



Minutes of the 28th meeting of the Working Group for Geodynamics within the Nordic Geodetic Commission

Lantmäteriverket, Gävle April 15-16, 2003

Participants:

Gabriel Strykowski	Denmark
Jaakko Mäkinen	Finland
Hannu Ruotsalainen	
Mirjam Bilker	
Björn Engen	Norway
Ove Christian Dahl Omang	
Hans-Georg Scherneck	Sweden
Anders Olsson	
Andreas Engfeldt	
Mikael Lilje	
Martin Lidberg	
Herbert Wilmes	Germany
Jürgen Müller	
Ludger Timmen	
Olga Gitlein	

1 Institute activity reports

Some reports are available from the home page of the working group at <http://www.oso.chalmers.se/~hgs/NKGGWG> (= WG-hp).

KMS, Denmark

In 2003 KMS has hosted an Absolute Gravity campaign and participated in Land Uplift Gravity Lines measurements. See [WG-hp](#).

FGI, Finland (Jaakko Mäkinen)

The new absolute gravimeter FG5 (221) is working and has been used for projects on the Azores islands, on the Iberian peninsula, on Antarctica (where also a permanent GPS station is running successfully since 2003), and in Finland.

Metsähovi has participated in its first geodetic VLBI campaign on 1st of March this year.

The superconducting gravimeter at Metsähovi is running, and a new paper is in preparation.

Geodetic observations (triangulation, Mekometer, precision gravimetry) at the Pasmajärvi post glacial fault (c. 67° N) have constrained possible motions to below 1 mm after about 14 years of observations. The project will therefore be closed down.

A summary of the Absolute gravity measurements of 2003 are available from the [WG-hp](#).

SK, Norway (Björn Engen)

Statens Kartverk is downsizing in terms of budget and personnel. The geodetic division will however keep most of its staff (with some early retirements).

New absolute gravity stations at Ålesund and Vågstranda are discussed.

NLH, Norway (Ove Christian Dahl Omang)

There are re-organisations of institutions at Norges Landbrukshøgskole.

NLH participate in the OCTAS project (<http://www.octas.statkart.no/>).

The new absolute gravimeter FG5 is bought and delivered. Also see [WG-hp](#).

Lantmäteriet, Sweden

Written report see [WG-hp](#). In short, Lantmäteriet has hosted Absolute Gravity campaigns and carried out measurements on Land Uplift Gravity profiles. They also report on recent efforts in precise levelling and SWEPOS GPS station monitoring.

OSO, Sweden

Written report see [WG-hp](#). In short, OSO covers earth rotation, tidal loading, and BIFROST GPS observation of glacial isostatic adjustment. See [WG-hp](#).

BKG, Germany (Herbert Wilmes)

The purpose of the geodetic activities at BKG is the realisation of a uniform reference system for Germany and to contribute to others. Examples are:

- permanent GPS services like IGS, EPN, RTK and NTRIP (broadcasting RTCM DGPS corrections through the Internet),
- earth rotation (the central bureau of IERS is hosted by BKG),
- operating the fundamental geodetic stations Wettzell and TIGO (in Chile),
- gravity with superconducting gravimeters operated at TIGO, Wettzell, and Bad Homburg (more on gravity presented during the scientific session)
- instrumental development:
 - remote control facility are under development for the FG5 gravimeter, maybe for operation at remote stations,

- the A10 absolute gravimeter agree now on the μgal level to FG5 after the test mass has been replaced to a non-metallic test mass.

IfE Hannover, Germany

Written reports see [WG-hp](#). They cover the Absolute Gravity campaigns of 2003 and add explanations to some important experiences.

2 Publication policies

Policies regarding internal and possibly external publication and data exchange are discussed. It is concluded that:

- FGI is proposed as data centre for the relative gravity observations on the gravity land uplift lines,
- An absolute gravity archive seems somewhat tricky to form because there are many critical parameters influencing the computed gravity value like ocean loading, ground water reduction etc.
- An “expert group” is proposed on sharing the data and exchange the knowledge on how to use them,
- A meta-data centre for absolute gravity is proposed. For the time being the information on the home page of this w.g. may serve this purpose.
- After a while all absolute gravity data will end up in the BGI archive anyway.

3 Non-gravity, recording gravity and gravity review and re-examination

Water tube tilt meter development project

Hannu Ruotsalainen presents the present status of the long fluid level tilt meter in the Tytyri mine near Lohja in southern Finland. The development has been towards automatic registration of interference fringes using CCD-camera and computer.

