



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

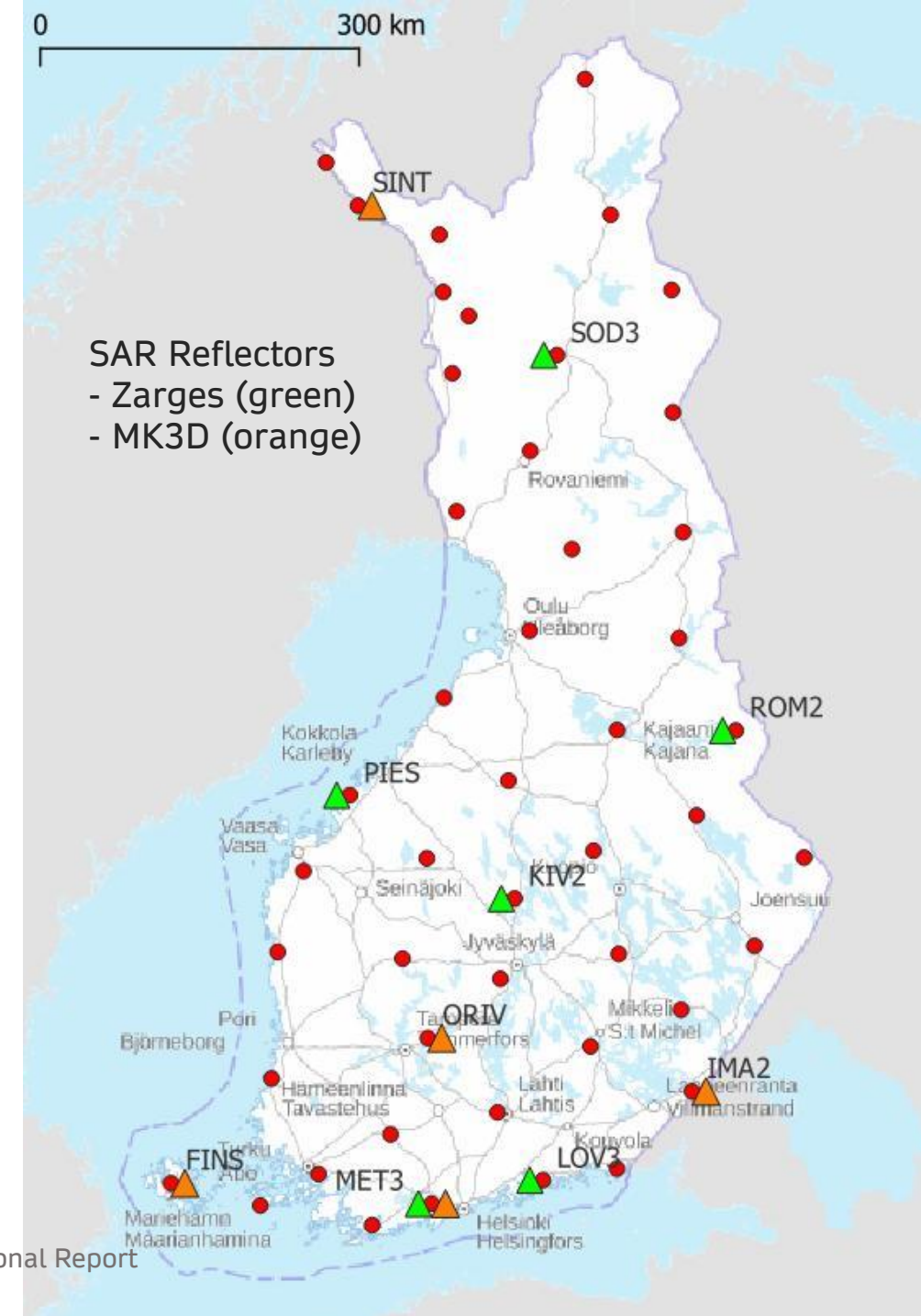


NKG work

- 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 Antartica)

