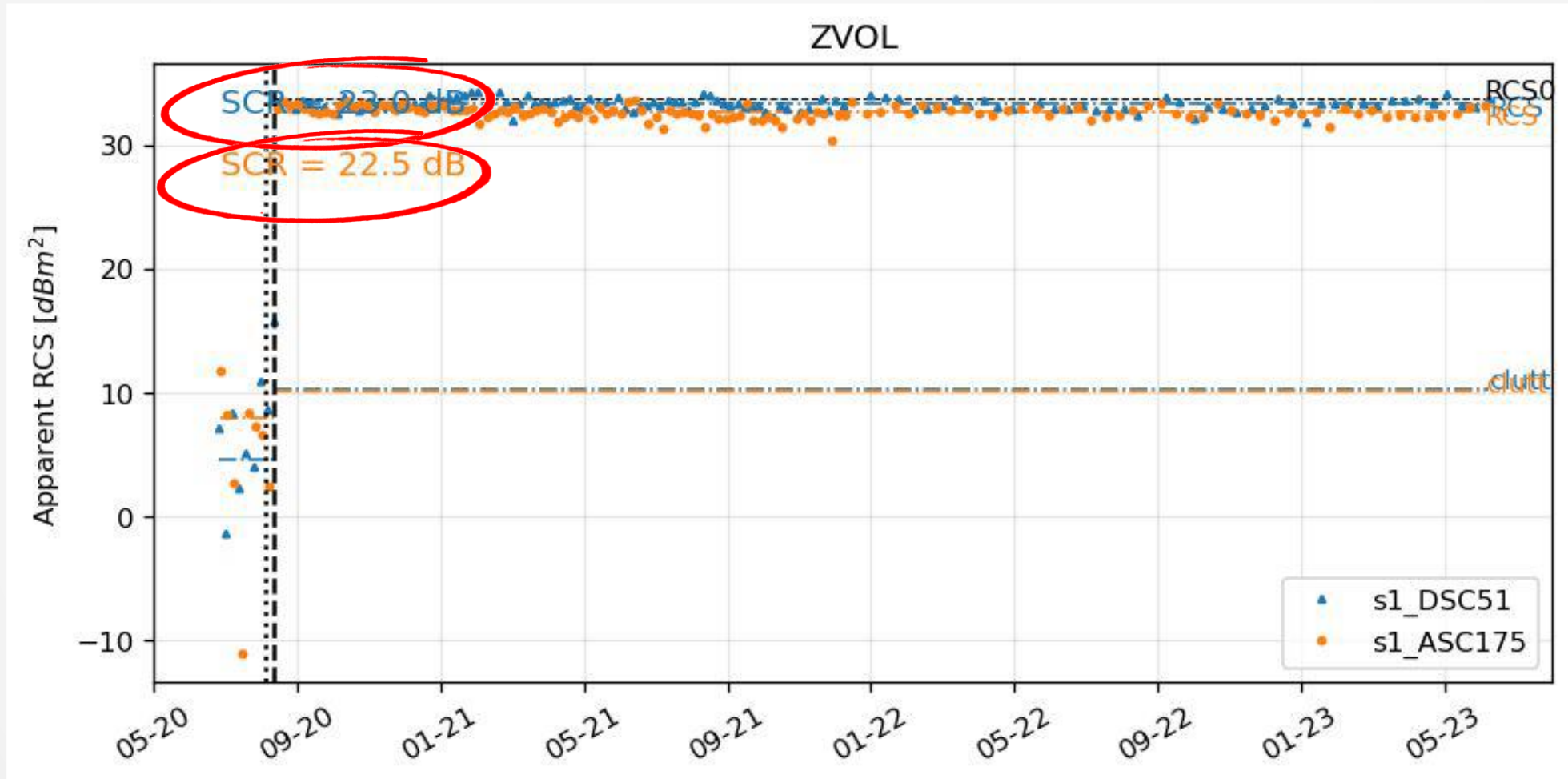
ZVOL (Zvolen, SR)



Determination of passive InSAR reflector phase center coordinates is very important

