# XXXV<sup>th</sup> Meeting of the EUREF Technical Working Group in Bratislava, 1. June 2004

Meeting place: Geodetic and Cartographic Institute Bratislava; Chlumeckeho 4; 827 45 Bratislava; Main Building, room No.136 – conference room

Begin: 1.6..2004; 9.30 am; end: 18.00 am.

# Agenda

- 1. Minutes of the 34rd TWG Meeting in Budapest
- 2. Campaign validation: Armenia 2002 (ARMRWF02)
- 3. EUREF Terms of Reference
- 4. Certification of Non-EUREF GPS Permanent stations
- 5. Legal entity for EUREF
- 6. EUREF & Galileo
- 7. Inter-Regional Working Group of IAG SC1.3
- 8. EGNOS RIMS survey and methodology validation
- 9. Special Project Troposphere Parameter Estimation, Status Report
- 10. EUREF-IP Pilot Project, Status Report
- 11. EUREF and GPS Meteorology
- 12. EPN Network update
- 13. EPN Data Flow
- 14. Development of EPN Products
- 15. Contribution of the Time Series SP to the European Velocity Field Project
- 16. European Velocity Field and EPN ETRS89 Coordinates
- 17. ECGN Status
- 18. Remarks on EVRS/EVRF re-definition
- 19. Nordic levellings and the Baltic loop
- 20. Short summary Work Plan ExG-G of EuroGeographics
- 21. Re-computation of GB 2001 campaign
- 22. Program of EUREF Symposium 2004 Bratislava
- 23. Varia
  - a) Next TWG meeting
  - b) Next EUREF Symposium

# **Participants**

ZUHEIR ALTAMIMI, Paris (Chairman) ELMAR BROCKMANN, Berne CARINE BRUYNINX, Brussels ALESSANDRO CAPORALI, Padova DUSAN FERIANC, Bratislava (guest) HEINZ HABRICH, Frankfurt (perm. guest) BJØRN HARSSON, Honefoss HELMUT HORNIK, Munich (Subcomm. Secretary) JOHANNES IHDE, Frankfurt LOTTI JIVALL, Gaevle (guest) KATHARINA LEITMANOVA, Bratislava (guest) AMBRUS KENYERES, Budapest

apologized: CLAUDE BOUCHER, Paris WERNER GURTNER, Berne FREDERICK KIJEK, Ottawa (guest)
MATEJ KLOBUSAK, Bratislava (guest)
JAAKKO MÄKINEN, Helsinki
HANS VAN DER MAREL, Delft
PETER PESEC, Graz (guest)
HANS-PETER PLAG, Honefoss (guest)
HERMANN SEEGER, Bad Neuenahr – Ahrweiler (perm. guest)
JAROSLAV SIMEK, Prague
GÜNTER STANGL, Graz (perm. guest)
JOAO AGRIA TORRES, Lisbon (Subcomm. President)
GEORG WEBER, Frankfurt

# Minutes

Remark: The presented papers and view graphs can be received, as far as available, on request from the EUREF secretary. Furthermore, some texts are published on the EUREF homepage (*http://www.euref-iag.net/html/twg\_meetings\_documentation.html*). Moreover some presented reports are partly identical to those presented to the following EUREF Symposium, a series of which is available at *http://www.euref-iag.net/symposia/symposia\_2004\_Bratislava.html*.

The chairman of the EUREF Technical Working Group, Z. ALTAMIMI opens the XXXVth Meeting of the TWG. This meeting is the usual one the day before the annual symposia. Z. ALTAMIMI welcome the participants and guests, especially K. KIJEK, economist from Canada, as a special interested person in the products of EUREF. Further the chairman heartily thanks the hosts for the invitation to Bratislava and their successful efforts to make this meeting efficient and agreeable as well. On behalf of the hosts, H. MAJOVSKA, director of the GKU Bratislava, and M. KLOBUSIAK, project and technical manager of the GKU Bratislava, welcome the EUREF TWG with their wishes for a successful meeting.

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

#### 1. Minutes of the 34rd TWG Meeting in Budapest

The minutes of the XXXIV<sup>th</sup> TWG Meeting Frankfurt a.M., March 22-23, 2004, are accepted after some small corrections. The text can be found in the EUREF homepage (http:// www.euref-iag.net/html/twg\_meetings\_documentation.html).

