



# Nordiska kommissionen för Geodesi Nordic Geodetic Commission

Working Group for Geodynamics and Earth Observations

## Minutes of the 43rd meeting of the Working Group for Geodynamics and Earth Observations, within the Nordic Geodetic Commission

The meeting was hosted by the Danish Technical University (DTU) on 11-12 March 2019 in Lyngby, Denmark. It was organized together with the meeting for the Working Group of Future Height Systems and Geoid. Both meetings took place at DTU Space, Building 202, meeting room Ly202-R8003.

### Participants:

Denmark	Joanna Balasis-Levinsen, Valentina Barletta, Kristian Evers, Nicolaj Hansen, Tim Jensen, Thomas Knudsen, John Merryman Boncori, Gabriel Strykowski
Estonia	Tõnis Oja, Sander Varbla
Finland	Mirjam Bilker-Koivula, Maaria Nordman, Veikko Saarinen
Iceland	Guðmundur Valsson
Latvia	Diana Haritonova, Janis Kaminskis, Ivars Liepiņš, Vieturs Sprogis, Madara Znotiņa, Vents Zuševics
Lithuania	Vytautas Puškorius
Norway	Halfdan Pascal Kierulf, Dagny Lysaker, Ove Omang, Olav Vestøl
Sweden	Mohammad Bagherbandi, Andreas Engfeldt, Thomas Hammarklint, Maxime Mouyen, Faramarz Nilfouroushan, Per-Anders Olsson (Secretary), Hans-Georg Scherneck, Holger Steffen (Chair), Per Steffen, Rebekka Steffen, Jonas Ågren

## 1. Introduction

The new Chair of the working group, Holger Steffen (Lantmäteriet), welcomed all participants to the meeting and noted that this working group has now changed names from Working Group for Geodynamics to Working Group for Geodynamics and Earth Observations (WGCEO).

The Chair introduced himself.

The agenda was approved.

The participants of the meeting were invited to comment on the minutes from the last meeting in Helsinki, March 2018. There were no comments to the minutes.

Per-Anders Olsson, Lantmäteriet, was appointed as secretary.

The Chair initiated the new 4-year period by recapitulating the resolutions, the NKG focus areas and structure, decided at the General Assembly in September 2018 in Helsinki.

## 2. InSAR

This topic was introduced to this working group with three invited presentations:

- John Merryman: “A top-down introduction to Spaceborne Synthetic Aperture Radar Interferometry”
- Joanna Balasis-Levinsen: “Building a national InSAR infrastructure”
- Hans-Georg Scherneck: “Inference of surface deformation along a central section of the Pärvie fault, Swedish Lapland, and at the Kiruna mine using InSAR”

A discussion on possible NKG-coordination of InSAR activities in this working group was initiated by two short national reports on InSAR status.

- Halfdan Pascal Kierulf: “InSAR plans at Kartverket and one slide about DRF”.
- Faramarz Nilfouroushan: “Some remarks on InSAR in Sweden”.

It was recognized that Norway and Denmark have already or have started implementation of ground motion services based on InSAR.

Lantmäteriet, FGI and Tallin University of Technology will participate in an ESA founded project called “Geodetic SAR for Baltic Height System Unification and Baltic Sea Level Research”.

It was discussed if/how the geodetic infrastructure can contribute to InSAR products and vice versa if/how InSAR can contribute to the geodetic infrastructure, e.g. by monitoring of local deformations around reference stations/points.

It was decided that at this moment no direct NKG cooperation/action is needed. All countries continue their work, best effort, and at the next WGCEO meeting we have an InSAR session where we follow up this work.

It was noted that it is important to stay informed about development of the European ground motion service.

John and/or Joanna were invited to participate also at the next WGCEO meeting to keep us informed about the progress within this field.

## 3. National/Institute reports

National/institutional reports were given by

- Norway, Dagny Lysaker, Kartverket
- Lithuania, Vytautas Puškorius, Vilnius Technical University
- Iceland, Gudmundur Valsson, National Land Survey of Iceland
- Sweden, Andreas Engfeldt, Lantmäteriet
- Sweden, Hans-Georg Scherneck, Chalmers
- Finland, Maaria Nordman, FGI
- Estonia, Tõnis Oja, Maa Amet
- Latvia, Ivars Liepins, Riga Technical University (no digital presentation)
- Denmark, Gabriel Strykowski, DTU.

## 4. Glacial Isostatic Adjustment

- Maaria Nordman gave an interesting scientific presentation on “Land uplift on High Coast and Kvarken archipelago”.

One of the main activities for this working group during the coming four years is to come up with a new state of the art GIA model with 3D Earth rheology for Fennoscandia, NKG2022GIA. This is a challenging task.

