54th Meeting of the EUREF Technical Working Group in Lisbon, 22.-23.11.2010

ICAT building, Campus of the Faculty of Sciences of University of Lisbon
Monday, 22.11.2010, 13:00 - 18:00; Tuesday, 23.11.2010, 09:00 - 13:00

Next events:

- EUREF TWG 2011 Spring Meeting: Thursday, 03. – Friday, 04.03.2011 (noon - noon)
- EUREF TWG 2011 Symposium Meeting: Chisinau/Moldova, Tuesday, 24.05.2011 (full day)
- EUREF 2011 Symposium: Chisinau/Moldova, Wednesday, 25.05.2011 – Friday, 27.05.2011; technical excursion: Saturday, 28.05.2011
- EUREF TWG 2011 Fall Meeting: Frankfurt a.M., date not yet fixed

Agenda

1. Opening (Bruyninx)
2. Minutes of the 53th TWG meeting in Gävle
3. Review of Action Items of 53th TWG meeting in Gävle
4. What does EUREF consider as a realization of EVRS?
5. ECGN Report
6. EUREF densification campaign in Republic of Serbia
7. EUREF campaigns – Web presentations and submitted data
8. EUREF home page
9. Report on ETRS89 Working Group
10. Monitoring of official national ETRF coordinates on EPN web
11. AFREF and connection with EUREF
12. COST initiative on the combination of regional solutions for positions and velocities
13. ITRF2008 and transformation to ETRF2000
14. Introduction of ITRF2008/IGS08 and IGS08.atx antenna calibrations in the EPN
15. Report of the EPN LAC-Workshop 2010 and first experiences using ITRF2008 and RINEX3 for EPN
16. Milestones for using Galileo IOV satellites in RT positioning
17. EPN real-time analysis
18. Jamming of the new receiver generation by nearby radio sources – legal and technical aspects
19. Guidelines for EUREF densifications
20. EUREF Symposium 2011
21. EUREF TWG membership
22. EUREF trademark
23. Commission 1 symposium – REFAG
24. ICG5 meeting
25. Next TWG Meeting
26. Action Items

Participants

ZUHEIR ALTAMIMI, Paris
ELMAR BROCKMANN, Berne
CARINE BRUYNINX, Brussels (Chair)
ALESSANDRO CAPORALI, Padova
JAN DOUSA, Prague (22.11.)
RUI FERNANDES, Covilhã
HEINZ HABRICH, Frankfurt a.M.
HELMUT HORNIK, Munich (Sub-comm. Secretary)
JOHANNES IHDE, Frankfurt a.M. (Sub-comm. Chair)
MARTIN LIDBERG, Gävle
JAAKKO MÄKINEN, Helsinki)
MARKKU POUTANEN, Helsinki
WOLFGANG SÖHNE, Frankfurt a.M.
GÜNTER STANGL, Graz
JOAO AGRIA TORRES, Lisbon
MANUELA VASCONCELOS, Lisbon (guest) (23.11.)
ZORAN VELJKOVIC, Belgrade (guest)

apologized: AMBRUS KENYERES, Budapest, HERMANN SEEGER, Bad Neuenahr-Ahrweiler (hon. member)

Minutes

1. Opening

In her property as chairwoman of the EUREF Technical Working Group (TWG), C. BRUYNINX opens the 54th meeting of the EUREF TWG and welcomes the participants. On behalf of the TWG she thanks RUI FERNANDES for hosting this meeting.

A draft of the agenda has been distributed among the TWG, the participants accept the agenda after some minor corrections.

2. Minutes of the 53th TWG meeting in Gävle

The minutes of the 52th TWG Meeting in Gävle, 01.06.2010, were distributed among the TWG members. Some few corrections are to be attached. The final text is to be published in the EUREF homepage.

3. Review of Action Items of 53th TWG meeting in Gävle

The Action Items of the previous TWG Meeting are reviewed concerning not yet accomplished tasks.

Action Item no 4: C. BRUYNINX and G. STANGL will contact M. GREAVES concerning the EUREF IE/UK 2009 Campaign to deliver the relevant data asap to be put into the data base.

No. 5: For the Greek Campaign "ETRS89 realization of the HEPOS network" the data will be requested, too.

