

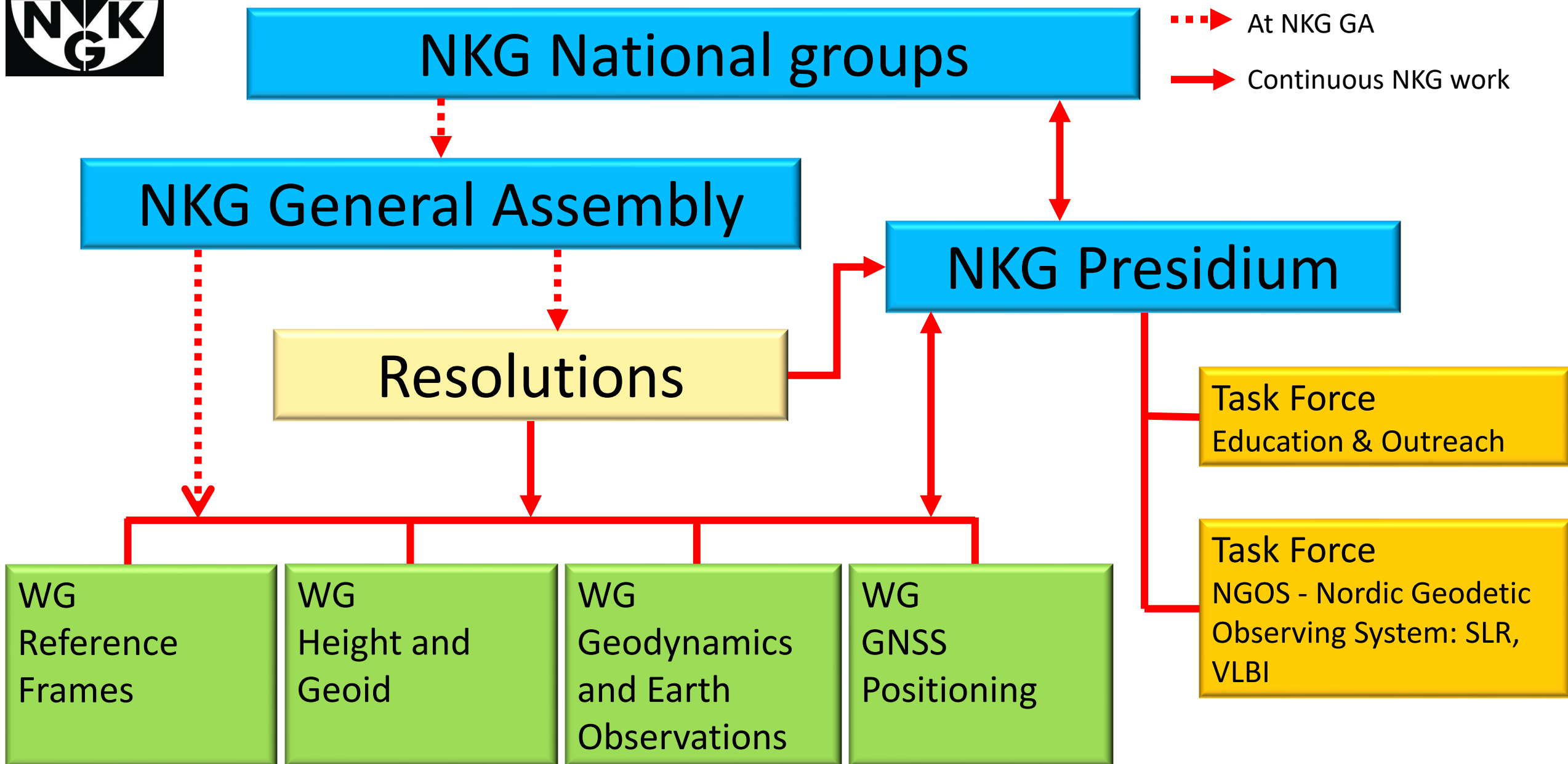


NKG structure 2026-2030

(version 2026-09-10)



NKG structure 2026-2030



Focus area: (2026-2030)

“Geodesy in a Challenged Environment”

The modern society is dependent on geodetic information for proper position, for operation of satellites, and for timing. From UN the fragility of the “Global Geodesy Supply Chain” has been identified.