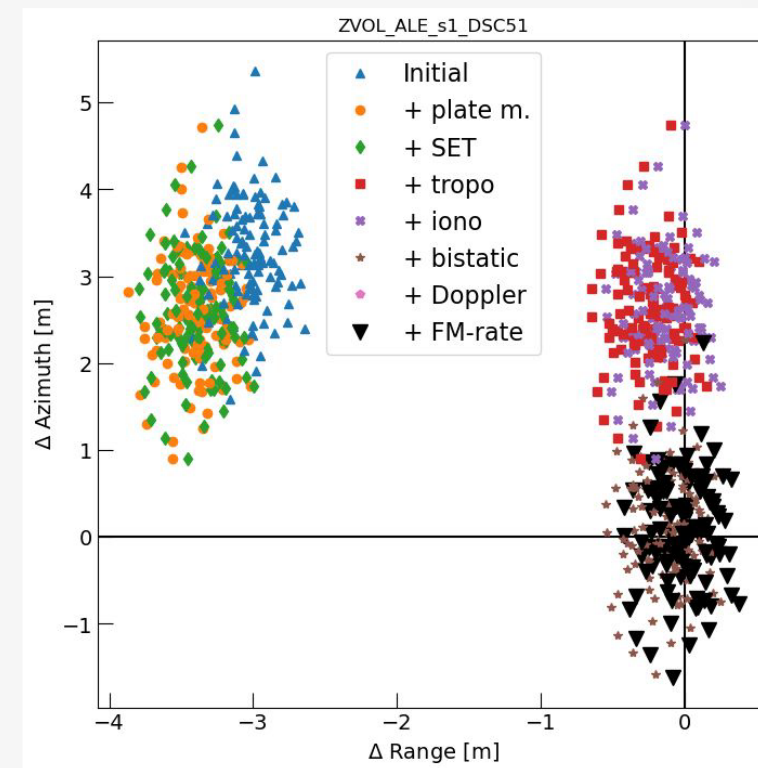
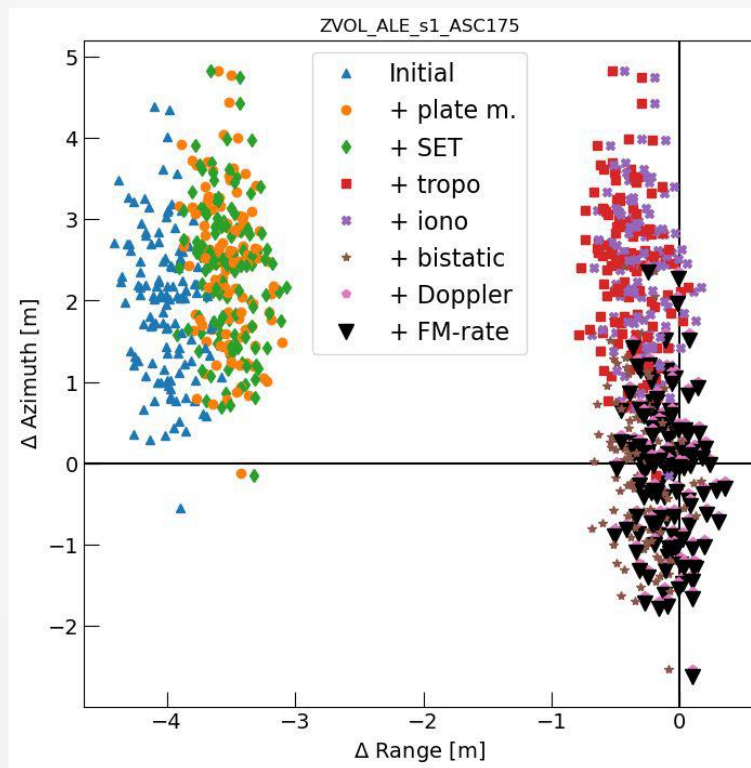