#### 2. Campaign validation: Armenia 2002 (ARMRWF02)

Introducing Z. ALTAMIMI points out that in geographical view Armenia is no real part of the European continent but is located in Minor Asia. On the other hand EUREF should be free to include such a directly neighbouring region into

EUREF especially considering the high interest and the cooperation of Armenia e.g. in operating a permanent EPN station. Moreover this country urgently needs help for economical, technical and scientific development. Thus the help of EUREF to install a reliable reference system within the country can give an important impetus.

A concerning report Zero Order Geodetic Network of Armenia Based on the GPS Campaign Carried out November 26<sup>th</sup> to December 1<sup>st</sup> 2002 had been distributed, L. JIVALL gives a detailed explanation. A first attempt to connect Armenia with EUREF and install a modern basic reference system was undertaken in 2000, but this campaign pointed out to be not successful due to missing EPN fiducial points. A second campaign with 5 days à 24 hours was carried out in November 2002 covering 4 new stations within Armenia and 8 in the 8 EPN/IGS. The results look rather good, the yielded accuracy amounts 1 cm for the horizontal and 2-3 cm for the vertical component. For installing a new accurate reference in Armenia, the ARMRWF02 was densified for a 1 order network, another densification for the 2 order is going on.

Z ALTAMIMI emphasizes that the results are to be considered in context with the less accurate surrounding EPN stations which are not provided with the accuracy of those in Middle Europe. Further all the territory is rather unstable due to terrain movements induced by earthquakes. H. V. D. MAREL points out that the ETRF shows velocities values of 1 cm/y for this region.

After some discussion referring especially the antennae phase calibration values for the used Leica Rover antennae, which are maunly used in RTK GPS, the TWG concludes to accept the ARMRWF02 as extension to the current realisation of ETRS89 on class B level (about 1 cm at the epoch of observation) and to propose the adoption of this campaign to the following EUREF Symposium (cf. *http://www.euref-iag.net/html/resolutions.html#Bratislava*,

Resolution # 1).

## 3. EUREF Terms of Reference (Torres)

Basing on the discussion at the last TWG Meeting in Budapest, J. A. TORRES has distributed an update for his proposal. Z ALTAMIMI mentions that the IAG has put up its terms of reference, so the Sub-Commissions are to follow with their own concerning terms following the IAG. The new items are intensively discussed, finally the TWG approves and adopts the new terms of reference of EUREF. The text will be proposed to the following EUREF Symposium to formulate a concerning resolution (cf. *http://www.euref-iag. net/html/resolutions.html#Bratislava*, Resolution # 2).

#### 4. Certification of Non-EUREF GPS Permanent stations

Basing on an initiative by A. CAPORALI, J. A. TORRES has worked out an updated text to this topic. J. A. TORRES points out that the action should be fit with the Sub-Commission guidelines, but new developments always have to be observed carefully and new steps are to undertaken if necessary and useful. The EPN comprises a large number of stations, however, there may be permanent GPS stations on a comparable accuracy level which are not included in the EPN due to clear reasons. So for example a NMA may ask for the certification of such sites for the use within a national network or other purposes. As an example the new Slovak network is mentioned. Z. Altamimi adds that such sites could give a valuable contribution for the definition of a precise velocity field. Also the certification of private sites as far as they fulfill the EUREF guidelines might be rather useful considering a broader recognition of EUREF in applied geodesy and surveying. C. BRUYNINX objects that the EPN stations represent a carefully and permanently tested data set. Especially the long term guaranteed reliability of the EPN is a most important fact. As the experiences show, many stations deliver very sufficient results in a first period, but get worse with time when they are not operated as careful as in the beginning. Therefore each EPN station is observed for a certain time before adopted into the EPN. Also then a station may be deleted again when not fulfilling the required accuracy and other rules. Although much work is done automatically, all these control activities need a lot of manual organizing and computing work. A considerable increase of work, however, cannot be done by the presently available staff. For such a case more duties are to be delegated to the ACs, LACs or other new groups.

Finally it is concluded to set up a group of colleagues (Z. ALTAMIMI, E. BROCKMANN, C. BRUYNINX, A. CAPORALI, H. HABRICH, B. HARSSON, J. IHDE, A. KÖSTERS, H. V. D. MAREL, J. A. TORRES (chair)) to investigate the possibilities and develop a proposal to be reported to the next TWG Meeting.