Still mostly unrecognized by the public, an increase in the number of disturbances in geodetic measurements is seen in the NKG area. GNSS positioning is disturbed by jamming and spoofing and VLBI observations are threatened by overlapping radio signals, among others. At the same time, the number of adequate personnel that can tackle these challenges is decreasing.

In the 2026-2030 period, NKG will strive for

- Strengthening the resilience, sustainability, and coordination of the Nordic geodetic observing system including fundamental geodetic stations
- Ensuring reliable and more precise GNSS-based positioning
- Supporting the geodesy education in the NKG area
- Supporting outreach campaigns to raise awareness for the fundamental role of geodesy in daily life



Vision and goals:

A common, harmonized, densified, continuous and up-to-date ITRFyy coordinate and velocity solutions are in a key role for maintaining/monitoring of the national reference frames (ETRS89) in the Nordic and Baltic countries. The GNSS solutions together with associated velocity/deformation models and transformations form the basis for high-quality national reference frames in the long term. The GNSS velocities are essential data especially for Glacial Isostatic Adjustment (GIA) and deformation modelling and up-to-date coordinates for accurate transformations from global to national reference frames. We produce and constantly improve the GNSS solutions, deformation models and transformations for the maintenance of national reference frames.

1. **NKG GNSS Analysis Centre (NKG GNSS AC):** We produce operational daily GNSS solutions for the Nordic and Baltic countries through local analysis centres (LAC) and combine the LAC subnets to NKG daily solutions. Subsequently these solutions are stacked and analyzed to obtain multiyear solution (coordinates, velocities and their uncertainties). We produce regular cumulative solutions (and necessary reprocessings) to keep solutions up-to-date. Furthermore, we make NKG GNSS AC results available to users, e.g. via a web-based solution.
2. **NKG transformations:** We create and maintain accurate links between global and national reference frames. Together with the transformation parameters we develop and/or incorporate existing crustal motion models to account for the deformations caused e.g. by the GIA. Furthermore, we make NKG transformation available to users, e.g. through PROJ transformation software.



WG Reference Frames

2(2)

Keywords: reference frames, EPN, ETRS89, ITRF, coordinate transformations, densified GNSS velocity field, time series analysis, local ties, GNSS stations, geodetic registries, dynamic reference frames

Milestones 2026-2030:

NKG GNSS analysis centre

- Operational processing and combined NKG solutions continuously
- Continue development of cumulative NKG solutions towards regularly updated solutions
- Improving codebase needed for the LAC operations, e.g. Github
- Operational GNSS time series analysis and visualization of NKG GNSS AC results
- Station classification

NKG transformations

- Continuing standardization via geodetic registries and PROJ to facilitate the use of existing transformations
- Updated NKG deformation model (2D+1D), coordination with WGGEO and WGHG
- Updated NKG transformations and implementations (after new NKG deformation model)
- Study dynamic reference frames and the “two frame approach” with special focus on Iceland

Research within WG on alternative GNSS processing software and use of artificial intelligence to enhance GNSS-related reference frame products and transformations

Chairperson proposal: Ksenija Kosenko (LAT)



Vision and goals:

- We develop and improve our geoid models, especially the NKG geoid model. The long-term objective is a common Nordic geoid model with relative uncertainty better than approx. 5 mm (1 sigma, for the gravimetric geoid model), which makes it possible to determine accurate heights by GNSS and to realize high-quality vertical reference systems in the future.
- We collect and maintain our geodetic data, and we share data within the NKG community for geoid and other purposes.
- We study new techniques for height determination and practical use of height systems, with and without traditional levelling, but without losing the accuracy of levelling.
- We study, develop and have methods for effective use of EVRS and IHRS for the Nordic/Baltic area, both on land and for maritime applications.
- We are continuously aware of the progress on “the Global Height System” and are involved in its development.
- We study and develop theory and methods to maintain, upgrade or create a modern height system in the Nordic area that is up-to-date w.r.t. the land uplift.
- We investigate different alternatives for a future unified Nordic height system/frame, taking European and International developments into account (EVRS/EVRF and IHRS/IHRF, respectively).
- We study, contribute and use emerging technologies such as quantum gravimeters and clock-based geodetic height determination (chronometric leveling), SAR nadir- and wide swath altimetry.



