



# National report, Denmark

NKG General Assembly, 2026-09-14/17



Klimadatastyrelsen

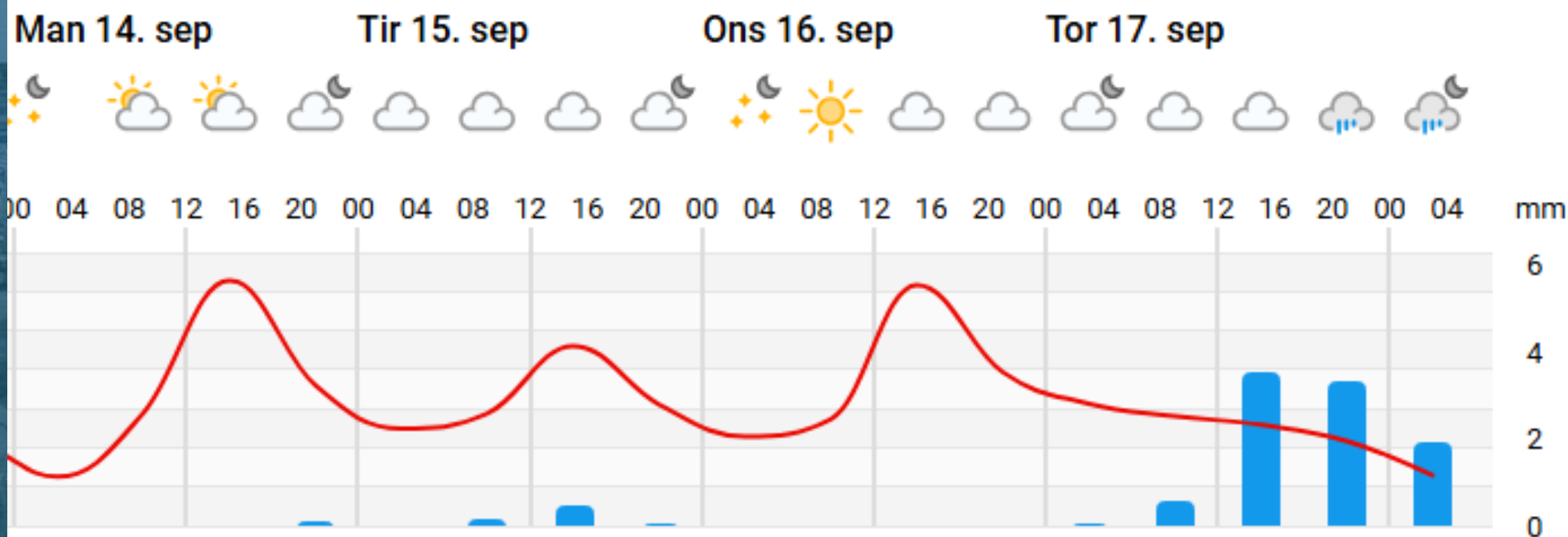


**Meteorologens kommentar:** Grå og våd tirsdag, afløses af sol og byger onsdag.

## Vilnius

SDFI ⇒ KDS ⇒ **DMI, Kort og Grunddata**

## An upcoming fusion with our meteorological neighbours



Klimadatastyrelsen

# New strategy for Nat'l geodetic Infrastructure: Making geodesy end-user accessible

- New geoid model aligned with the DVR90 height system (2023)
- New LAT and MSL realizations
- EPSG codes registered for (almost) all current and legacy systems
- New transformations between ETRS89 and legacy systems, using contemporary methods
- Everything available in PROJ
- Outreach: Numerous publications and documentation, talks and meetings within the sector of surveying

# Danish infrastructure

- 20 permanent GNSS stations.
- 1 new station – HANK00DNK
- The TAPAS network is no longer active
  - › 2 GNSS stations included in DK-CORS
  - › 4 GNSS stations have been terminated in 2025
  - › 5 GNSS stations continues as part of the DTU research infrastructure



InSAR, integration and datum referencing using reflectors co-located at CORS sites

