

46th Meeting of the EUREF Technical Working Group in Helsinki, 31. March – 01. April 2008

Next events:

- TWG 2008 Symposium Meeting: Brussels, 17. June 2008 (whole day)
- Symposium 2008: 18. - 20. June (21. June: technical excursion), Brussels
- TWG 2008 Fall Meeting: Munich, 3. - 4- November

Meeting place: *House of Arts and Sciences of the Federation of the Learned Societies in Finland. Kirkkokatu 5, 00170 Helsinki*

Time schedule: Monday, March 30, 2008 – 09:00-18:00

Tuesday, April 01, 2008 – 08:30-13:00

Agenda

1. Opening (*Bruyninx*)
2. Minutes of the 45th TWG meeting in Paris (all)
3. Information
 - a) Collaboration with EuroGeographics (Ihde)
 - b) ICG meeting in Vienna, Feb. 2008 (Hornik)
 - c) Support for the establishment of a GNSS station in Malta (Ihde)
 - d) Status of EUMETNET/EUREF MoU (Brockmann)
 - e) INSPIRE (Habrich, Caporali)
 - f) GGOS (Altamimi)
4. EUREF TWG membership (*Bruyninx*)
5. EUREF Permanent Network
 - a) EPN CB status report (*Bruyninx*)
 - b) GLONASS observability (Soehne)
 - c) EPN rapid analysis (Habrich)
 - d) Next LAC workshop (Habrich)
 - e) Real-time clock corrections (Weber)
 - f) Support of the real-time IGS Pilot Project (Weber)
6. Realization of the EVRS/EVRS2007 (Ihde, Mäkinen)
7. EVRS and the permanent tide: background to conventions (Mäkinen)
8. EUVN_DA products (Kenyerer)
9. ETRS89/ETRF2005 (Ihde et al)
10. Home page of EUREF (Hornik, Ihde)
11. Preparation of EUREF 2008
 - a) EUREF 2008 (*Bruyninx*)
 - b) Financial support for participants (Hornik)
 - c) EUREF proceedings (Hornik)
12. Next TWG Meeting (all)
13. Action Items (Hornik, Bruyninx)

Participants

ZUHEIR ALTAMIMI, Paris
 ELMAR BROCKMANN, Berne
 CARINE BRUYNINX, Brussels (Chair)
 ALESSANDRO CAPORALI, Padova
 WERNER GURTNER, Berne
 HEINZ HABRICH, Frankfurt a.M. (perm. guest)
 HELMUT HORNIK, Munich (Sub-comm. Secretary)
 JOHANNES IHDE, Frankfurt a.M. (Sub-comm. Chair)
 AMBRUS KENYERES, Budapest

JAAKKO MÄKINEN, Helsinki
 HERMANN SEEGER, Bad Neuenahr-Ahrweiler (perm. guest)
 JAROSLAV SIMEK, Prague
 WOLFGANG SÖHNE, Frankfurt a.M.
 GÜNTER STANGL, Graz (perm. guest)
 JOAO AGRIA TORRES, Lisbon
 GEORG WEBER, Frankfurt a.M.

apologized: CLAUDE BOUCHER, Paris; HANS VAN DER MAREL, Delft

Minutes

Remark: The presented papers and view graphs are published, as far as available, on the EUREF homepage (<http://www.euref.eu/TWG/EUREF%20TWG%20minutes/46-Helsinki2008/TWG-Helsinki2008.html>).

The minutes will be discussed at the next TWG Meeting and after approval be put into the web.

1. Opening

J. MÄKINEN welcomes the participants on behalf of the Finnish Geodetic Institute to the 46th TWG Meeting. C. BRUYNINX as chairperson opens the meeting. She thanks the hosts for the invitation to hold this meeting in Helsinki.

The agenda was distributed by e-mail, some topics are changed in the sequence due to time limits of some participants, the plenary accepts the agenda.

2. Minutes of the 45th TWG meeting in Paris

The minutes of the last TWG Meeting in Paris, 29-30.11.2007 were distributed among the TWG members. Some few corrections are to be attached. The final text is published in the EUREF homepage <<http://www.euref.eu/TWG/EUREF%20TWG%20minutes/45-Paris2007/TWG%20Paris%202007%20minutes.pdf>>.

