

The NKG InSAR Report A Nordic Overview of InSAR Activities and SAR Fiducial Infrastructure

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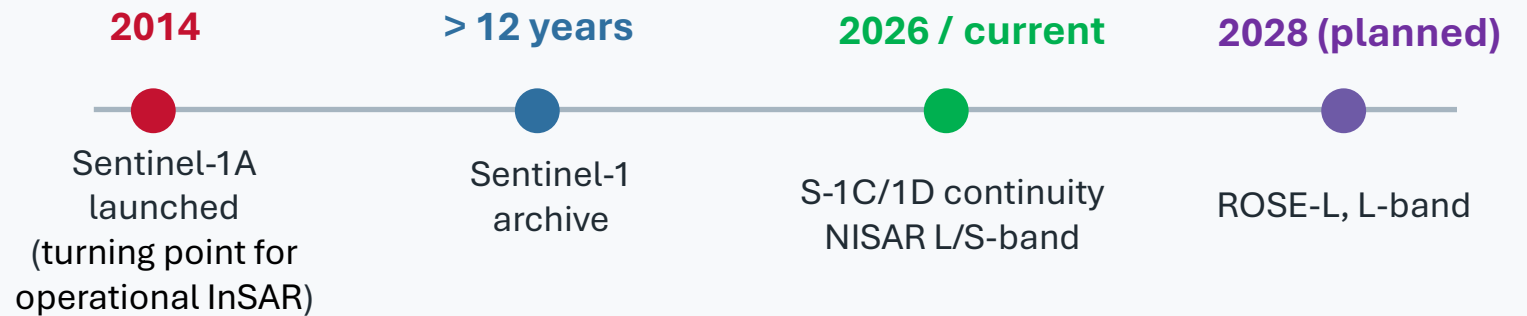
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Why this report?

Motivated by NKG Resolution No. 3 (2022):

- Bring together national InSAR activities and experience.
- Identify common needs, gaps and opportunities for collaboration.
- Support coordinated development of InSAR for geodetic applications.

Why now?



Growing regional activity

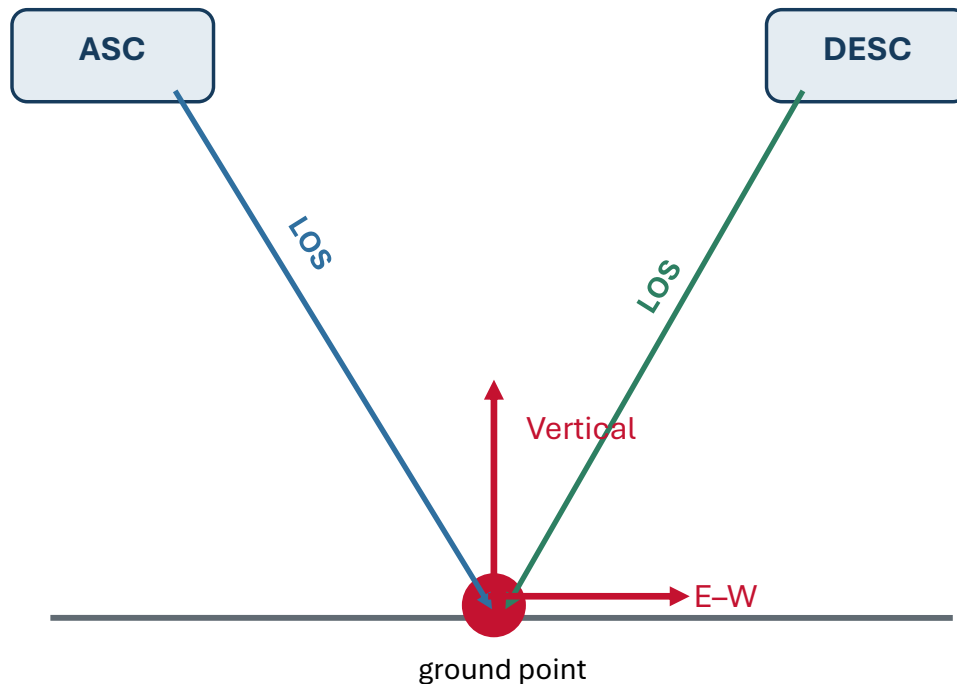
Expanding InSAR activities and ground-motion services, with increasing interest across Nordic–Baltic countries.

