



# NORDISKA KOMMISSIONEN FÖR GEODESI

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## MINUTES

### 61<sup>st</sup> NKG PRESIDIUM MEETING

Time: 6-7 April, 2016 Lunch - Lunch  
Place: Kartverket, Hønefoss, Norway

#### **Item 1) Opening of the meeting**

Niels and Per-Erik welcomed us to Kartverket and the meeting. A special welcome to Søren, Martin, Ove and Oddgeir. Ove replaces Dany as WG chair for Geodynamic group and Oddgeir replaces Torbjørn.

#### **Item 2) Approval of the agenda**

The agenda was discussed and agreed.

#### **Item 3) Approval of the Minutes from NKG Presidium meeting No 60**

The minutes from the last meeting was approved.

#### **Item 4) Brief reports on financial and organising issues at the organisations**

##### **Norway: Kartverket**

Per-Erik gave a presentation about the status and current projects at Kartverket. Among the issues he raised we notice the following;

- Geodetic observatory at Ny-Ålesund; the delivery of the VLBI antennas was done the day prior this meeting! The project is on time. With the delivery of the antennas it means that six months from now is needed for the installation of the antennas. Regarding SLR, there are currently negotiations going on with NASA. Per-Erik foresee a challenge ahead regarding the SLR and VLBI since the system needed to run remotely is not ready or developed.
- Budget; Next year he expects a reduction of the budget with some 4-5 %. It is uncertain what will happen in the coming future. It is already known that the operations at Ny-Ålesund will cost more meaning external funding or increased internal funding will be needed.
- Permanent geodetic infrastructure; the network now consists of 180 stations covering the country. It is still under densification. It is financed by users but there is a discussion if it should be free of charge.



- Per-Erik notes and believes that services are going more and more in the direction that national positioning services are replaced by global services and that they need to do much more on items as climate research, sea level prediction and subsidence of earth surface. The question will be when we do need to go from national reference system to global reference system for all spatial information? Ny-Ålesund is a part of this development.
- The software GeoSat is going to be changed to a new software currently called "Where". In total some 7-8 persons are involved. Among the things included are quality control of data from Ny-Ålesund as well as contribution to the determination of ITRF and more.

## **Sweden**

### **Lantmäteriet**

Lantmäteriet continues with its Open data policy and the DGSS service is available as such since the 1<sup>st</sup> of January. Mikael reported that Lantmäteriet is also preparing what would be the next step including the financial support needed and mentioned that he was hoping that network-RTK could be part of that.

Also since the 1<sup>st</sup> of January, the Geodetic infrastructure department went through a minor change in the internal structure when establishing a third section. We have also decided to buy a marine gravimeter, mainly due to our involvement in the FAMOS project, but also for other long term needs. Last year we built 41 new SWEPOS stations including 16 for the speed railway called Östlänken. Currently SWEPOS consists of some 360 stations and having 3000 users (350 new users last year). Lantmäteriet has also stated to monitor EGNOS, currently with great support from Norway.

### **Onsala/Chalmers**

Jan reported on the status of Ott. The infrastructure is prepared and the project is on time concerning the two pillars and the GNSS monitoring facilities. The next steps concerns

- Telescopes: transport on site (week 22, 23)
- Installation/commissioning: w 22-w41
- Installation of receiving systems etc. after that
- First light expected: early 2017 and full operation by mid 2017

Onsala is under evaluation and that is mainly regarding radio astronomy. The investigators have e.g. been asking about how many geodetic users there are that uses Onsala.

Concerning the project Close III, the final reports are under preparation. The project is focusing on high accuracy and real time applications, station environment, site effects and PPP.



## **Finland**

### **NLS**

FGI has now been part of NLS for one year. Besides that, Jarkko reported that FGI has had the best year ever with 120 staff members, 11 scholarships from other countries, 139 reviewed papers, 1 science paper and 10 mEuro (2,9 mEuro governmental money) from mainly European research grants.

At Metsähovi, the SLR installations are taking place at the moment. The first measurements will be in May. The SLR includes two different lasers. The VLBI ITT is open until end of summer meaning that it could be the same manufacture as for Onsala.

Regarding FinnREF; observations from the current 20 stations are accessible openly and for free. NLS has cooperation with Microsoft/Nokia to reach half metre accuracy on the positioning service for users. According to research (40-50 stations) would give sub-decimetre level. There is a Governmental decision that cm-accuracy should be left for the private market. Leica and GeoTrim are building nationwide positioning service for cm-accuracy.

