



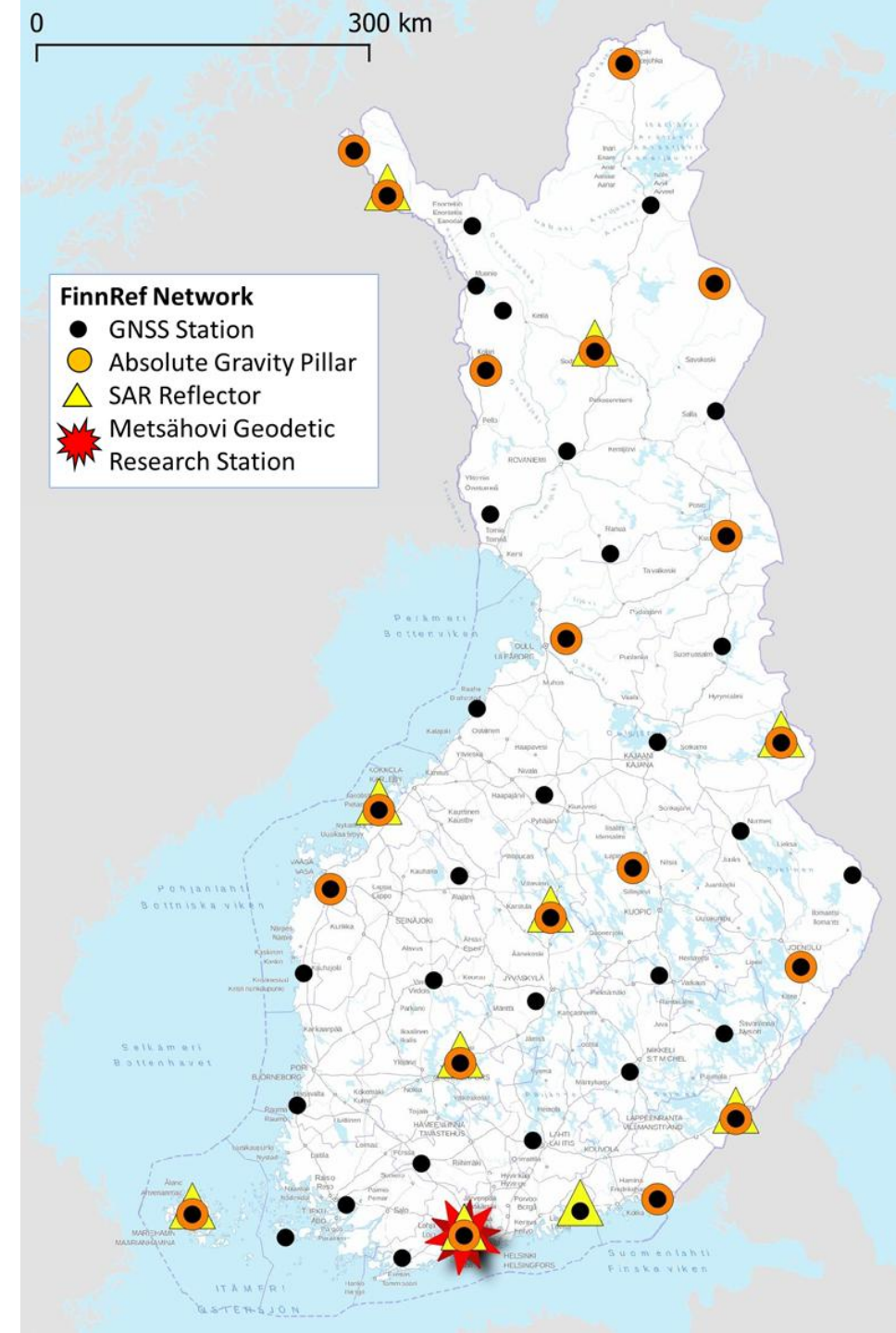
NLS
FINNISH GEOSPATIAL
RESEARCH INSTITUTE
FGI

National Report - Finland

Hannu Koivula, National Land Survey of Finland
Maaria Nordman, Aalto University

FinnRef

- 47 CORS Stations
- Absolute gravity pillars at 20 stations.
 - measured with FG5X-221 every three years. Time series 5-47 years
- SAR reflectors at 10 stations.
- Nearly all stations are connected to precise levelling network
- Seismometers at 12 stations
- Includes Metsähovi Geodetic Research Station



