NLS
FINNISH GEOSPATIAL
RESEARCH INSTITUTE
FGI

National Report - Finland

NKG WGRF meeting

Reykjavik, Iceland, March 13-14, 2024

Pasi Häkli

+ FGI Geodesy and Geodynamics department

+ NLS Core geospatial data services - Geodetic infrastructures

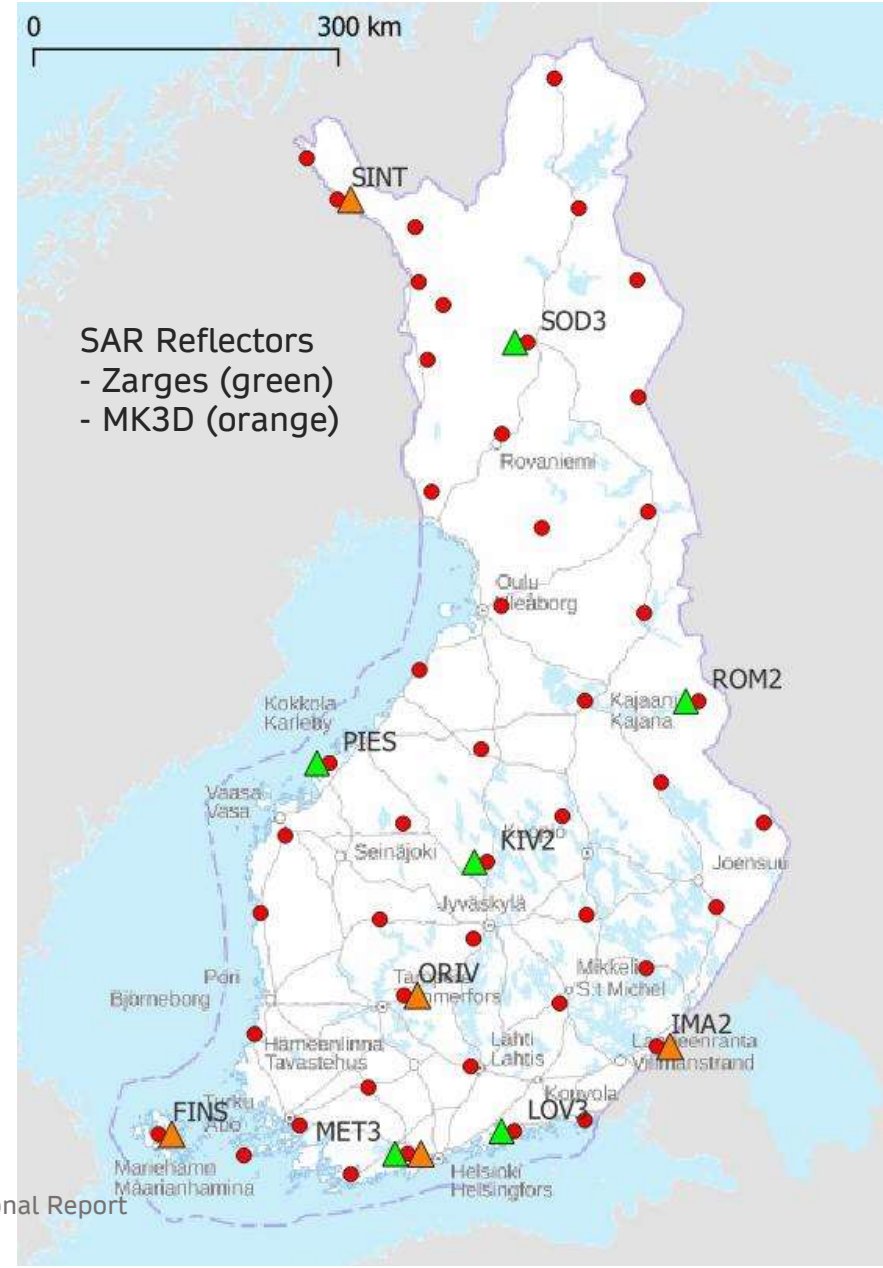
Reference frames

NKG work

- NKG Analysis Centre
  - Cumulative solution C2237 was released in June
  - Operational processing: switch to IGS20
  - Repro2 project
- NKG transformations
  - NKG2020 transformation: Documentation https://doi.org/10.1515/jogs-2022-0155
  - NKG_RF17vel model: Improved velocity uncertainties almost ready, documentation in progress