Collocation station suitability check (SCR value) before vs after instalation



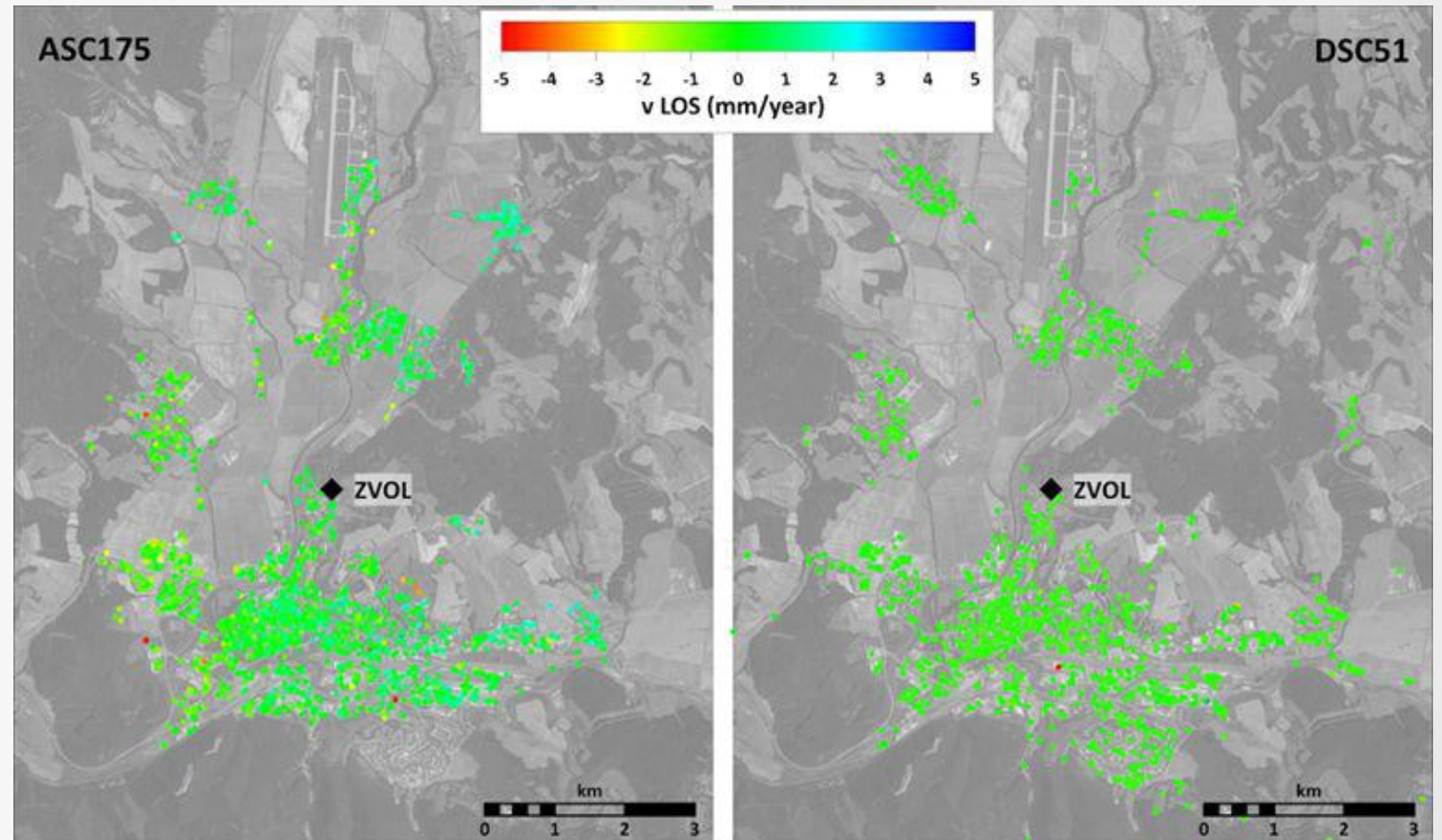
Absolute positioning errors

- **InSAR reflector coordinates differences:**
 - true coordinates = coordinates from GNSS/InSAR collocation sites
 - observed coordinates = from Sentinel-1 epoch measurements