New BIFROST GPS solutions for Fennoscandian glacial isostatic adjustment

Martin Lidberg presents current status of the re-computation of the BIFROST GPS data set. The BIFROST standard solution is a network solution computed using the GIPSY software. The new solutions are first a Precise Point Positioning solution using GIPSY with reduced elevation cut-off angle (10° compared to 15°), second we also try to fix ambiguities to integers, and third we compute the BIFROST data using the GAMIT/GLOBK software. The current status of the GAMIT solution is presented.

So far 5 years between mid 1998 to mid 2003 have been computed. In general the GAMIT solution confirms the results from the standard solution. Some strange

features seen in the standard solution that stem from limitations in the old data set are removed (e.g. Leksand). Comparison of the vertical velocity show good agreement with values computed from mareograph and levelling data (from Ekman 1998), especially at the coast of the Baltic Sea.

Gravity from GRACE

Jürgen Müller presents the GRACE satellite gravity mission including the first results. A first global geoid model has been computed from preliminary analysis of 111 days of GRACE observations give an accuracy on the order of 1 cm at 270 km half-wavelength. This is much better than anything previously presented but still not as good as expected. The standard is on a level where there are no other datasets available to do an independent check of the GRACE data.

More information may be found at http://op.gfz-potsdam.de/grace/index_GRACE.html.

Long-term gravity variations from repeated absolute gravity measurements in the period 1993 to 2003 (Herbert Wilmes)

BKG started a series of observations of absolute gravity in the Fennoscandian land uplift area in 1993. Included in the estimated trends are also some observations from 1991 done by FGI. For all BKG measurements there have been reference observations performed at Bad Homburg.

Almost all observations are within $\pm 5 \mu\text{Gal}$. From experience we should not expect better than $2 \mu\text{Gal}$ and also this requires that the instruments are very well kept.

Trial to relate the absolute gravity measurements of IMGIC in 1976 to the recent observations

Herbert Wilmes presents the trial to relate the old absolute gravity observations to the time series of the modern observations. It seems to work successfully except some problems with the Vaasa station.

The problems with Vaasa have been indicated earlier. E.g. when the (at that time) new Swedish gravity system RG 82 was computed, the IMGIC observations at Vaasa were excluded due to bad consistency with other absolute gravity stations.

4 Review and results of campaigns 2003

Fennoscandian land uplift gravity line 63 measurements and results in international campaign by the danish/finnish team (Hannu Ruotsalainen)

During the field campaign 12-26/9 2003 there were problems with a strong micro-seismic background.

New values on the gravity change have been computed to:

section Vaasa-Joensu: -0.911 $\mu\text{Gal}/\text{yr}$

section Vågstranda Kramfors: 1.068 $\mu\text{Gal}/\text{yr}$

The new values are within about 0.2 $\mu\text{Gal}/\text{yr}$ compared to previous values. The value of 1.068 $\mu\text{Gal}/\text{yr}$ appears low; it seems to depend rather much on measurements with the G290 gravimeter during the 1998 and 2003 campaigns that are significantly off the linear track.

Fennoscandian land uplift gravity lines 63 and 56 measurements (Andreas Engfeldt)

Written documentation is available at [WG-hp](#).

Campaigns 2003: measurements, results and experiences (Ludger Timmen, Olga Gitlein)

Written documentation of the presentations is available at [WG-hp](#)
(NKG_WGG_15042004.ppt, experiences2003.doc)

Comparisons with BKG and FGI observations, and possibility to make parallel observations at some sites are discussed.

Results of the BKG absolute gravity campaign in Scandinavia 2003 (Herbert Wilmes)

For gradients it is proposed to use the mean value of all determinations for each site performed through the years. The gradient is also to some extent non-linear.

Comparison of absolute gravity observations is discussed:

- Reference observations should be done before and after the campaign.
- In practice it is difficult to use “some same stations” to compare results from different gravimeters.
- Participation in regional comparison efforts (like Luxemburg 2003) is important.
- Next international comparison campaign will be in Paris.

Results from the FGI absolute gravity campaigns in Scandinavia 2003

Mirjam Bilker tells about the FGI observations during 2003. The new FG5 gravimeter has been used in several projects outside Finland during 2003, but the stations Metsähovi, Vaasa (A and B), and Joensuu have been observed.

The trend in gravity for Metsähovi has been computed to about $-1.2 \mu\text{Gal}/\text{yr}$ ($\pm 0.5 \mu\text{Gal}/\text{yr}$) from only JILAg observations.

5 New plans, campaigns, joint work

5a Relative g

It is concluded that it is now time to compile, compute and publish what have been achieved from the relative gravity observations on the land uplift gravity lines up to now.

Norwegian observations from the 1998 field campaign on the 63°N relative gravity line are not received by the Nordic co-operation yet. Jaakko will take action to solve this.

Possible continuation with closing relative campaigns on the 65°N and 61°N gravity land uplift lines are discussed.