3. Information

a) Collaboration with EuroGeographics

J. IHDE informs that NICK LAND has left his post as EuroGeographics Executive Director, his successor is DAVE LOVELL. First steps of contact have already been taken to explain to one another the mission of EUREF and EuroGeographics respectively. Especially the MoU (<http://www.euref.eu/documentation/OtherDocuments/MoU_EuroGeographics-EUREF_fin.pdf>) is considered as an essential link between EUREF and EuroGeographics. D. LOVELL intends to participate at the 2008 EUREF Symposium in Brussels. He further expressed his intention to

invite a representative of EUREF into the EuroGeographics Governing Board. J. IHDE declares to prepare a relevant information report.

J. IHDE gives a summarizing sketch of the history of co-operation with formerly CERCO (Comité Européen des Responsables de la Cartographie Officielle) and now EuroGeographics. He emphasizes that the products of EUREF still are lacking a legal aspect and thus are not as official as e.g. the gravity values. This aspect is to be discussed in more detail together with EuroGeographics considering the fact that this institution officially represents the great majority of the European NMAs. ETRS89 has been recommended as official reference system by the European Union and then might get a legal basis.

The financial support by for EUREF is explicitly acknowledged. By this support for travel costs colleagues from economical weak countries are enabled since several years to participate at the EUREF symposia. Moreover EuroGeographics also will support countries to improve their reference systems by installing e.g. permanent GNSS stations, processing data activities or training courses for future operators. At present an application from Malta is discussed (cf. topic 3.c).

b) ICG meeting in Vienna, Feb. 2008

H. HORNIK gives a summarizing report on the Planning and Organizational Meeting of the International Committee on Global Navigation Satellite Systems (ICG), held in the United Nations Office at Vienna, 18-19 February 2008. Detailed information is available on <<http://www.unoosa.org/oosa/SAP/gnss/icg/pf/02/pres.html>>.

It is pointed out that ICG is internationally considered as an umbrella institution for GNSS providers, thus it is important to keep in contact. Moreover the ICG would be suitable organization for receiving the label legal aspect for EUREF products. It is emphasized that a representative of EUREF also should attend the next 3rd full meeting of the

ICG, which is to be hosted by R. NEILAN at NASA's Jet Propulsion Lab in Pasadena, California, 8-10.12.2008.

J. IHDE mentions the European Position Determination System (EUPOS) which is an associate member of the IAG and is mainly active in the establishment of GNSS in Eastern Europe. C. BRUYNINX offers the use of EPN stations for other networks than EUREF as well as to process data of those in order to generate long term data sets. Especially long term data sets are very beneficial for the analysis and interpretation of data and error detection. J. SIMEK informs that at present EUPOS operates about 300 permanent stations in Eastern Europe, up to altogether 800 sites namely in Russia are planned. It is emphasized to take care to avoid duplication of work, the efforts better should be concentrated on the accurate and reliable long term monitoring of registrations.

c) Support for the establishment of a GNSS station in Malta

E. DEBONO from Malta has send a letter to EUREF asking for support to install a permanent GNSS station for the EPN in Malta. J. IHDE explains that EuroGeographics could help via the BKG in this case as it already was done similarly for Moldova. A. CAPORALI mentions that according to his knowledge a permanent GNSS station is already operated by the Institute of Physics of Malta. Therefore it is concluded to inform E. DEBONO to check whether the data of this station could be achieved and be used for the EPN.

d) Status of EUMETNET/EUREF MoU

E. BROCKMANN informs on new activities to get access to meteorological data. The colleagues of the meteorological institutions have promised to facilitate the access. Obviously various data files exist and could deliver worthful information. Therefore all efforts should be undertaken to make these data available and harmonize them for common use. The EPN could serve as an adequate facility for the collection and archiving the data.

The next annual expert GPS meeting for meteorological data will take place in Potsdam in May 2009. It should be tried to bring the relevant representatives together at this meeting.

e) INSPIRE

H. HABRICH and A. CAPORALI as EUREF representatives in INSPIRE WG 'Coordinate reference system' present an overview on the participation of EUREF in the activities of INSPIRE (Infrastructure for Spatial Information in Europe).