No. 8 – The relevant questionnaire will be updated by J. TORRES. J. TORRES and J. IHDE then will distribute the letter to the NMAs.

No. 8 b) – H. HORNIK will collect all existing files of hitherto campaigns and deliver the data to G. STANGL.

No. 9 – As A. KENYERES is not participating, the topic wil be discussed at the next Meeting.

No. 10 – ITRF2008 and transformation to ETRF2000 will be discussed with topic 13 again.

No. 11 – The report on ETRS89 Working Group is on the agenda again.

No. 14 – M. POUTANEN is asked to prepare asap the draft of the white paper among the TWG.

4. What does EUREF consider as a realization of EVRS?

M. LIDBERG refers the background of the topic relating the connection to INSPIRE. According to the European law, the INSPIRE rules concerning the availability and format of spatial information within the European community write that

- ETRS89 for geographical coordinates, and as base for coordinates in map-projections
- EVRS/EVRF for "gravity related heights"

should be used definitely as geodetic reference frames within the participating countries.

For the practical application, however, it has to be decided which coordinates and heights can be considered to fulfil the requirements for ETRS89 or EVRS. Regarding ETRS89 the "national" realizations are recognized and accepted by EUREF through resolutions representing the relevant data sets. For EVRS, however, at present no adequate data are available.

J. IHDE adds that the results of the present EVRS solution have been distributed to the countries involved in EVRS and requesting to compute transformation parameters for the national systems. The majority of

the countries already fulfilled the task, so the project can be considered to be on a good way.

Showing a map of the systematic height differences and zero point definitions, M. LIDBERG comments that the situation is not so clear at the moment. Nevertheless, the EUREF TWG should urgently develop adequate ideas how to continue the work in order to obtain soon a suitable EVRS realization which could be used as a common data base for all countries. As J. IHDE declares, especially Russia is not yet connected to the European Geoid and thus considerable deviations occur. Further the levelling data in some countries are not connected with tide gauges sufficiently and nodal points sometimes are not well defined. Thus a lot of work has still to be done.

J. TORRES declares that INSPIRE is proceeding and thus the EUREF Sub-commission as the competent body in the field is enforced to react. He recommends to put these questions as a main topic on the agenda of the next EUREF Symposium. In order to prepare the next steps, J. IHDE will prepare an updated list of transformation parameters and an overview on the situation in the participating countries.

5. ECGN Report

M. POUTANEN explains that the white paper for the ECGN could not yet be completed. The ECGN is not planned to compete with GGOS, in fact GGOS should be used to orientate the European project. Valuable input concerning the gravity data can be yielded from the special satellite missions GRACE and GOCE.

For the combination of data of different origin adequate models have still to be developed. The idea of the ECGN included a number of core stations equipped with multi techniques, these data should help to find a well adjusted model for the different data. C. BRUYNINX recommends to start a case study with one station comprising all possible data. Z. ALTAMIMI adds to focus more on GGOS as in this initiative much work has already been carried out and the ECGN could receive benefit.

Moreover M. POUTANEN states that for the thorough accomplishment of the ECGN project more personnel is needed, unfortunately up to now there is no real offer for support.

The TWG asks M. POUTANEN once more to complete the white paper asap and to distribute it among the members to be prepared for the discussion of the topic at the next TWG again.

6. EUREF densification campaign in Republic of Serbia

A concerning paper has been distributed among the TWG. Z. VELJKOVIC explains the campaign and presents the results. The campaign includes 20 EPN class A stations, 48 stations from national permanent networks and further 19 field points. The observations have been carried out in GPS weeks 1595-1599, the field points have been observed within 5 days during GPS week 1597. For the data processing the Bernese GPS Software, version 5.0, was used. The "Guidelines for EPN Analysis Centers" were strictly followed. The datum definition refers to ITRF2005 epoch 2010.631 and is based on EPN cumulative solution EPN_A_ITRF2005_C1585.

The resulting coordinates show an internal quality of 1 to 2 mm in the horizontal components and about 3 to 5 mm in the vertical. The repeatability of the fiducial stations can be considered as about 2 mm in all three components. A comparison with the EUREF Balkan 98 campaign show a general agreement within a level of 20 mm.