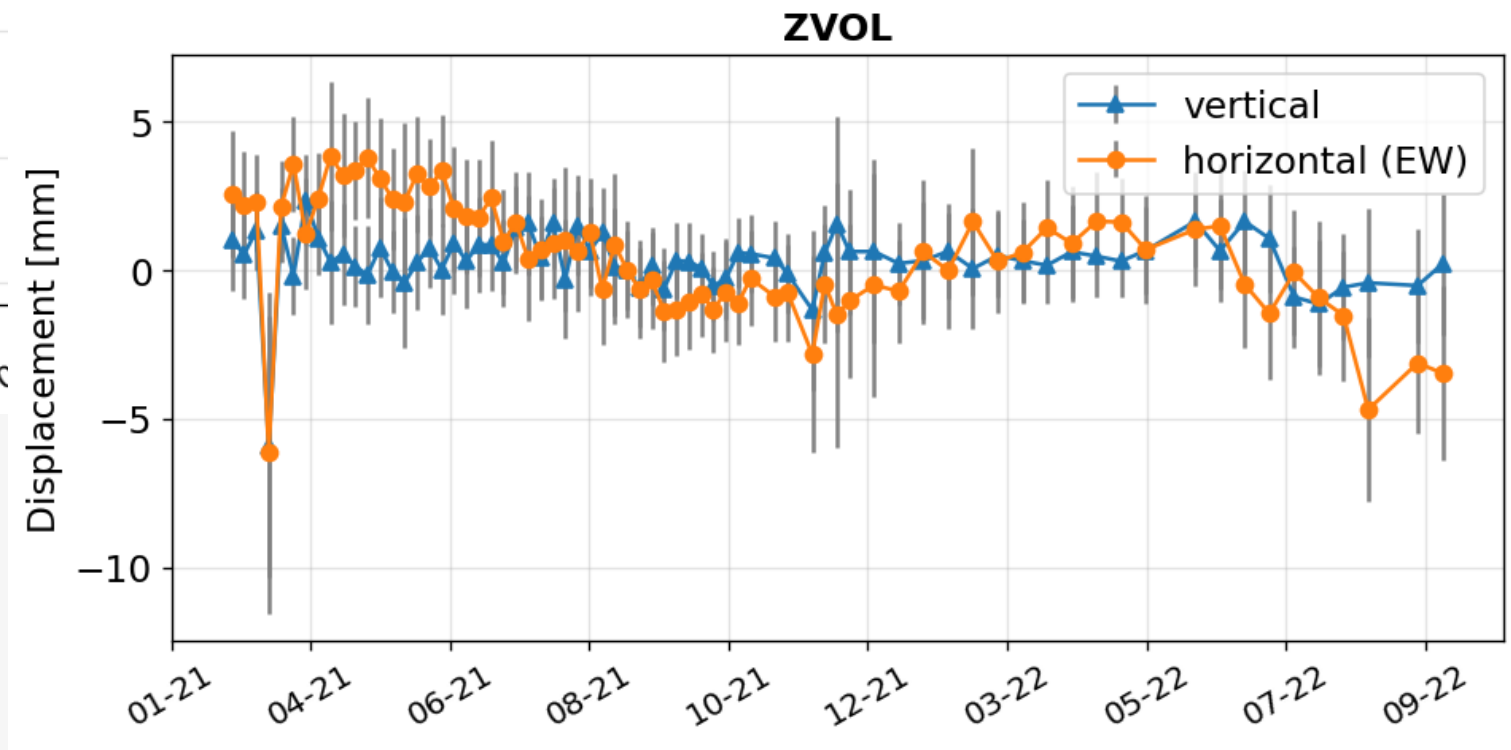
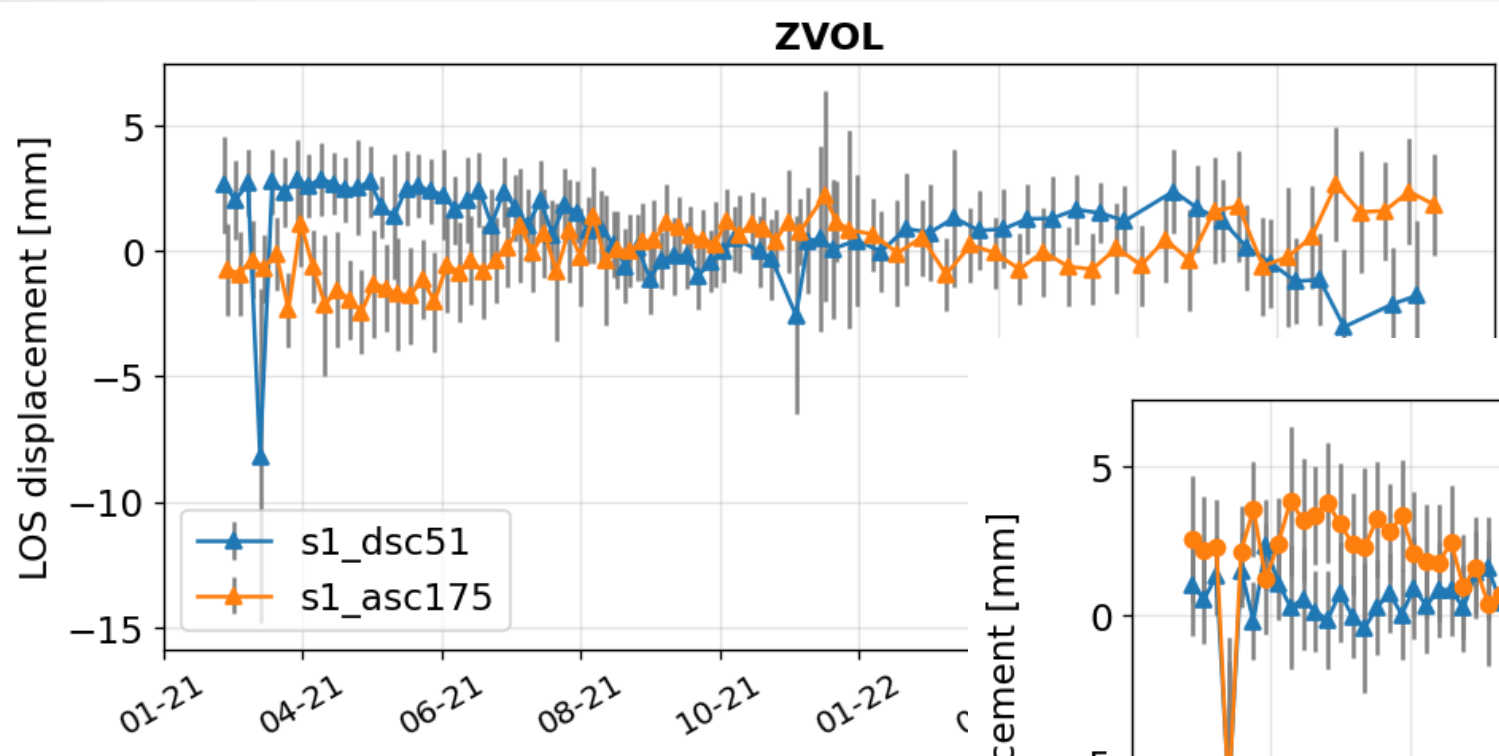