## CATs have been tested

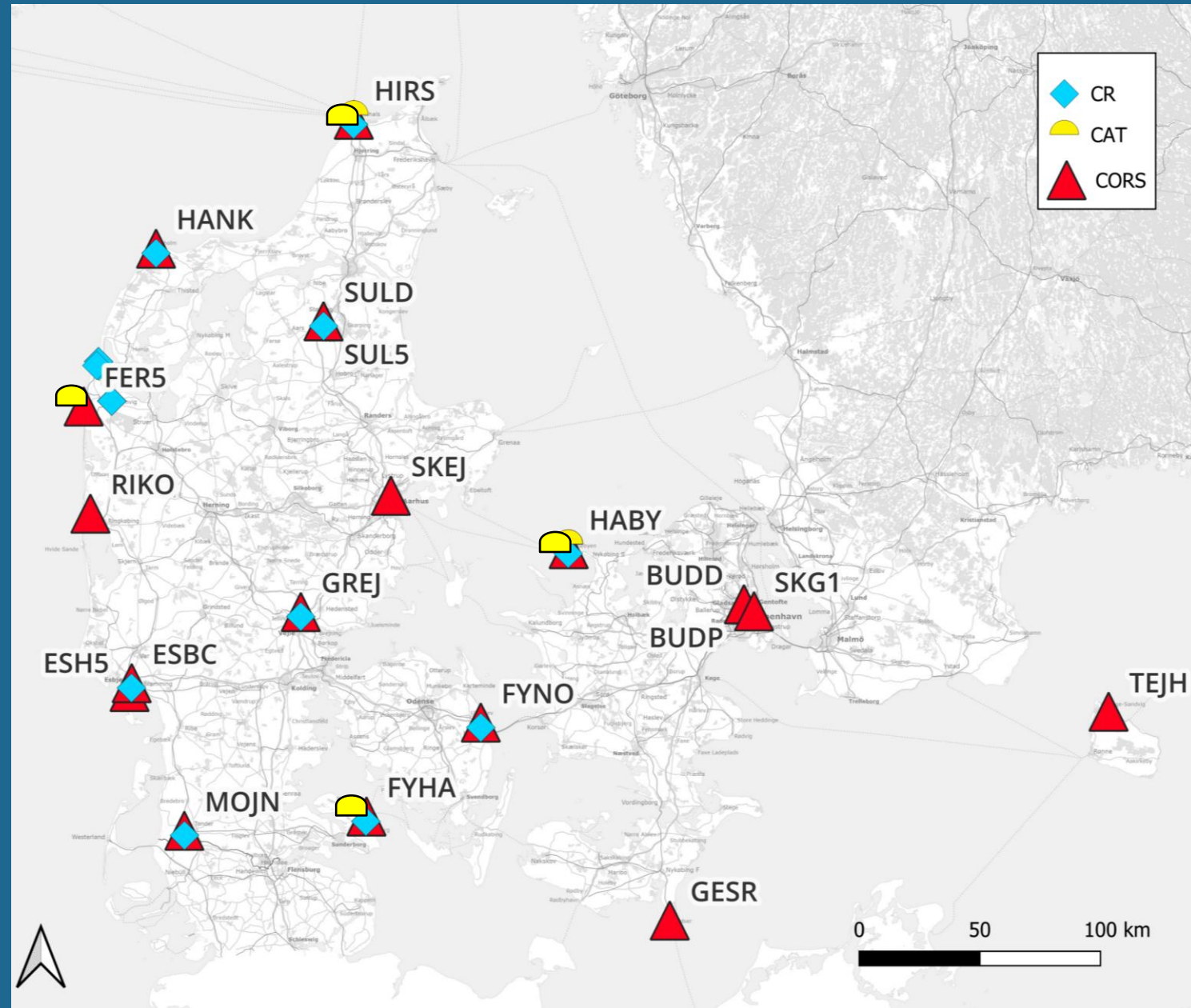
Compact Active Transponders (CAT) may be useful for geodetic and technical applications *if practical issues regarding maintenance and durability can be solved*