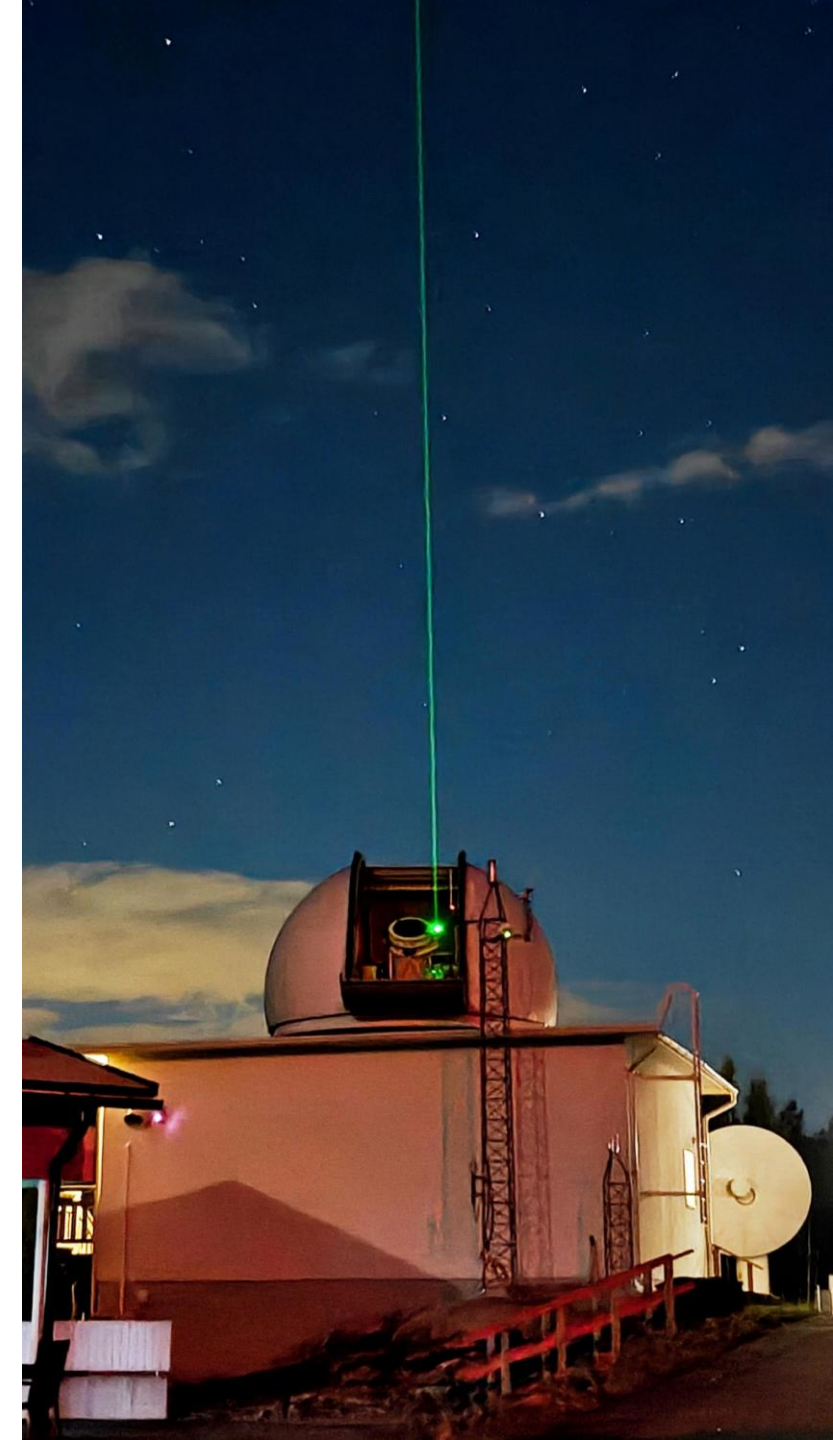
NRTK Positioning Services in Finland

- TrimNet, commercial network and service
- Hexagon, commercial network and service
- FinPOS, NLS network and service
 - 47 Finnref, 55 FinPOS and 4 monitoring stations
 - Service for NLS internal use and research,
 - **Data streams are commercial service**
- Karera, commercial service (NLS data streams)
- TopNet, commercial service (NLS data streams)



Metsähovi Geodetic Research Station

- Geodetic core station within the GGOS
- Finland's contribution to the UN GA resolution in 2015 on sustainable Global Geodetic Reference Frame
- Major upgrade of all instruments 2013 – 2026: GNSS, absolute gravimeter (AG), superconducting gravimeters (SG), **Quantum Gravimeter (QG) 2026**, Doris, SAR-reflectors
- **Satellite laser ranging (SLR), first observations in 2026.** Operational in 2027
- Geodetic VLBI, Hydrogen maser purchased 2024, operational 2027
- **SLR will also contribute to the EU Space Surveillance and Tracking network (EU-SST) (2027)**
- Local tie measurements 2025



National Aerial Imaging and Lidar Programs

Kallio 1: 2020-2025

- Aerial images on a 3-year cycle (50 cm orthophotos)
- Laser scanning point cloud on a 6-year cycle (5 pts/m²)

Kallio 2: 2026-

- Aerial images on a 3-year cycle (30 cm orthophotos)
- Laser scanning point cloud (5 pts/m²) 2026-2031