It is mentioned that some sites were equipped with an antenna type which is not used in the IGS, therefore the relevant sites should not be considered as EUREF sites. Moreover it is stated that according to the usual evaluation of a campaign the coordinates of the sites which should be considered as EUREF sites are to be published and not be restricted for political reasons.

Z. VELJKOVIC is asked to provide a map showing the geographical correlation of sites of the residuals of the estimated coordinates with respect to the last EPN cumulative solution and to include this map into the final report. The presented report will be updated according to the recommendations of the TWG to be presented to the EUREF Symposium 2011 to be accepted by the plenary as extension of EUREF on Class B level.

7. EUREF campaigns – Web presentations and submitted data

This topic was discussed within topic 3.

8. EUREF home page

M. VASCONCELOS presents a draft for the new EUREF homepage. Some important links are to be added, too, e.g. EUPOS (A. KENYERES) and ICG (J. IHDE). Moreover the links for individual institutions (BKG, DGFI, JPL) are to be deleted, but other links which are really related to EUREF (SIRGAS, IAG Commission 1) are to be installed.

All TWG members are requested to check the new version within 2 weeks and to submit their comments to the webmaster to complete the draft and to install it for public use before the end of the year.

In order to keep the homepage permanently updated, all TWG members are urgently requested to provide news to M. VASCONCELOS to be included into the

homepage; news which are no more relevant will be removed.

9. Report on ETRS89 Working Group

Introducing M. LIDBERG reports on the initial reasons for this Working Group. The high precise and dense field of permanently observing EPN sites yields a set of coordinates which are changing as well due to different reasons. These are mainly the jumps due to the introduction of new ITRF's and crustal movements. These coordinates represent the best possible data and are valuable input to derive intra-plate movements. On the other hand EUREF should provide coordinates for users (NMAs, INSPIRE) which should be stable at least for a certain time period. Within the stable part of EUREF the vector field of coordinate changes is rather homogeneous, in other parts, however, the movements are partly considerably large and vary within relatively small zones.

Several countries have introduced ETRS89 by law for their national reference, the existing velocities, however, are not mentioned in any way. Thus EUREF has take care for the permanent availability of these data.

M. LIDBERG proposes to study the topic more in detail and then formulate recommendations for the users. It must be assured that the users are not confused but consider EUREF as a reliable source of data for application in positioning.

In order to proceed, the Working Group and A. CAPORALI are asked to collect relevant information on velocities and lifetime of coordinates as used by National Mapping Agencies and present their findings to the next TWG.

10. Monitoring of official national ETRF coordinates on EPN web

E. BROCKMANN refers the development of the initiative. The idea was created at the LAC Workshop in Frankfurt, October 2008 and presented to the TWG on its meeting in Munich, November 2008. Then a pilot project with 15 countries was started, the results were presented to the 2009 EUREF Symposium in Florence. In Resolution # 4 subsequently all countries are asked to contribute. At the 2010 EUREF Symposium in Gävle the results for 22 countries could be presented, in August 2010 the data were put into the EPN-website. Although some countries still have not delivered their data due to different reasons, the project has proceeded very well with 157 stations in 29 countries. E. BROCKMANN states that the different ETRF realizations are realized very homogeneously (1-2 cm horizontally, 1-4 cm vertically). Special consideration has to be given to countries with larger movements w.r.t the stable part of Europe (tectonical movements, postglacial rebound), there the reference epoch has to be considered with highest priority.

As next step E. BROCKMANN will try to install an automatic procedure to monitor coordinate changes exceeding a certain level (e.g. extreme case in L'Aquila) and publish the results frequently in the web.

11. AFREF and connection with EUREF

R. FERNANDES reports on the present status and the attempts to compute a first AFREF solution. In fact the practical work now is limited to a few countries only, especially South Africa. Although political and technical problems are delaying the progress and responsible co-workers hardly can be found, it will be tried to continue the initiative further on. The efforts mainly should help to to secure a permanent operation of the already existing sites as well as to facilitate the access to the data which often are not freely available.

R. FERNANDES states that the tectonic fault lines on the African continent are of special interest, in some regions enormous movements occur. Unfortunately the data records mostly are too short and not precise enough to allow a relevant interpretation.