For now, CATs are being replaced by ordinary MUSE corner reflectors

## Long term plan

Install corner reflectors at all CORS  
Present: 9 CR and 4 CATs active

Control: precise levelling every 2 years



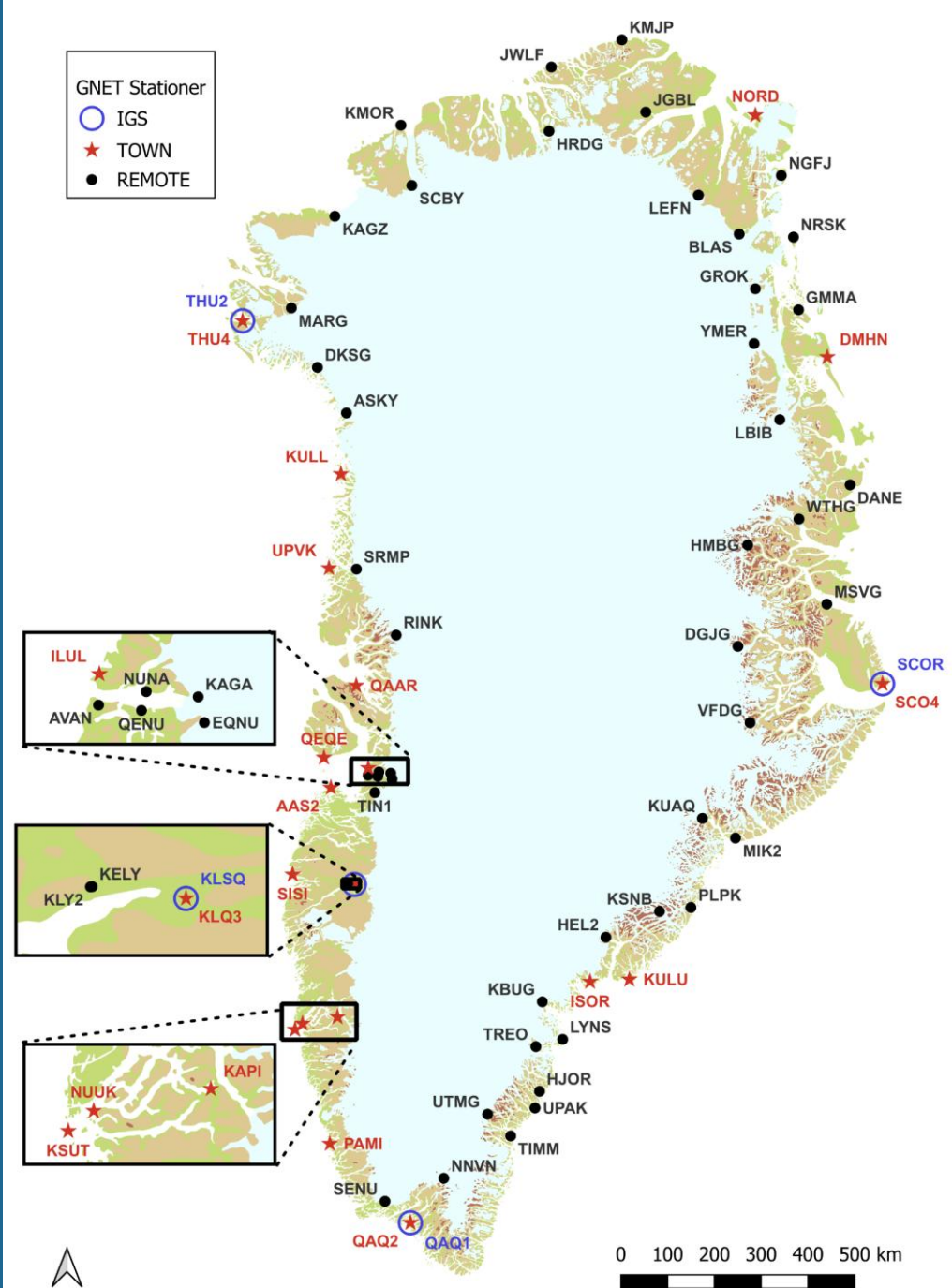
# Greenland - GNET

## Greenland GNSS Network (GNET)

- Collaboration with US NSF stopped on 2025-01-01
- 72 permanent GNSS stations.
- 9 new stations since 2022
- Satellite comm. using Iridium, OneWeb and Starlink.
- Continued collaboration with DTU Space

## Greenland Reference Frame 1996 (GR96)

- Re-realization published in 2025 – GR96(2021)
- Based on 2021 surveys
- GNET is now bound to GR96
- Future updates to GR96 derived directly from GNET.



# GNSS data management

- Real time data transitioned to NTRIP 2 and distributed freely via secure connection (TLS)
- **NTRIPmonitor:** In-house developed, open-source software for QC of real-time data streams
- Distribution of data to EPOS-GNSS
- Management and distribution of all GNET data, historical as well as real-time
- New servers, in compliance with governmental IT security requirements
- Work in progress on new agency-wide data platform and *closing of public FTP*



# Data handling and processing

**FIRE:** Levelling adjustment and geodetic data base handling system

- FIRE  $\Rightarrow$  GIS integration

**AutoBernese:** Automation of GNSS-calculation workflows around and with the Bernese GNSS Software <https://sdfidk.github.io/AutoBernese/>

1. Create Bernese campaigns.
2. Download and organize data for general or campaign-specific use.
3. Prepare selected campaign-specific files
4. Run the BPE for a complete processing of one or multiple campaigns

# Decennial border inspection. 1920 border DK-DE



1924-2024

Grænse/Grenzinspektion



- Agreement at the end of the first World War. Keeping the border visible
- Dictates that a joint border inspection must be held every ten years
- First time held in 1924. 2024 was 100th anniversary
- Protocol provides the overall framework for the next ten years
- Digitizing the old documentation. Joint task towards 2034



**Day 2: The land border East and West**  
Day 2 begins at Kupfermühle (the yellow circle) of the land border is inspected. We travel by bus to the western part of the border, where we have lunch and inspect selected locations (the yellow pins). End of inspection day 2 is in Tønder, where we will have a joint dinner. After dinner a shuttle bus will bring people back to the starting point in Kupfermühle.

**DAY 2**  
The land border  
East and West

**Day 1: Flensborg Fjord sea border**  
Day 1 begins at Kollund Mole (the red circle), where we will inspect the eastern sea border by boat. The sailing route is highlighted in red. At Sønderborg Castle we disembark and have lunch. After lunch we will go to Sandager (the red pin) by bus to inspect a pair of Baaker from the land side. Inspection on day 1 ends when we return by bus to Kollund Mole.

**DAY 1**  
Flensborg  
Fjord sea  
border

**A specific technical purpose and a commitment to maintaining good neighbourly relations**

THE  
**TREATY OF PEACE**  
BETWEEN  
ALLIED AND ASSOCIATED POWERS  
AND  
GERMANY,  
Protocol annexed thereto, the Agreement respecting  
military occupation of the territories of the Rhine,  
AND THE  
**TREATY**  
BETWEEN  
FRANCE AND GREAT BRITAIN  
RESPECTING  
assistance to France in the event of unprovoked  
aggression by Germany.  
Signed at Versailles, June 28th, 1919.

[With Maps and Signatures in facsimile.]