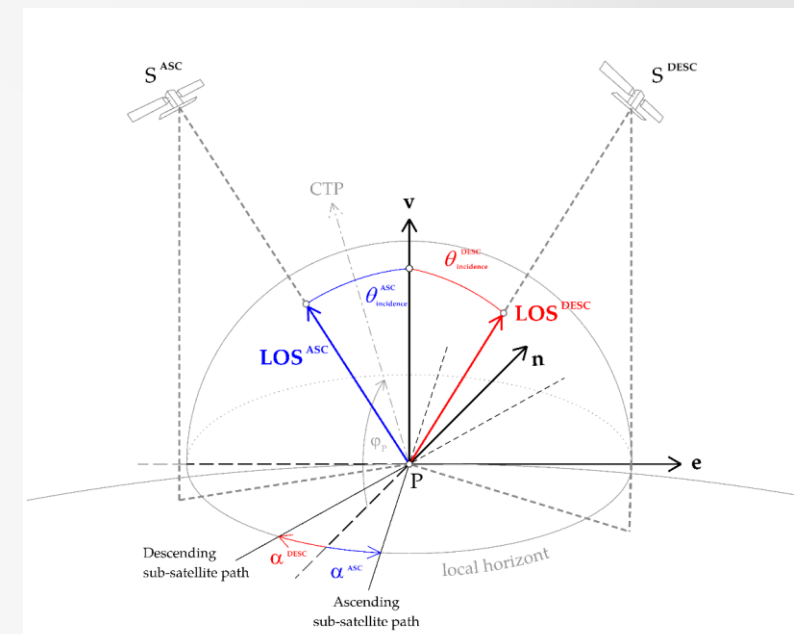