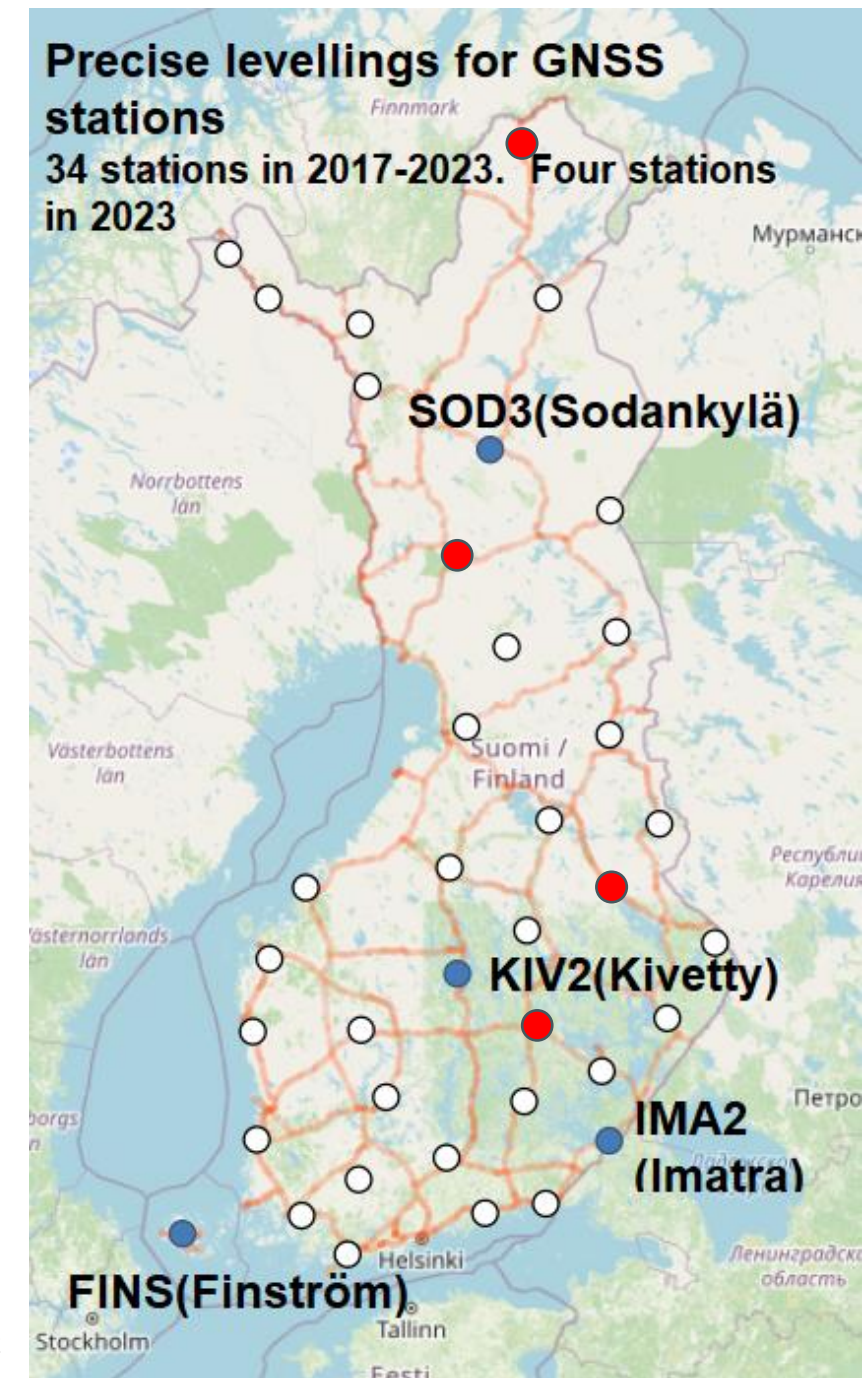


Levelling 2023 & 2024

- Precise levellings for GNSS stations in 2023

Station	Distance (double run) Stations measured as loops	Std. dev. mm/ $\sqrt{\text{km}}$
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	