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# News



- New professor in physical geodesy, Jon Kirby
  - The SWOT satellite revolutionizes satellite altimetry (Ole Ba. Andersen)
  - New uplift model for Denmark (Per Knudsen)
  - 2 new megaprojects (Abbas Khan)
  - Quantum gravimetry: Cold atom gravimeters
  - Upgrade of Greenland tide gauges
  - Antarctic circumnavigation:  
Gravity + airborne radar
- 
- A satellite map of Greenland and the surrounding Arctic region. A pink line traces a path along the eastern coast of Greenland, with several red dots indicating the locations of tide gauges. Labels for these gauges include 'Gould Bay', 'South Bay', 'Narsarsuaq', 'Narsarsuaq', 'Narsarsuaq', 'Narsarsuaq', and 'Narsarsuaq'. The map also shows the 'ARCTIC OCEAN' and 'NORTH ATLANTIC OCEAN'.



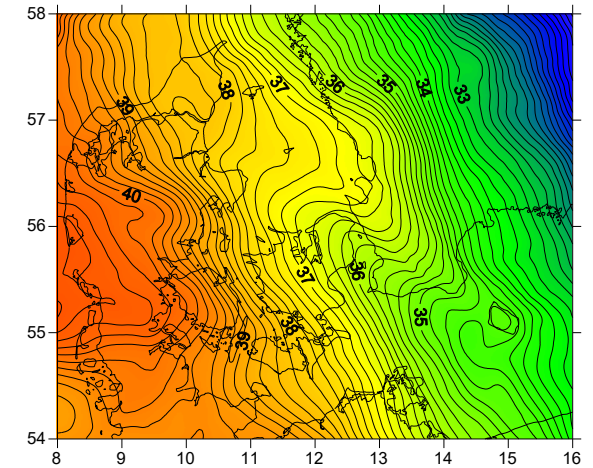
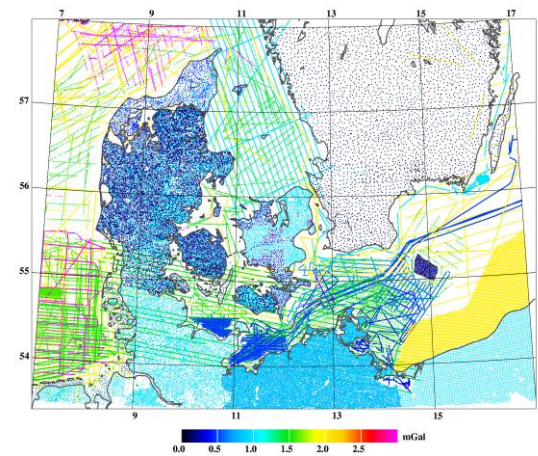
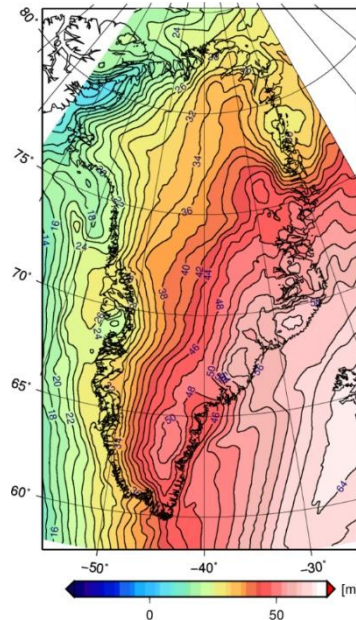
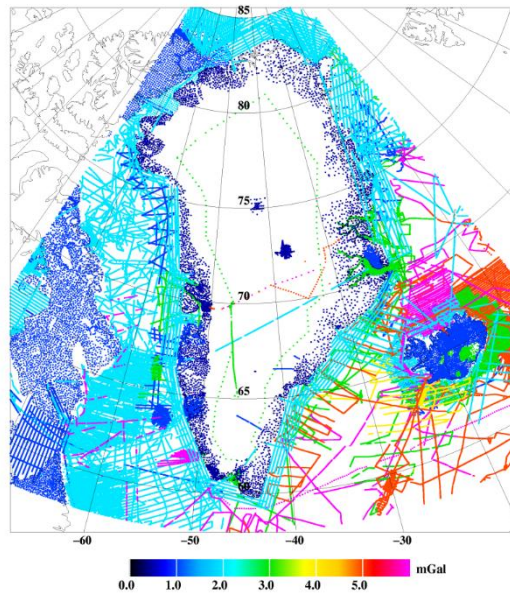
# Geoid Models: Denmark, Greenland & NKG

## Denmark

- 5 mm geoid released in fall 2023.
- New release 2026 with improved GNSS-levelling.
- Gravimetric geoid fitted to ~150 GNSS-levelling observations.

