



NKG, Working Group: Positioning and Reference Frame 15.-16th January 2008, DTU, Space, Copenhagen

After a light lunch the meeting started at 13 by some welcome remarks from the chairman Per Knudsen. The agenda was adopted by:

DK: Karsten Engsgaard, Bo Madsen, Abbas Kahn (at some points), Marianne Knudsen (day 2), SF: Hannu Koivula, Passi Halki, LAT: Janis Kaminskis, N: Thorbjørn Nørbech, SV: Lotti Jival, Martin Lidberg, Dan Norin,

- 1) Welcome and practical informations
- 2) Status / Brief national reports (including report from the NKG LAC)
- 3) Expectations
 - Input from previous WG
 - Input from presidium – proposed activities
- 4) Other activities (WGs, NGOS, projects)
- 5) Plan future works
- 6) And Other Business
- 7) Next meeting
- 8) End of meeting

Draft minutes.

1. Maps and time for the dinner was given. Wednesday the meeting will be 9-13, thereafter lunch.

2. National report Denmark:

KMS: Mette Weber will return from leave about april 1st. Marianne Knudsen will join tomorrow.

Danish National Space Centre is now merged with DTU and is now named “DTU, The National Space Institute” (short: DTU, Space). New agreements for cooperation with KMS are under preparations in the ministries. The Geodetic activities continue but new have come up. E.G.:

GNET: Greenland Network. A joint venture with Ohio State University and Luxemburg University. Aim: To describe the climate change by observing the melting of the inland ice of Greenland through permanent and semi-permanent GPS observations all around the coast. In 2007 23 stations were established each station with GNSS equipment, Iridium communication, up to 4 solar panels, 2 wind turbines (sail boat type) and up to 24 batteries (100AH); most heavily equipped (800 kg) in the north due to the long winter darkness. The data from the stations will be freely available on:

http://facility.unavco.org/data/gnss/perm_sta.php. The GNET is expected to improve the uplift model for Greenland and contribute to a better definition of a zero level for Greenland.

National Report from Finland:

Matti Ollikainen retired in 2007. H. Virtanen leads the Department of Geodesy and Geodynamics. Hakli Pasi will continue with some of the duties. Markku Poutanen leads DynaQlim (Upper Mantle Dynamics and Quaternary Climate

in Cratonic Areas) , which is a Regional Co-ordination committee of the International Lithosphere Program (ILP) 2007-2012.

New base-maps on EUREF-FIN UTM 1:25.000 have been produced.

A “Transformation Manual” has been written and a web-application developed in GML 3.1.1 (An example was given).

The EUVN_DA stations were published in 2006 and data delivered to EUREF.

The N2000 Height System has been published including a geoid model FIN2005.

In Mätsahovi observations continue on GPS/GNNS, the super conducting gravimeter and the FG5 operation;- but the satellite laser ranging (SLR) is under reconstruction. A JPL GPS receiver was installed in 2006.

The 100 stations in EUREF-FIN have been re-measured; 6 stations simultaneously 24-48 hours.

Test on accuracy and static of VRS gps is continued.

National report Latvia:

An interesting movie presented the work done in Geodetic Survey Latvia including the topography.

A web-transformation service has been established. The first order levelling miss only 800 km to be measured in 2008 and 2009. The permanent station RIGA has had 2 receiver shifts and 1 antenna replacement.

National report Norway:

The head of the Geodetic department Knut Floten will leave after 13 years employment. Per Erik Opseth has taken over after Bjørn Engen.

2 goals have been formulated:

- Before 2015 have a positioning service better than 1 cm
- Work for improvement of the geodetic observations to monitor the earth environment.

In 2001 an ad hoc transformation from ITRF97 to Euref89 (N) was determined on 20 points. Now the NKG standard transformation is used on land and a 7-parameter transformation is used offshore having an accuracy of 3 cm in the plane and 6 cm in the height.

National report Sweeden:

SWEPOS: Has 156 stations of which 21 are fundamental and 7 are EPN's. 5 new station are planed near Tärnby and 12 near Kiruna. All are equipped with dual frequency GPS/GLONAS receivers. SWEPOS has 1000 subscribers.

RIX95: There are determined 9029 control points, and there has been determined transformation to 240 municipalities (out of 290). Discussions undergoes wether to start a program for re-measuring maybe only a subset of 300 stations.

SWEREF99, RH200: RT90 has been replaced by SWEREF99. 30 municipalities has changed to the new system. Gotland got a precise levelling in 2007. 8 municipalities have changed to RH2000 and 50 are ongoing.

Antenna calibration field: 8 more stable stations have been established on the roof, The coordinate are determined with total station giving $\sigma_{hor} \approx 0.5$ mm and $\sigma_{vert} \approx 0.3$ mm . 30 antenna has been calibrated. New antennas will be calibrated before use.