- Laser scanning point cloud on a 9-year cycle (20 pts/m²)

Current Geodesy Related Research Projects of FGI and A?

- 2025-2027 TULANET Postdoc program: 2 postDocs
- 2025-2028 ScanClouDT (EURAMET EMP) - Traceability for industrial 3D digitalization by advanced scanning systems
- 2025-2028 DynEAnt (RCF) - Understanding the dynamic Earth in East Antarctica with multitechnique geodetic measurements
- 2025-2027 MoveAnt (RCF) – Dynamic Earth in East Antarctica
- 2025-2028 EXQALIBR (RCF) - EXceptional Queen mAud Land Ice mass Balance incRease – causes and effects
- 2025-2028 EPOS-Finland (RCF FIRI) - European Plate Observing System
- 2025-2029 EQUIP-G (EU Horizon) - European QUantum Infrastructure Project for Gravimetry
- 2025-2028 SPACEECONOMY (RCF Strategic Research) - Advancing Sustainable Economic Growth through Space Economy
- 2026-2027 GEMOP (EUSPA) - Galileo and EGNOS Monitoring Of Performances by Member States
- 2026-2027 Q-Sense (MATINE) – Usability of quantum gravimeters for object detection
- 2026-2027 Geofuture(MMM) – Need assessment for Reference Frames
- 2026-2029 ERIGMEA (EURAMET EMP) – Gravimetry Metrology project
- 2026-2030 GraFEPoR (RCF) - Satellite and terrestrial Gravity data Fusion for Enhanced Postglacial Rebound Modelling
- 2026-2030 VGOS (RCF) - Systematic Error Elimination in VGOS for a 1-mm Accurate Terrestrial Reference Frame