- In not too far future the lines will be observed with a portable absolute gravimeter.
- FGI has done observations on the 65°N in 1999 and 2001.

It is concluded that for the moment no further joint relative gravity campaign will be planned, and that relative gravity observation campaigns will be decided on a national level.

5b Absolute g

Absolute gravimetry at NLH (Ove Christian Dahl Omang)

The absolute gravimeter, FG5-226, was delivered on March 30 this year. On-site training will be held at NLH on May 10-15.

An observation locality has been prepared at NLH. It was visited by IfE with FG5-220 on March 16-21 this year.

Four persons will be trained as operators for the field campaign 2004 where the stations Stavanger, Ålesund, Vågstranda, Trondheim, Trysil, Hønefoss and Onsala (Onsala simultaneous with FG5-220) will be observed.

The future:

- NLH will apply for operation funds for the period 2005 to 2007,
- NLH will apply for funds for a superconducting gravimeter.

Supporting contributions are very welcome.

Plans for 2004

Observations for 2004 are discussed.

Björn Engen presents possible stations for absolute gravity in Norway, entitled "Brief status and ideas on integrated geodetic stations in Norway":

For the absolute gravity observation planned for Northern Norway in 2004 the following sites are already available: Tromsø, Andøya and Bodø.

SK has located new potential sites in Honningsvåg, Kautokeino and Vardø. The old absolute gravity site in Hammerfest is effected by construction of new buildings and a location which makes it difficult to find a new site. SK will recommend that new

sites are established at Honningsvåg which will also include a levelling connection to the precise levelling network. The site is however owned by the Norwegian Defence and negotiations carried out since mid 2003 have not reached a final agreement. We have similar experience in Kautokeino and concluded that the final preparations of the sites with construction of observation piers will not be ready in time for this years observations. During the summer we will have to reconsider the present concepts for new sites and give priority to the northernmost location.

The benefit of possible automatic registration of ground water level is discussed.

A map with proposed stations to observe during 2004 are available at (http://www.oso.chalmers.se/%7Ehgs/NKGWG/M2004/scand_all_planned2004.gif) as a summary of the outcome of the discussion.

6 NGOS and ECGN matters

NGOS document – current status (Mikael Lilje)

The Nordic Geodetic Observing System (NGOS) may be considered as a Nordic independent implementation of the Integrated Global Geodetic Observing System (IGGOS).

The purpose of the NGOS is to provide for a regional system of observing stations and geodetic measurements in application to

- geodetic positions and to infer the kinematics of the Earth surface,
- gravity and its temporal changes, and
- Earth rotation and its temporal changes.

See the Power Point Presentation by Mikael Lilje available at

http://www.oso.chalmers.se/~hgs/NKGWG/M2004/NGOS_Geodynamikmote_Gavle.ppt

The European Combined Geodetic Network – An Integrated Network for Height and Gravity in Europe; Status for the ECGN Project (Herbert Wilmes)

ECGN is considered as a European contribution to IGGOS, but it is also an independent component of its own.

The “core” observations for ECGN stations are positions (by continuous GPS) and absolute gravity. Additional observation techniques like tide gauge, superconducting gravimeter, water vapor radiometer (WVR) etc. are included where available.

For details see the ECGN home page at <http://www.bkg.bund.de/ecgn/>

7 Review and updates of the NKG Absolute Gravity Plan

There is a need to keep the station list in the NKG Absolute Gravity Plan updated.

An updated station list is available at (<http://www.oso.chalmers.se/~hgs/NKGWG/index.html>).

8 NKG matters

Porto meeting

Attendance at the IAG International Symposium on Gravity, Geoid and Space Missions, GGSM2004, in Porto Aug 30 to Sept 3 was discussed.

Some preliminary results from the 63°N Gravity Land Uplift Line could possibly be presented. Jaakko Mäkinen, Bjørn-Geirr Harsson, Gabriel Strykowski, Hannu Ruotsalainen, and Andreas Engfeldt compile the results.

Comparisons of observed gravity differences in 2003 between relative and absolute gravimeters could maybe also be presented?

Workshop

The NKG Presidium propose a workshop on the experience on absolute gravity campaigns. This request is considered fulfilled by this meeting.

Meta data information

Each group is asked to compile information about the absolute gravity observations performed. The absolute gravity meta-data should include:

- station
- date
- no of drops
- gradient observation
- auxiliary observations
- problems and highlights.

Thanks

On behalf of working group members the chairman thanks Lantmäteriet and the local organisation committee for the generous hospitality at the restaurant "Helt Enkelt" yesterday evening.

9 Next meeting

Next meeting will be held in Finland preliminary in April 2005.

Gävle, Aug. 11, 2004

Martin Lidberg