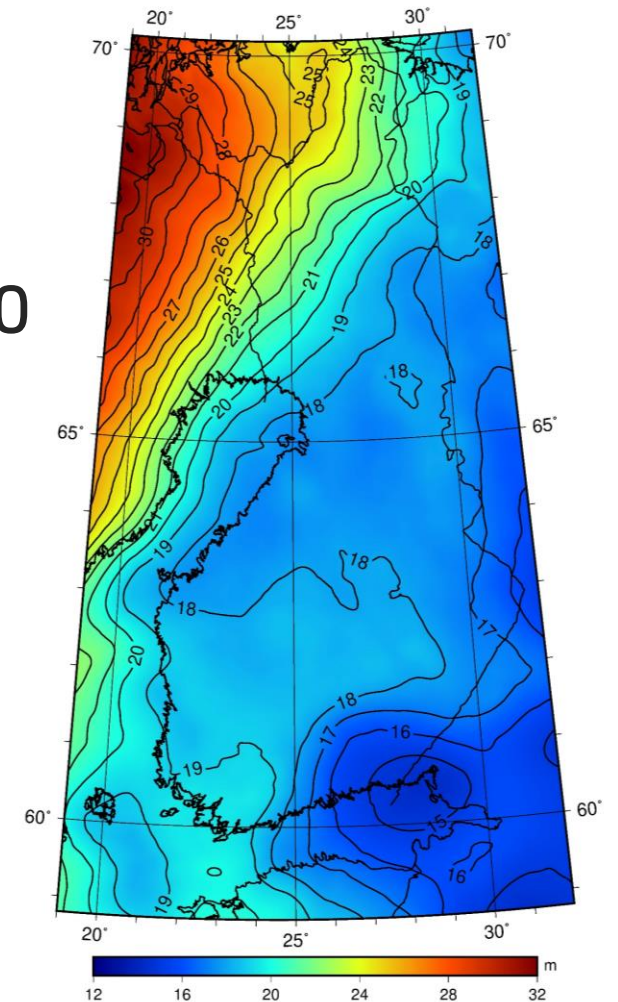
- 2024: Rovaniemi, Kevo, Nurmee (,Pieksämäki)
- Calibrations of precise levelling rods at the FGI rod comparator in Espoo
 - Paavo Rouhiainen retires 31.3.2024
 - New contacts: Veikko Saaranen and Heli Suurmäki
 - FGI_KML_Pituus@nls.fi

