XXI[th] Meeting of the EUREF Technical Working Group in Dresden, October 28 – 29, 1999

Meeting place: Technical University of Dresden.

Begin: 28.10.1999, 13.00 p.m., end: 29.10.1999, 12.00 a.m.

Agenda

1. Minutes of the XXth TWG Meeting in Prague (HORNIK)
2. New member list of the TWG (HORNIK)
   – Contacts with the Geoid Community (VERMEER)
3. Interface between CERCO WG VIII and EUREF (GUBLER)
4. Engagement of EUREF in Galileo (GUBLER)
5. EUREF AC Workshop summary (BRUYNINX)
6. EUREF site requirements (GURTNER)
7. Campaign guidelines (GURTNER, V. D. MAREL, BOUCHER)
8. EUREF Database Service
9. Status of ITRF2000 (BOUCHER)
10. Status of EUVN/UELN (IHDE)
11. Status of EVS 2000 (AUGATH)
12. Use of GLONASS data within EUREF network, report on IGEX meeting (GURTNER)
13. Status of COST action 716 (GPS troposphere) (V. D. MAREL)
14. Status of COST action 40 (EOSS)
15. Status of WEGENER COST activities
16. References for Digital Terrain Data (DUNKLEY)
17. Terminology for ISO 15046 (postponed from previous TWG meeting) (HARSSON)
18. EUREF Symposium 2000 in Tromsø (HARSSON)
19. Should we trademark EUREF asap? (cf. appendix 2) (M. VERMEER)
20. Education and training on the use of EUREF (TORRES)
21. Varia
    – Moldova Campaign (GURTNER)

Participants

JÓZSEF ÁDÁM, Budapest
JOAO AGRIA TORRES, Lisbon (Subcomm. President)
WOLFGANG AUGATH, Dresden
CLAUDE BOUCHER, Paris
CARINE BRUYNINX, Brussels
PAUL DUNKLEY, Brussels
WERNER GURTNER, Berne (Chairman)
ERICH GUBLER, Berne-Wabern (delegate of CERCO)
BJORN HARSSON, Honefoss
HELMUT HORNIK, Munich (Subcomm. Secretary)
JOHANNES IHDE, Leipzig (guest)
HANS VAN DER MAREL, Delft
ROLAND RAWLINGS, Brussels (guest)
HERMANN SEEGER, Bad Neuenahr – Ahrweiler (guest)
JAROSLAV SIMEK, Prague

MARTIN VERMEER, Helsinki
GEORG WEBER, Frankfurt (guest)

Minutes

Remark: the presented papers and viewgraph can be received on request, as far as available, from the EUREF secretary.

Topic 0: The new elected chairman of the EUREF Technical Working Group (TWG), W. GURTNER, opens the meeting and welcomes the participants, especially J. SIMEK as new member of the TWG as well as the guests. He thanks W. AUGATH for the invitation and for hosting this TWG meeting.

Topic 1: The minutes of the TWG meeting in Prague, June 1, 1999, have been distributed. Some comments and corrections are to be added.

Topic 2: H. HORNIK presents a viewgraph of the list of TWG members as nominated at the last EUREF symposium in Prague (June 2 – 5, 1999). H. SEEGER and J. ZIELINSKI have retired from the group, as new members A. CAPORALI, W. SCHLÜTER and J. SIMEK were elected.

M. VERMEER informs that his presidency of the former *Subcommission for Europe* of the *International Geoid Commission* has ended. Both commissions were dissolved at the IUGG General Assembly in Birmingham, August 1999. The former *International Geoid Commission* and the *International Gravity Commission* were replaced by an *International Gravity and Geoid Commission*, of which M. VERMEER was made President-Elect. This new commission again comprises a *Subcommission for Europe*, the president of which is AMBRUS KENYERES, Budapest. In order to continue the fruitful cooperation between EUREF and geoid commissions, M. VERMEER suggests to nominate A. KENYERES as member of the EUREF TWG at the next EUREF symposium in Tromsø. The TWG adopts this proposal.