FinnRef: Backbone of Finnish reference systems

- Precise levelled N2000 (EVRS) heights for all (or most of the) stations by ~2025
  - Now 36/47
- Centering measurements (heights from the reserve markers to the GNSS antenna)
  - now 37/47
- Repeated absolute gravity measurements
  - 20/47 stations with AG pillar
  - Measured every 3 years
- SAR reflectors
  - 6/7 stations Zarges
  - 5/5 stations MK3D (+ 2 at Aboa Antarctica)

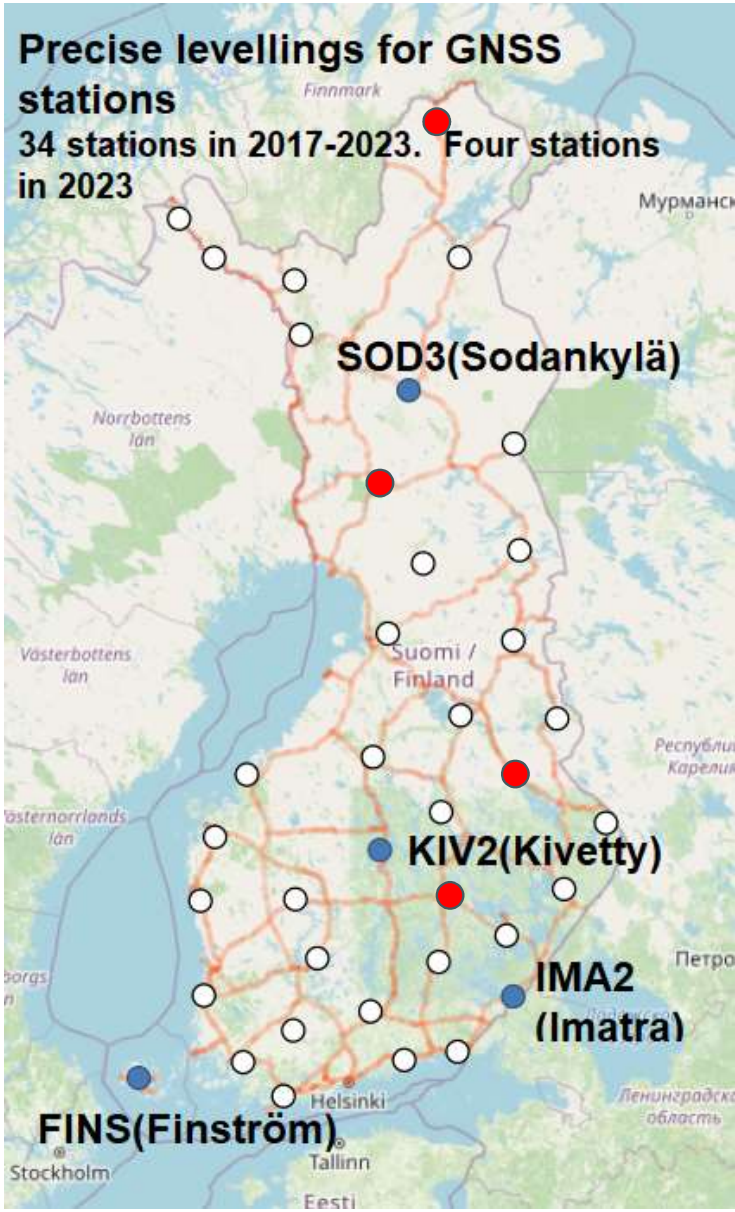


Levelling 2023 & 2024