#### 5. Legal entity for EUREF

Z. ALTAMIMI explains that the tasks of EUREF concerning the member countries. As discussed in the topic before, NMAs or similar institutions could ask EUREF for certifications or validations of data. In the EUREF group basically a considerable amount of expertise is available, however, any statement should be formulated carefully with respect to any responsibility or claim of recourse. As EUREF is no national institution, it cannot be compared e.g. with the NGS or NOAA which have defined duties on their level. On the other hand EUREF is strongly related to the IAG and EuroGeographics which have certain official tasks. H.-P. PLAG mentions e.g. EGNOS and GALILEO, the treatment of these topics automatically involves some degree of safety. These or similar topics will surely tough EUREF in the next future. It has to be stated that at present no European group exists to take over the duties of an official expert group. Although such task are rather difficult and time consuming, it might be rather useful for EUREF to play an active role in this field. Z. ALTAMIMI, B. HARSSON, J. IHDE (chair), J. MÄKINEN and J. A. TORRES are asked to discuss this item to develop a strategy for the future and propose their findings to the next TWG Meeting.

#### 6. EUREF & Galileo

Continuing the topic as discussed at the last meeting in Budapest, Z. ALTAMIMI shortly explains the progress of the project (cf. *www.galileoju.com*). EUREF could play an active role as interface between the universities working on Galileo and the NMAs on the field of geo-referencing. H.-P. PLAG explicitly emphasizes that EUREF should take part in this matter and send an attendant to the Galileo Group meetings.

Z. ALTAMIMI, C. BRUYNINX, H, HABRICH and G. WEBER are asked to develop commonly a strategy for these questions. It is proposed that at least one member of this group should attend the next Galileo Meeting in Paris, 16.-17.6.2004. Z. ALTAMIMI offers to coordinate the activities and asks for proposals and support. He points out that Galileo surely will be a part of the ITRF within the next years and EUREF could be a competent partner on the European level. G. WEBER adds that the Galileo project is widely based on commercial aspects and therefore such aspects have clearly be considered if a cooperation is going to be fixed.

#### 7. Inter-Regional Working Group of IAG SC1.3

As president of IAG Sub-Commission 1.3 *Reference Frames* Z. ALTAMIMI explains that this sub-commission covers several regional ones including EUREF, the others concern South and Central America, North America, Africa, Asia-Pacific, Antarctica. A working group of SC1.3 chaired by M CRAYMER, Canada, was founded to develop harmonized and possibly common specifications for the regional reference frames implementation and ITRF densification. E. BROCKMANN, H. HABRICH and J. A. TORRES are asked to formulate ideas how EUREF could contribute for a common understanding of the work done by the Sub-Commissions and make it widely known to the public.

#### 8. EGNOS RIMS survey and methodology validation

H.-P. PLAG gives some explanatory remarks to his distributed paper which presents the network of EGNOS (European Geostationary Navigation Overlay Service). At present EGNOS coversa considerable number of sites, the accuracy of the coordinates is generally estimated with 1 cm in the horizontal and 1.5 cm in height. In order to keep a long term stability of the coordinates and to avoid expensive reobservations, the RIMS method (Ranging and Integrity Monitoring Stations) was introduced for estimating the time dependant coordinate variations. In the moment the method is not yet sufficiently working but it is hoped to develop it up to a adequate level in the future. So for the moment the question arises how the ESA can manage the certification for its stations and whether EUREF could help in this matter.

In the discussion Z. ALTAMIMI emphasizes that EUREF basically evaluates national/multinational campaigns and approves the results. This activity, however, does not comprise a legal aspect. This responsibility is only given to the NMAs. EUREF of course can give recommendations or also express criticism, but EUREF does not represent an institution with legislative properties. Moreover, EUREF is competent for the area of the European continent and the edges of it, but not for global projects. The coordinates in the EGNOS project are connected to those of the ITRF but not the ETRF. Concerning the remark by G. WEBER, that "safety" comprises much more than precise coordinates, H.-P. PLAG adds that in this case a comprehensive error budget will be set up in which coordinates respective coordinate differences due to terrain movements are a part of it. H.-P. PLAG remembers that the EUREF Sub-commission should clearly reflect about its tasks. The above mentioned EGNOS project will be connected with Galileo, so EUREF could yield influence and recognition by this way.

Concluding Z. ALTAMIMI summarizes the meaning of the TWG that the presented method for evaluating coordinates for EGNOS is estimated to be a correct and usable one and no objections can be found. It is proposed that some members of the TWG re-read the article by H.-P. PLAG and present their findings to the next TWG meeting.