Topic 3: E. GUBLER gives a short report on his new task as successor of H. SEEGER in WG VIII of CERCO. In this community almost all European countries are gathered as members or at least observers. The task is mainly to promote the national Mapping agencies within their countries and especially in their common European work. WG VIII serves as connection between CERCO and EUREF. After a long period of preparation work now the practical tasks are going to be started with projects such as MEGRIN (Multipurpose European Ground Related Information Network).[1]

For promoting the work of EUREF, CERCO will support the next EUREF symposium in Tromsø with 6000 ℋ. This help is thankfully acknowledged by the EUREF subcommission.

Another support by CERCO could be a contribution in the maintenance of the Permanent EUREF Network because normally universities have no possibility to operate permanent GPS stations indefinitely.

Relating the establishment of a common European reference it is emphasized that obviously the public is not sufficiently informed on the availability of EUREF with its ETRS89 but sometimes initiatives to use still the old ED50 or define other new systems besides EUREF are undertaken. This concerns especially sea navigation. H. V. D. MAREL underlines this possibility to link the old triangulation systems accurately to EUREF by eccentricity measurements.

W. GURTNER summarizes that there is an urgent need to make it clear that ETRS can serve as ***the*** European reference system for all practical purposes in geodesy, surveying and cartography (1 : 50.000 mapping) on European level. This fact must be repeatedly made be clear to the national agencies and the members of CERCO. A delegate of EUREF should e.g. participate at the next CERCO/MEGRIN meeting and inform on the products of EUREF.

Topic 4: . C. BOUCHER and W. GURTNER inform on the aspects of Galileo. It cannot be ignored that this system will be installed anyway due to political reasons. Currently the definition phase is carried out by the European Commission and ESA; the first satellite is intended to be launched in 2005, the complete system be operational in 2008.

Galileo probably will not replace the GPS systems completely, but there surely will be a large overlap. So it is a strong demand for EUREF to get into close contact with the Galileo groups in time in order to be engaged in this work. Moreover EUREF is to be presented to these groups and possible links be defined. EUREF could also serve with its expertise in maintaining the new system.

It also is emphasized that an important tool of Galileo is not only geodesy but the economical aspect to sell products for all kinds of navigation. Another view is the catastrophic scenario of the possibility that GPS could collapse or be no more available for civil purposes because presently GPS practically represents the only really usable system of satellite navigation.

C. Boucher is asked to send a letter to the EU concerning GALILEO as well as to organize a workshop/meeting with

[1] copies of the transparency sheets "CERCO WG VIII and EUREF" are available from the EUREF secretary.

the GALILEO-group.

Topic 5: C. BRUYNINX reports on the EUREF ANALYSIS WORKSHOP *"Multi-disciplinary EUREF products"*, Sept. 9-10, 1999, Paris (see also *http://homepage.oma.be/euref/*). Concerning the analysis of GPS-data for meteorological purposes a near-real time processing with at least hourly data upload is necessary. Although this work looks very promising und useful, the enormous effort has to be considered. For organizing the work as efficiently as possible it is decided to wait for new version of the Bernese software. C. BRUYNINX is asked to prepare a proposal how to reorganize EUREF permanent network coordination till next TWG.

Moreover it is decided to nominate for EUREF (similarly to IGS) a "troposphere coordinator", applications for this task should be directed to the EUREF TWG chairman.

It is stated that in Norway presently no permanent EUREF stations exist. For support W. GURTNER will write an official letter to urge the Norwegian agencies to participate again at Permanent EUREF Network.

Finally W. GURTNER mentions that the results of the Permanent EUREF Network are more and more used for geodynamic networks. According to the enormous need of accuracy for such applications more extensive investigations should be carried out whether these data can fulfil sufficiently the requirements.

Topic 6, 7, 8: W. GURTNER explains his view graphs for *EUREF Site Requirements* and *Campaign Guidelines*. While formerly the sites normally were monumented very well nowadays the monumentation often is less stable so that the repeatability of observations exactly on the same centre can become less accurate. Similarly the problem occurs in the permanent network with the accurate maintenance of the sites and precise description of changes in the antennae centres when these are moved for necessary manipulations. In some cases much work was done for nothing due to missing exact descriptions of changes. In any case all necessary information on the sites should be given in the forms. Unfortunately for many sites these informations are missing, the listings in the proceedings do not always comprise the useful data set. The pure coordinate files are available in the EUREF data bases, this information, however, refers only the coordinate values. B. HARSSON and J. SIMEK are asked to go through the guidelines and prove the available references.

