

Activities and New Initiatives of the EUREF Technical Working Group

C. BRUYNINX¹

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1 INTRODUCTION

The EUREF activities are coordinated by the EUREF Technical Working Group (TWG) which brings together representatives from both research agencies and mapping agencies. The TWG was created at the EUREF symposium in Bern, 1992, and its current member list is given in Table 1. The EUREF TWG is constituted by members elected by the plenary, ex-officio members, honorary members and members in charge of specific tasks. The positions of elected members are filled for terms of 4 years, which are renewable once (see EUREF Terms of Reference,

http://www.euref.eu/Overview_of_EUREF/Terms_of_reference/EUREF-ToR-2008.pdf).

Typically, the TWG has 3 one-day meetings a year: a spring meeting, a meeting just before the EUREF symposium (May-June) and a fall meeting. During these meetings, in addition to the general EUREF policy and its implementation, also technical issues related to the ETRS89, EVRS, etc... are discussed. The minutes of the TWG meetings are published in the EUREF proceedings, but are also available online at the EUREF web site from http://www.euref.eu/html/twg_meetings_documentation.html.

MEMBERS	AGENCY	COUNTRY
Z. Altamimi	IGN/ENSG	France
E. Brockmann	SwissTopo	Switzerland
C. Bruyninx	Royal Observatory of Belgium	Belgium
A. Caporali	University of Padua	Italy
J. Dousa	Geodetic Observatory Pecny	Czech Republic
R. Fernandes	UBI,CGUL, IDL	Portugal
H. Habrich	Bundesamt für Kartographie und Geodäsie	Germany
H. Hornik	Deutsche Geodaetische Kommission	Germany
J. Ihde	Bundesamt für Kartographie und Geodäsie	Germany
A. Kenyeres	FÖMI Satellite Observatory	Hungary
M. Lidberg	Lantmäteriverket	Sweden
J. Mäkinen	Finish Geodetic Institute	Finland
M. Poutanen	Finish Geodetic Institute	Finland
W. Söhne	Bundesamt für Kartographie und Geodäsie	Germany
G. Stangl	Institut für Weltraumforschung	Austria
J. Torres	SPUIAGG, Instituto Geofisico D. Luis	Portugal

Table 1: EUREF TWG member list (status June 2010)

2 RECENT ACTIVITIES

The following gives an (incomplete) overview of the major activities of the EUREF Technical Working Group since the last EUREF symposium held in Florence, May 2009.

¹ Royal Observatory of Belgium, Av. Circulaire 3, B-1180 Brussels, Belgium, C.Bruyninx@oma.be

2.1 Conventional frame ETRF2000

The ETRS89 is linked to the International Terrestrial Reference System (ITRS) and up to the release of the ITRF2005, each new realization of the ITRS (i.e. ITRFyy) was followed by a new realization of the ETRS89 (i.e. ETRFyy). However, from ITRF2005 on, the TWG decided to continue using the ETRF2000 as the ETRS89 realization and it adopted the ETRF2000 as the conventional realization of the ETRS89. The ETRF2000 will thus also be the ETRS89 frame adopted in conjunction with the latest release of the ITRS, ITRF2008 (release May 2010, see http://itrf.ign.fr/ITRF_solutions/2008/ for more information).

The mathematical transformation from ITRFyy to ETRF2000 can be done in a two-step approach using two successive Helmert transformations (ITRFyy \rightarrow ITRF2000 followed by ITRF2000 \rightarrow ETRF2000), or can be done by one single 14-parameter transformation (directly from ITRFyy \rightarrow ETRF2000), (Altamimi, 2009). The parameters of all these transformations are available from the Memo by Boucher and Altamimi (2008) which was updated on Nov. 24, 2008 and which will soon be updated to include the transformation formula to and from the ITRF2008 (Altamimi, 2010). To help users to perform the necessary transformations, an on-line transformation tool, which allows transforming between any ITRS/ITRS, ITRS/ETRS89 and ETRS89/ETRS89 realization has been put on-line at http://epncb.oma.be/dataproducts/coord_trans/.