- Precise levellings for GNSS stations in 2023

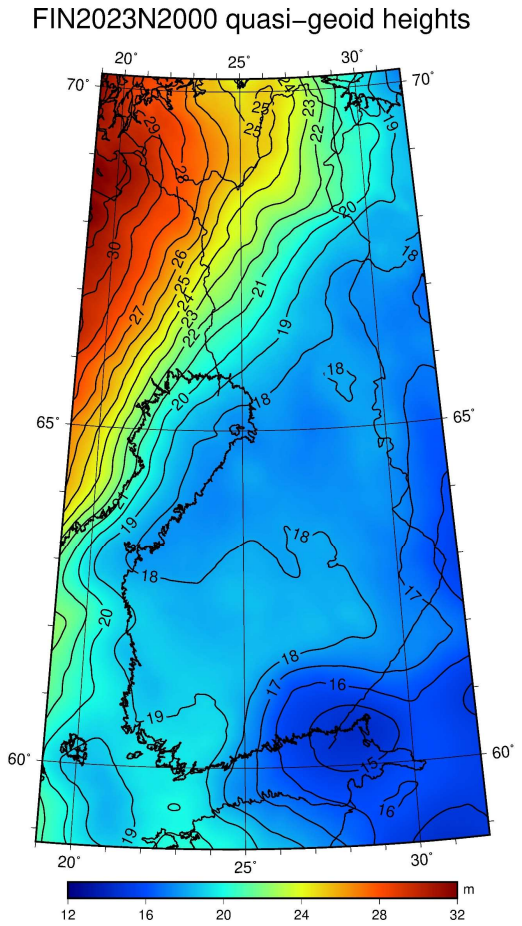
Station	Distance (double run) Stations measured as loops	Std. dev. mm/√km
IMA2	23,566 km	0,25
SOD3	24,482 km	0,16
FINS	8,921 km	0,33
KIV2	19,486 km	0,32
	76,455 km	

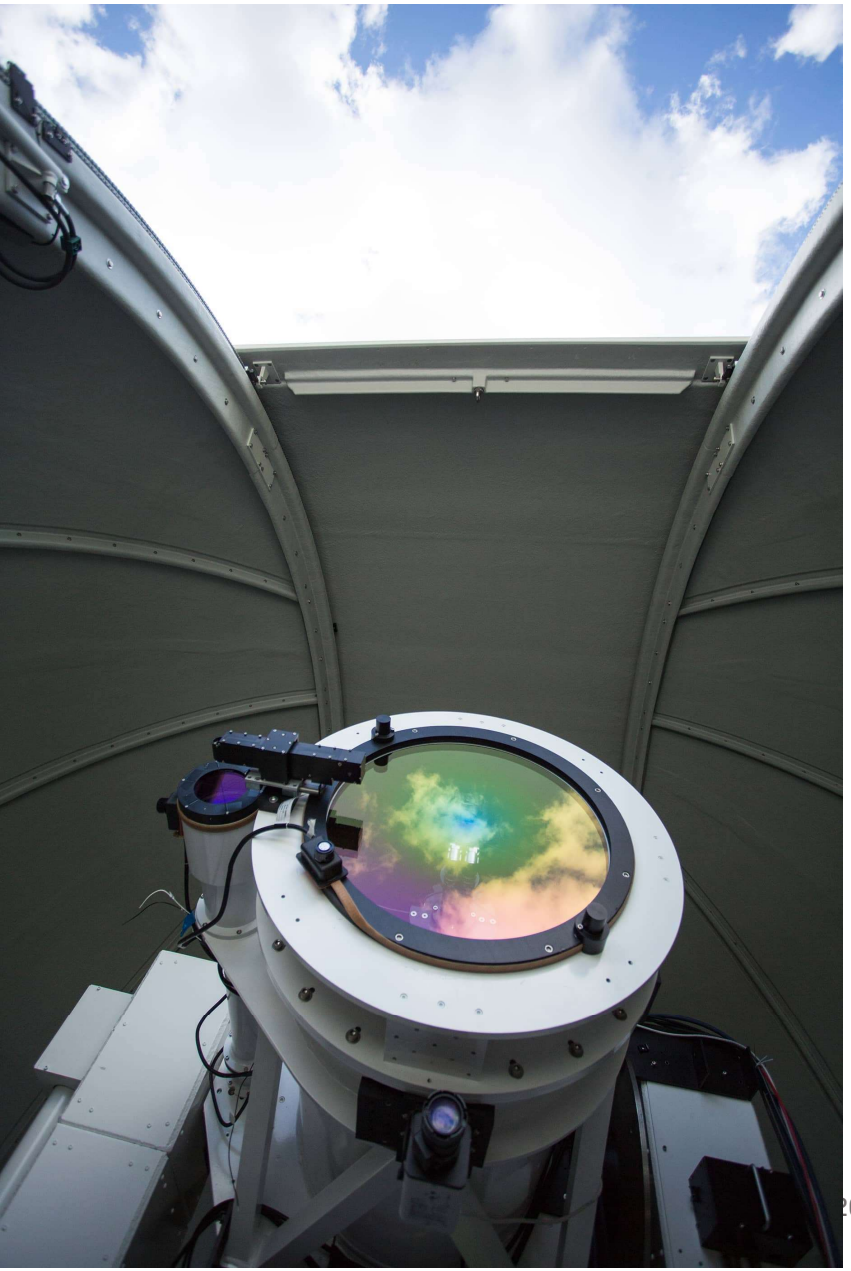
- 2024: Rovaniemi, Kevo, Nurmes (,Pieksämäki)
- Calibrations of precise levelling rods at the FGI rod comparator in Espoo
  - Paavo Rouhiainen retires 31.3.2024
  - New contacts: Veikko Saaranen and Heli Suurmäki
  - FGI_KML_Pituus@nls.fi