Aalto University
Geodesy group

Research topics

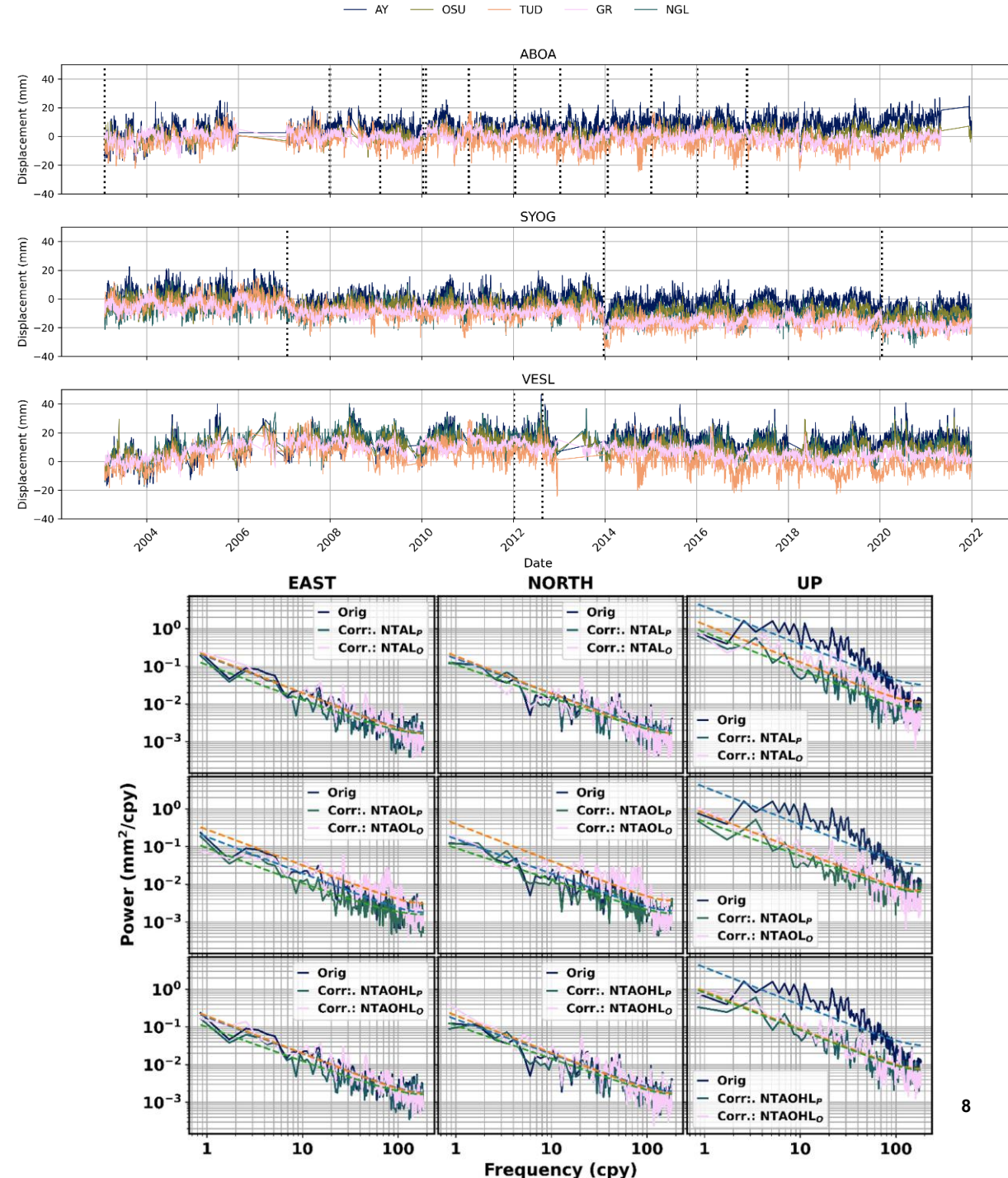
Current projects:

- Geodynamics in Antarctica (Aino's presentation on Wednesday)
- Gravity change in Fennoscandia (new, Mirjam's presentation on Thursday)

Past projects:

- Indoor positioning
- Non-tidal loading in Fennoscandia
- Sea level rise scenarios on the Finnish coast

A!