Considering the possibilities to proceed, it is proposed to support the efforts in some few selected countries where a successful work within the next future might be probable and to urge others to join later on.

12. COST initiative on the combination of regional solutions for positions and velocities

A. CAPORALI reports on the activities of the LAC University of Padua concerning the reprocessing of a subnetwork comprising EPN 45 sites. These activities are in context with the maintenance of the national NMA IGMI for the realization of the Italian reference network RDN within ETRS89. The results of the RDN were presented to the 2009 EUREF Symposium in Florence and adopted by the plenary as an improvement and extension of ETRS89 on Class B standard. At present this work refers the weekly processing of a dense regional network comprising altogether 135 permanent stations. In this context the request of the geophysical/geodynamical community to monitor in detail the 3D velocities in Europe and surroundings arose. In order to meet this request a new COST Action is proposed. As A. CAPORALI declares, COST Actions refer a 4-year programme intended to support meetings among people addressing the same scientific topic. As previous/present actions on this field the initiatives 716 – "Exploitation of Ground-based GPS for Climate and Numerical Weather Prediction Applications" and ES0701 – "Improved Constraints on Models of Glacial Isostatic Adjustment" are mentioned. New Cost Actions are to be proposed by 5 to 10 different COST countries commonly and a

specific deadline be defined. The new Action TEGO – Towards an European GNSS Observatory is supported by 10 different countries. A. CAPORALI explains the details of the objectives. The tentative list of TEGO Study Groups comprises

- combination of network solutions;
- standardization of data and processing centers;
- quality criteria and coordination of permanent GNSS station deployment;
- integration of the dense velocity field into the global velocity field;
- liaison/interface to EPOS, Topoeurope and other EU and global programs.

A previous proposal was not accepted, thus the proposal was updated and re-formulated to be submitted once more in March 2011.

13. ITRF2008 and transformation to ETRF2000

Version # 8 of the "Boucher-Altamimi Memo" was distributed among the TWG to be studied and discussed. Z. ALTAMIMI reports on the details. For the realization of EUREF solutions within the conventional frame of the ETRS89 system, ETRF2000 has to be adopted as numerical basis. The transformation formulae provide 14 transformation parameters for the ITRF2005 and further realizations to the ETRF2000 with the goal to harmonize the ETRS89 realizations overall Europe and to avoid coordinates jumps due to reference frame changes.

Z. ALTAMIMI informs that the IGS will probably adopt the ITRF2008/IGS2008 at the coming AGU2010. The IGS intends to change the ITRF2008 a little related to some calibrations of specific stations and then adopt this solution. The resulting numerical values then will not be absolutely identical with the initial ITRF2008 solution.

The TWG discusses the memo and asks Z. ALTAMIMI to check the values fo the conversion ITRF94 – ITRF97. Moreover the relevant parameters will be extended backwards till 1989. The updated Memo then will be distributed again and the TWG members should give their feedback in order to generate a completed version for the next TWG Meeting.

14. Introduction of ITRF2008/IGS08 and IGS08.atx antenna calibrations in the EPN

As background C. BRUYNINX explains: the actual ITRF2005 version was released Oct. 2006. The IGS contribution to the ITRF2005 was based on an IGS cumulative solution computed with relative antenna phase center (APC) models. Therefore the ITRF2005 is not consistent with absolute antenna calibrations. Absolute antenna calibrations, however, are introduced simultaneously with the ITRF2005. Therefore the creation of the IGS05 is aligned to the ITRF2005 being consistent with absolute antenna models.

C. BRUYNINX demonstrates graphs showing the influence of the introduction of absolute antenna phase center models on the IGS reference frame stations related to EPN stations as well as the differences between ITRF2005 and IGS05.

Moreover C. BRUYNINX reports that GEO++ initially did not permit calibrations by the EPN, thus individual calibrations were introduced. Meanwhile GEO++ does no more restrict that for EPN, however for the IGS the situations has not yet changed for the moment. M. POUTANEN adds that investigations in Finland turned out that in some cases the calibrations by the manufacturers are not correct, so it is recommended to test them in high precise networks and use individual calibrations as far as necessary.