According to Directive 2007/2/EC of the European Parliament and of the Council of 14.02.2007 INSPIRE is a legal entity (http://inspire.jrc.it/directive/I_10820070425en00010014.pdf). The term 'infrastructure for spatial information' comprises metadata, spatial data sets and spatial data services / network services and technologies / agreements on sharing, access and use / and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with this

Directive. 'Spatial data' means any data with a direct or indirect reference to a specific location or geographical area.

The guiding principles of INSPIRE include

- to design the infrastructures for spatial information in the Member States to ensure that spatial data are stored, made available and maintained at the most appropriate level;
- to combine spatial data from different sources and make them available among the Community in a consistent way and share them between several users and applications;
- to archive spatial data collected at one level of public authority to be shared between all the different levels of public authorities;
- to reduce restrictions for the use of spatial data;
- to facilitate the access to spatial data, to evaluate their fitness for purpose and to know the conditions applicable to their use.

Concerning the presence of EUREF, ETRS89 and EVRS in the present INSPIRE documents, the ETRS89 as an example for a coordinate reference system in Europe is explicitly pointed out. The ETRS89 has been adopted by the European Commission. The long term data files of the EPN comprise at present more than 200 permanently operating GNSS observing stations. This realisation provides static as well as kinematic information of spatial referencing. Thus ETRS89 and EVRS could be implemented in a spatial information system following the ISO 19111 standards with the above mentioned restrictions concerning kinematic aspects.

The INSPIRE Thematic WG KOM met in Ispra/Italy, 14.-15.02.2008. At this meeting an COREF-WG for position, interfaces and assignments was created. An important focus of the work is the definition of coordinate reference systems with relation to the INSPIRE directive.

J. IHDE presents a proposal of a *Comment of the Technical Working Group (TWG) EUREF on objective and work content of the INSPIRE Thematic Working Group Coordinate Reference Systems*.

It is stated that the formulation of clear „user requirements“ would be an essential contribution of EUREF for INSPIRE. J. IHDE will write a letter to P. SMITS as chairman of the INSPIRE-TWG CRS to explain the position of EUREF to the work of the INSPIRE-TWG. J. TORRES is proposed to represent EUREF as facilitator to this group.

f) GGOS

Z. ALTAMIMI presents the new structure of GGOS which represents an own organization within the IAG.

It is planned to install about 45 world wide distributed core sites equipped with all relevant techniques. This necessity is widely accepted, the realization, however, will need much time.

4. EUREF TWG membership (Bruyninx)

C. BRUYNINX presents her ideas to install a time limit for the membership in the EUREF TWG as well as a clear procedure for the nomination of new members according to the EUREF Terms of Reference (ToR). At present the TWG consists of the following members (in brackets the year of nomination):

- Z. ALTAMIMI (2003)
- C. BOUCHER (1992)
- E. BROCKMANN (2003)
- C. BRUYNINX (1996, TWG Chair)
- A. CAPORALI (1999)
- W. GURTNER (1992)
- H. HORNIK (1992, ex officio as EUREF Secretary)
- J. IHDE (2003, ex officio as EUREF Chair)
- A. KENYERES (2000)
- J. MÄKINEN (2003)
- H. V. D. MAREL (1993)
- J. SIMEK (1999)
- J. A. TORRES (1999)
- G. WEBER (2002).

Further

- H. HABRICH
- H. SEEGER
- W. SÖHNE
- G. STANGL

regularly join the TWG meetings as permanent guests.

It is proposed as generally done in the IAG to use the four-years-term for membership. The TWG discusses the reasons for/against the possibility of one/two renewals for the membership. 2 terms (i.e. 8 years) would be in general accordance with the most IAG groups, 3 terms (i.e. 12 years) are considered to bring more continuity into the EUREF TWG. In any case the symposium plenary should vote for all memberships at the symposia following the IUGG General Assemblies. It is proposed to install also the possibility of supplementary ex-officio members e.g for the Head of the EPN Central Bureau or the EPN Analysis Coordinator. Moreover the possibility of honorary membership such as for former chairpersons etc. is discussed.