#### 9. Special Project Troposphere Parameter Estimation, Status Report (Weber)

In context to the report presented to the TWG Meeting in Budapest, G. WEBER presents an overview of the ACs taking part in this project.

#### 10. EUREF-IP Pilot Project, Status Report

G. WEBER informs that meanwhile fortunately more data streams and more ACs (Finland, Hungary, Slovenia, Spain, Switzerland) are available and the work can be distributed such that the efforts are tolerably for each participating institution. A near real time evaluation requires a rather high level of data delivery. The latency is showing now better results. In principle 10 or 30 minutes delay can be handled easily, one hour or more, however, cause serious problems. The map of the global Ntrip NRT network shows that the majority of stations is concentrated in the US and middle Europe, far extended other regions are covered by few sites only. As the meteorological data of these sites are of utmost interest, they are to be considered very carefully. G. WEBER means that within some years Ntrip will deliver applicable data for navigation, tests performed in Finland are rather promising.

As activities in the next future more relief of the BKG by

other groups has to be organized, then also a standardized software has to be developed. Some more EPN stations as well as globally well distributed ones as reference are to be included in the project. Further the work on a RTCM'2 Ntrip version 2.0 (UPD) will go on.

#### **11. EUREF and GPS Meteorology**

H. V. D. MAREL refers on the presentation *GPS Meteorology* in Europe - COST 716, EUMETNET and EUREF (cf. http://www.euref-iag.net/symposia/symposia\_2004\_ Bratislava.html) for the following EUREF Symposium. The contributions by EUREF are highly appreciated as data of the best available quality.

#### 12. EPN Network update

C. BRUYNINX presents her usual progress report on the EPN. In the last period one new station (Como/Italy) has been introduced into the EPN after having fulfilled all required tests. The homepage now shows a permanently updated documentation of time delays for all sites. C. BRUYNINX shows some examples for quality checks. These tests are permanently refined to guarantee the long term reliability of the EPN data as well as to help the contributing stations to improve their own work.

#### 13. EPN Data Flow

Z. ALTAMIMI remembers the discussion at the last TWG meeting concerning security of the data flow especially in the case of a computer break down in a AC. G. STANGL states that up to now no evident improvement could be achieved. About 70 stations are related only to the BKG as primary data center, some others have arranged alternatives. Therefore the problem is not yet solved and in the case of severe failures the loss of data might be evident. As a possible solution 2 data centers synchronized with each other would be possible. For the moment it is proposed that all Regional and Local Data centers make their own backups and keep the data for a certain period. G. STANGL offers that the Observatory Lustbühel Graz (OLG) could operate as a backup DC providing all daily files since 2000. A commercial service seems not affordable due to the high expenses.

In the discussion C. BRUYNINX is asked to contact all LACs to declare the situation and search for a solution. Moreover, C. BRUYNINX as EPN manager, H. HABRICH and G. STANGL are asked to develop guidelines for solving the data security problem as well as to optimize the work to be done.

#### **14. Development of EPN Products**

Due to the permanent input of new data, more accurate data, extended networks and new methods it is inevitable that the coordinate sets change as well. For the ITRF e.g. various realizations exist. H. HABRICH states that the EPN time series also depend on such changes and therefore variations occur. For the future it is necessary to provide public and official ETRS89 coordinates of the EPN as weekly and commutative solutions. It may be reflected to introduce also version numbers for the EPN e.g. after important changes in the EPN analysis. In any case a clear description of all data has to be published in order to inform the users such that no misunderstandings can occur.

As conclusion Z. ALTAMIMI, C. BRUYNINX, H. HABRICH and H. V. D. MAREL are asked to formulate a proposal to be discussed at the next TWG meeting.

#### 15. Contribution of the Time Series SP to the European Velocity Field Project

A. KENYERES presents his progress report. The offset estimation was done by different strategies, e.g. a manual site by site comparison, symmetric weekly subsets etc. For setting up a realistic reliable velocity field for the whole European continent considerable densifications of the present networks are necessary.

## 16. European Velocity Field and EPN ETRS89 Coordinates

Z. ALTAMIMI proposes to accumulate in future all data, collected in the EPN permanently, once per year into the data set for the velocity field. The Working Group on time series chaired by A. KENYERES be provided with weekly solutions and store these data also to allow later analysis and comparisons. A procedure how to manage all the data in an optimal way has still to be developed.