Holger suggested a GIA modelling group consisting of:

- Holger Steffen (SE): coordination, 3D modelling
- Maaria Nordman (FI): 1D high resolution test, 1D benchmarking, data analysis (tide gauges)
- Valentina Barletta (DK): test of other rheologies in 1D models, elastic correction from Greenland, Arctic ice caps and High Mountain Areas
- Karin Kollo (EST) & Vents Zuševics (LAT): 1D benchmarking with Spada’s code

In addition to this group the following people are closely connected to this work and will most likely contribute:

- Glenn Milne: GIA modelling
- Lev Tarasov: ice load history, data analysis uncertainty determination
- Rebekka Steffen: 3D GIA modelling, glacially induced faults

## 5. Gravimetry

This session started with two interesting presentations from Chalmers:

- Hans-Georg Scherneck: “Superconducting and Absolute Gravimetry: Reprocessing of the multi-campaign adjustment 2009-2017 --- and obstacles for adding 2018”
- Maxime Mouyen: “Investigation of hydrological effects at the superconducting gravimetry site of Onsala”.

Mirjam Bilker-Koivula reported that the Finnish AG-paper was submitted to Journal of Geodynamics but needed major revision and will hopefully be resubmitted (perhaps to another journal) before the end of this summer.

The joint Nordic AG paper is now published (open access) in Geophysical Journal International (<https://doi.org/10.1093/gji/ggz054>). There the NKG2016LU\_gdot model is presented and all repeated AG observations in Fennoscandia till 2015 are published as Supplementary material.

Work is going on with a new publication, with Jaakko Mäkinen as first author, investigating the Baltic AG stations deeper.

All owners of AG data were encouraged to submit their data, preferably also raw data/drop files, to the AGrav database.

In 2012 there was an agreement, signed of the heads of all Nordic geodetic institutions with AG data, saying that all Nordic repeated AG data should be collected and stored at common place (LM) with a copy at another place (FGI). The purpose is to make sure that there is a backup of all data, i.e. that they are secured for the future, and that there is an easy way to get access to all the data for further research. Since 2015 no data have been delivered to this Nordic AG database. It was now agreed that we should continue according to the agreement and update the database with all new observations. With observations we here mean raw data like drop files, project files, \*.fg5 files etc. So, everyone is now encouraged to send their data to Andreas Engfeldt (LM) who is managing this database.

It was noted that the first realization (IGRF) of the International Gravity Reference System (IGRS) is approaching. To qualify for being a reference station in IGRF some criteria needs to be fulfilled, i.e. continuous recording of temporal gravity changes, like a superconducting gravimeter, and/or regular AG measurements 6-12 times/year with gravimeters that took part in international comparisons. Metsähovi, Onsala and Märtsbo have been suggested as candidates, so far.

It was noted that the work with repeated AG observations in Fennoscandia is proceeding well at the moment. Both DTU, Kartverket/Ås, LM, and FGI observed at many stations in their counties, respectively, last year. In Finland several new AG stations have also been built.

It was decided that a Nordic comparison of absolute gravimeters should be arranged at Onsala. Only two gravimeters can observe at the same time in Onsala but using the SG as a link the comparison can be conducted over several consecutive days. With the Finnish instrument, FG5X-221, participating there will also be an official link to the international key comparisons. LM and Chalmers (in co-operation) will arrange this.

Mirjam summarized the status of the work with publications on the relative gravity land uplift lines. Jaakko Mäkinen is a key person here with much knowledge and access to the data. Mirjam suggested three possible publications to be finalized:

- Jaakko is working on a scientific paper on the 63-degree line where he will compare the results with e.g. ICE-6G and NKG2016LU.
- Accompanying this paper there should also be a technical paper or report with observations, gravity differences, gravimeters, stations etc. Andreas Engfeldt volunteered to take care on this in case Jaakko sends all data to him.
- A small paper or technical report on the other lines (other than the 63-degree line). Authors tbd.

Next to Jaakko, also Hannu Ruotsalainen, Gabriel Strykowski, Andreas Engfeldt and Tõnis Oja have been once involved in measurements of the lines and are active to date. It was suggested that these colleagues should be closely involved in the work.

At the next WGGE0 meeting there will be a point on the agenda to follow up this work.

## **6. Dynamic Reference Frame**

The scientific part of this meeting was ended with two interesting presentations related to Dynamic Reference Frames:

- Rebekka Steffen: “Deformation model for Europe: Application of the least-square collocation”
- Diana Haritonova: “The impact of the Baltic Sea loading on GNSS station coordinate time series in the territory of Latvia”

## **7. Business matters**

- The status of the NKG website is still unclear – the chair will take this question to the next presidium meeting.

- The chair called for a better way to keep the mailing list to the members of this group up to date. It was suggested to evaluate if a mailing list for the group can be created with available web services. The Chair will do that before the next meeting.
- The chair announced that there will be a GIA Training School at Lantmäteriet in August, anyone who is interested should apply before 2019-03-31.

## **8. Closing of the meeting**

It was a suggestion to hold the next WGGE0 meeting in Iceland (who is next in turn), maybe in connection to a science week (on dynamic reference frames?). The chair will take this suggestion to the presidium. A second choice would be Sweden (who is in turn after Iceland).

The chair thanked to local organizing committee for their hospitality and closed the meeting.