## **Aalto University**

Martin Vermeer joined the Presidium meeting for the first time in many years. He reported that there is a good number of students at the University but the teaching situation is not good. Geodesy is disappearing and at the same time Physical geodesy, navigation courses, laser scanning etc. are removed or decreased. The professorship after Martin Vermeer is not clear and could be a combination between geodesy and photogrammetry if any.

## **Denmark**

### **SDFE - Agency for Data Supply and Efficiency,**

The GST - Agency for Geodata - is moving to Ålborg on 1<sup>st</sup> of November 2016. Approximately 20-25 % of the staff will follow. Geodesy will stay in Copenhagen and at the new agency called SDFE.

There is a new agreement with DTU Space focusing on;

- Research, give advice and running operation
- Focus on strategic developments – GNSS, Galileo
- GNET – financing and further development (GNET is on Greenland)
- New least square adjustment processing software. Starting from scratch, open source etc.

## **DTU**

Niels reported that with the new government there are also budget cuts everywhere. The DTU director board decided to remove DTU Transportation as well as budget cuts of 1 % per year annually coming 5 years. DTU Space is currently based on 60% external funding.

The focus at DTU are:

- ESA program. Program board, e.g. Grace follow-on



- Scalable space infrastructure; from satellite missions to drones.

Regarding the education; Geodesy is not mentioned in the course names but is still a master programme. There is a lot of interest with many students.

## **Item 5) NKG Summer School 2016, Sweden**

Mikael and Jan presented on the status regarding the NKG Summer School. The registration fee is believed to be maximum 2500 SEK which is OK with the presidium. There will be no special fee for students since we keep the registration fee as low as possible. The Scientific program is more or less prepared with GNSS as the theme. We discussed Pre-school assignments which could encourage people to come well prepared but it is important that it does not prevent. Pre-school assignment could also give the summer school a higher profile. One or several lecturers should include the pre-school assignment in their presentation.

## **Item 6) Nordic working group on Geodesy**

At last year Storcheftsmöte, a meeting organised by the Director Generals of the Nordic NMCAs, a discussion was held on the subject if a Nordic working group on Geodesy is needed in parallel to NKG. A group with participants from the mapping authorities from all Nordic countries was established and Mikael Lilje was asked to lead the group. The majority of the Presidium propose that a parallel group should not be established but urge the Mapping authorities to use NKG more actively. Further discussions will take place at Storcheftsmötet in August this year.

## **Item 7) Reports from the working groups.**

### **Working Group on Positioning and Navigation**

The working group had a meeting in November and the next meeting is scheduled to June 16-17 (Sweden). The correspondents and members now also include representatives from the Baltic countries.

At the last meeting the discussions concerned

- Real time positioning
- Positioning/navigation services
- New GNSS and modernisation
- Quality checking/monitoring
- Making reference frames and vertical reference systems available to users

The working group also discussed topics for coming NKG summer schools and has suggested PPP, GNSS Services, Modernisation and development of GNSS and Troposphere.



## **Working Group on Geodynamics**

The working group held its last meeting in Tallinn (Estonia) together with the working group on Geoid and Height Systems. The scientific program included presentations by HG Scherneck, Rebekka Steffen and Hannu Ruotsalainen. Also, national reports was given.

The working group also discussed the following projects;

1. Absolute Gravity Measurements in Fennoscandia (Oev)
  - i) Paper lead by Per-Anders
    - (1) Start-up last year
    - (2) All data collected May
    - (3) Draft ready by end of year
  - ii) All countries may/will publish their own data
    - (1) Denmark will not
    - (2) Norway will
    - (3) Finland will
    - (4) Sweden has published (IUGG2015)
  - iii) Discussion on National gravity systems and their relations to a future global absolute gravity reference system.
  
2. NKG2016xGIA (Dagny)
  - i) A model of glacial isostatic adjustment for Fennoscandia
  - ii) An activity established WG meeting Iceland 2013, led by Holger S
  - iii) Ice model identified as a weakness
  - iv) Led to cooperation with Lev Tarasov
  - v) 35 ice histories for Fennoscandia
  - vi) And 11 000 GIA models
  - vii) Holger ha selected one
    - (1) – best fit for Bifrost
  - viii) The uplift model – presented by Jonas Ågren
    - (1) Release an absolute semi-empirical model NKG2016LU\_ABS without tide gauge data
    - (2) Release an semi-empirical model NKG2016\_LU\_LEV which gives the uplift related to the geoid
    - (3) Not released the apparent model NKG2016\_LU\_ABS. Jonas Ågren and Olav Vestøl agrees on the best approach and publish the apparent model (what type of apparent land uplift that is really needed, the time internal and how it should best be computed.

