

XXVIIIth Meeting of the EUREF Technical Working Group in Berne, March 14 – 15, 2002

Meeting place: University of Berne, Senatszimmer

Begin: 14.03.2002, 13.30; end: 15.03.2002, 12.30.

Agenda

1. Minutes of the TWG Meeting in Padova, 1-2 October 2001
2. Report about the EPN CB activities
3. EPN Flyer
4. New EPN products
5. Contribution of EUREF to IGS
6. Status of the EUREF station BZRG (Bozen, N. Italy)
7. Authorization to accept new EPN stations
8. Alpine Permanent Network
9. Special Project on the Estimation of Troposphere Parameters
10. ONSA and the UK Campaign
11. Replacement of EUREF epoch markers
12. Draft of the final EUVN report
13. Coordinates in Civil Aviation
14. Working Group "European Geoid"
15. EUVN densification
16. EUREF guidelines
17. The future of EUREF
18. New project EPN-I
19. EUREF Symposium, Azores
20. Real-time streaming of DGPS corrections via Internet
21. Corrections for different tide systems (resolution No.3 of Dubrovnik symposium)
22. EUREF name protection
23. ESEAS Proposal Status
24. Galileo
25. Workshop "Multi-functional GNSS System of Reference Stations for Europe", Berlin, March 04-05,2002
26. Varia

Participants

JÓZSEF ÁDÁM, Budapest	HELMUT HORNIK, Munich (Subcomm. Secretary)
ZUHEIR ALTAMIMI, Paris (perm. guest)	JOHANNES IHDE, Frankfurt (perm. guest)
VIDAL ASHKENAZI, Nottingham (guest)	AMBRUS KENYERES, Budapest
ELMAR BROCKMANN, Zurich (guest)	HANS VAN DER MAREL, Delft
ALESSANDRO CAPORALI, Padova	HERMANN SEEGER, Bad Neuenahr – Ahrweiler (perm. guest)
ERICH GUBLER, Berne-Wabern (delegate of EuroGeographics)	JAROSLAV SIMEK, Prague
WERNER GURTNER, Berne (Chairman)	GÜNTER STANGL, Graz (perm. guest)
HEINZ HABRICH, Frankfurt (perm. guest)	JOAO AGRIA TORRES, Lisbon (Subcomm. President)
BJØRN HARSSON, Honefoss	GEORG WEBER, Frankfurt

Apologized: WOLFGANG AUGATH, Dresden; CLAUDE BOUCHER, Paris; CARINE BRUYNINX, Brussels

Minutes

Remark: The presented papers and view graphs can be received, as far as available, on request from the EUREF secretary. Furthermore, the texts are published on the EUREF homepage (<http://www.euref-iag.org/>).

The TWG chairman, W. GURTNER, opens the XXVIIIth meeting of the EUREF TWG in Berne. On behalf of the Astronomical Institute of the University of Berne as well as the Swiss Federal Office of Topography, he welcomes the participants, especially the guests, VIDAL ASHKENAZI, Nottingham, and ELMAR BROCKMANN, Zurich.

The agenda was distributed among the TWG members by mail and is adopted by the plenary.

1. The minutes as well as action items of the last TWG meeting in Padova, Oct. 1-2, 2001

The minutes of this meeting have been distributed. The plenary accepts the texts, the minutes will be published in the next proceedings volume (cf. also EUREF homepage http://www.euref-iag.org/TWG_Padova.pdf).

2. Report about the EPN CB activities

A report of the EPN center¹ was distributed by mail. Z. ALTAMIMI points out that the resulting coordinates are influenced by the choice of the reference overall frame, e.g. the coordinate jumps which occur in the change from ETRF97 to ETRF2000. The changes can amount the cm level, however, they are more or less identical to the differences between the corresponding ITRFs. If a transformation using the known transformation parameters is applied, the differences get much smaller and then can mostly be regarded as random errors. Nevertheless, it has to be considered that the sites located on the stable Eurasian Plate turn out to be considerably more consistent than the others located in tectonically less stable areas.