NKG InSAR report: from resolution to draft



InSAR gives spatial density and geodesy gives the reference

Viewing geometry



Ascending + descending commonly resolve mainly vertical and east-west motion; north-south is weakly observed.

Geodesy adds

Reference frame

Datum / long-wavelength control

Independent control

GNSS • levelling • gravity

Fiducial targets

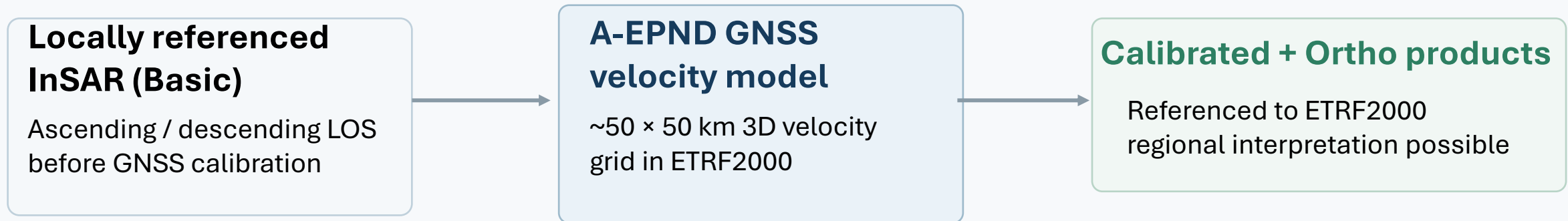
CR/ECR coordinates + local ties

Atmosphere

GNSS-derived parameters for assessment and correction modelling

EGMS makes the reference-frame issue explicit

EGMS products differ in how ground motion is referenced and represented.



Key message: InSAR products are only geodetically useful when reference-frame handling is explicit.