## Greenland

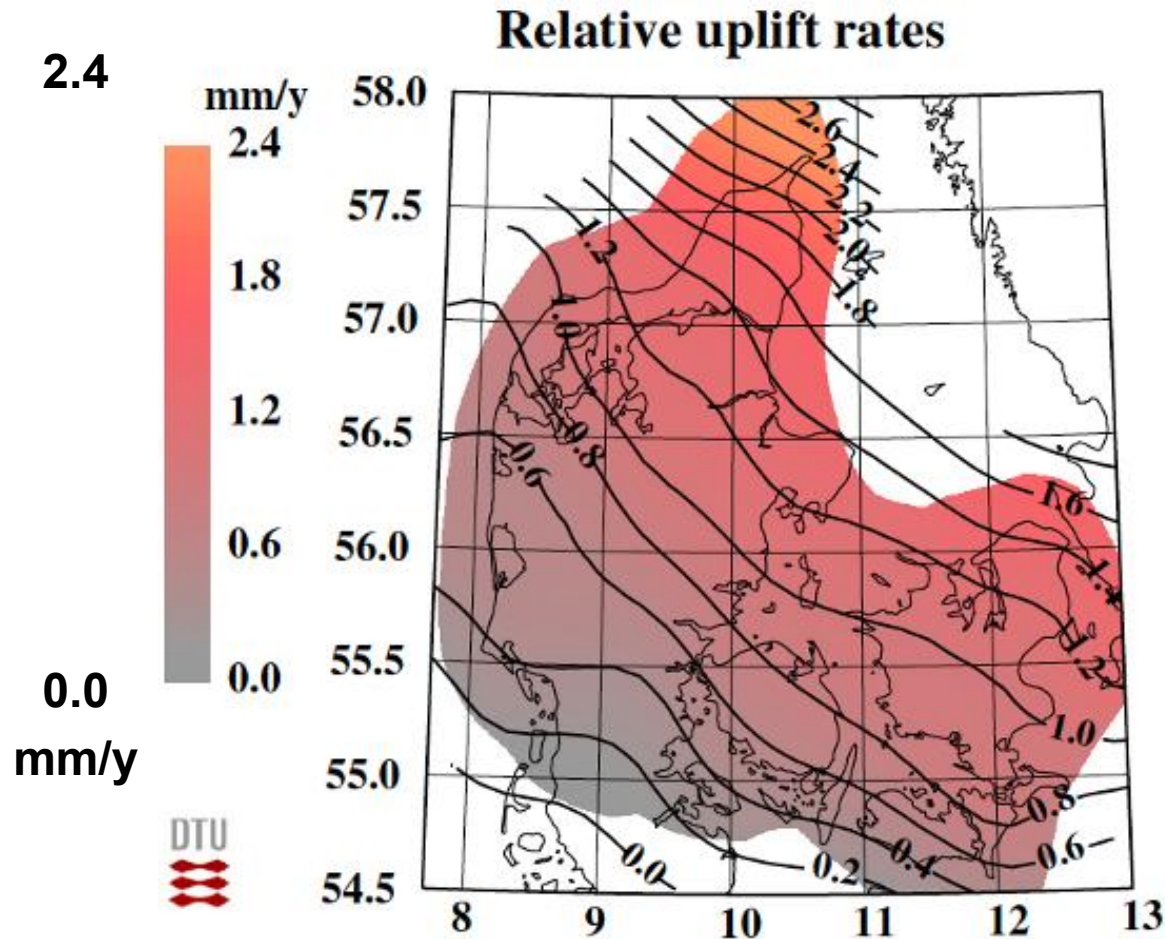
- GGEOID2016/GVR16 height system to be updated 2026.
- Nuuk geoid project, cm level.



## NKG

- New release 2026 to include Faroe Islands.
- Need gravity & GNSS-levelling data from UK & Ireland.
- NKG gravity database being updated.

# New DK uplift model 2024



The model is derived using:

- Levelling data from the three national campaigns carried out in  
**1885-1905 leading to DNN GM<sub>1891</sub>,**  
**1940-1953 leading to DNN GI<sub>1944</sub>, and**  
**1986-1992 leading to DVR90**
- GNSS permanent reference stations
- Tide gauge data (trends over 1900-2000)