In station Herstmonceux: the antenna problems are solved now, so this important laser station can be used in the EPN data base now as a reliable site. It is reported that Penc is now cooperating in the group of analysis centers of the EPN.

C. BRUYNINX is asked to produce an updated list of the EPN stations among the TWG and to be also published in the EUREF homepage¹.

W. GURTNER expresses his thanks to C. BRUYNINX for her excellent and continuous work for the EPN.

3. EPN Flyer

C. BRUYNINX has created an EPN flyer². The TWG discusses the draft, some ideas to improve the contents and layout are developed. The use of EPN should be explained more explicitly. Moreover EuroGeographics should be mentioned as well as the relation to the IAG. All TWG members are asked to send their proposals directly to C. BRUYNINX.

4. New EPN products

A written report is distributed, H. HABRICH explains the development since the TWG meeting in Padova, October 2001. From 31 May - 1 June 2001, the EPN 3rd Local Analysis Centres Workshop took place in Warsaw, Poland³.

The various possibilities of solutions (free/(fully) constrained solutions, accumulated/combined solutions, time span for the solutions (weekly/accumulative)) show residuals in the cm level. The change in the ITRFs also shows obvious differences, however, after the change to ITRF2000 the results are fitting better.

W. GURTNER emphasizes that the slight differences are less important, but it should be decided which products are needed and to follow a definite direction. For all users and applications (EuroGeographics, NMAs, scientific applications, geodynamics, navigation) accurate and long time series are very important.

Z. ALTAMIMI mentions that the ITRS is based on a multi technique solution whereas the IGS and EPN represent mono technique solutions. The obvious differences between GPS and other techniques are less really physically, but are mostly caused by modelling errors.

It has to be discussed again for which purposes the EPN products should fulfill. In any case the weekly solutions should be computed further on. H. HABRICH is asked to discuss this item in detail with the representatives of the IGS.

5. Contribution of EUREF to IGS

It is stated that the weekly solutions have slight differences depending on the procedures by which the data are processed. It has to be discussed more in detail to formulate a definite contribution of EUREF to IGS.

6. Status of the EUREF station BZRG (Bozen, N. Italy)

A. CAPORALI announces to continue his investigations for monitoring coordinates shifts initiated by earthquakes⁴. This project is to be regarded as a special EUREF project in A. KENYERES' WG "Time Series".

The derived coordinate shifts as well as the investigations by G. STANGL for the Austrian sites within this region at the time of the earthquake near Merano on July 17, 2001, show a rather strange behaviour. E. BROCKMANN adds that already before the event some unexplored coordinate shifts occurred.

7. Authorization to accept new EPN stations

W. GURTNER states that the TWG has formulated rules on the acceptance of EPN stations concerning their quality, accessibility as well as the maximum number of official sites per country. The responsibility for the stations is delegated

¹ http://www.euref-iag.org/TWG_Bern.html, section "Report of the EPN CB" and "Report to the EUREF TWG"

² http://www.euref-iag.org/TWG_Bern.html, section "EPN - The EUREF Permanent Network (Brochure)"

³ The proceedings are published in: Reports on Geodesy, Warsaw University of Technology, Institute of Geodesy and Geodetic Astronomy, no. 3 (58), 2001.

⁴ http://www.euref-iag.org/TWG_Bern.html, sections "Azimuth and elevation at BZRG station" and "Status of the EUREF station BZRG (Bozen, N. Italy)"

to the station operators. The EPN analysis centers are controlling the quality and homogeneity of the delivered data. If a station is not fulfilling the requested quality it is eliminated from the data file. The question whether the subset of sites with hourly data should be restricted, too, is not relevant because that refers only a data handling problem. So the coordinators of the local data centers should decide on the maximum number of hourly processed sites by their own.

