

2018-2022 REPORT OF THE WG GEODYNAMICS AND EARTH OBSERVATION

NKG GENERAL ASSEMBLY, 7 SEPTEMBER 2022

HOLGER STEFFEN & THE WG GEO MEMBERS





GEODYNAMICS AND EARTH OBSERVATION (2018-2022)

Vision and goals

Improved understanding of the Earth and climate system is key to the interpretation and use of geodetic observations. Here, the GIA process is of particular importance for the countries within NKG but we will also welcome and support investigations and research on other geodynamic processes (e.g., plate tectonics, hydrological changes) important for our activities. In addition, we will follow the progress of the European Plate Observing System (EPOS).

1. We continue our work on **developing and improving GIA models (Milestone #1)** as well as empirical models of geophysical processes. Our GIA models will be tested against new paleo and geodetic data. We will provide GIA model uncertainties and further investigate models with lateral changes in Earth structure.
2. We continue our cooperation on the **collection and analysis of absolute gravity data**. These data will be used and made available for new studies of GIA and other geophysical processes. We will refine our analyses of the absolute gravity data by, for example, investigating and applying corrections for hydrological changes.
3. We encourage **collaboration with the InSAR community**. We will investigate the potential applications of new data from this technique that are relevant for our WG.
4. We will begin a cooperation on the **analysis and preservation of data from existing relative gravity lines. (Milestone #2)** This may lead to another joint NKG publication.
5. We will foster a culture of code and data sharing where **“NKG products” are made available to users and the scientific community** at regular intervals. We encourage continued collaboration with universities and other institutions and participation in funding proposals.

Keywords

Glacial isostatic adjustment, Plate tectonics, Environmental effects, Gravity measurements, Satellite data, Modelling

Milestones 2018-2022

1. **NKG2022GIA: Expected deliverables are modelled output of land motion, gravity, sea level, and stress field changes over time (from the past glacial, to today, and in the future). Modelled uncertainty estimates will also be given.**
2. **Relative gravity lines: Joint NKG publication on the data from the relative gravity lines.**

WGGEIO OBJECTIVES FOR 2018-2022

- Holger (S) new chairman after Matt Simpson (N)
- Continue the excellent cooperation and back-to-back meetings with WGFHSG
- *Continue with invited talks that Matt started*
- *Try to give WG members some outside perspectives and helpful advice*
- *Try to increase # of scientific talks and # of participants in WG meetings*
- *Modernize a few administrative tasks and meeting organization*
- *Support the preparations for Baltic countries becoming members of the NKG*



REPORT ITEMS

1. Developing and improving GIA models & NKG2022GIA
2. Collection and analysis of absolute gravity data
3. Collaboration with the InSAR community
4. Analysis and preservation of data from existing relative gravity lines
5. NKG products are made available to users and the scientific community
6. Cooperation and meeting organization with WGFHSG
7. Invited talks, outside perspectives and helpful advice
8. # of scientific talks and # of participants in WG meetings
9. Modernize administration
10. 2022-2026

DEVELOPING AND IMPROVING GIA MODELS

NKG2022GIA model:

- At least one meeting per year with colleagues involved
- Much work on collecting and harmonizing observation data used for model constraining (velocity field, relative sea-level data, gravity data, glacially induced faults) → data publications
- New 3D spherical method FEMIBF:
 - Combination of FE software Abaqus with Python3 scripts, allows compressible Earth parameters
 - Benchmark with 1D models successful
 - Implemented at LM computers with increased modelling power
 - Plans to make it open access in future
- Modelling phase commenced in April 2022
- More in the NKG2022 talk later

BIFROST2020 and NKG202XLU activity:

- Incorporating data from countries south of the Baltic Sea
- International team of NKG countries and Poland + NKG GNSS AC is involved
- Preparations of input data for BIFROST processing started, processing will start soon