# 17. ECGN Status

J. IHDE explains that for the realization of a high accurate European Combined Geodetic Network (ECGN) the delivery of adequate absolute gravity measurements is problematic. The former organizations and structures do not exist anymore and new partners are not yet available. so it has be searched further on for getting a stable standard for gravity. In general the individual countries organize their own absolute gravity measurements. However, some countries have no adequate stations and measurements at all. So it has to be reflected how to find a way how to proceed.

In September 2003 and May 2004 the ECGN Working group has met. In all 72 stations located in 20 European countries are proposed. A call for participation has been sent out, however, only few countries have answered. Some of them proposed a large number of sites within their area, but not for all stations the required information was delivered. J. IHDE states that this lack of information has to be solved soon by strict deadlines, otherwise the project cannot be continued successfully.

#### 18. Remarks on EVRS/EVRF re-definition

J. IHDE remembers the EVRS workshop in the BKG in Frankfurt, April 2004. J. MÄKINEN has distributed a paper *Some remarks and proposals on the re-definition of the EVRS and EVRF* describing how to solve the discrepancy between a World Height System (WHS) referred to the geoidal potential, and the EVRF2000 as its realization through the tide gauge datum NAP. Regional systems should be defined through a numerical offset to the WHS, rather than through MSL at tide gauges or geopotentials conventionally assigned to physical artefacts (bench marks). J. MÄKINEN remembers resolution # 7 of the EUREF 2000 Symposium in Tromsø (*http://www.euref-iag.net/html/*  *resolutions.html#Tromso*) concerning the realization of an EVRF2000, but up to now this work is not completed. He proposes that the TWG endorses a new resolution of the following EUREF Symposium to ensure the preparation of technical specifications for a new European Vertical Reference Frame (EVRF), to be available by 2006 (*http://www.euref-iag.net/html/resolutions.html#Bratislava*, resolution #3).

#### 19. Nordic levellings and the Baltic loop

The item is delayed for a later meeting.

#### 20. Short summary Work Plan ExG-G of Euro-Geographics

J. IHDE distributes a *Draft Work Plan* of the *Expert Group* (*ExG-G*) of *EuroGeographics*. He points out that after time consuming discussions now fortunately a work plan of projects of the ExG-G could be formulated. The projects are closely related to the present EUREF actions and also follow the EuroGeographics requests to realize an ESDI (European Spatial Data Infrastructure). As the majority of representatives in the EUREF Sub-commission and the ExG-G are members of both groups, the EUREF symposia will serve as a platform for all further discussions. In the EUREF Symposium a special session will be held concerning the topics of EuroGeographics.

#### 21. Re-computation of GB 2001 campaign

A detailed report *Reprocessing the EUREF GB 2001 GPS campaign* has been distributed in time, M. GREAVES gives some additional comments. This campaign already had been presented to the EUREF 2002 Symposium in Ponta Delgada and adopted in Resolution # 1. Unfortunately some time later an antenna offset was detected, this effect has not changed significantly the results so that the error could be visible. M. GREAVES asks the EPN managers to improve the identification of antenna offsets within the data base such that errors cannot occur any more. So a new computation was performed using the corrected values, all other items were kept identical with the first solution. The results are rather similar to those of the first computation but show slightly better values.

In the discussion Z. Altamimi emphasizes that considering the campaign evaluation in 2002 and adoption by the EUREF Sub-Commission, the new results should be approved as well. The TWG agrees to this proposal and will inform the plenary of the following EUREF Symposium in this sense (cf. *http://www.euref-iag.net/html/resolutions. html#Bratislava*, Resolution # 1).

#### 22. Program of EUREF Symposium 2004 Bratislava

In cooperation with the Slovak hosts (D. FERIANC, M. KLOBUSIAK), J. A. TORRES presents the programme for the following EUREF Symposium. The TWG states the excellent preparations by the LOC.

#### 23. Varia

#### a. Next TWG meeting

J. SIMEK invites the TWG to hold its next meeting in Prague.

The TWG thankfully accepts the invitation, the date is fixed for Monday, November 8 – Tuesday, November 8, 2004. As usual the meeting will start and end at noon.

# b. Next EUREF Symposium

J. A. TORRES informs that the Austrian colleagues have invited EUREF to hold its 2005 Symposium in Vienna. Due

to necessity to organize funds and reserve the respective conference room in time, the decision has already been made. The date is fixed for Wednesday, June 1 - Friday, June 3, 2005; Saturday (June 4): Excursion; the TWG will meet as usual the day before the symposium, i.e. Tuesday, May 31. The TWG expresses its thanks to the Austrian colleagues for the generous invitation.