8. Alpine Permanent Network

E. BROCKMANN reports on the *Alpine Group* which is processing about 50 sites which are not included in EUREF⁵. Although this project has a different structure than EUREF, it could be a valuable contribution. W. GURTNER proposes to formulate guidelines for the integration of 2nd order sites which are no official EUREF sites but contribute to some special project

9. Special Project on the Estimation of Troposphere Parameters

G. WEBER has distributed a report on this item⁶. At present, 155 sites are contributing, 118 of them are processed by at least 3 Local Analysis Centers. Since GPS week 1143, the data are referred to ITRF2000. The results of the Central Analysis Centers BKG and GFZ show some small discrepancies which are investigated in detail. An interesting project is the backwards computation of data in order to receive longer time series.

In this context, H. V. D. MAREL gives a short report on the "Status of COST-716 Near real-time demonstration"

10. ONSA and the UK Campaign (vd Marel) (short communication)

H. V. D. MAREL reports that in the recently presented new solution for the UK⁷, Onsala had been held fixed. In order to analyze the influence of coordinate jumps of Onsala (1.2.1999) while the UK campaign on the results, M. GREAVES has carried out an extensive investigation of these effects. The influence on the UK coordinates turned out to be negligible, however, this problem has to be investigated in general and guidelines should be formulated how to handle such problems (physical and geological effects, unexpected actions by the operators, antenna changes, software, other reasons for changes).

Z. ALTAMIMI adds that similar jumps on cm-level also occur in the IGS data, the effects can range between very local shifts up to the definition of IGS as well as ITRF.

Time series investigations by A. KENYERES show that in general the first six months of new sites are not sufficiently reliable to be used for the definition of a reference frame, however, other effects, some of them show a periodicity,

are real existing problems. It can be assumed that for ca 25% of the EPN sites jumps are occurring. He announces to report on this item in detail on occasion of the next EUREF symposium to draw the attention of the EUREF community onto this problem. E. GUBLER proposes to define a "reliability data base", indicating incorrect registration periods of the individual permanent stations.

A working group chaired by C. BRUYNINX is formed and asked to write a report to be presented at the next symposium.

11. Replacement of EUREF epoch markers

G. STANGL⁸ arises the question if the maximum number of official permanent sites within a country is already reached and some site should be replaced. Then within a certain time span two sites should be operating. It is suggested to handle this case as it is done in the UK where a certain number of official sites exist and numerous others on the same quality level are operated. As soon as the new site is working sufficiently, the old one can be removed from the files and be replaced by the new one.

In Austria now about 30 permanent sites are registering (maximum number: $4 + 3 = 7$), some of them belong to private companies. As EUREF is accepted as general quality certificate, the operators are eager that their sites be considered as EUREF sites. Here the same procedure as above could be used. W. GURTNER emphasizes that in any case the rules used of official sites are to be strictly applied also for the other sites, otherwise they should not be considered. These rules comprise the free access to the markers and the data as well as the guarantee of a long period registration and maintenance.

12. Draft of the final EUVN report

J. Ihde reports that the EUVN documentation is completed now, the tide gauge part, however, is not yet ready. If the data will not be delivered in the next time the report presented to the Tromsø symposium will be extended and presented to the next symposium.

13. Coordinates in Civil Aviation

The TWG discusses a short presentation by V. ASHKENAZI from Nottingham Scientific Limited, on the issue of "Heights for Civil Aviation". Unlike almost all other disciplines which use geodetic gravity-based height systems, the civil aviation community is interested in "geometrical separations" between two aircraft or between an aircraft and the ground.

On continental or oceanic phases of flight, the accuracy levels of these separations are not critical. However, when entering the phases of "final approach" and "landing", the accuracies required are of the order of one or two decimetres. This is when it becomes important to express heights in terms of high precision geometrical values in a globally consistent system. "Ellipsoidal heights" best meet these requirements. All the heights of features of interest, e.g. the aircraft, land topography, obstructions, runways and GPS reference

⁵ http://www.euref-iag.org/TWG_Bern.html, section "Alpine Network"

⁶ http://www.euref-iag.org/TWG_Bern.html, section "EUREF Special project - troposphere - Parameter estimation"

⁷ TWG Meeting Padova, Oct. 1 - 2, 2001, Minutes, Topic 2 (http://www.euref-iag.org/TWG_Padova.pdf)

⁸ http://www.euref-iag.org/TWG_Bern.html, section "Replacement of EUREF Epoch Markers"

stations (WAAS and LAAS), can be expressed in ellipsoidal terms.