WG Height and Geoid

2(2)

Keywords: Height systems, gravity, levelling, height determination, chart datums, EVRS, BSCD2000, IHRS/IHRF, geoid uncertainty, relative gravimetry, gravity database, GNSS/levelling database, methodology for geoid determination, chronometric levelling, optical lattice clocks, satellite altimetry, SWOT, tide gauges, empirical land uplift modelling, InSAR, Quantum Gravimetry

Milestones 2022-2026:

- NKG202XGEOID: two new geoid estimated based on updated gravity data.
 - First estimate a geoid covering same area as previous quasigeoid model (2027).
 - Secondly, a large area model is estimated covering from Baltic to parts of Greenland..
- NKG2026LU: Cooperate with WGGEO to develop a new land uplift model.
- Develop a common Nordic realization of IHRF (International Height Reference Frame) and derive relations to the existing national height systems and BSCD2000 (realizations of EVRS with land uplift epoch 2000.0)
- Maintain and update the NKG gravity and GNSS/levelling databases.
- Research on how the present geoid can be improved assuming already collected data.

Chairperson proposal: Ove Christian Dahl Omang, Kartverket, Norway



WG Geodynamics and Earth Observations 1(3)

Vision:

Improved understanding of the Earth and climate system is key to the interpretation and use of geodetic observations. Being of utmost importance in detecting environmental changes, geodetic observations are, in turn, often undesirably affected by them. The GIA process and ongoing climate-related changes such as glacial melting (especially in Greenland, Iceland, Svalbard, Norwegian glaciers) and hydrological changes are of particular importance for the NKG countries. We investigate and study these and other geodynamic processes (e.g., plate tectonics, regional and local subsidence, erosion, sedimentary loading) in our working group, providing state-of-the-art models, highly accurate geodetic observations, analyzing tools and guidance for the community.



WG Geodynamics and Earth Observations 2(3)

Goals:

1. We **develop and improve 3D models of geophysical processes, most notably GIA**, affecting the NKG and adjacent areas (e.g., Greenland). Our models are benchmarked, can explain the most up-to-date observations of the process, and are provided with uncertainties.
2. We collect, quality-control, share and use different types of observation data to **investigate geophysical processes** in the NKG and adjacent areas. This includes, among others, **absolute and relative gravity, GNSS, levelling and InSAR data**. We constantly refine our data analyses and share latest developments.
3. We follow new developments in geodetic instrumentation, such as **satellite and quantum gravimetry**, and geodetic methods.
4. We serve as the Nordic and Baltic platform for **collaboration of geodesists and geophysicists working with InSAR**.
5. We undertake periodic (Nordic) comparisons of absolute gravimeters.
6. We **investigate** and/or provide data for studies on and projections of **climate-related changes, sea level and different types of loading**.
7. We **make NKG products**, i.e data, models and codes, **available to users and the scientific community** at regular intervals and according to FAIR principles. We support international activities from, e.g., EPOS and GGOS.
8. We foster continued collaboration with universities and other institutions and participation in funding proposals.



WG Geodynamics and Earth Observations 3(3)

Keywords

Glacial isostatic adjustment, Plate tectonics, Environmental effects, Climatic Changes, Ice melt, Sea-level changes, Gravity measurements, InSAR, Quantum techniques, Modelling, FAIR data, Education & Outreach

Milestones 2026-2030

1. NKG2026GIA: Deliverables are modelled output of land motion, gravity, sea level, and stress field changes over time, i.e., from the past glacial, to today, and in the near future (max.1000 years), together with their uncertainty estimates.
2. BIFROST2025: New 3D velocities including corresponding uncertainties and corrections will be calculated with three different software for a, compared to the previous BIFROST2015 processing, largely extended time series (+10 years) and GNSS station network (~1000) that includes the forebulge area and Faroe Islands. Cooperation with WGHG and WGRF (NKG GNSS AC).
3. NKG2026LU: Based on BIFROST2025, NKG2026GIA and an extended levelling dataset that includes Germany and Poland, a new land uplift model will be generated in a one-step approach. Cooperation with WGHG.
4. Relative gravity lines: Joint NKG publications on data and results from the relative gravity lines.

Chairperson proposal: Holger Steffen, Lantmäteriet, Sweden



WG GNSS Positioning

1(2)

Vision and goals

GNSS data is a fundamental pillar of modern geodesy supplying precise positioning data for establishing robust reference frames, modelling of land motion and supporting reliable land surveying services. Furthermore, data from CORS networks is used in a wide range of geodetic research beyond positioning and is essential for climate adaptation efforts. The focus area of the WG is to achieve resilient GNSS CORS data and services.