New Finnish height transformation surface (geoid model) FIN2023N2000

- Gravimetric FIN_EIGEN-6C4_GEO-geoid model (calculated from global EIGEN-6C4 model and Finnish gravity data) fitted to GPS-levelling data → FIN2023N2000
- Height transformation surface: EUREF-FIN ↔ N2000
- Accuracy n. 1.4 cm (1σ)
- Released in 1/2024
- Replaces previous FIN2005N00 model
- Data available at the webpage of the NLS
- Included in the BSCD2000 model





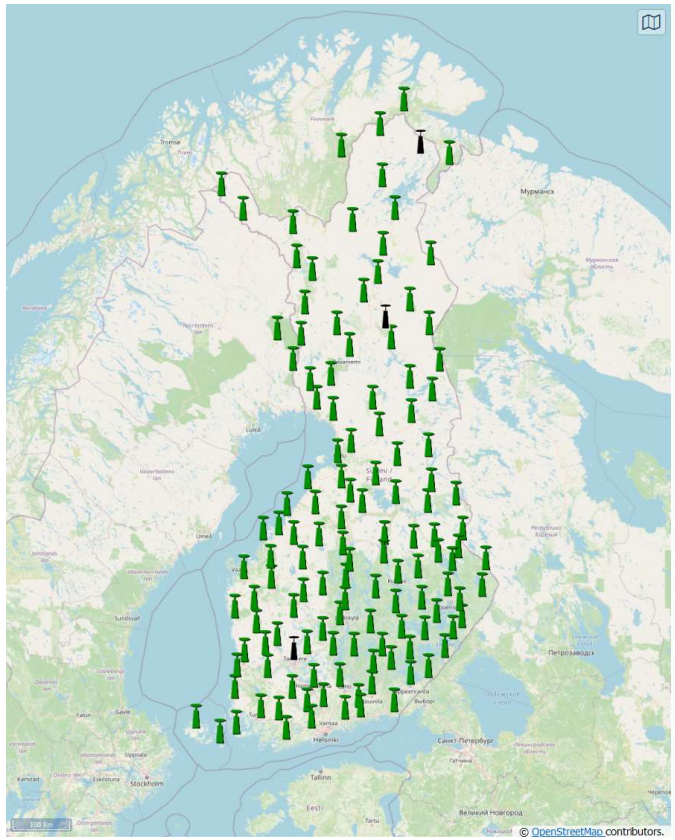
Metsähovi

- New Main Building is in use
- VLBI almost ready for observations
  - H-Maser needed
- SLR ready for first measurements by the end of 2024
  - Agreement with DiGOS Potsdam
  - New laser has arrived
- Superconducting gravimeters
  - iOSG-022 and iGrav-013 working fine

GNSS positioning

FINPOS positioning service

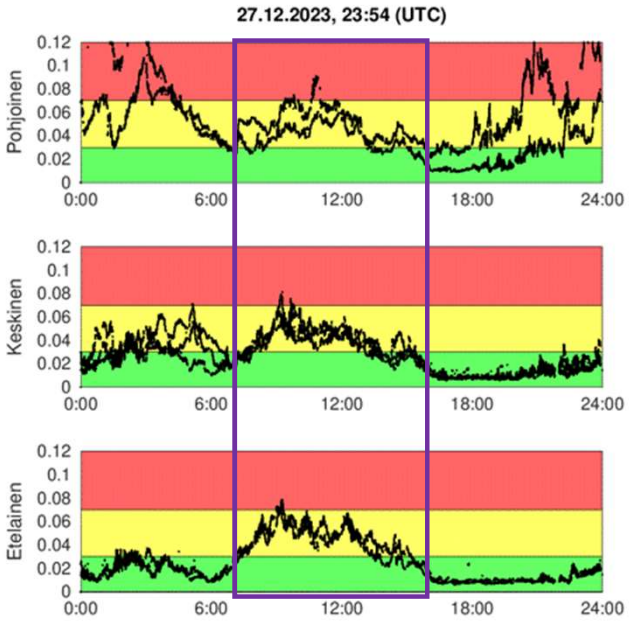
- About 5-10 new stations per year, now own stations total about 100
- Used by NLS (RTK) daily all works, 437 RTK rovers in NLS
  - + growing number of RD users out of NLS (RTK + SSR corrections)
- Raw data streams to 5 customers providing RTK/PPP services