Nearly all important airports in Europe and North America have already been surveyed by GPS, and so it should be relatively simple to provide the relevant ellipsoidal heights. This leaves the continental topographic surface data, which could be provided by national surveying and mapping agencies, after suitable transformations from local/national height systems to ellipsoidal heights.

There remains a small problem, which again is specific to the Civil Aviation community. Aircraft make use of barometric altimetry, which has a current accuracy of about 10 metres, with new higher precision altimeters expected to provide an accuracy of about 5 metres above sea level. Barometric altimeters will continue to be used jointly with GNSS receivers, or as a back-up system. There is therefore a need to subtract a constant from ellipsoidal heights to turn them into equivalent "heights above sea level" (compatible with the barometer), without losing their original accuracies.

The TWG discusses the pros and cons of various potential solutions to this problem of presentation, and concludes that using a global geoid model would be the most appropriate approach. It is worth noting that this issue is one of global consistency rather than local or regional accuracy, and therefore it must be made clear that once a specific geoid is adopted for this purpose it should not be modified in the future.

14. Working Group "European Geoid"

A. KENYERES informs on the plans to compute an improved European geoid based on all available various data. However, it has to be considered that a geoid on cm-level will need still much field work. The adequate field campaigns would need a lot of personnel and money. But also the use of the still available data, e.g. the various GPS data sets, will cause extensive investigations for especially systematic deviations. In general global influences have to be checked carefully as well as the references of national geoids and other references in comparison to the existing geoid computed by H. DENKER.

Before really starting this project, the geodetic community should be informed in detail. In order to prepare people for this work all existing relevant reports should be put into the web and be distributed.

15. EUVN densification

In context to the item above, A. KENYERES gives a short report on the plans for a densification of the EUVN.

16. EUREF guidelines

B. HARSSON informs on the progress of the work of the *Guideline Group* (B. HARSSON, J. SIMEK). The existing guidelines will explicitly shown in the EUREF homepage.

17. The future of EUREF

The TWG discusses a draft proposal "EUREF – The next step" prepared by J. TORRES, considering the new IAG structure and bylaws. J. TORRES gives a short review on the

development of the EUREF Subcommission since its creation (IUGG/IAG General Assembly 1987 in Vancouver). Initially the main task was the organisation of EUREF campaigns and their unification for a common GPS horizontal network, later numerous other tasks (EPN, heights, gravity etc.) were taken over. So EUREF got the status of a usual subcommission of IAG as well the function of a service. Additionally there are strong relations to other groups such as EuroGeographics. For the future structure of the EUREF Subcommission several possibilities are presented:

1. keep EUREF as a Subcommission, integrated in the future Commission I, eventually reformulating the objectives and the requirements; this is more or less the present situation;
2. keep EUREF as a Subcommission, integrated in the future Commission I, but with a more formal link to a Service (the European branch of IGS?) with its own responsibility to provide products and services;
3. keep EUREF as a Subcommission, integrated in the future Commission I, and also as a formal branch of EuroGeographics for the delivery of products and services; this means that the involvement of EuroGeographics should be greater than a single Working Group;
4. create a new IAG Service for Europe. In this case, the proposal must be made before the next IUGG General Assembly, because the creation of a Service and respective tasks is a decision of the Council;
5. the combination of b) and c);
6. others?

All colleagues are asked for proposals to be discussed at the next TWG meeting to formulate a definite proposal describing the status of EUREF within the new IAG structure which it to be presented at the symposium to be presented to the plenary. The final document then should be submitted to the IAG via Comm X. J. TORRES will write to official bodies of IAG and announce a statement that the EUREF Subcommission is thinking about these things and is preparing a proposal.