Currently the following EUREF data bases exist:

IGN: Web site: http://lareg.ensg.ign.fr/EUREF
FTP archive: schubert.ensg.ign.fr/pub/euref

ORB: Web site: http://homepage.oma.be/euref/
FTP archive: ftpserver.oma.be/pub/astro/euref/

DUT: Web site: http://www.geo.tudelft.nl/mgp/euref.html

It is decided to install besides the existing homepages a general new EUREF webside giving more information on EUREF for the public comprising the following parts:

topic	*responsible*
Introduction	BRUYNINX, TORRES
Permanent EUREF Network (management)	BRUYNINX
Reference system, transformation, definitions of ETRF:	BOUCHER
Data base of coordinates, campaigns	V. D. MAREL
Heights, UELN, EVS2000, EUVN	IHDE
EUROCONTROL	DUNKLEY
Connection to geoid (involved in EUVN partly)	VERMEER, KENYERES
MEGRIN, CERCO	GUBLER

G. WEBER proposes to think about a logo for EUREF, J. A. TORRES declares to work out a draft and to prepare it to the next TWG meeting.

Concerning the national reference systems and their compatibility to others C. BOUCHER asks all countries and national agencies to describe definitely how their national reference is implemented in ETRS and give a link to the definitions.

Topic 9: . C. Boucher reports on the work to provide a new International Terrestrial Reference Frame ITRF2000. A call for participance has been issued (http://hpiers.obspm.fr/iers/info/gazette.45), a working group installed (chairman: J. RAY).

EUREF is already extensively contributing to the definition of the ITRF especially by the permanent sites data which are directly sent to IERS, but also campaign results can give a worthful input. Especially the EUVN as a European reference for heights will be used.

Topic 10: The *Status Report of the EUVN Project* prepared by the EUVN Working Group has been presented to the last IUGG General Assembly in Birmingham. The text will be published in the proceedings.

The GPS part of the EUVN is finished, the other terrestrial data sets, however, are not yet complete. The levelling data are generally all available, but for some countries still no terrestrial connection is possible but only via the EUVN. In all, about 85% of the data is available. The collection of tide gauge data could also not yet be completed and still will take some time, although many sites are included in the PSMSL data records. In January 1999 a circular has been distributed asking for the missing data, however some sites didn't yet transmit the requested data.

J. IHDE shows an example for the documentation which will include each one page/site with an exact description of the station (photos, sketches) and the responsible agency. A draft will be distributed to the corresponding agencies for confirmation. It is hoped to publish the volume in 2000 in the EUREF series.

The UELN95/98 adjustment has been continued with the inclusion of Estonia and Latvia, colleagues from these countries were invited to the BKG to prepare the data. The accuracy is estimated to 1.3 resp. 1.7 mm/km. Unfortunately up to now theses levellings cannot be directly connected to the main part of UELN due to lack of data of Russia. Moreover, the data of Romania are now going to be processed. The still missing connection to Hungary will be observed and made available in the next time. An internal data check showed good results for the raw levelling data, but the results got worse after the gravity correction. So the consistency of the gravity values has to be tested more extensively.

Topic 11: In continuation of J. IHDE's report on the UELN. W. AUGATH informs on the EVS 2000 project. In order to start the work after the enormous time consuming data collection a test area consisting of the kinematic networks of the blocks D, DK and NL will be adjusted.

It is again discussed how to use the partly rather old levelling observation, some of which are dating back till 1850. Although especially these observations often show an excellent quality and could give an interesting insight into terrain movements, the corresponding gravity values mostly are insufficient or not available as well as the correlation with new data is poor due to an insecure reference. Moreover the observation periods partly were lasting for years so that the data can hardly be referred to an exact epoch.