The coordinate differences between igs05.atx and igs08.atx due to the influence of calibrations can reach values up to 4 mm in horizontal and 8 mm in vertical. Therefore the EPN Reprocessing should be carried out by using igs08.atx and IGS REPRO2 products.

The TWG asks C. BRUYNINX to continue the investigations by test processing for the various antenna types and to report again at the next TWG Meeting.

15. Report of the EPN LAC-Workshop 2010 and first experiences using ITRF2008 and RINEX3 for EPN

H. HABRICH presents the programme of the recent 7th EPN LAC Workshop– Troposphere reprocessing, Warsaw,. 19.11.2010. A presentation of the results of the re-processing at the next EUREF Symposium is intended .

It is planned to carry out a "benchmark campaign" for 7 days comprising 30 EPN sites analyzed by all LACs. The site selection will be done in December 2010, a second re-processing is intended for 2011.

Moreover H. HABRICH will compare the coordinate differences of a EUREF weekly solution tied to the IGS08 and ITRF2008 and report at the next TWG in order to decide whether the combined EUREF solution should be tied to IGS08 or ITRF2008.

16. Milestones for using Galileo IOV satellites in RT positioning

H. HABRICH gives a summarized overview on the schedule of altogether 13 implementation steps for the next future.

17. EPN real-time analysis

The present status of the project is presented by W. SÖHNE. Now altogether 7 Analysis Centers (DLR,

ESOC, NRCan, BKG, GFZ, GMV, TU Vienna) are contributing to the orbit and clock combination. Each AC is using an individual software, some even deliver 2 different solutions. The clock and orbit combination is done in post-processing as well as in real-time. A new product-related Ntrip broadcaster products.igs-ip.net <*http://products.igs-ip.net/home*> has been set up.

Concerning the IGS-RT PP-redundancy concept each station hosts at 2 or more casters and each RDC should have onsite and off site casters. Further computational redundancy has to be secured and the combination be performed by at least 2 combination centres.

A new working group "Ambiguity Fixing" (chair: M. GE, GFZ) has been established. The tasks of the WG are

- collect and discuss existing approaches of the various real-time (zero difference, single difference) ambiguity fixing methods developed and implemented so far for PPP,
- select suitable approaches for PPP in real-time,
- regional networks are mentioned as necessary especially for the aspect of reducing convergence time.

18. Jamming of the new receiver generation by nearby radio sources – legal and technical aspects

As G. STANGL reports, a new Leica receiver installed on a site in Vienna by the Austrian BEV did not record correctly GLONASS signals. Further investigations showed that other receivers (Trimble NetR5, Leica GRX1200GNSS, JAVAD Triumph-1, TPS E_GGD, TPS GB1000) partly failed to record L2 signals of GLONASS as well. A remark form the Ministry of Traffic, Innovation and Technology explains that there are primary users of frequencies 1164-1300 MHz (GPS, GLONASS, GALILEO, Military Broadcasters). However, secondary users (amateur broadcasts and ultra wide band broadcasters) may repress the signals and thus disturb severely the operations of the receivers. Principally such problems should not happen, but in practice a stringent use of frequencies is hardly enforceable. Consequently it is recommended to achieve only receivers which are basically equipped with an antijamming tool.

Regarding these problems C. BRUYNINX and G. STANGL will check the guidelines for EPN station operation and extend the guideline if necessary.

In the following G. STANGL gives a short report on his activities for the installation of the EUREF Campaigns and stations data base. As example he demonstrates the HEPOS Campaign, each involved site is related to a special log sheet informing an all available details such as antenna and receiver type.

Although the practical use of this information may be limited, the further completion of the data base is considered as useful as it represents a clear documentation of the various EUREF Campaigns validated by the Sub-commission.

19. Guidelines for EUREF densifications

The topic is postponed to the next TWG Meeting, C. BRUYNINX will prepare a detailed report.

20. EUREF Symposium 2011

The website for the EUREF 2011 Symposium, Chisinau/Moldova, 26.-27.05.2011 (technical excursion: Saturday, 28.05.2011) has been prepared by the Symposium LOC chaired by M. OVDII. J. IHDE will distribute the link to the new Symposium Homepage <*http://www.euref2011.md/*> to the TWG members to update asap the relevant links as well to comment the draft. M. VASCONCELOS then will install the link to the Symposium Website into the new EUREF Website.