18. New project EPN-I

J. IHDE has circulated a paper⁹ with a proposal for the future work of EUREF. The goal is the creation and maintenance of spatial, vertical and gravity networks which constitute the core of EUREF to realize an integrated reference frame. At present no global height network exists at all, the accuracy of height network in general is about 2 degrees lower in comparison to horizontal networks. For the European continent EUREF supports the definition of a common height reference by the UELN, EUVN and EVS. Moreover EUREF cooperates with the International Geoid Commission. On the other hand the kinematic EVS needs the support by gravity data, too. The planned EPN-I could serve as a frame for the integration of spatial references and the gravity field.

⁹ http://www.euref-iag.org/TWG_Bern.html, sections "Proposal to the Technical Working Group of the IAG Subcommission for Geodetic Networks in Europe (EUREF)" and "Table-III of the EPN-I Proposal"

The existing EPN could give valuable support with long time observation series which allow an improvement of meteorological influences, too.

A. KENYERES invites the TWG members to participate at the next meeting of the IAG Gravity Commission in May 2002.

J. IHDE, A. KENYERES, J. ADAM, C. BRUYNINX and J. SIMEK are asked to formulate a proposal describing the possibilities to initiate the EPN-I project to be presented to the Azores Symposium.

19. EUREF Symposium, Azores

J. TORRES informs on the coming EUREF symposium from 5 - 8 June 2002 in Ponta Delgada, Azores, Portugal. H. HORNIK will write a new circular as well as a EUREF mail urging all interested colleagues are asked to make their registrations asap as well as to send the titles and abstracts of papers/posters to be presented. Z. ALTAMIMI will announce the EUREF Symposium in the IGS mail.

20. Real-time streaming of DGPS corrections via Internet

G. WEBER explains his paper¹⁰ concerning the EUREF - IP (internet protocol). The estimated costs for an EPN station amount about 20000 EURO for the initial investment and 5000 EURO/year for maintenance, so the European wide costs for the EPN per year are about 1.6 millions EURO in total. The additional costs to maintain a EUREF IP would only be marginal in comparison to this amount, but could help a lot for many users who do not need very high accuracy but reliable long term data.

21. Corrections for different tide systems (resolution No.3 of Dubrovnik symposium)

J. SIMEK reports on the influence if different tide systems on the accuracy of height data. J. SIMEK is asked to distribute his findings on the numerical estimates resulting from different tide systems especially to the National Mapping Agencies. This item should also be discussed at the Azores Symposium, J. TORRES is asked to put this item into the web page.

22. EUREF name protection

B. HARSSON presents the certification for the registration of the name *EUREF* in Norway. The costs in all amount 2500 EURO. Before getting a general name protection the registration in one country is needed. This has been done now. Denmark has refused, it will be tried to make the registration also there. The time limit for the final registration is not yet over, so this item has to be discussed at later meetings again.

23. ESEAS Proposal Status

B. HARSSON informs on the status of the ESEAS project. At present 18 European countries are involved, the EU has given 2.8 mio. EURO to establish a better insight whether the sea level is increasing/stable/decreasing. B. HARSSON is asked to inform P. PLAG that EUREF is willing to cooperate with ESEAS on the basis of common interests of both bodies.

24. Galileo

W. GURTNER informs that an expert group has been invited by the ESA to discuss questions relating orbits, reference systems, relationship to ILRS etc. and to the GALILEO bodies. W. GURTNER will report on the development of the project again at the next TWG meeting.

25. Workshop "Multi-functional GNSS System of Reference Stations for Europe", Berlin, March 04-05, 2002

J. SIMEK informs on an initiative of the European Academy for Environment to create a system for East Europe similar to SAPOS. Especially Russia has expressed its interest and intends to install permanent network in Russia.

26. Varia

The next TWG meeting will be held on June 4, 2002, before the Azores Symposium. The 2002 fall meeting will be held in Delft or Paris. The date will be fixed later.

E. GUBLER announces that Mr. Brandenberger/ETH Zurich has initiated a new WG for Map Projections. It is suggested that EUREF should participate in this group. E. GUBLER will inform the *EUREF Transformation Group* (J. ADAM, E. GUBLER, B. HARSSON, J. IHDE, J. TORRES) in detail and formulate a proposal.

¹⁰ http://www.euref-iag.org/TWG_Bern.html, section "EUREF - IP"