## **Working Group on Geoid and height systems**

The Working Group of Geoid and Height Systems recently had a meeting in Tallinn March 16-17, which was co-organised together with the Geodynamics meeting. According to Jonas, the meeting



was very successful and attracted many participants, around 35. It is still difficult to get submissions of scientific presentations or other contributions from the WG members and the meetings are increasingly becoming more and more like pure project meetings. Good or bad? It depends on who you ask.

A new point on the agenda was the session on “Future Height Systems in the Nordic and Baltic area”. Internationally, much is happening now regarding height systems, for instance the IAG resolution on the International Height Reference System (IHRIS) and the planned introduction of the Baltic Sea Chart Datum 2000 (BSCD2000) for maritime applications in the Baltic Sea. It is important that we have a forum within in NKG to discuss such matters and what this implies to us. We should also try to push the development in a direction favourable to us.

It was decided that anyone who has contact with the international/European level working groups developing and discussing height systems, will inform the NKG working group of the new developments. The whole NKG working group of Geoid and Height systems will work as a reference group. No new NKG project or specific sub-group is formed at the present time. It was agreed instead to have this topic as a standing point on the agenda at the future working group meetings. The aim of these sessions will be to raise the question, collect and share information, exchange views and keep an on-going discussion of both scientific and administrative questions regarding height systems and their realisation.

One crucial point on the agenda was to discuss the finalisation of the NKG2015 geoid modelling project. After presenting the status in the project, Jonas suggested to the WG meeting that, since there is an urgent practical need for a new Nordic geoid model, for instance as a basis for a new national Swedish model, a NKG2015 model must be released now/soon (within 1-2-3 months). After that, a new long term “NKG geoid improvement project” should be defined instead.

This was thoroughly discussed and, to make a long story short, the WG meeting decided to choose the Lantmäteriet computation strategy (Solution 1a) for the final solution, but before the final computation is made René and Gabriel have to fix two crucial gravity data problems (within a month). The two data problems are that gravity data are currently missing in Sognefjorden in Norway and that a few different publications differ significantly between each other in Skagerrak (marine and airborne). As soon as Jonas receives these data fixes, he will rerun the computation using exactly the same scripts as before and release the model.

It was further decided that the NKG2015 geoid model (actually quasigeoid model) will be released after a 1-parameter fit/transformation with respect to GNSS/levelling and that a correction is included to take into account the fact that the GNSS heights refer to the non-tidal permanent tide system. In this way we will keep the gravimetric character of the model, but the NKG2015 geoid model will be directly usable for height determination using GNSS (on the ~1.5-3.0 cm level). Then each country can fit it to their GNSS/levelling data using an interpolated residual surface as they



prefer. Each country knows their own data and situation best and can tailor this residual surface as they find best).

The final NKG2015 model will be published in one main publication with Jonas as main author and another more specialised publication on data gridding with Silja Märdla as main author. The final model will be presented at the GGHS2016 conference in September 2016.

Another very important discussion was regarding NKG land uplift models. Before the WG meeting, Olav Vestøl had computed a new purely empirical model and Holger Steffen a new GIA model called NKG2016GIA\_prel0306. These two models had then been combined by Jonas to get the semi-empirical NKG2016LU\_test. There was a long discussion in both WG meetings on how to proceed now. The main conclusions are the following:

1. Release an absolute semi-empirical model NKG2016LU\_ABS computed *without* tide gauge data now. The same approach as earlier is used with Olav Vestøls empirical model combined with the for now best NKG2016GIA model (NKG2016GIA\_prel0306).
2. Together with this, another semi-empirical model is released that gives the uplift relative to the geoid. This NKG2016LU\_LEV model is computed using *either* the scaling factor as before *or* by taking the geoid rise from the NKG2016GIA\_prel0306 model and removing it from the NKG2016LU\_ABS. Jonas Ågren and Olav Vestøl agree on the best approach and release both NKG2016LU\_ABS and NKG2016LU\_LEV without consent from the whole working groups. (The latter is meant to be used for the adjustment of levelling networks, where the possible uplift relative to the geoid is required)
3. It was decided **not** to release NKG2016LU\_APP together with the other two components now, but to wait until we have reconsidered the question what type of apparent land uplift that is really needed, the time interval and how it should best be computed. We will thus have to continue the work before we release this part, but this should not stop us from releasing the other two components above as soon as they are finished.
4. Give more attention to the horizontal velocities in the NKG2016GIA modelling.
5. Encourage the working group of Reference frames, positioning and navigation to come up with new horizontal velocity estimates and to compute a corresponding NKG\_RF16vel model with NKG2016LU\_ABS as the vertical component.

The next WG meeting will take place in Riga, Latvia, during week 11 2017. As usual, it will co-organised with the WG of Geodynamics.