Local InSAR processing results (station ZVOL)

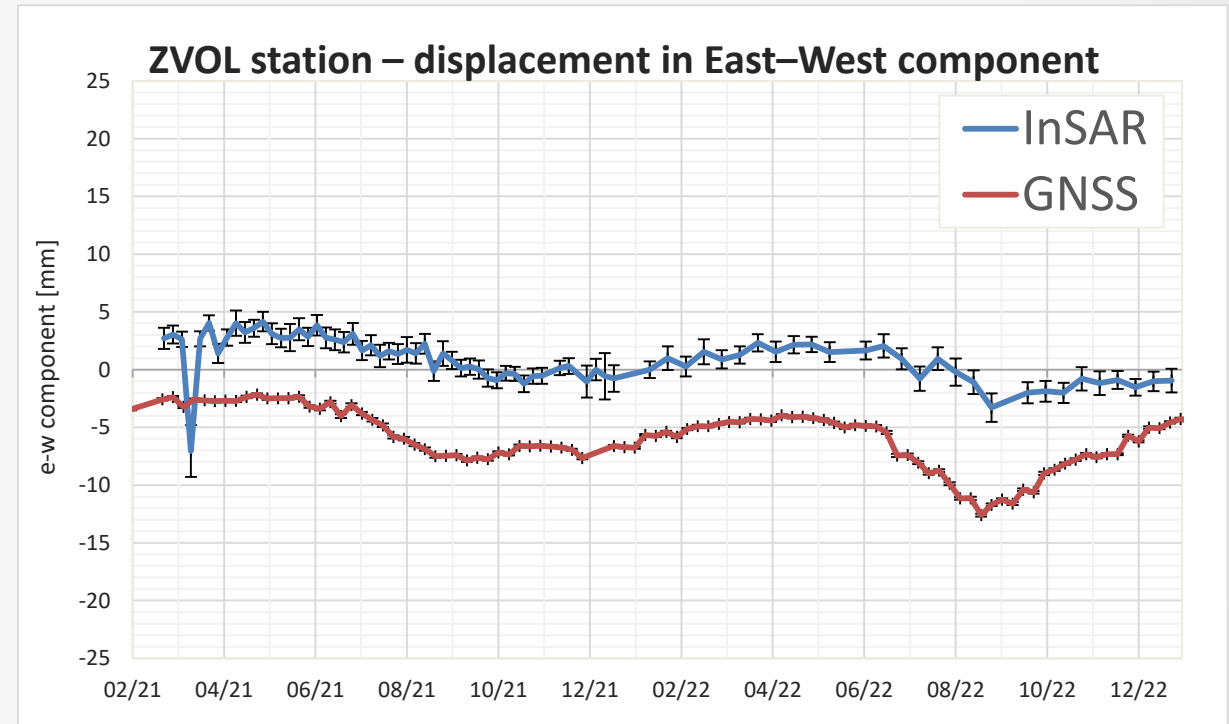
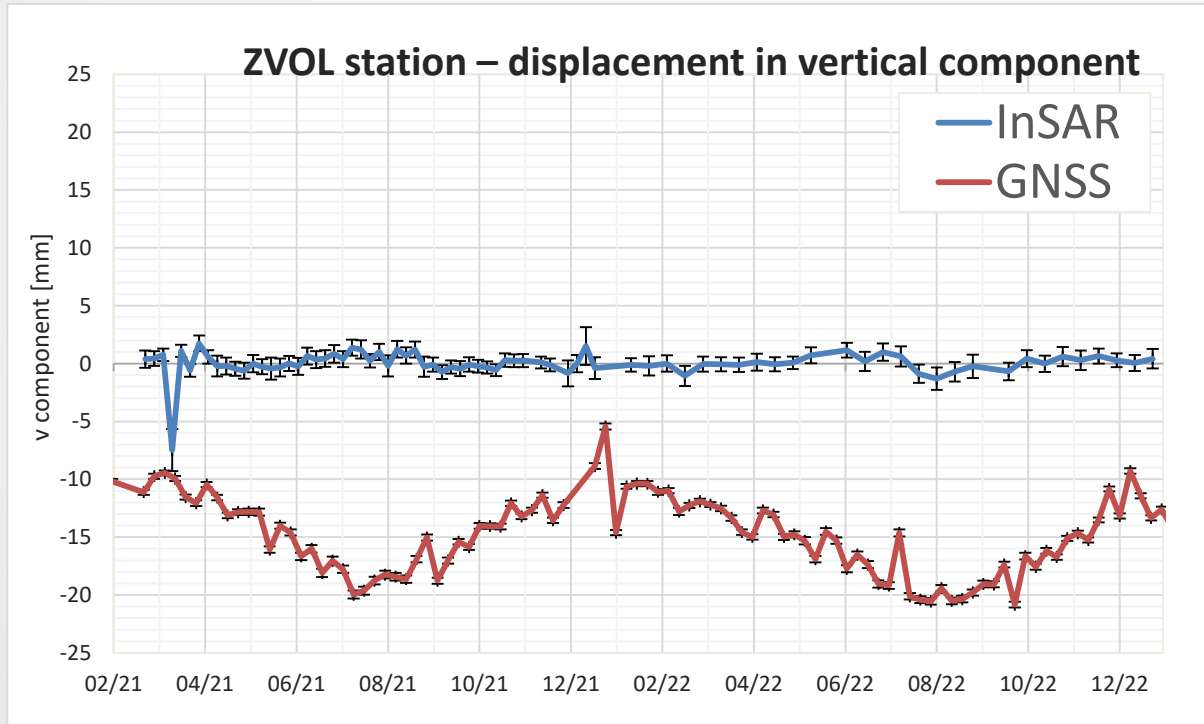
- GECORIS (Czikhardt et al. 2021)
- SNT1 ASC175/DSC51
- 2021/02 - 2022/10