Concerning the election of members it is discussed to propose the present permanent guests as full members. Moreover three applications for new members have been sent to the EUREF chair. A procedure for the application, the introduction and finally the election is discussed.

It is stated that according to the present conditions representatives for geographical regions are not as necessary as in the past. However, typical topics such as campaigns, data base, ETRS89, GNSS systems, heights, reference systems, gravity, geoid etc. are to be covered by adequate specialists.

Finally it is concluded that E. BROCKMANN; C. BRUYNINX, H. HORNIK, J. IHDE and J. A. TORRES define profiles for the open positions in the TWG and distribute them among the

TWG to be discussed and then recommended to the symposium plenary. Moreover the EUREF ToR are to be adapted for all kinds of different membership.

5. EUREF Permanent Network

a) EPN CB status report

As head of the EPN CB, C. BRUYNINX presents the usual status report. At present the EPN comprises altogether 198 stations. Since the last TWG meeting 2 new sites have been included, 7 others withdrawn due to different reasons, 21 sites are proposed to be included in the EPN. Meanwhile 90% of the active sites deliver hourly data and 43% real-time registrations. Altogether 27% are equipped both with GPS and GLONASS receivers. A series of EPN sites in Eastern Europe is additionally operating in EUPOS.

C. BRUYNINX explains the updated EPN website <http://www.epncb.oma.be/> which lists station coordinates, coordinate time series, site zenith path delays and other information. Especially the long time series give a highly valuable insight into the behaviour of GPS registrations and the derived results. G. WEBER remarks the necessity to offer one set of coordinates for the user community. Differing coordinate sets basing on different data may be very interesting from the scientific point of view, for practical use, however, they might induce confusion. Therefore clear instructions are stringently necessary, other results should be offered as well but have to be clearly labelled. C. BRUYNINX replies that the best available coordinates are to be offered to the users and these data should be provided with an priority label.

The real time data streams are no more considered as a pilot project but are part of the EPN routine operations. The corresponding data are available from the website as well. Further also the activities of the time series SP can become from now on part of the routine EPN operations. The EPN-CB website will be updated accordingly.

b) GLONASS observability

W. SÖHNE informs on the development of the GLONASS system. In autumn 2007 two satellites have been launched, two more are planned for 2008, then 18 – 20 satellite will be permanently available. 55 EPN stations (status 10.03. 2008) are equipped with combined GPS+GLONASS receivers.

The observability of GLONASS satellites is still varying considerably, thus the system is still lacking a satisfying reliability which should be guaranteed by a permanently available GNSS for real time service. This item will be put also on the agenda of the next LAC workshop.

c) EPN rapid analysis

An action item of last TWG Meeting requests a detailed report, the TWG members were asked to communicate their comments and ideas. H. HABRICH presents an updated report. Basing on the various input data, rapid, hourly, daily and weekly products are generated.

Especially rapid data combinations require a highly automated processing according to a fixed schedule without manual interaction. As far as possible automated event handling has to be enforced, allowing the elimination of obviously erroneous data as well as the computation of a suitable reference solution. All necessary information on the elimination of data and the corresponding findings are to be submitted as far as automatically to the responsible station managers.

Concerning the planned long term analysis, H. HABRICH announces to present a report on the investigation of the constraint between different sub-solutions at the coming EUREF 2008 Symposium in Brussels. Moreover he expresses his confidence to realize the re-computation of previous long term data records as already practiced in the IGS and IERS.

d) Next LAC workshop

H. HABRICH gives a summarizing report on the 5th EPN LAC Workshop, 15.-16.03.2006, Padua, Italy. The next meeting will take place from 20.-24.10.2008 in the BKG in Frankfurt.

e) Real-time clock corrections

G. WEBER informs on the progress of the project. The new version 1.5 of the BNC (BKG Ntrip client) is explained. For the 15-min high rate RINEX the data turned out to be complete for 95% after 1 epoch.

