



# NORDISKA KOMMISSIONEN FÖR GEODESI

Nordic Geodetic Commission, Working Group of Reference Frames, Positioning and Navigation

Chairman

PASI HÄKLI

Finnish Geodetic Institute

Geodeetinrinne 2

FI-02430 MASALA

Finland

## Working Group of Reference Frames, Positioning and Navigation

### Minutes for the meeting in Reykjavik, Iceland, March 14, 2013

#### Participants

Denmark	Mette Weber Per Knudsen Niels Andersen
Estonia	Karin Kollo
Finland	Pasi Häkli (chairman of the WG) Markku Poutanen Sonja Nyberg (secretary of the meeting)
Iceland	Pórarinn Sigurðsson
Latvia	Jānis Kaminskis Ieva Lasmane Ksenija Kosenko
Norway	Torbjørn Nørbech Oddvar Tangen Michael Dähnn Halfdan P. Kierulf
Sweden	Lotti Jivall Martin Lidberg Jan Johansson

#### 1. Agenda and minutes of last meeting

The proposed agenda of the meeting was approved. Pasi presented minutes of last meeting.

#### 2. Scientific presentations

- Pasi Häkli: New recommendations for public administration in Finland – Measuring of the control points in EUREF-FIN reference frame



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New recommendation for public administration of measuring control points in EUREF-FIN reference frame was published in 2012. The guidelines describe hierarchy of EUREF-FIN control points and how to measure and determine the coordinates in each class. The RTK reference stations are recommended to be classified as E2 stations if they are widely used for positioning. FGI determines the coordinates of the E2 stations and monitors them. Recommendation can be found from [here](#) (only in Finnish).

- Sonja Nyberg: GNSS antenna offset field test in Metsähovi

FGI has carried out GNSS antenna field test in Metsähovi to verify individual antenna calibration values. A set of Ashtech and Leica antennas were tested. The measurements were done in summer 2011 and the results reported in FIG Working Week in 2012. Probable inconsistencies between the antenna types, especially on L2 frequency, were found. The full paper is available [here](#).

- Jānis Kaminskis: MELINA proposal for precisely monitoring earth surface deformations related to natural disasters within FP7-PEOPLE-2013-IRSES

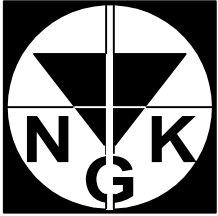
GGI of Latvian University has proposed a MELINA project for [EU FP7 package](#) together with GeoMatLab of TU Crete, University of Shanghai (TJU) and Hong Kong Polytechnic University. The aim of the project is to develop an integrated GNSS observing system for monitoring earth surface deformations related to natural disasters. All satellite systems will be integrated into a one monitoring system and statistical tools developed for observing system. Bernese, GAMIT and Panda (for BeiDou, developed by Wuhan University) software will be used. The decision of the proposal is expected in autumn 2013.

- Jānis Kaminskis: Analysis of kinematic coordinates from GNSS stations in Latvia

Research of kinematic coordinates of EUPOS-RIGA and LATPOS stations have been carried out at GGI. The data processing was done using Bernese 5.0. Nearby EPN stations were used as static stations and kinematic coordinates were estimated for Latvian stations. The kinematic time series showed some outlying epochs due to problems at one of the reference stations. Weather and ionospheric conditions were the most probable reasons for the outliers.

- Jānis Kaminskis: Plans for Struve Arc and GNSS possibilities at GGI

GGI has plans to popularize the Struve Arc and in that way get attention to geodesy and improve e.g., funding possibilities. Already 16 stations points (+ some more recently) have been found including two Unesco stations points.



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[EeaGrants](#) offers a possibility for Baltic countries for co-operation e.g., with Norway. Preliminary plans have been made for co-operation under the topic of “Digital zenith camera for vertical deflection determination”, see [full paper](#).

- Lotti Jivall: Update of SWEREF 99 to fit igs08.atx

SWEREF99 was determined using relative antenna calibration model. The change of the antenna models affects the stations coordinates, which are updated to maintain SWEREF99. In earlier antenna model updates, very good agreement was achieved for Dorne Margolin choking antennas, but in the latest update for of igs\_08.atx, larger differences were found (residuals up to 5 mm). Corrections provided by IGN worked well for Swedish stations, but additional shifts had to be estimated for Finnish stations. Differences varied between 3 and 17 mm depending on the antenna type.

- Lotti Jivall: Simplified transformations from ITRF2008/IGS08 to ETRS89 for maritime applications

A simple 7-parameters transformation was determined for maritime applications for next couple of years, as the official transformations were considered too complicated. Coordinates of EPN densification (EPN\_A\_IGS08) were used to determine the transformation. The transformations parameters were solved between ITRF2008/IGS08 coordinates that were propagated into upcoming epochs and ETRS89 coordinates. The general accuracy of the transformation is 1–2 cm, but in some areas the differences to national ETRS89 is considerable larger. The report can be found from [here](#).