Teaching



Bachelor in Real Estate Economics and Geoinformatics

- 1-3 Bachelor theses is geodesy topics

Master in Geoinformatics

- ~30 new students every fall
- 20-30 graduating every year

Graduates

Doctors

Timo Saari 2022

Ulla Kallio 2023

Fatemeh Khorrami 2026

Masters (with geodesy themed thesis)

14 (2022-2026), 3 on-going

Students in
Metsähovi in
October 2025



SAR Worskhop in
Dipoli March 2023

Latest publications

Iivarinen, O., Daubass, S., & Nordman, M. (2026). Simulated GNSS Signal Strength Variation Under Leaky Feeder Segments in a Tunnel — a Case Study. IEEE Journal of Indoor and Seamless Positioning and Navigation. Advance online publication. <https://doi.org/10.1109/JISPIN.2026.3731198>

Schulz, A., Ejigu, Y. G., Näränen, J., and Nordman, M. (2025), Improving the precision of Antarctic GNSS time series through non-tidal loading corrections, EGUsphere [preprint], <https://doi.org/10.5194/egusphere-2025-5358>

Khorrami, F; Kierulf, P. H; Ejigu, Y. G; Nordman, M. (2026). Assessing non-tidal atmospheric loading effects on GNSS position time series: A comparison of processing strategies. Pure Appl. Geophys. 183, 117–135. <https://doi.org/10.1007/s00024-025-03867-z>

Iivarinen O., S. Daubas, A. Ziadi and M. Nordman, (2025). Recurring Oscillation Patterns in Underground GNSS Signal Simulations, International Conference on Indoor Positioning and Indoor Navigation (IPIN), Tampere, Finland, 2025, pp. 1-6, doi: 10.1109/IPIN66788.2025.11213187.

Ejigu, Y.G., Nordman, M. (2025), Improving GNSS data accuracy: Implementing Non-tidal Corrections at the Observation-level in GNSS data. GPS Solut 29, 159. <https://doi.org/10.1007/s10291-025-01921-w>

Kropsu E., Pellikka H., Heilala T., Rytteri T. & Nordman M. (2025): Coastal habitats and sea level rise in Finland — vulnerability and adaptation. Boreal Env. Res. 30: 111–123. <https://doi.org/10.60910/ber2025.3q20-vz35>

Khorrami, F., Ejigu, Y.G., Näränen, J., Raja-Halli, A. and Nordman, M., (2024). Exploring Non-tidal Atmospheric Loading Deformation Correction in GNSS Time Series Analysis Using GAMIT/GLOBK Software, *International Association of Geodesy Symposia*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/1345_2024_272

Ejigu, Y. G., J.-P. Boy, A. Raja-Halli, F. Khorrami, J. Näränen, M. Nordman (2024), Analyzing the 3D deformation induced by non-tidal loading in GNSS time series in Finland, In: *International Association of Geodesy Symposia*. Springer, Berlin, Heidelberg, https://doi.org/10.1007/1345_2024_259

Jussila, A., Kettunen, P. and Nordman, M., 2023. Higher accuracy for smartphone positioning: post-processing, centre points and repetition. In International Conference on Location Based Services (pp. 65-70). International Cartographic Association (ICA). DOI: 10.34726/5400

Pellikka, H., M.M. Johansson, M. Nordman, K. Ruosteenoja (2023) Probabilistic projections and past trends of sea level rise in Finland, *Natural Hazards and Earth System Sciences* 23 (4), 1613-1630, <https://doi.org/10.5194/nhess-23-1613-2023>

Nordman M., Peltola A., Bilker-Koivula M., Lahtinen S. (2023) Past and Future Sea Level Changes and Land Uplift in the Baltic Sea Seen by Geodetic Observations. In: *International Association of Geodesy Symposia*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/1345_2020_124