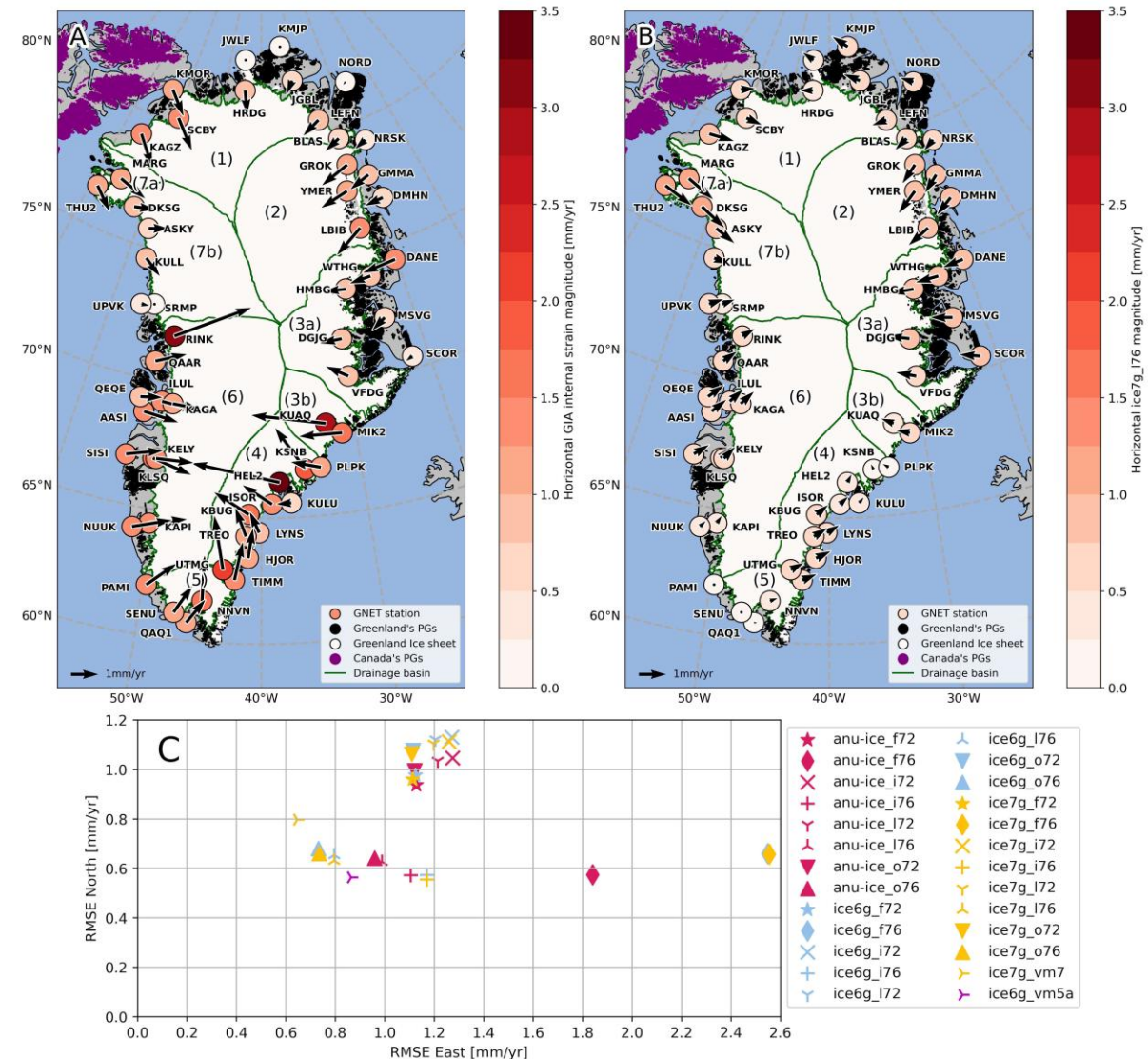
And back-ground models:

- NKG2016GIA model by Steffen et al. (2016)
- GRACE+GFO for geoid change

# Horizontal GIA in Greenland

- 70 GNET stations – new stations added
- Remove:
  1. Tectonic plate movement
  2. Present-day elastic deformation
  3. GIA translation field from the Laurentide ice sheet
- Compare GIA internal strain rates with best-fit GIA models

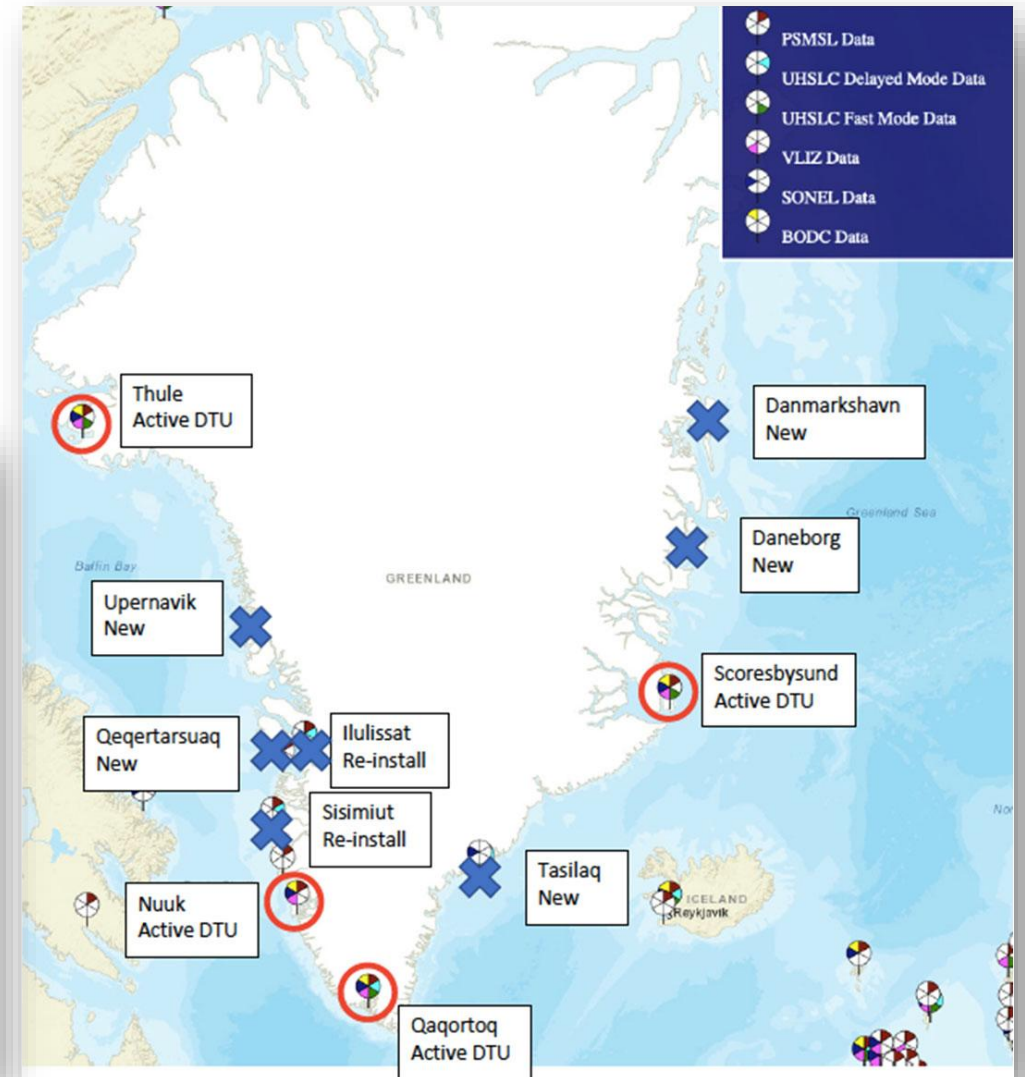
Berg et al. 2025 (Danjal Berg)  
Abbas Khan's group