Nordic/Baltic status: selected documented examples

Sweden

InSAR Sverige; 23 national targets; mining + urban examples

Norway

InSAR Norway + InSAR Svalbard; rockslides, roads/rail and Arctic infrastructure,

Finland

11+2 CRs; Turku levelling validation

Denmark

2018 nationwide InSAR map; CATs experiments; 10 KDS targets

Estonia

Baltic-city monitoring; SAR-derived DEM; Tartu levelling + GNSS

Iceland

Countrywide InSAR + GNSS; GIA, plate motion, volcanoes, geothermal

Latvia

1 CR submitted; ~12 planned; height-system / local deformation focus

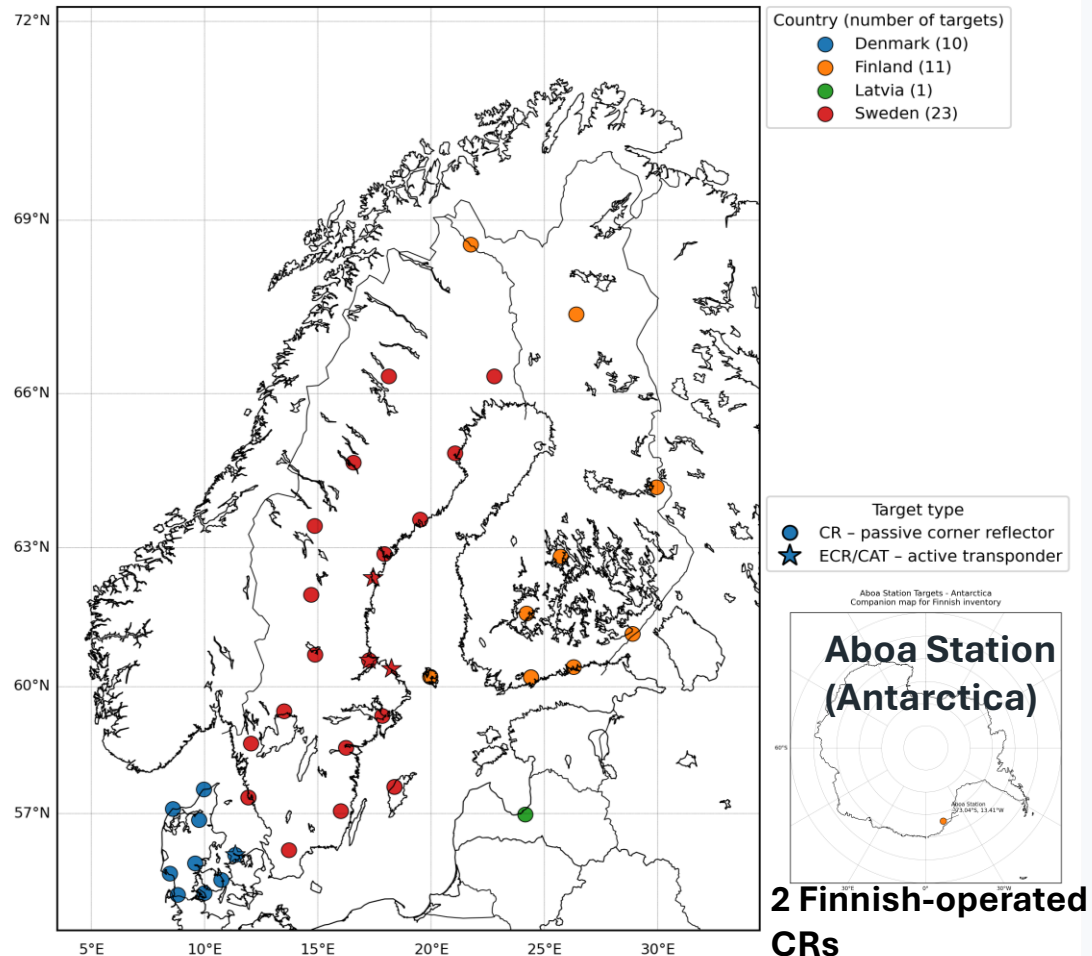
Lithuania

Preliminary profile; detailed material and inventory still to be expanded

Current SAR fiducial inventory: 47 documented target entries

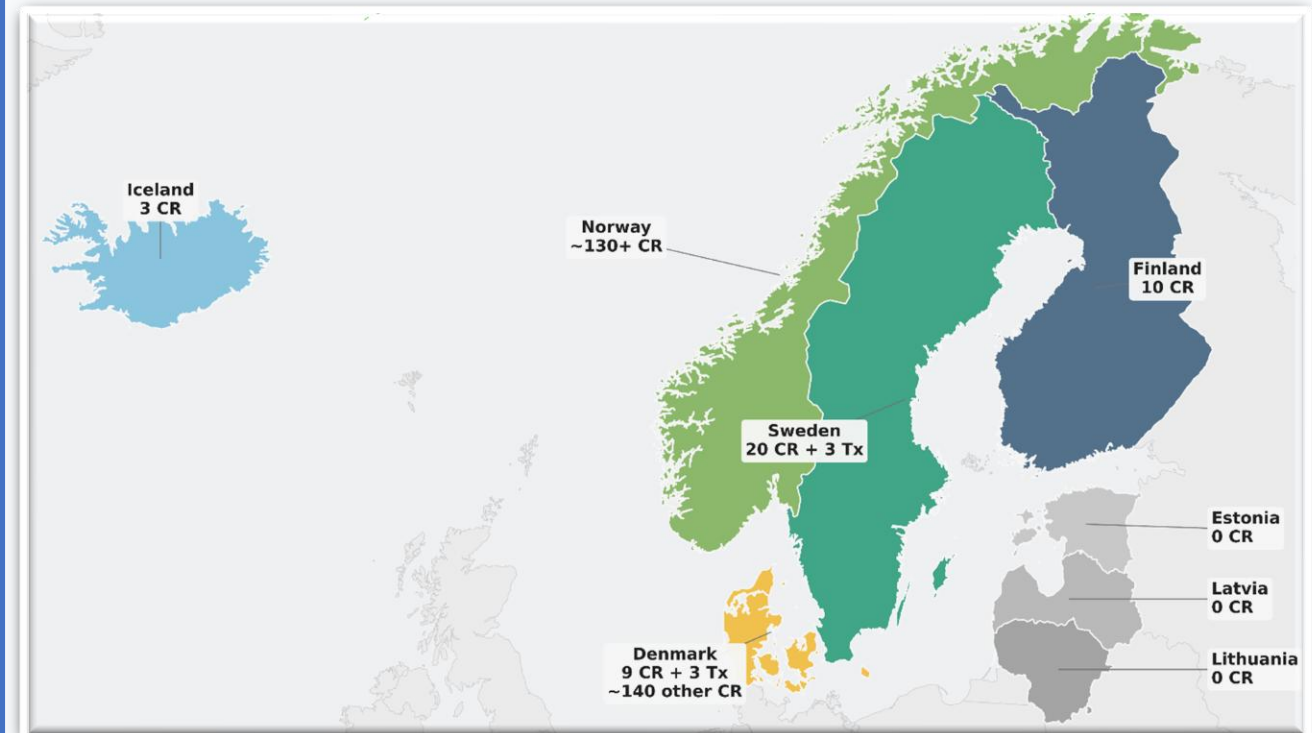
45 targets are in the Nordic/Baltic regional map; 2 Finnish-operated targets are at Aboa Station, Antarctica

NKG InSAR Target Inventory – Nordic and Baltic Region
Passive corner reflectors and active ECR/CAT transponders



Indicative target counts from feedback form

Some are included where metadata are available; others remain indicative counts



A bright radar target is not yet geodetic infrastructure!

The geodetic value comes from coordinates, ties, stability, metadata and long-term maintenance.



Sinettätunturi, Finland

Triangular CR
(photo: Jyri Näränen)



Vilhelmina, Sweden

Double back-flipped CR
(photo: Faramarz Nilfouroushan)



Riga, Latvia