E. GUBLER says that investigations in Switzerland have shown that these old data especially in mountainous regions be better not used because of their poor quality. W. AUGATH remarks that not only the accuracy of the measurements but also the time span between the first and present data is an interesting topic in studying recent crustal movements. J. IHDE adds that the transition from levelling to GPS height determination shows an interesting experience for the connection of good older data with new ones and a long time period of observations gives a better insight into the consistency of the results as well as the behaviour of non-linear movements especially when more than only two data sets are available. However, the old data should be discarded if they are not reliably correlated with the new ones. On behalf of CERCO E. GUBLER expresses the need of a precise dynamic height system on European level. Concerning future activities, C. BOUCHER states that height determination for large height control networks will hardly be carried out by terrestrial levelling but by modern techniques.

Summarizing these arguments, W. GURTNER rises the question whether it is useful to continue this in deed time and personnel consuming project or stop the EVS2000 now. In contrary to earlier times, now precise positions can be determined quickly at relatively low costs and station velocities within in some years of repeated or even permanent observations. In any case it has to be considered that the more perfect the project is carried out the more time will pass and the results are no more used for practical applications as intended by CERCO. So the task should be finished as soon as possible also if gaps in the data are not filled in. It is decided to adjust the proposed test part and to present the results not later than mid of 2000. Then it can be decided whether to continue or stop the project.

Topic 12: The *Use of GLONASS data within EUREF Network* is treated by W. GURTNER. On an IGEX Workshop, hold in Nashville, Sept. 13-14, 1999, the results of the IGEX-98 Campaign were discussed. The goal was the simultaneous application of GPS and GLONASS signals especially by dual-frequency receivers. The data analysis showed clearly that a useful combination with good results is possible if the adequate hard- and software is available. This experience is also rather interesting for the development of future GNSS systems. Another interesting is the bias of some cm between SLR and GPS which is not yet explained.

Currently the IGEX data are not used in the IGS, however, it is intended to use them at a later time. Depending on the decisions of the IGS board whether to accept such data this topic also could influence the strategy of EUREF. Similarly to Galileo it is emphasized that this opportunity gives a chance to depend not only on a single system such as GPS. W.

GURTNER objects that the larger problem is the establishment of a reliable long-term operational GLONASS tracking network.

C. BOUCHER reports that in the IERS it turned out that results get worse when combined, this fact, however, should initiate more extensive investigations to clear the source of such biases. G. WEBER explains that the BKG in Frankfurt a.M. will carry out a series of experiments.

It is agreed to set this topic on the agenda of the next TWG meeting again.

Topic 13: On the *Status of COST* (Coopération Européenne dans la Domaine de la Recherche Scientifique et Technique) *action 716 (GPS troposphere)* reports H. V. D. MAREL. Three Working Groups have been installed to start the practical work. The next meetings will be hold in Matera in March 2000 and from July 10-12 in Oslo (together with the IGS workshop).

The application for climate research does not need real time data but long and accurate data. For this purpose the Permanent EUREF Network could be used as an adequate basis. Another goal is whether prediction with the help of GPS for which real time data are necessary. Hereby EUREF could be used to connect dense subnetworks. The practical tests are planned for summer 2000 and winter 2000/2001.

Topic 21: The next TWG meetings will be hold:

- Brussels, Monday / Tuesday, 20 – 21.3.2000 (if possible link to Galileo meeting);
- Tromsø (as usual before the EUREF symposium);
- an autumn meeting in Lisbon in October 2000.

Topic 14: COST Action 40 – EOSS (European Sea-level Observing System) is presented by C. BOUCHER. Currently 13 European countries are gathered in this project which is divided into the following working packages:

- height reference systems, fixing tide gauge benchmarks
- mean sea level determination
- sea surface topography
- tidal models, storm surge warning
- storage and exchange of data

The main goal is to organize long-term monitoring activities and data exchange of tide gauges along the entire European coastline which are connected to permanently observing GPS stations. COST Action 40 is officially finished with the end of 1999, so EUREF could include the sites into the Permanent EUREF Network to continue project.

W. GURTNER remarks that EUREF determines the positions of markers. The precise link between these markers and the tide gauges should be done by other groups.

Topic 15: : J. A. Torres reports that currently the *WEGENER COST activities* remain in a standby status. On a meeting in November the future work will be discussed.

Topic 16: P. DUNKLEY reports: The Navigation Strategy for the European Civil Aviation Conference (ECAC) Member States has been developed and agreed for the period 2000 – 2015. One of the requirements to meet the strategic implementation is the provision of positioning and navigation data at the required performance levels to support the various applications of the Communications-Navigation-Surveillance/Air Traffic Management environment.