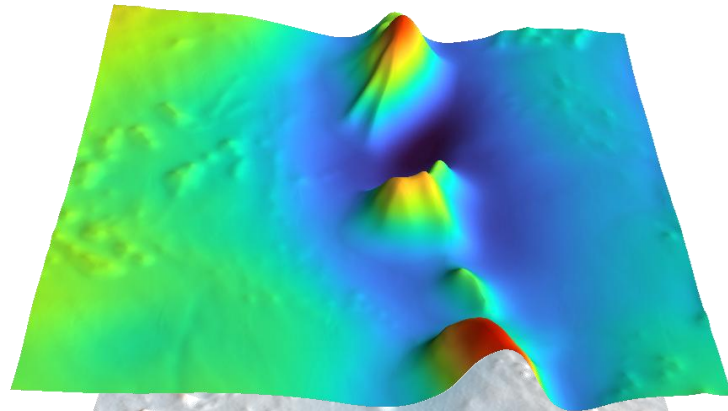
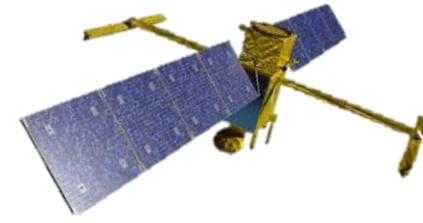
RINK, HEL2 and KUAQ have anomalous GIA rates

# Improving the sea-level monitoring in Greenland

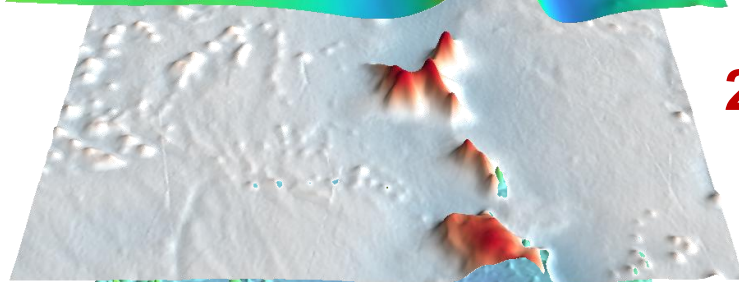
- Integration of tide gauge observation with geodetic control,
- Development of scientific quality control,
- Experimenting with GNSS-IR.



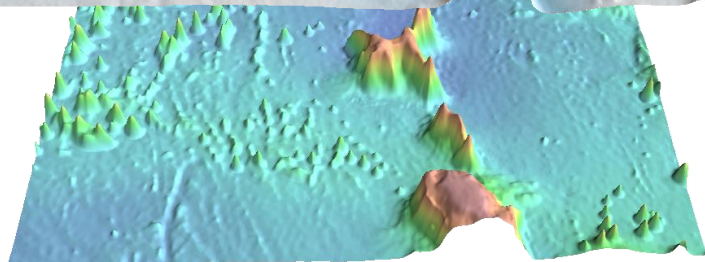
# Marine Geodetic fields from SWOT



**1. Mean Sea Surface**  
DTU25MSS



**2. Gravity field**  
DTU26Gra (prelim)



**3. Bathymetry**  
DTU\_DKL\_Bath

- The Hydrosphere group is a part of DTU Space, Geodesy and Earth Observation
- A part of our work is based on utilizing and processing **Satellite Altimetry data** for modelling marine geodetic fields
- The Surface Water and Ocean Topography (SWOT) satellites is a major step forward in regard to **precision, resolution** and **coverage**
- Current work includes utilizing SWOT data to improve models for the Mean Sea Surface, Marine Gravity Field and Bathymetry