This example case showed that users are also requesting this kind of simple transformations that should be kept in mind in the ITRS-ETRS89 transformations project.

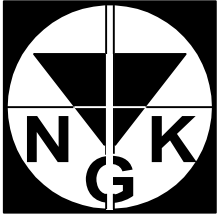
- Karin Kollo: Re-computation of 1997 and 2008 GPS campaigns: First results

The GPS campaigns of 1997 and 2008 were re-computed in order to validate the land uplift rates from re-levelling and GNSS permanent stations. The preliminary results of the re-computation were presented. The data was processed using Bernese 5.0 software. Some problems remained still in the data or processing, as the repeatabilities were up to several cm in up component and the uplift values were the same for every station. High repeatabilities may indicate problems in reference frame fixing.

### 3. Projects

- NKG GNSS AC

The aim of the NKG GNSS AC project is to produce NKG GNSS time series for maintaining reference systems and for geodynamical studies. The project was started



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in March, 2012. So far, a pre-study including questionnaire and benchmark test has been carried out. The benchmark test with Bernese 5.0 showed good consistency with the solutions.

Project meeting was held on 13<sup>th</sup> of March as a part of the NKG Science Week. It was agreed that

- each contributing country process their own sub-network with nearby EPN stations,
- the coverage of current sub-network is adequate also for land uplift studies,
- the preliminary processing parameters for Bernese 5.2 were decided and they will be checked after EPN publishes the guidelines for analysis centers,
- GST (Denmark) will host the ftp-server for sharing the results and products,
- the analysis centers submit their solutions latest 2 weeks after IGS products are available (except holidays),
- Norway will not contribute to the routine processing as they cannot meet the deadlines, but they will contribute according to their own schedule.

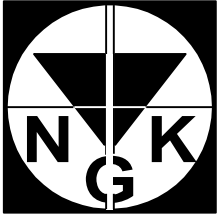
The schedule of the project was updated. In the spring/summer 2013 additional test with new Bernese features will be done, a preliminary processing setup delivered and benchmark test run on the Bernese 5.2. The final processing setup will be ready in August and the routine processing will start in September. After that re-processing of GPS data history back to 1997 will start. The project team aims to get first velocity estimates for the NKG General Assembly in 2014.

- ITRS-ETRS89 transformations

The aim of the ITRS-ETRS89 transformations project is to finalise the transformation part of NKG2008 campaign and later continue with new transformations. The current status of the project was discussed.

First the question of how to constrain the NKG2008 campaign solution to ITRF2005 was discussed. The solution presented at the NKG General Assembly 2010 was achieved by using minimum constraint over translations and rotations. The residuals of the fiducial stations were up to 1 cm on the outer edge of the network, which is much lower than was achieved with a standard no translation minimum constraint solution. The problem was that a small deformation of the network was detected. The maximum difference between this solution and the standard no translation minimum constraint solution is 8 mm (VARS in northern Norway) in the area where we will determine transformations to ETRS89. It was decided that current solution was good enough and it will be the final one.

Second the question of the transformation to the ETRS89 was discussed. Martin presented his work from last WG period. These preliminary results (residuals, not transformation parameters) were already published in NKG General Assembly 2010



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Proceedings. It was agreed that each country will submit their correct coordinates and after that, Martin finalizes and publish the parameters. The data and results (coordinates, parameters) will be sent to national representatives (Pasi, Torbjørn, Mette, Lotti, Karin, Ksenija, Eimuntas), who verify the results by the end of June. Final results (transformation parameters) will be available in autumn and publication will be prepared according to Martin's schedule.

- Conclusions from the workshop

The recommendations of the LU workshop and their influence on this WG were discussed. It was concluded that the GNSS AC project will contribute after a few years to the LU modelling. Meanwhile other work done under this WG (GAMIT and GIPSY solutions) will contribute to the LU modelling. Halfdan will work for the uncertainty estimates of GNSS velocities.

- New projects

A separate project for the time series analysis and velocity estimation was proposed to be started after the NKG AC is routinely running, because we have a lot of experience on the topic inside and outside the NKG AC project group. Also a workshop on the topic might be successful. The project proposal should be well prepared for the next NKG General Assembly.

## 4. National reports

- Denmark (Per, Mette)

The reference network consists of 10 permanent GNSS stations and 120 benchmarks. The 5D network (position, height, gravity) is measured every 3<sup>rd</sup> year.

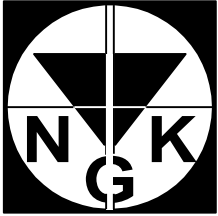
A research has been carried out to study land uplift and to identify regions that are vulnerable for floods and land subsidence.