The usage of Global Navigation Satellite Systems requires for the vertical reference frame to be defined at runway thresholds. The initial introduction of Satellite Based Augmentation (EGNOS in Europe) will be on a regional basis and requires a uniform European solution for the provision of height in a common reference frame. Whilst local augmentation systems are being developed for the longer term, wide area augmentation systems such as EGNOS need to be catered for.

GPS geometry provides good horizontal positions but less good height determination. the aviation requirement however is more constrained by the height element. This is not ideal and means that for EGNOS to be used, all error sources have to be minimised. The height of the runway thresholds therefore needs to be known to a higher order of accuracy, at around the decimeter level across Europe.

The second requirement for data relates to obstacle and terrain information in the Terminal Area (TMA) surrounding aerodromes. This is primarily for the determination and protection of airspace from obstacles and terrain during departure, approach and landing procedures. For these 3D routes in space, the anticipated accuracy of terrain and obstacle data within the TMA is of the order of 0.5 to 1 meters. For en-route, the accuracy criteria reduces rapidly due to the existence of the requirement for minimum safety altitude, a minimum altitude above ground taking into consideration obstacles and terrain. However data consistency and integrity remain key issues for all data.

The EUREF TWG have been contacted for technical advice with regards to the adoption of a suitable vertical reference frame at the decimeter level across Europe. Guidance is also sought through the TWG (or through referral to an

alternative body), on the options available for the handling of the vertical reference at aerodromes with respect to terrain and obstacle data within the TMA. The issues of ETRS or National Heights needs to be evaluated further to determine the most appropriate and achievable solution for height information, to meet the future navigation strategy.

In the discussion the question on the kind of heights requested for air navigation resp. determined by GPS is raised. It has to be considered that an aircraft is moving in the physical space which does not exactly coincide with the geometrical space. This problem, however, can be solved by clear guidelines including strict transformation formulae for each airport. In any case a consistent model for all airports should be used to avoid troubles and misunderstandings.

C. BOUCHER, B. HARSSON and J. IHDE (chair) are asked to formulate their ideas, submit them to P. DUNKLEY and discuss a common strategy for a common reference system for airports (high precise sites on runway, digital terrain model for surrounding area).

Topic 17: This topic is postponed to the next meeting.

Topic 18: B. HARSSON informs on the preparations for the next EUREF symposium in Tromsø (June 22-24, 2000), technical excursion June 25-27). The symposium is supported financially by the Norwegian Ministry for Foreign Affairs (3000 US$) and CERCO (6000 ₰). As already at previous meetings, this support will partly be used to enable colleagues from financially weak countries to join the symposium. H. SEEGER emphasizes to select carefully these colleagues (two per country) to guarantee that only competent people who practically are engaged in the work are invited.

B. HARSSON asks to registrate as early as possible in order to organize cheap charter flights Oslo – Tromsø.

For further information see

http://www.gdiv.statkart.no/EUREF2000/

Topic 19: This topic is postponed to the next meeting.

Topic 20: Basing on the successful experiences of a course *Cartography for Decision Makers*, J. A. TORRES explains his ideas to promote the use of EUREF in relationship to IAG and CERCO. It seems useful to organize a workshop by the EUREF Subcommission or a National Mapping Agency to spread the knowledge on the use of EUREF and its possibilities. Moreover lectures should also be published via the Internet for “tele-learning”.

J. A. TORRES, J. ADAM, C. BOUCHER and J. SIMEK are asked to work out a detailed plan to be discussed at next TWG meeting.

Topic 21: W. GURTNER informs that *Swiss Photo* has carried out a GPS campaign in Moldavia on the basis of bilateral development support. The data have been delivered and are going to be analyzed.

W. GURTNER as chairman of the EUREF TWG thanks the colleagues from the Technical University Dresden, especially W. Augath, for hosting this meeting and closes the session.

By courtesy of the *Friends of the Geodetic Institute of the Technical University Dresden*, the participants were invited to a dinner in the restaurant *Applaus* in Dresden in the evening of October 28.