Chairman

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Secretary

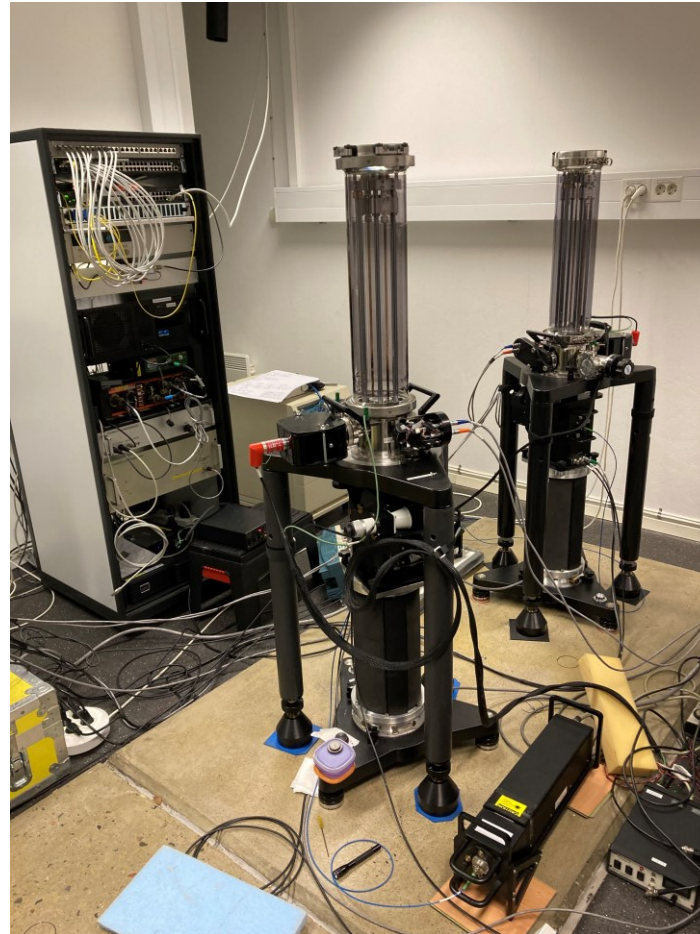
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COLLECTION AND ANALYSIS OF ABSOLUTE GRAVITY DATA

Nordic comparison in Onsala!

- 15 instruments (6 FG5X, 5 FG5, 2 A10 and 2 AQG) came to Onsala
- 2 gradient measurements were performed
- See talk by Mirjam later

Submit your data to the Nordic AG database!



NKG International Absolute Gravimeter Comparison in Onsala Space Observatory, Sweden, 2022

On behalf of the Nordic Commission for Geodesy we are pleased to announce the supplementary absolute gravimeter comparison that will take place at Onsala Space Observatory in Sweden during the period 30th May to 14th July 2022. The comparison will be organized as an Additional Comparison as described in §4.1.4 of the CCM – IAG Strategy for Metrology in Absolute Gravimetry.

The Gravimetry Laboratory at Onsala Space Observatory allows parallel measurements at 3 pillars. Individual measurements are limited to one day (24 hours) duration. The dual sphere superconducting gravimeter SG-054 is recording gravity variations continuously. The derived reference function allows for a longer comparison period without the need in parallel observations.

Please inform us before 7th January if you are interested in participating. We will then prepare and circulate the technical protocol as well as housing information.

Kind regards,


The Organization Committee:

Andreas Engfeldt, Lantmäteriet, Sweden (andreas.engfeldt@lm.se) – Administrator
Maxime Mouyen, Onsala Space Observatory, Sweden – Local organizer
Mirjam Bilker-Koivula, Finnish Geospatial Research Institute, Finland – Pilot laboratory



COLLABORATION WITH THE INSAR COMMUNITY

- Started in the 2019 WGGEO meeting with 3 invited InSAR presentations
- InSAR has become a major part of NKG WGGEO/WGFHSG meetings (half day with many discussions)
- Participants confirmed a need for cooperation and sharing of knowledge
- A continuation of the InSAR session is appreciated (more tomorrow)



ANALYSIS AND PRESERVATION OF DATA FROM EXISTING RELATIVE GRAVITY LINES

- 2-3 publications are planned regarding the relative gravity lines (Jaakko Mäkinen & Andreas Engfeldt)
 - Steady progress despite the pandemic
 - Jaakko sent majority (~90%) of the data and preliminary analysis to Andreas
 - More later by Jaakko

NKG PRODUCTS ARE MADE AVAILABLE TO USERS AND THE SCIENTIFIC COMMUNITY



Journal of Geodesy
<https://doi.org/10.1007/s00190-019-01280-8>

Quaternary Science Reviews 266 (2021) 107071

ORIGINAL ARTICLE

NKG2016LU: a new land uplift model for Fennoscandia and the Baltic Region

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journal homepage



Contents lists available at ScienceDirect

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A Holocene relative sea-level database for the Baltic Sea

Alar Rosentau^{a,*}, Volker Klemann^b, Ole Bennike^c, Holger Steffen^d, Jasmin Wehr^e, Milena Latinović^b, Meike Bagge^b, Antti Ojala^{f,g}, Mikael Berglund^h, Gustaf Peterson Becher^{i,j}, Kristian Schoningⁱ, Anton Hansson^k, Lars Nielsen^l, Lars B. Clemmensen^l, Mikkel U. Hede^{l,m}, Aart Kroon^l, Morten Pejrup^l, Lasse Sander^{l,n}, Karl Stattegger^o, Klaus Schwarzer^o, Reinhard Lampe^p, Matthias Lampe^q, Szymon Uścińowicz^r, Albertas Bitinas^s, Ieva Grudzinska^t, Jüri Vassiljev^u, Triine Nirgi^a, Yuriy Kublitskiy^v, Dmitry Subetto^{v,w,x}



A GNSS velocity field for geophysical applications in Fennoscandia

Halfdan Pe
Jan Johans



PANGAEA.