The goals of this working group are to

- (1) ensure precise, reliable and resilient CORS networks, monitored using modern and secure software systems*
- (2) improve resilience to disturbances caused by jamming and spoofing*
- (3) exchange knowledge and experience on base station installation and hardware*
- (4) develop methodologies for quality control and monitoring of atmospheric events*
- (5) develop capabilities for monitoring of networks, nationally and mutually between NKG member states*
- (6) explore new technologies complementing existing GNSS products or offering alternative PNT*
- (7) follow development of data formats and standardization to improve compatibility, accessibility, and discoverability of GNSS data*



WG GNSS Positioning

2(2)

Keywords: *GNSS, cyber security, quality control, knowledge exchange, software development, best practices*

Milestones 2026-2030

- A summary table of good practices for base station installation, maintenance, interference, cyber security etc., [3]
- A data quality table, including integrity, that describes what is data quality, what are the thresholds for good data quality, what software is used to perform data quality analysis, etc. [1]
- Extend the collaboration regarding ionosphere monitoring in the NKG member states. [2, 4]
- Exchange of jamming and spoofing experience [2]
- Continued collaborative development of software for monitoring of CORS networks [5]
- Research and case studies on new technologies and products. [6, 7]

Chairperson proposal: Christian Brønnum-Hansen, KDS, Denmark



Task Force Education and Outreach

Geodesy is needed widely in the current society. The challenge at the moment is that the number of dedicated geodesy teaching is diminishing whereas the understanding of geodetic topics and techniques is becoming increasingly important. There are three levels of education that need to be considered. Firstly, the geodesy experts needed by the observatories, universities and agencies. Secondly, the wider scientific community using geodetic techniques and concepts wanting to understand them better. And thirdly, educating the whole society, to make geodesy better known and appreciated. The goal of this task force is to see which geodesy topics are taught in NKG countries and at which level, and discuss the opportunities for collaboration in both teaching (experts in both geodesy and other fields) as well as rising the awareness level of the experts and general public.

Proposed to be chaired by Maaria Nordman, Finland.



Task Force Nordic Geodetic Observing System, NGOS

The task force aims to strengthen the resilience, sustainability, and coordination of the Nordic geodetic observing system. The focus will be in observatories including at least VGOS (VLBI Global Observing System) and/or Satellite Laser Ranging (SLR) equipment. However, at these stations all co-locating equipment will be included as well. These observatories form a critical part of the global geodetic observing system GGOS. They operate under constrained financial and human resources, making them vulnerable to disruptions and slow recovery in the event of technical failures. No intergovernmental agreements exist to guarantee long term operations. The task force will assess the status of all Nordic and Baltic VGOS and SLR stations. This includes infrastructure, staffing, funding mechanisms, operational risks, and recovery capabilities. This way we try to identify vulnerabilities and interdependencies, addressing concerns raised in UN-GGCE reports regarding hidden risks in the global geodetic supply chain. Based on this assessment, the task force will produce a suggestion for enhanced regional cooperation. These may include shared technical support, coordinated contingency planning, mutual aid agreements, joint training programs, and structured knowledge exchange. Governance models for collaboration will also be explored. The goal is to establish a more robust, cooperative Nordic geodetic network that can better withstand disruptions and contribute reliably to global geodetic services.

Proposed to be chaired by Hannu Koivula, Finland.



The NKG Presidium 2026-2030

Denmark

Jonathan Kirby
Thorbjørn Nielsen

Estonia

Karin Kollo
Artu Ellmann

Finland

Hannu Koivula (NKG President proposal)
Maaria Nordman

Iceland

Pórarinn Sigurðsson
Guðmundur Valsson

Latvia

Ivars Liepiņš (NKG Secretary proposal)
Armands Celms

Lithuania

Saulius Urbanas
Eimuntas Paršeliūnas

Norway

Ola Øvstedal
Astrid Marie Flattum Muggerud

Sweden

Jan Johansson
Martin Lidberg

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Ksenija Kosenko (LV), WGRF
Ove Christian Dahl Omang (NO), WGHG,
Holger Steffen (SE), WGGE0
Christian Brønnum-Hansen (DK), WGGP