2.2 Access to the ETRS89

The EUREF TWG has continued to manage the EUREF Permanent Network. Within the last year, 21 new EPN stations joined the EPN bringing the total number of EPN stations to 243. The EPN tracking network is becoming a multi-GNSS tracking network with 53% of the EPN stations observing both GPS as GLONASS signals; more details are given in (Bruyninx et al, 2010) and the web site of the EPN Central Bureau (<http://epncb.oma.be>). In 2010, one new Analysis Centre joined the group of EPN analysis centres, bringing the total number to 17. It concerns the Military University of Technology (MUT, Poland), see Habrich (2010).

The EPN provides full access to the ETRS89 through its publicly available GNSS observation data and the regularly updated ETRS89 coordinates of its stations (<http://www.epncb.oma.be/trackingnetwork/coordinates/>).

Using the 15-weekly updates of the EPN site coordinates, the EPN sites are classified (Kenyeris, 2010) in two classes:

- Class A stations with positions at the 1 cm accuracy at all epochs of the time span of the used observations
- Class B stations with positions at the 1 cm accuracy at the epoch of minimal variance of each station

Following the “Guidelines for EUREF Densifications” (Bruyninx et al, 2010), only Class A EPN stations can be used for densifications of the ETRS89.

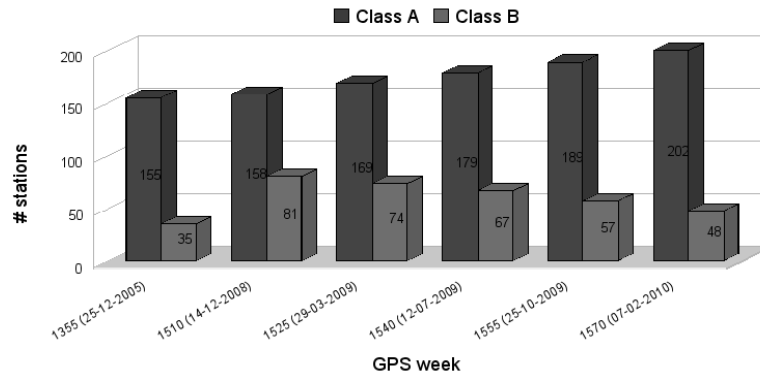


Figure 1 – Evolution of the number of Class A and Class B EPN stations. Thanks to the regular updating of the EPN cumulative solution, more and more Class A EPN stations become available.

2.3 Promotion of Adoption of the ETRS89

Since 1989, many European countries have defined their national reference frames in (or closely aligned to) ETRS89 by calculating national ETRS89 coordinates following the EUREF guidelines. The national ETRS89 coordinates, adopted by the different countries, can differ from each other due to differences in datum definition: they are often based on different ETRFyy frames and each of them refers to different observation times. The difference between the ETRS89 adopted in each of the different countries wrt the most recent estimates of the ETRS89 coordinates of the EPN stations is now monitored on a regular basis by EUREF (Brockmann, 2010). The results of the comparison show an agreement of a few cm (see Figure 3).