C. BRUYNINX recommends that G. WEBER should prepare a detailed document on "Enhancement of EPN real-time data streams" as a basis to set up the new EPN Special Project for the 2008 Brussels Symposium. The document should be distributed among the TWG in time to be discussed and, if necessary, be completed. Moreover the EUREF website should soon be supplemented in detail by the topic EUREF-IP to inform the community on this method.

f) Support of the real-time IGS Pilot Project

The question to use real time data also was discussed with J. DOW as representative of ESA. ESA recognizes this new development as a useful contribution and supports the activities.

6. Realization of the EVRS/EVRS2007

Based on a contribution by J. IHDE, J. MÄKINEN and M. SACHER on *Conventions for the Definition and Realization of a European Vertical Reference System (EVRS) – EVRS Conventions 2007*, J. IHDE remembers the development of the vertical networks within the recent decade. A first result was achieved with the solution UELN95/98. Afterwards various new data were achieved and projects initiated such as the ECGN, EUVN_DA, EVRS etc. On occasion of a common workshop of EuroGeographics and EUREF in 2004, the urgent need for a unique vertical reference system for Europe was expressed. The ETRS89 was adopted as horizontal reference by the EC. For the vertical component,

however, not sufficient solution could be achieved up to now.

The objectives EVRS2007 are as follows:

- request of European Commission,
- consideration of user requirements in Europe,
- realization of an up-to-date European height reference frame,
- continuation of the previous development of EVRS,
- guarantee of a 1 cm accuracy level for datum and network realization,
- alignment to IVRS/WHS.

The European Vertical Reference System 2000 (EVRS 2000) is prepared by EUREF for adoption by the European Commission to promote the widespread use as a de-facto standard for future pan-European GIS data products and services. It is defined as a World Height System (WHS) and realized for practical use as a static system under the name EVRF2000 by the datum of 'Normaal Amsterdams Peil' (NAP). It is recognized that this level is only virtual, for the physical level no marker with sufficient accuracy is accessible.

A second contribution by M. SACHER, J. IHDE, G. LIEBSCH and J. MÄKINEN refers the *EVRF07 as Realization of the European Vertical Reference System*. Since 1999 updated and/or new data of 14 countries have been made available. As reference point 000A2530 located in the Netherlands was used for the realization of the datum of EVRF2000. For the realization of the datum of EVRF07, however, several datum points distributed over the stable part of Europe are used. Altogether 19 points were proposed, 14 of them were finally selected for use. Concerning the post glacial uplift the data in northern Europe were reduced to the epoch 2000 by the land uplift model NKG2005LU (ÅGREN and SVENSSON). As the investigations show, the results now are fitting rather good.

At present no agreement on the exchange of leveling data as well as results among the participating countries and for the scientific community has been developed. According to the existing rules only the national part of the results will be handed over to the respective countries. This item has to be discussed in detail at the coming 2008 Symposium in Brussels. The relevant countries will be contacted in the next future.

7. EVRS and the permanent tide: background to conventions

A detailed report on *The Permanent Tide in Height Systems* by J. MÄKINEN and J. IHDE has been distributed before the meeting by circular letter.

J. MÄKINEN remarks that the ITRFxx solutions and with it the ETRS89 represent tide free realizations. For the realization of EVRF2007 through Earth Geopotential Models (EGM) and European Gravimetric Quasigeoid (EGG) it therefore has to be reflected whether a correction from ITRFxx tide free ellipsoidal heights to mean-tide corrected ellipsoidal heights is needed.

The effects of the use of a non-tidal or tide-free system / mean tidal system / zero tidal system are demonstrated in detail. The concerning IAG resolutions are explained and the current situation relating national as well as continental/global height systems described. It is emphasized that EUREF as an IAG body has to follow the IAG recommendations. The EVRS2000 is zero-tide by definition, but due to the mixed systems (mostly mean, some non-tidal) of the national observations as input for the going into the UELN-95/98 the current realization EVRF2000 is mixed, too.

Concluding the reflections it is stated that the described problems have to be dealt more intensively before starting the work for a zero-tide World Height System.

The TWG asks J. IHDE, J. MÄKINEN and A. KENYERES to contact H. DENKER for discussing the subject in more detail to come to an agreement which can be submitted to the next TWG Meeting and the EUREF Symposium.