Double back-flipped CR
(photo: Ivars Liepiņš)

1

Defined radar
reference point

2

Precise 3-D
coordinates

3

Local tie to GNSS /
benchmarks

4

Uncertainty +
maintenance status

5

Mission visibility +
metadata

Different purposes of corner reflectors and CATs

National geodetic infrastructure

Long-term reference / GNSS co-location

Operational-service validation

EGMS or national ground-motion service

Research infrastructure

e.g. Geodetic SAR Baltic Sea

Application / project network

e.g., mining, rockslides

Temporary field experiment

short-duration performance tests



Triangular trihedral CRs in Aboa Research Station, Antarctica

(photo: Jyri Näränen)

Record each target's purpose in the inventory.

Recommendations for NKG

Reference frame & GNSS

- Link InSAR to geodetic reference frames using GNSS velocities and land-uplift models.
- Co-locate CRs/CATs with GNSS to support atmospheric correction.
- Record GNSS–InSAR co-locations in M3G (EUREF resolution, 2026).

Inventory & validation

- Require target classification in the inventory.
- Flag “validation-ready” sites.
- Document local ties and survey uncertainties.

Governance & future missions

- Harmonise target identifiers and metadata across NKG, M3G and SARCalNet.
- Keep the Report and inventory updated.
- Distinguish geodetic SAR infrastructure from application-specific SAR targets.
- Consider C-band and L-band compatibility in future target designs.

Thank you!

Questions?