New height system and geoid has been established on Faroe Islands.

New permanent GNSS stations have been established on Greenland to support global infrastructure. Also research on ice sheets and melting has been carried out.

Denmark participates also to Arctic Testbed project 2012-2014, which will develop and deploy an Arctic Testbed to support Galileo services over ARCTIC.

- Estonia (Karin)



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Weekly GNSS routine processing is carried out using Bernese 5.0. The time series has been analysed using CATREF software.

Estonian Land Board maintains 9 permanent GNSS stations and 15 more stations will be established by 2015. In addition, Estonian Land Board monitors and computes coordinates for commercial stations. However, there are no regulations on commercial operators – if they change coordinates or not.

- Finland (Pasi)

The recommendation for public administration of measuring control points in EUREF-FIN reference frame was published in 2012 (see Scientific presentations).

The FinnRef GPS network is under renewal. Altogether 19 new GNSS stations will be established. The new stations will improve the coverage of the network, especially in northern Finland. Partly stations are located on the same site as old FinnRef stations. JAVAD receivers and antennas will be used. Eight stations are already operational and others will be ready at the end of this year. FGI will also provide 0.5 m accurate DGPS service at the end of this year.

The renewal of Metsähovi station is also on-going. New SCG has been ordered, FG5 gravimetry has been upgraded to FG5x and a tender has been opened for new SLR. Also new VLBI antenna is going to tender soon. Metsähovi is also included in GGOS (core station network).

- Iceland (Þórarinn)

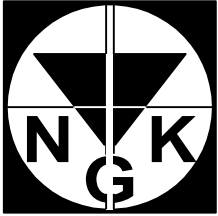
The GNSS network consists of 11 permanent GNSS stations. New stations are planned to build in co-operation with geophysicists. This year three new stations will be established. The challenging environment sets constraints on the establishment of stations (e.g., land ownerships, electricity). Most of the resources are used for the height network this year.

- Latvia (Ksenija)

LatPos network is operational with 23 GNSS stations. Most of the stations are located on roofs of buildings. LGIA plans to establish new 0 order permanent GNSS network on concrete monuments that will define reference frame.

The precise levelling is finished and the analysis is going on. The new EVRS will replace the old Baltic system.

- Norway (Torbjørn)



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The upgrade of Ny-Ålesund geodetic observatory is going on. New VLBI telescopes will be operational by 2018.

A new project GEOSAT has been started to study the different geodetic techniques in the field of climate change.

The more accurate RTK positioning service is aimed for. New RTK software (Trimble VRSnet3) will be installed. Co-operation with Trimble is going on to develop integrity tools. The network will be densified.

- Sweden (Martin)

SWEREF99 is operative in 250/290 municipalities and height system RH2000 in 103/290 municipalities. 300 control points covering the whole country are used to validate the SWEREF 99. They are measured in 6 year cycle (2013 is the 6<sup>th</sup> year).

The research of SWEPOS site calibration has continued. Site specific effects have been noticed due to the monument and mounting. Paper on the topic will be published.

The densification of SWEPOS network is going on. Roughly 40 new stations are established annually to reach a maximum station distance of 35 km. The RTK service center has been upgraded with new software (Trimble VRS3) and hardware. Also new ionosphere monitoring system is provided for clients to improve the accuracy of RTK measurement from 5 to 25 mm from south to north, respectively. Read more on ionosphere tool on [web](#).

The handbooks for surveying (HMK) will be updated.

## 5. AOB

- Torbjørn presented ideas of changing the epoch of the height component of their national ETRS89 realisation. The suggestion of the WG was to either keep in the observation epoch or change to 2000.0 instead of 1989.0.
- Martin presented the main topics of EUREF working group on deformation models. The aim is to improve knowledge of surface deformations in Eurasia and adjacent areas. The proposed activities consists of
  - evaluation of stations velocities,
  - work towards models of crustal deformation in Europe, and
  - consideration of deformation models in maintenance of national ETRS89 solutions.



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The group is open for scientists; contact Martin if you are interested in the topic.

- Martin presented the proposed modification on INSPIRE D2.8.II.1. Data Specification on Elevation (Draft Guidelines). Martin will send the modifications by email. If institutes agree that the modifications are appropriate, they may ask national representatives to support the change.
- Markku will ask later for data and/or input for NGOS project.

## 6. Conclusions of NKG Science Week

WG concluded that NKG Science Week was a successful meeting to bring the working groups together and enhance co-operation between WGs. The ordinary single WG meetings were considered also necessary (e.g., every second year), as the costs are lower and therefore more people can participate.

The GNSS AC project meeting before the WG meeting worked also well, so that the topic did not take the whole time of the WG meeting.

## 7. Next meeting

The next meeting will be held in spring 2014 in Denmark.

## 8. End of meeting

The meeting was ended at 16:45.