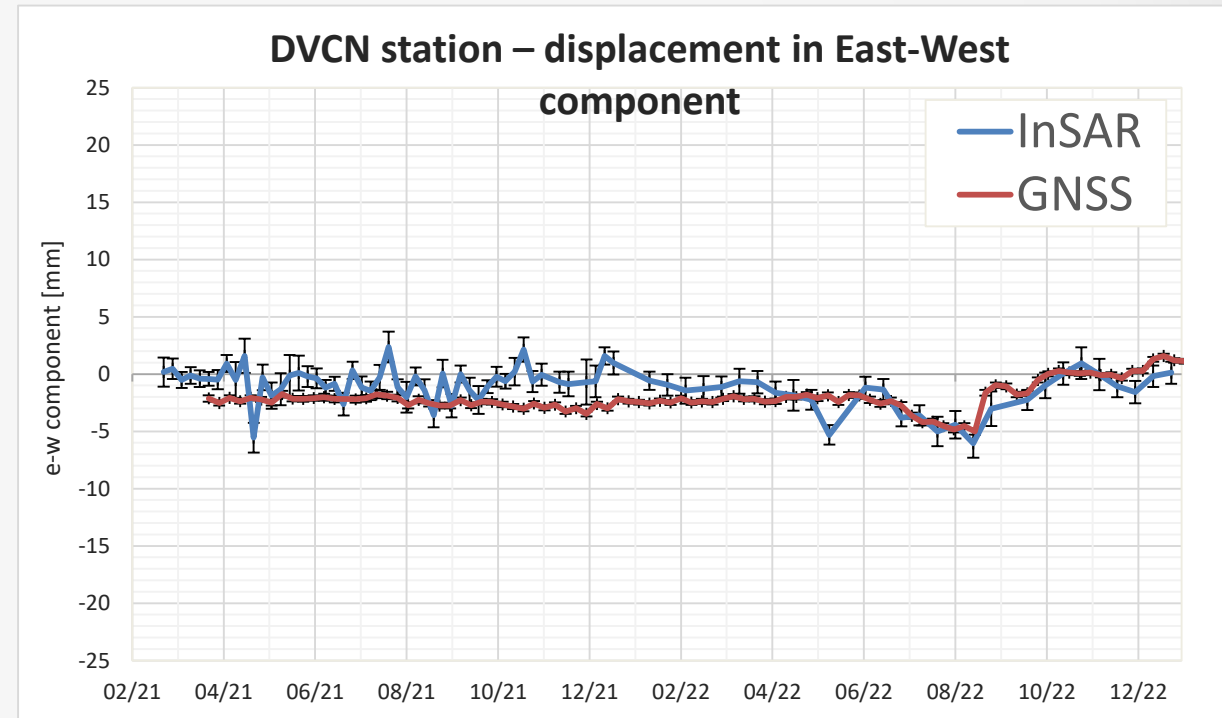
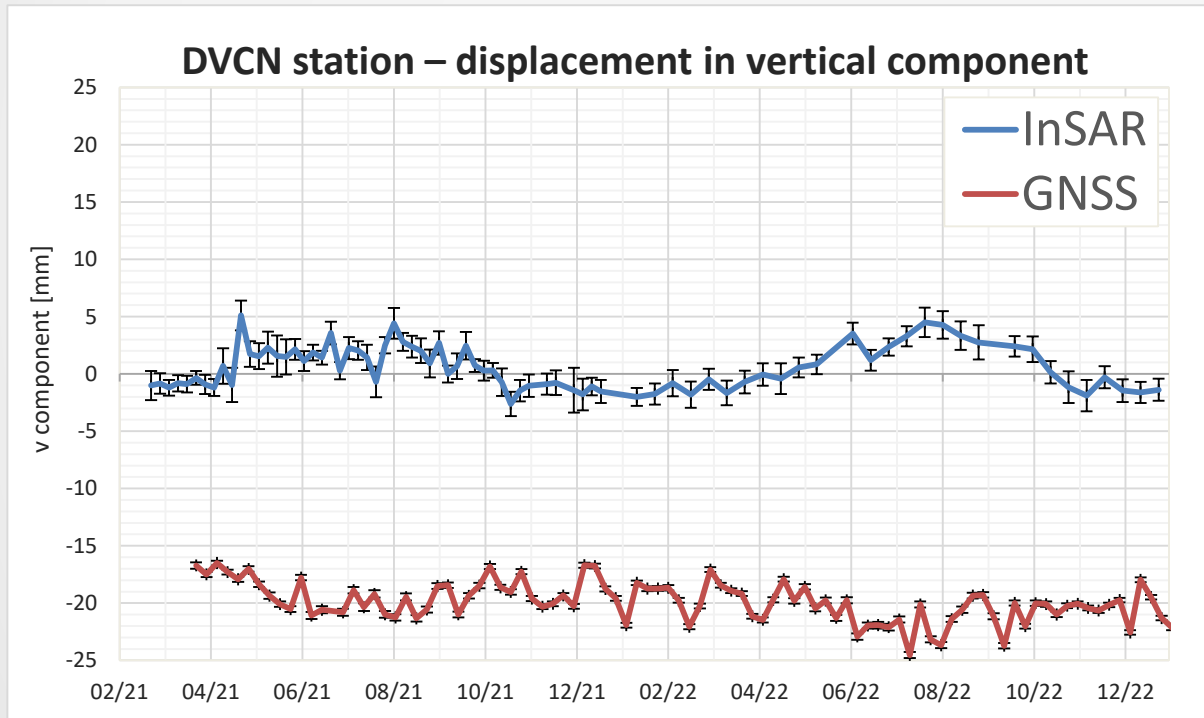
InSAR – LOS displacement and decomposition (station ZVOL)