## Working Group on Reference frames



The next working group meeting is planned to be held in Vilnius on 11-12 April, 2016. One intention was to support our Lithuanian colleagues to join the NKG GNSS analysis centre project. The working group is not ready to hold the earlier discussed planned time series analysis workshop yet but it will be discussed in the WG meeting. Future plans to be discussed at the meeting includes

- Testing/implementing of the ITRF2014
- Creating a new and updated PGR model (horizontal + vertical), in collaboration with other WGs
  - Vertical model NKG2016LU (soon) available
  - Horizontal model under discussion
  - Testing and implementing into the transformations
- Use of time series in the transformations?
  - BIFROST
  - NKG GNSS analysis centre
- Keep up-to-date with e.g. EUREF activities/initiatives

### ***Report on project NKG Transformations.***

The objectives of the NKG transformations are

- Up-to-date and accurate transformations from ITRF<sub>x</sub> to the national ETRS 89 realisation in the Nordic-Baltic area
- Common, homogenous and accurate reference frame(s) in the Nordic-Arctic regions

The status is

- NKG2008 campaign
  - New transformation method
  - New common NKG reference frame aligned to the ETRF 2000 at epoch 2000.0
  - Methodology explained and results published in the Journal of Geodetic Science (March 2016), open access at <http://www.degruyter.com/view/j/jogs.2016.6.issue-1/jogs-2016-0001/jogs-2016-0001.xml?format=INT>

The Presidium expressed its thanks to Pasi for an excellent job in preparing the paper as well as the extensive discussion in the preparation.

### ***Report on project NKG GNSS AC***

- The network consists of 245 stations
- 6 national LAC + NKG\_EPN and 2 combination centres (NKF and NKL)
- Daily and weekly solutions since GPS-week 1795
- Changed troposphere modelling GMF to VMF GPS-week 1860
- ISS started later but is now on time with operational solutions
- Denmark is almost ready to start to deliver operational solutions
- Lithuania has started with the benchmark test
- The setup of individual logins with different authorities at the GST ftp-server has shown to be very hard to implement, a more simple approach is considered
- The re-processing activity has started and we are including data from 1997





- Guidelines and benchmark test are defined
- Some LACs have delivered benchmark test (FGI, SK\_, EST, ENG)
- Some LACs have performed the mainpart of their re-processing (FGI, LM\_, SK\_, ENG)
- Some LACs are preparing for re-processing (EST, LAT and ISS)
- Some LACs will start when the operational processing is fully operational (GST)

## **Item 8) UN-GGIM and UN Resolution on Global Geodetic Reference Frame**

Anne J joined us in the meeting to brief us on the latest news. She also gave us all the latest Newsletters. The main point right now is the preparation of the Road map.

## **Item 9) EUREF (Markku)**

Since Markku was not able to join us in Norway we set up a Skype meeting with him. He reported that the EUREF TWG had a meeting in February in Lisbon. The main topics were:

- Relation EUREF-EPOS. EUREF want a MoU between EPOS and EUREF for data. However, EUREF not a legal body. No real conclusion in the end to find a good solution. We need to ensure that EPOS does not start building an infrastructure in parallel to EPN.
- ITRF2014 is now available.
- Vertical reference frames as well as Dynamic Reference Frames are discussed but really not on the table at the EUREF TWG at the moment.
- EUREF symposium 2016 will be held in San Sebastian, Spain. It includes tutorial on Reference frames.
- UN GGIM GGRF: Europe: Markku is working on the guidelines together with Johannes Ihde, Daniel Thaller and Wolfgang Söhne.

## **Item 10) Other Business (All)**

The presidium suggests that a Science day will be arranged in November and hosted by Lantmäteriet, Gävle. Jonas will be the scientific leader with Pasi and Per also included in the scientific committee.

## **Item 11) Next meeting of the Presidium (All)**

The 62<sup>nd</sup> Presidium Meeting will be held in Sweden in conjunction to NKG Summer School. It was decided that we hold it on Tuesday evening.

Current order; Iceland – Denmark – Norway – Sweden – Finland



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## Participants:

### Denmark:

Niels Andersen, DTU Space (Chair)  
Per Knudsen, DTU Space  
Sören Fauerholm Christensen, GST

### Finland:

Jarkko Koskinen, NLS  
Pasi Häkli, NLS  
Martin Vermeer, Aalto University  
Markku Poutanen, NLS (Item 10, Skype)

### Norway:

Oddgeir Kristiansen, Kartverket  
Per Erik Opseth, Kartverket  
Ove Omang, Kartverket  
Anne Jørgensen, Kartverket (item 8)

### Sweden:

Mikael Lilje, LM (Secretary)  
Jan Johansson, Chalmers  
Jonas Ågren, LM