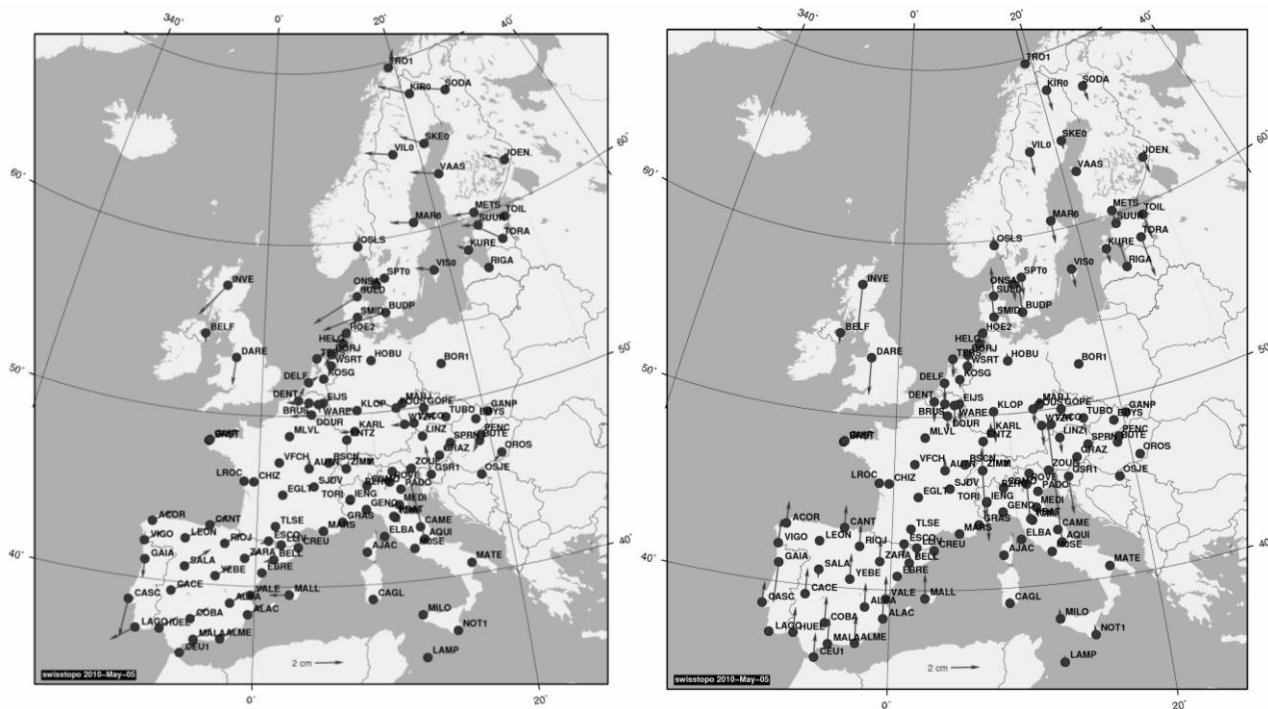


Figure 2 – Difference between ETRS89 coordinates adopted in the different countries and the latest EPN cumulative coordinate solution.

In addition, the EUREF TWG also decided to update its information concerning the usage of ETRS89 in the different countries. The goal of this activity is to issue a new questionnaire that will be distributed among the National Mapping and Cartographic Agencies. This questionnaire will be the follow up of the questionnaire that was distributed in 2005.

2.4 EPN Real-time Analysis Project

The EPN Project on “Real-time Analysis” focuses on the processing of the EPN real-time data (almost half of the EPN stations) to derive and disseminate new (or extended) real-time GNSS products. Within that frame significant progress has been made. Since some months, the EPN regional broadcaster at BKG (<http://www.euref-ip.net>) is now also broadcasting satellite orbits in the ETRS89 (ETRF2000 frame). Using these orbits, users can directly derive in real-time coordinates in the ETRS89.

At the same time the project aims at increasing the reliability of the EPN real-time data flow and decreasing the workload on today’s EPN regional broadcaster. For that purpose, two new regional broadcasters have been put in operation, one at ASI (Italian Space Agency, <http://192.106.234.7:2101/>) and one at ROB (Royal Observatory of Belgium, <http://www.euref-ip.be/>). Currently, 44 of 115 EPN real-time stations are streaming data to these 3 EPN regional broadcasters in parallel. With the existence now of 3 regional broadcasters, more and more stations are starting to upload their data in parallel to all of the broadcasters. This will avoid dependency on one broadcaster and make the real-time data flow more robust. More information of the EPN “Real-time Analysis” Special Project is available from http://www.epncb.oma.be/organisation/projects/RT_analysis and (Söhne, 2010).