*Ole Baltazar Andersens group: Carsten Ludwigsen, Bjarke Nilsson & Sara Jensen*

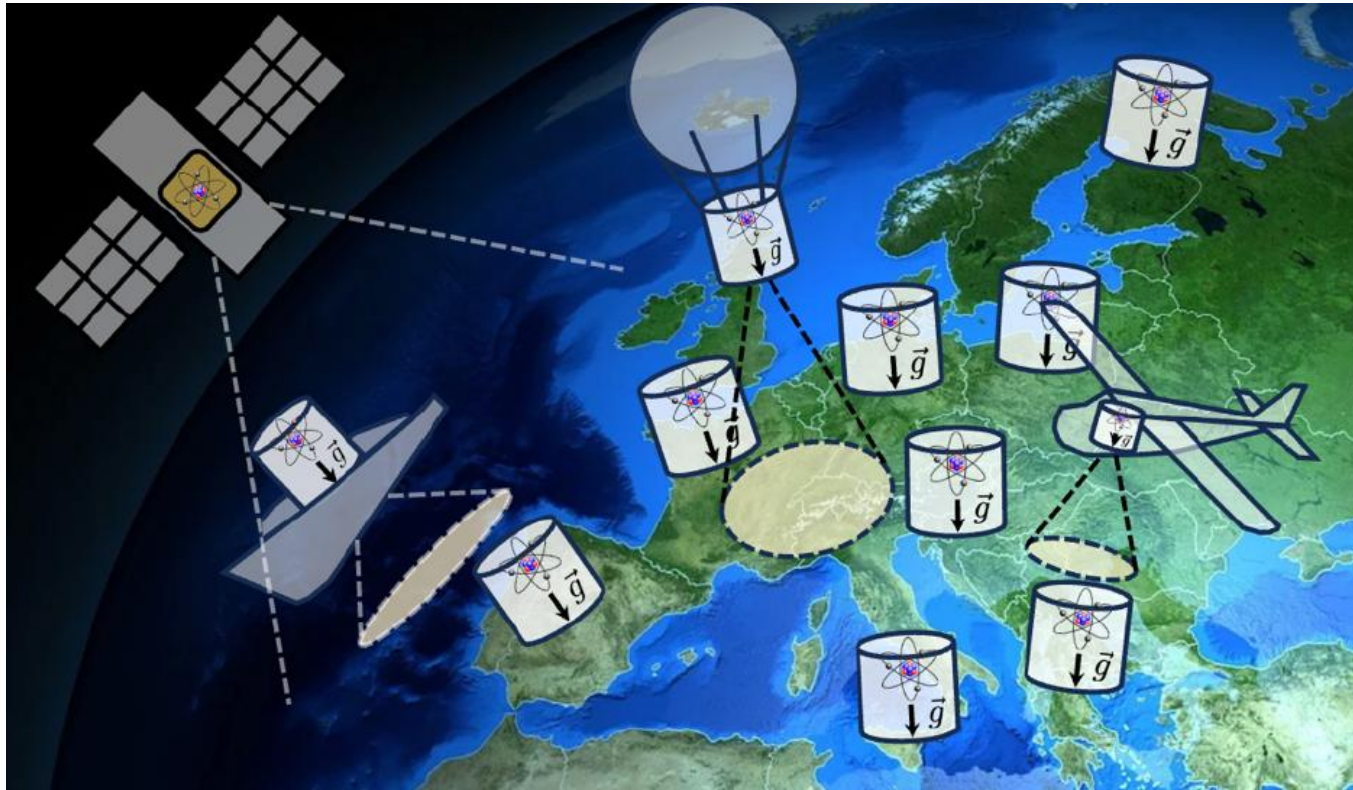
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Title

# The EQUIP-G Project – Quantum Gravimetry

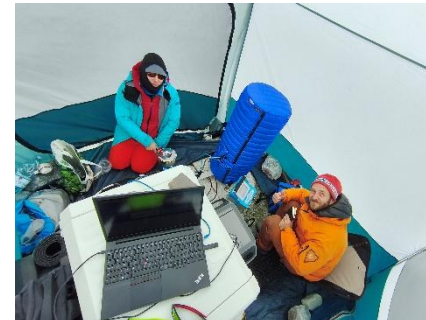
Reflects EU vision a pan-European quantum gravimetry infrastructure >2030 and beyond

- Array of quantum gravimeters
- Networked quantum sensing infrastructure covering all Europe
- Quantum space gravimetry pathfinder mission



- **Acquisition of new quantum gravimeters within EU**
- **10 Use Case Demonstrations**
  - 2 Hydrology
  - 1 Nuclear waste
  - 2 Vulcanology
  - 1 Climatology
  - 1 Geothermic
  - 1 Geodetic network
  - 2 Airborne survey

KAGA GNET station, Greenland



Tim Jensen, DTU Space

New Center of excellence lead by DTU was granted by NOVO Nordisk Fonden  
Includes partners from University of Copenhagen, GEUS and Dartmouth College

novo  
nordisk  
**fonden**

Main goal: predict Greenland and Antarctica's contribution to sea level rise by 2100.

Funding: 37 MDKK (~ 5 M€) from 2023-2029