Local Analysis Center: Now the radomes are taken into account giving a **jump of 2-3 cm in the height** at the epoch of changed strategy.

EGWAP: is processed by GIPSY on hourly basis.

The Swedish reply on Resolution no.5, London 2007, was handed out. The response was appreciated.

3. Expectations.

The working group is continuing with the same expectations from the last period: "Positioning in four-dimensional reference frames"

Objectives: Studies of methods for positioning using satellite techniques, development of methods for the monitoring of reference frames and implementation of the results from the monitoring in the realisation of the reference frames for practical use. The working group shall also be a forum for exchange of information and studies related to the four-dimensional reference frames and the present reference frames issues.

Activities:

- Studies of methods for high precision three dimensional positioning using satellite observations, being a forum for data and information exchange on high precision positioning.
- Studies of methods for the monitoring of reference systems, networks of permanent reference stations and repeated campaigns.
- Exchange of information and studies related to the present reference frame issues, e.g. methods for transformation between different reference frames, selection of reference frames, kinematic height systems.
- Studies of the concept for four dimensional reference systems issues.
- Act as NKG regional GNSS Data Analysis Centre for EUREF/IGS

Task of the group: To establish the new common Nordic reference frame the following tasks were considered:

1. Campaign specifications, epoch, link modern geodetic monitoring stations (EPN) and original defining points.
2. Data processing on more soft-wares to establish the common Nordic reference frame.
3. Defining transformations to the national ETRS89 realisations and furthermore to
4. Establish a velocity field to secure future applications, i.e. the long term stability of the common Nordic reference frame.

Results of the period 2002-2006:

- A common Nordic reference frame with up-dated accuracy in ITRF2000_2003.75 has been established.
- Transformations to the national ETRS89 realisations have been made.
- A velocity field in 3D (consistent with ITRF2000) has been selected to secure the long term stability.

Covering Greenland and Norway we have an arctic frame valuable for the IPY.

Latvia and Lithuania got new ETRS89 coordinates approved by the EUREF-TWG Riga 2006.

The NKG Analysis Centre is working.

Feed-back to NGOS and other NKG activities.

Recommendations for 2006-2010: Proposed focus:

- Feedback from the users on the product established so far, especially from “the Nordic Positioning Service” and from other NKG WGs.
- Further development of the velocity models, including feedback to/from EUREF TWG and other NKG WGs.
- Strategy for implementation of ITRF2005
- Possible a new campaign including multiple techniques.
- Study and possibly further development of positioning techniques (VLBI, SLR, GNSS), including GNSS antenna calibrations.
- Give feedback to the NGOS task force.

From the Presidium: The activities mentioned above were adopted and a concern for the effect of change to ITRF2005 raises the question of a re-measuring campaign of the Nordic area.

4. Other activities.

Martin Lidberg presented some items from his dissertation. It was emphasized that the **velocity field was changed** by the shift and improved. The globally reference frame fixing is however very complicated and the selection of the basis stations may influence the velocity field. Some time series for permanent stations had the well known “banana shape” in the height component which might be caused by the modelling of the antennas (and radomes). Abbas noted that the new ICE05 model has better ice modelling which might change the uplift rates with up to 0.5 mm/y compared to the old model.

Abbas presented local GPS surveys at the Jacobshavn Glacier and at the Helheim Glacier. The number of ice-quakes has increased within the last 4 years and the highest number is recorded in august each year during the last 10 years. The GPS surveys show 20 km³ mass loss at Jacobshavn and 167 km³ at Hellheim. GRACE estimates mass loss of 220 km³ water per year.

Martin Lidberg presented the site dependent error at permanent GPS stations. When modelling these errors improvement could be seen. A method to calibrate antennas at the site was presented. 3 well calibrated antennas were setup in control points near the permanent station to in detail determine the pattern of the error signals and absolute phase centre of the permanent antenna.

5. Plan on future works.

A GPS campaign in week 40, 2008 were agreed on.

Revision of the guidelines before july 2008 by **Lotti**.

Computations in ITRF2005 before july 2009 by **more Teams**.

- 2-3 Bernese + GIPSY + Gammit
- Distribution of the computation scripts by **Lotti (?)**

Analysis (incl. Velocity field) before dec. 2009

Re-computation of the 2003 campaign in ITRF2005 before jan. 2009.

Data repository: FTPSERVER:: <ftp2.kms.dk>: nkg: *****

Testdata for Antenna calibration calculations before july, 2008 by **Lotti**.

6. Other businesses: none.

7. Next meeting:

4-5th nov. 2008, Norway. (week 45)

After the WG meeting it has been decided by DK to include 5 stations on the Faroe Islands in the campaign week 40, 2008 to produce an official ETRS89 realisation to be adopted in EUREF TWG summer 2009.