https://www.maanmittauslaitos.fi/en/finpos

Ionospheric activity

- How big effect to user? → Separate presentation: WG GNSS positioning: *Experiences from solar maximum 25 (so far)*
- Preparations (mainly for RTK service)
  - Information and guidance to field
  - Up-to-date RTK service and user equipment/software
  - Densified network → collaboration NMAs and companies
  - Indicators → data / https://finpos.nls.fi/iono/
  - Back up methods: ”traditional RTK with mobile base stations” (data delivery modern way via cloud)



Human made troubles

- Interference, jamming and spoofing
  - No large-scale problems (so far) with stations and rovers on ground as in NLS
  - Much news from aviation
- Security conserns of open data (coming..)
  - EPN realtime stream decreasing from Finland
  - signal monitor GNSS-FINLAND behind authentication
- FGI-NAVI projects:
  - Jamming and spoofing detection e.g OSNMA
  - National Emergency Supply Agency –projects
  - WG GNSS Positioning Session 3 !

EGNOS RIMS

- New EGNOS RIMS station (V2) into use in Kuusamo 12/2023

→ Enhancing performance of service in north-eastern Europe

- Both EGNOS stations in Finland are being upgraded to new V3 version (augments also Galileo). V3 and V2 stations will run parallel for years

Original figure: EUSPA

FGI research project examples?

- HASlib, Galileo high accuracy service..
- MATKO crowdsourced marker positioning, ”Marker quest” app for public
- REASON – Resilience and Security of Geospatial Data for Critical Infrastructures
- AIRING – Aviation Resilience to GNSS Frequency Jamming and Cyber Threats
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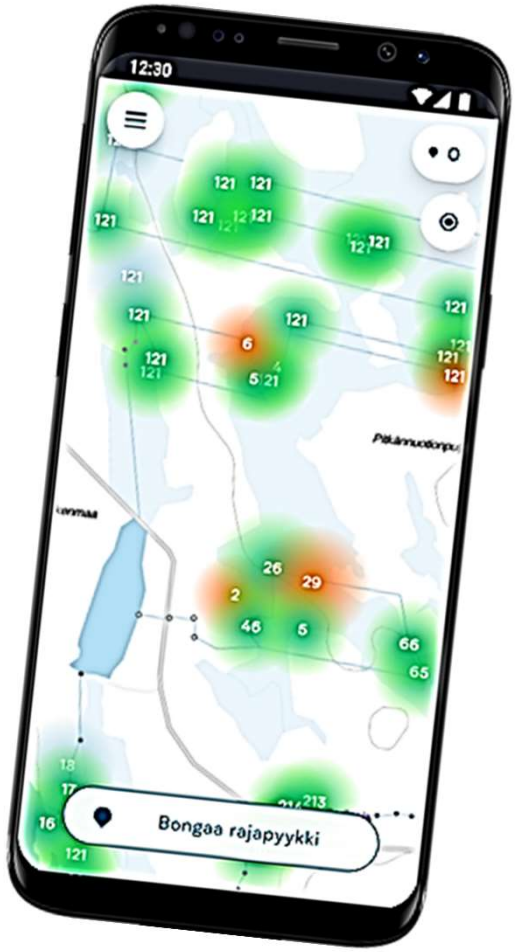

NLS & FGI 2023

- New NLS & FGI Strategies
  - *Knowing the Earth – Securing the future*
- Reorganization of the Geodesy and Geodynamics department
  - Merge of Gravity group and Reference Systems group
  - Starting October 2023: 2 research groups
    - References Systems (Mirjam Bilker-Koivula + 9 members)
      - Houses both National Standards Laboratories
    - Space Geodesy (Jouni Peltoniemi + 6 members)
- PhD defence: Ulla Kallio 6.10.2023: Towards daily-based local ties at Fundamental Geodetic Sites

Knowing the Earth – Securing the future