8. EUVN_DA products

A. KENYERES reports on behalf of the EUVN_DA Working Group (A. KENYERES, M. SACHER, J. IHDE, H. DENKER) on the progress of the EUVN_DA. He mentions that the project now is definitely going to be concluded. The input data comprise about 1400 high quality reference GPS/leveling points. For the final solution the choice of the tidal system has to be clearly defined. The outcome of comparisons between the draft results of EUVN_DA and EGG97/07 are shown.

The next steps in EUVN_DA will comprise the implementation of permanent tidal effects, the update of the web site and – as far as possible – the compilation of a final report for the coming 2008 EUREF Symposium in Brussels. Another report will be submitted to the GGEO08 Symposium in Crete.

For the future EUVN_DA policy A. KENYERES mentions the possibility for upgrades if considerable new data or/and data improvements would be available. A password protected data access will be installed. Concerning the computation of the EGGP, A. KENYERES describes the challenge for EUREF to participate by the project as a contributor on the field of geoid GPS/leveling combination.

9. ETRS89/ETRF2005

J. IHDE reports that according to the action items of the 45th TWG Meeting, Paris, 29.-30.11.2007, several TWG members met on 15.01.2008 in Paris to continue the discussion on this topic and to prepare new ideas. For this TWG meeting 3 papers are presented:

- J. IHDE, W. GURTNER, J. LUTHARDT: *ETRS89 Realizations* (2 versions)
- H. HABRICH: *ETRS89 Realisation*
- Z. ALTAMIMI: *ETRS89 Realizations*.

The presentations are explained in detail, followed by an extensive discussion. A main subject deals the question of a long term invariant reference system for practical use or

whether continuous jumps should be allowed. In all the urgent necessity is emphasized not to confuse the user community but to guarantee a reference system which is compiled by the best available data and which is stable as far as possible. Any jumps, even when being based on better data, might induce confusion and in the worst case that users switch to an other reference system.

It turns out that this items obviously need to be discussed in more detail, an other meeting will be scheduled in May 2008 to prepare a report for the next symposium in Brussels to describe clearly the situation. As the presently published transformation parameters for ETRF2005 cannot be considered as absolutely reliable, the values published in the EUREF website should now be withdrawn and be replaced later when a common agreement has been found.

10. Home page of EUREF

The item is postponed, J. IHDE and H. HORNIK are asked to report at the next TWG Meeting.

11. Preparation of EUREF 2008

a) EUREF 2008

It is proposed to try to develop the EUREF Symposia to more scientifically oriented conferences. Although the technical aspects are considered to be necessary and useful, the main aspect should be concentrated on more science and less application.

Considering the 14th General Assembly of WEGENER – 15-18.09.2008, Darmstadt/Germany, J. TORRES rises the question to invite a representative of WEGENER to give a report on the activities.

C. BRUYNINX, J. IHDE and H. HORNIK are asked to distribute a proposal for the session chairpersons among the TWG asap.

b) Financial support for participants

As already done for previous EUREF Symposia Euro-Geographics has made available a limited amount to support participants from economical weak countries. H. HORNIK is asked to complete the Symposium web site describing the way/rules for receiving financial support.

c) EUREF proceedings

In order to accelerate the publication of the Symposium Proceedings, the deadline for the submission of contributions is set up for the end of July. The presented viewgraphs will be put into the EUREF homepage as usual immediately after the Symposium. H. HORNIK mentions that the long time span for the publication of the proceedings is a) often due to the latency of delivery of the texts, but b) mainly to very complicated bureaucratic rules at the BKG which has taken over the responsibility for printing the proceedings. It is emphasized that this latency is not the fault of any colleague but is due to the existing restrictions. Therefore it should be tried to find a possibility to publish also the full texts in the homepage without breaching the copyright.

12. Next TWG Meeting

The TWG asks H. HORNIK to arrange the 2008 TWG Fall Meeting in Munich. A circular offering the possible dates will be mailed asap, the TWG members will vote for the most applicable date among the given possibilities¹.

13. Action Items

The action items are projected and discussed. H. HORNIK will distribute the final text among the TWG in the next days

¹ The voting for the date of the TWG 2008 Fall Meeting in Munich resulted in 3.-4. November 2008.