Data Publisher for Earth & Environmental Science



SEARCH SUBMIT HELP ABOUT CONTACT

Munier, Raymond; Adams, John; Brandes, Christian; Brooks, Greg; Dehls, John; Einarsson, Páll; Gibbons, Steven J; Hjartardóttir, Ásta Rut; Hogaas, Fredrik; Johansen, Tor Arne; Kvaerna, Tormod; Mattila, Jussi; Mikko, Henrik; Müller, Katharina; Nikolaeva, Svetlana B; Ojala, Antti; Olesen, Odleiv; Olsen, Lars; Palmu, Jukka-Pekka; Ruskeeniemi, Timo; Ruud, Bent Ole; Sandersen, Peter B E; Shvarev, Sergey V; Smith, Colby A; Steffen, Holger; Steffen, Rebekka; Sutinen, Raimo; Tassis, Georgios (2020): International database of Glacially Induced Faults. PANGAEA, <https://doi.org/10.1594/PANGAEA.922705>

COOPERATION AND MEETING ORGANIZATION WITH WGFHSG

1st day, afternoon – WGFHSG presentations & discussions

2nd day, morning – **National reports** & WGFHSG cont.

2nd day, afternoon – WGGE0 **InSAR**

3rd, morning – WGGE0 presentations & discussions

1st day, afternoon – WGGE0 presentations & discussions

2nd day, morning – **National reports** & WGGE0 cont.

2nd day, afternoon – WGFHSG **InSAR**

3rd, morning – WGFHSG presentations & discussions



INVITED TALKS, OUTSIDE PERSPEKTIVES AND HELPFUL ADVICE

- 2019: Introduction to InSAR with 3 invited presentations
- 2020: "Science Week" in Reykjavik with much geodynamics
- 2021: Invited InSAR presentation by Yasser Maghsoudi (Leeds University)
- 2022: Invited presentation by Fabio Cramer (Switzerland) on use of colour in data processing and science communication



43th WGGE0 meeting participants in the meeting room at DTU Space (Photo: H. Steffen).

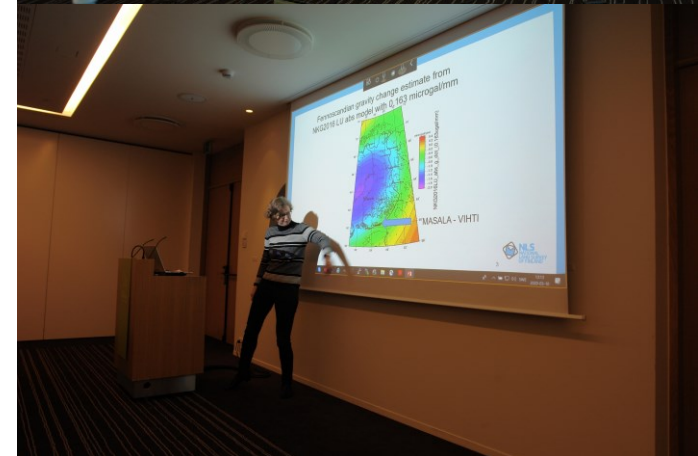
NUMBERS

Year	Location	Participants In pers.+online	Countries	Scientific presentations	Other presentations
2019	Lyngby, DK	36+0	8	8	6
2020 ^a	Reykjavik, IS	18+2	8	6	7
2021 ^b	Online	0+72	11	11	6
2022 ^c	Gävle, S	31+25	11	8	6

a Science Week, already pandemic-influenced

b Rather open link distribution and no real registration

c Registration enforced





ORGANISATION ETC.

- We can do hybrid; we can do digital only
- Since 2020 Combined national reports with WG FHSG; much appreciated, will be continued
- Secretary duty is determined in advance (Lithuania in 2023!)
- Mailing list has been created nkg_wggeo@freelists.org; solely used for NKG meeting invitations, also for job and conference advertisements

2023 Glacial Isostatic Adjustment (GIA) Training School



4 days of lectures & practical exercises, a 1-day field trip to examine records of land uplift and sea level change, and a unique opportunity to interact with leading researchers in the GIA community

Instructors

Martin Ekman • Glenn Milne • Nicole Khan • Mirko Scheinert • Giorgio Spada • Rebekka Steffen
Lambert Caron • Andrew Lloyd • Torsten Albrecht • Mike Bentley • Volker Klemann
Jacky Austermann • Erica Ashe • Holger Steffen • Terry Wilson • Natalya Gomez • Anne Le Brocq

First Circular soon; Applications open in November 2022

More info soon at: <https://polenet.org/2023-gia-training-school/>