InSAR vs GNSS displacement comparison - local InSAR network vs GNSS (station ZVOL)

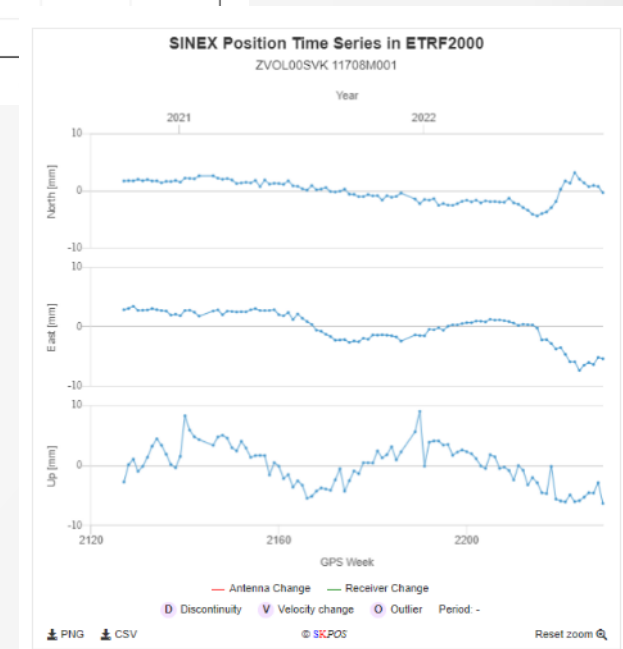
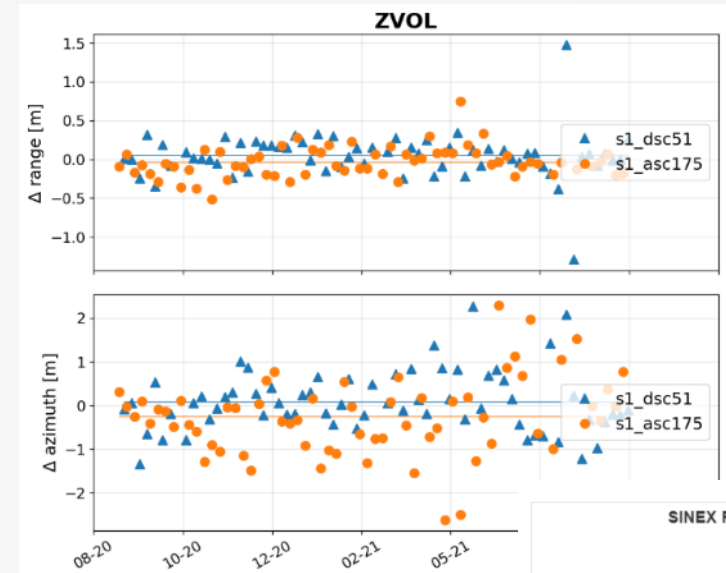


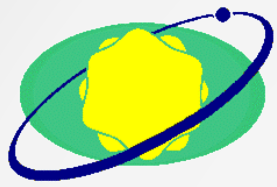
InSAR vs GNSS displacement comparison - local InSAR network vs GNSS (station DVCN)



Plans and next steps

- to finish „National InSAR reflector network“ and start providing of the reflector phase center coordinates for referencing
- to compute displacement and do comparison on all GNSS/InSAR SKPOS collocation sites
- to check some stations with different behaviour in time series
- to create the state wide referenced displacement maps from InSAR
- to set (vertical) monitoring of whole Slovakia





SKPOS®

Thank you for your attention

Branislav Droščák

branislav.droscak@skgeodesy.sk



9th EUPOS Technical meeting
22-23 November 2023, Riga, Latvia