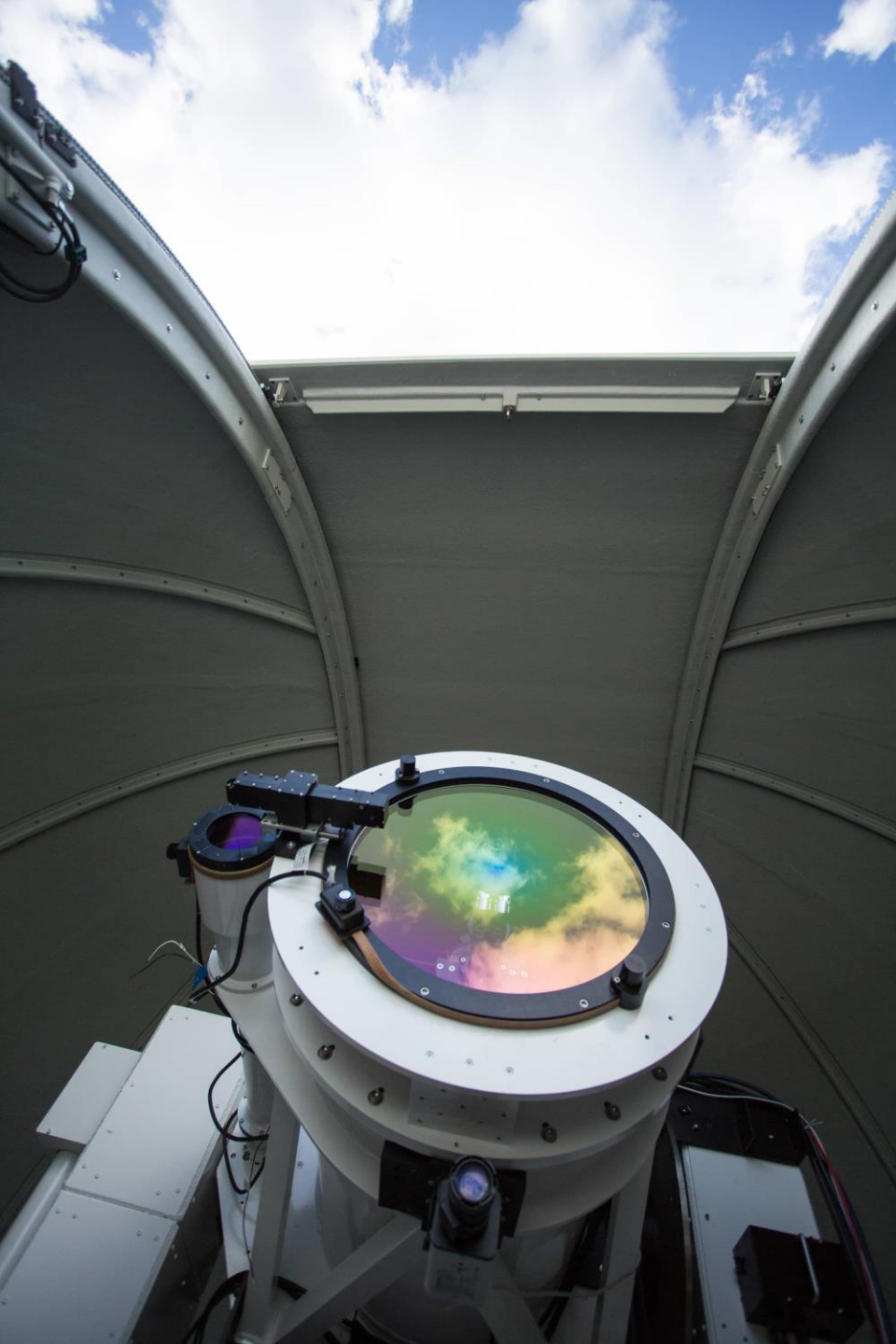


New Finnish height transformation surface (geoid model) FIN2023N2000

- 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

FIN2023N2000 quasi-geoid heights





Metsähovi

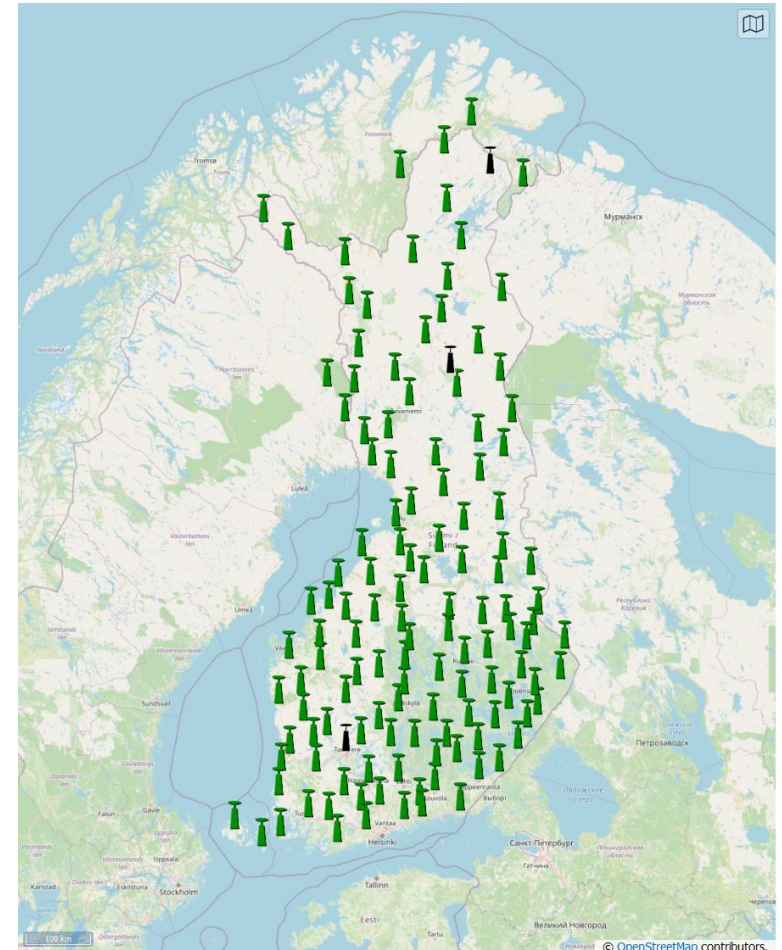
- New Main Building is in use
- VLBI almost ready for observations
 - H-Maser needed
- SLR ready for first measurements by the end of 2024
 - Agreement with DiGOS Potsdam
 - New laser has arrived
- Superconducting gravimeters
 - iOSG-022 and iGrav-013 working fine