2.5 EPN Reprocessing Project

The aim of the EPN reprocessing project is to obtain improved coordinates, position time series and tropospheric parameters. Each of the EPN Local Analysis Centers (LAC) participates to this project and different software packages like BERNESE, GIPSY, GAMIT and MicroCosm are used. Presently, within the Pilot Phase of the reprocessing, the data of 2006 are re-analysed with different models and strategies in order to select the best common strategy for the complete data re-analysis of the EPN. At the time of writing, almost 60% of the LACs have already provided their first reprocessed solutions for the pilot phase.

The first results of the reprocessing will be presented and discussed at the EPN Local Analysis Centers workshop to be held in Warsaw from Nov. 18-19, 2010. More information the EPN reprocessing is available from <http://epn-repro.bek.badw.de/> and (Völksen, 2010).

2.6 New EUREF Campaigns

Three EUREF densification campaigns have been validated by the TWG in the last year:

- The EUREF-Czech-2009 campaign consists of the 44 available permanent GPS stations on the territory of the Czech Republic and 17 EPN stations in other European countries, see Dousa et al (2010)
- The EUREF EIR/UK 2009 campaign consists of 54 stations in the UK and Ireland and 13 EPN stations, see Greaves and Bell (2010)
- The EUREF GR 2007 campaign consists of 98 permanent GPS reference stations distributed throughout Greece and 14 EPN stations in and around Greece, see Gianniou (2010)

All campaigns have been processed following the “Guidelines for EUREF Densifications” (Bruyninx et al, 2010) and the coordinates are expressed in the ETRF2000.

2.7 UELN and EUVN_DA

The United European Levelling Network (UELN), as the backbone of the realization of the new European Vertical Reference System EVRS2007, contains now the commonly adjusted levelling network of 26 European countries related to 13 well distributed datum points. The EVRS2007 geopotential numbers and the equivalent normal heights are expressed in the zero tidal system.

The EUREF TWG initiated the EUVN (European Unified Vertical Network) Densification Action (DA) in 2003 in order to establish a dense, homogeneous continental GPS/leveling data base. For that purpose, National Mapping Agencies provided existing, updated or new measurement data sets. The submitted data was carefully checked and transformed into common reference frames (ETRS89/GRS80 for the GPS and EVRS2007/UELN for the leveling data). As of December 2009, 25 countries participated, and the database contained more than 1400 GPS/leveling points. The EUVN_DA project has been closed in 2010 and its final report is available from (Kenyeres et al., 2010).

2.8 INSPIRE

INSPIRE was adopted in March 2007 by the Directive 2007/2/EC of the European Parliament and the Council. The goal of INSPIRE is to deliver to users from different communities an interoperable and integrated European spatial information service. The Directive defined the Themes and grouped them in three Annexes. Two of the themes within Annex I “Coordinate Reference Systems” (CRS) and “Geographical Grids Systems” (GGS) were of concern to EUREF. The EUREF TWG registered as a SDIC (Spatial Data Interested Community) within INSPIRE, appointed two experts for the development of the Implementing Rules (IR) related to Coordinate Reference Systems, and one member was invited as facilitator (coordinator). The EUREF experts reported their work at several TWG meetings and got suggestions of the TWG for the improvement of the IR. In December 2009, the Implementing Rules for the nine INSPIRE themes of Annex I were adopted. Thanks to the efforts of the TWG, the European Terrestrial Reference System (ETRS89) and the European Vertical Reference System (EVRS) defined by EUREF play now a fundamental role in the CRS IR. For more details, we refer to (Torres et al., 2010).

3. OUTLOOK

The EUREF TWG builds on continuous work performed by TWG members with the support of the complete EUREF community. Next to the continuation of the EUREF core tasks (of which an incomplete list is given in this paper), future plans of the EUREF TWG will concentrate on the development of a new EUREF web site.

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