Further J. IHDE proposes to set up the same programme of sessions as done for the last Symposium in Gävle. The TWG nominates the following session chairpersons:

- Opening Session: a colleague from the LOC
- Session 1: Activities of the EUREF Technical Working Group: J. IHDE, C. BRUYNINX
- Session 2: New developments in GNSS Networks: H. HABRICH, A. CAPORALI
- Session 3: Modelling the Earth with GNSS: J. DOUSA, R. FERNANDES
- Session 4: Mitigation of GNSS error sources: E. BROCKMANN, G. STANGL
- Session 5: Height, Gravity, Geoid, and Combination of Techniques: M. POUTANEN, J. MÄKINEN
- Session 6: Improvements and densification of ETRS89: J. TORRES, M. LIDBERG
- Session 7: National Reports: J. KRYNSKI, W. SÖHNE
- Closing Session, Resolutions, EUREF Symposium 2011: a colleague from the LOC, M. GREAVES, J. TORRES

All chair- and co-chairpersons should provide the detailed descriptions for their sessions till mid of December to be gathered and put into the website.

The EUREF TWG 2011 Symposium Meeting will take place as usual the full day before the begin of the Symposium, i.e. on Tuesday, 24.05.2011. H. HORNIK will contact M. OVDII to provide a suitable conference room.

21. EUREF TWG membership

J. MÄKINEN has asked whether his membership in the TWG might be finished in 2011 according to the

TWG-ToR. H. HORNIK has checked the list of all TWG members and informs that for 2011 no membership will end and thus no elections will be necessary.

22. EUREF trademark

H. HORNIK reports on a letter by the P. CHR. BRATHEIM from the Norwegian Statens Kartverk informing that the registration of the EUREF trademark will expire with April 2011. The EUREF trademark has been installed on an initiative of the former TWG member B. HARSSON in 2001. Because it was convenient at the time of registration, the registration fee was paid by the Norwegian Mapping Authority. Now this authority urges to transfer the responsibility for the trademark and payment of the registration fee to the EUREF sub-commission. The fee for all European countries would amount in total to € 10.373.

The TWG discusses this item and states that obviously no institution will be ready to pay this high fee. Concerning the further use of the name "EUREF" as well as the logo, M. LIDBERG states that EUREF has no property as a legal body at all, thus also no juridical problems can arise if the name and the logo are used further on. Moreover already now there are other organisations which use the word EUREF as abbreviation, but there is no real danger to mix the organisations and run into any problems. The TWG therefore decides to undertake no action.

23. Commission 1 symposium – REFAG

Z. ALTAMIMI reports on the recent IAG Commission 1 Symposium 2010 "Reference Frames for Applications in Geosciences (REFAG2010)", Marne la Vallée, 04.-08.10.2010. The Symposium was attended by 150 participants. 6 sessions were held, Z. ALTAMIMI informs on the details. Summarizing the results of the Symposium, Z. ALTAMIMI states that the usage and applications of reference frames in geosciences are basically fundamental to

– Earth science (e.g. sea level change)
– planetary science (e.g. interplanetary spacecraft navigation)
– society (e.g. precision agriculture).

Improved reference frames are essential to enable a better understanding of Earth structure and processes (lower mantle viscosity from improved estimates of secular geocenter motion, constrain present-day ice mass change). As a concept for improving terrestrial reference frame, co-located measurement techniques on the Moon are to be mentioned.

The Symposium Proceedings will be published in the Springer IAG Symposia Series.

24. ICG5 meeting

As J. IHDE informs, no relevant final documents available at present. A report wil be given at the next TWG Meeting.

25. Next TWG Meeting

A. CAPORALI invites the TWG to hold the 2011 Spring Meeting in Padova. The plenary fixes the date to 03.-04.03.2011, noon - noon. J. IHDE then invites for the 2011 Fall Meeting to Frankfurt a.M. The date will be fixed later. The TWG thankfully accepts both invitations.

26. Action Items

H. HORNIK will compile the action items of this meeting as soon as possible and distribute the text among the TWG members.

C. BRUYNINX closes the 2010 Fall TWG Meeting with cordial thanks to the hosts, especially to R. FERNANDES, for the excellent organization.