GNSS positioning



FINPOS positioning service

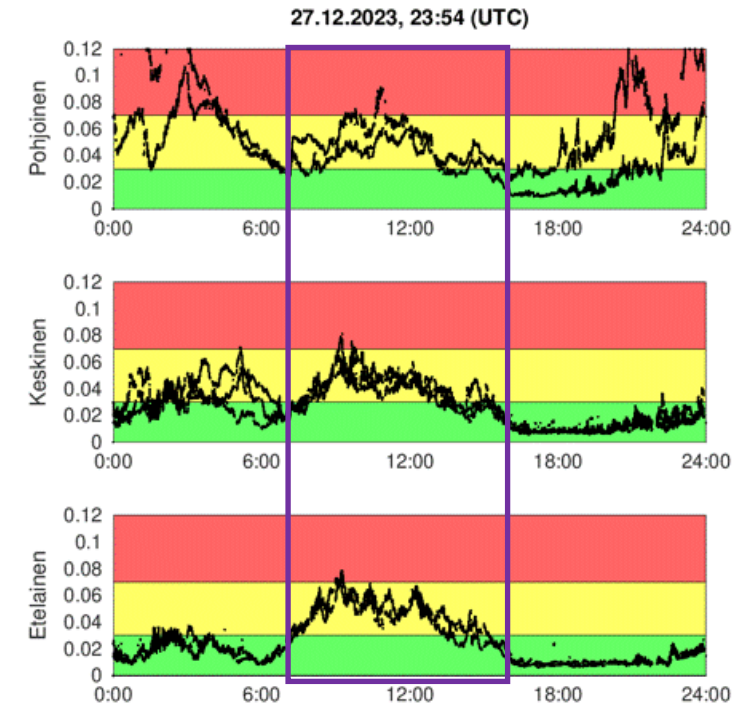
- About 5-10 new stations per year, now own stations total about 100
- Used by NLS (RTK) daily all works, 437 RTK rovers in NLS
 - + growing number of RD users out of NLS (RTK + SSR corrections)
- Raw data streams to 5 customers providing RTK/PPP services



<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 concerns 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 !

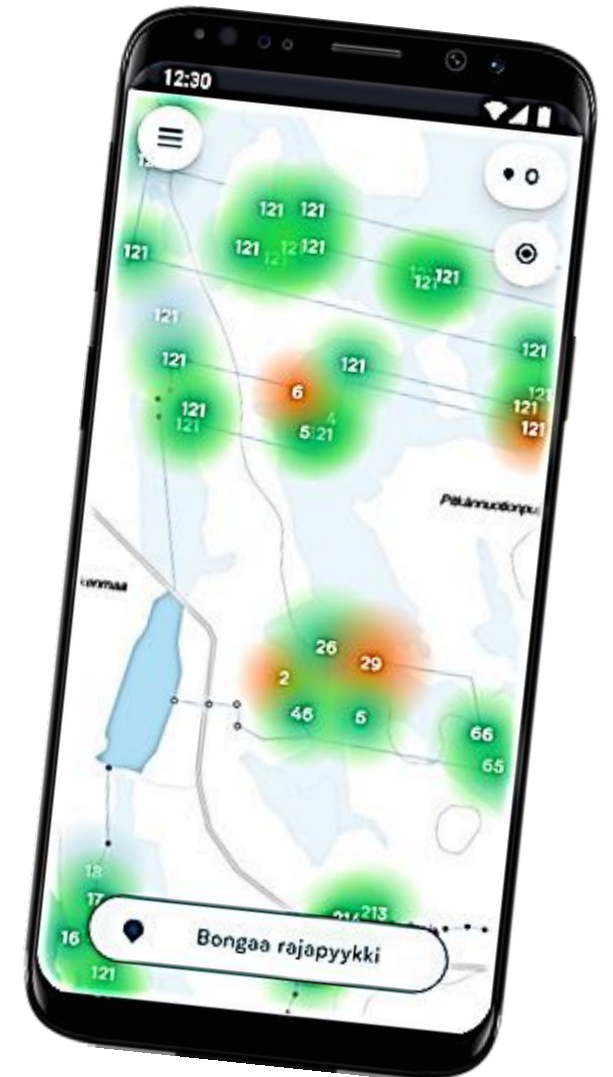
EGNOS RIMS

- 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



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

