

Time & location:

Monday, October, 15, 2018, 13:00-18:00

Tuesday, October, 16, 2018, 09:00-12:25

Hotel Scandic Simonkenttä, Simonkatu 9, Helsinki

MINUTES**1. Opening (Kenyeres)****2. Approval of minutes of 77th GB meeting in Amsterdam (Söhne)**

WS reviews the progress of the minutes before this meeting. ML comments on the minutes concerning the tide model used in the EVRS. After clarifying this, WS will send the final version to Manuela Vasconcelos for publication on the EUREF web page.

3. Review of Action Items from previous GB meetings (Söhne)

WS presents the new scheme (excel table) of the action items which he distributed before the meeting. In general, the GB agrees on this scheme, although it might be a bit difficult to read, and proposes to either remove the older (upper) lines from time to time or to insert additional sheets for current and historic AIs to make it more readable. WS proposes to update it frequently and to send the updated version to the GB members.

CV gives some news from the company Geo++ concerning the robot calibration of GNSS antennas. Although Geo++ did not reply to the EUREF letter concerning antenna calibration the letter has had some impact. Geo++ started to work on the update of their robot calibration infrastructure towards multi-GNSS. First results might be expected in early 2019.

4. Usage of Digital Object Identifier (DOI) (Bruyninx)

DOI can be assigned to both GNSS data and products. CB explains the purpose of the DOI that cannot only be used for scientific data but also for other works. It is a stable link to online resources. The link is valid for a lifetime of the published data or the scientific publication. She presents some examples, in particular from GFZ and CDDIS. Assigning a DOI helps to trace back who has to be recognized when specific data and products are used. The creator is the agency/individual that has created the data/products and who will get recognition for it (e.g. in references). The publisher is the data centre where the data or products are made available (possibly can also refer to other location by indicating the corresponding url in the landing page of the DOI). It is the publisher who requests the DOI registration and has to pay an annual fee. The analogy with the papers is simple: author and publisher correspond for data/product to creator and data centre. That does not mean that the creator (e.g. a data provider or an author) has to pay money for the publication but he needs to find a publisher that will offer his service. The procedure within EUREF could be the following: each AC asks for a DOI by their own or get in touch with a data centre to do this. The daily/weekly combined solution and the 15 weeks accumulated solution can also get a DOI which is then referring back to the DOIs of the ACs. AK suggests as a first step that everyone will ask in their own country who is providing DOIs and who supports such procedure etc. CB explains that this is only necessary for data/products that are only made available at national level. It is possible to have the EUREF data/products centralized in a single publisher.

5. News regarding the next EVRF (Sacher)

MS informs about the availability of new data that arrived shortly before and after the Amsterdam symposium. First product considered is from Slovenia. It is quite dense, has a higher accuracy than the old one, but there are still missing border connections. The new Italian data don't cover the whole country, missing the Southern part and the islands. The update for Norway covers two groups of data, one with historical leveling data and one with more recent leveling data. Additional measurements were provided, up to 2016. For the Czech Republic there are new measurements available up to 2017. For Slovakia, some errors were discovered by MS in the coordinates used for corrections. A revised data set has been

delivered, but there are some larger differences to the first one which have to be investigated. A discussion on the selection of datum points for the next EVRF, EVRF2019, follows. Should more and wider distributed datum points be used? There is a 2.7 mm constant height bias between the 13 datum point solution (like in the EVRS2007) and 15 datum points. The 15 points contain only one point per country but obviously not all countries have a datum point. One question is why no datum point from Scandinavian countries or from France was used? It was mainly due to uplift and tilt (France) issues. EB asks for the uplift model for central Europe, but there isn't such a model ready to use for leveling. The GB discusses the two new proposed datum points in Spain and Portugal. ZA asks for the possibility of publication of the leveling data. This seems to be different from, e.g., GNSS. MS explains that the adjusted levelling results are available for all contributors. This part is concluded by a side-discussion on gravity within EUREF and the consequences, if any, from the resolution of the Amsterdam symposium.

6. Coordinators

a. Analysis Combination Centre – Galileo (Liwosz)

TL presents first investigations on the differences between the operational combined solution and the test combination where three contributions (BEK, BKG, ROB) were replaced by their parallel computed solutions including Galileo observations (3G). Maximum mean position differences are below -0.87 mm in North (LEON, MARS, OBE4) and -0.59 mm in East (OBE4), -2.14 mm in Up (MARS, ENTZ, LEON), based on 40 weeks. AC and ZA propose a comparison of the three solutions with and without Galileo only, not with all 16 ACs. EB states TL's comparisons very valuable. He mentions OBE4 as the station with the largest impact using Galileo or not in the LPT solutions. A general discussion follows on switching the new solutions to operational. Some GB members are not in favor, mainly due to the insufficient antenna models for Galileo. Since the shown differences are on that low level, EB asks how long EUREF is going to wait. Having in mind that the comparison already covers 40 weeks, it is not motivating for the other ACs if parallel processing does not have a visible timeline. He gives the example of GLONASS where the switch was done AC by AC over a longer time span. CB mentions that the MGEX products which are a necessary input for the 3G processing are not the operational products of the IGS and are not going into the ITRF for example. Some GB members refer to the resolution on using Galileo at the ACs. But this resolution is not very strong formulated and does not contain anything about 3G going operational. EB would like to see a timeline for switching to Galileo for the operational products. AK proposes to see more comparisons in the next meeting. LH supports EB's position to see a strategy. CB points to the upcoming IGS workshop. JL asks for the impact on the standard deviation of the combination.

Action Item to RD, RF, Arturo Villiger and other attendees to the IGS workshop: follow very carefully the discussion on the IGS workshop in terms of antenna calibration.

b. Analysis Combination Centre – “EPN goes global” (Liwosz)

In his second part, TL presents initial ideas for the action item 5 of GB76 on “EPN going global”. For his tests, covering GPS weeks 1990 to 1997, he used four global solutions named IGG, IGI, COF, and WUG. Solutions IGG, IGI, and WUG are from IGN, IGE, and WUT EPN ACs respectively. Solution COF is the operational CODE solution for IGS. IGI had a very small number of stations only.

TL shows the RMS values of position residuals between EPN global and EPN operational after different Helmert transformations (translations only and translation+rotation), and the transformation parameters themselves. The RMS values are very small (e.g. 0.61 mm in Up, if only translations are estimated,

decrease to 0.58 mm, if the rotations are also estimated), showing that the internal consistency of EPN network has not changed when adding global sites, and that the main differences between operational solutions and solutions with added global stations come from the reference frame alignment. Therefore, no degradation of the quality of the EPN solution is expected by adding global stations. TL also compared both solutions using Helmert comparisons with respect to the IGS daily combined solutions. The plots showing the transformation parameters don't indicate any large values. AC notices that the scale for the rotation had to be increased by 10 in order to be comparable to the translations. JL notes that the value of the position differences themselves would be more relevant to highlight the necessity of adding global station to the EPN. It is concluded that more tests and more results have to be shown in order to have a better understanding of the situation.

After meeting remark: the discussion has been continued after the meeting, and TL and JL made some additional plots showing the position differences themselves rather than the value of the translations and rotations. It was decided to show those results at the next GB together with more analyses (see action items).

Action Item to TL: prepare a map of the differences mapped into the station coordinates.

Action Item to TL and JL: make some more comparisons with respect to global solutions.

c. Report of the troposphere coordinator (Söhne (on behalf of Pacione))

WS shows the plots on behalf of RP on the troposphere combination operational versus the test combination with the three Galileo solutions added. The differences are very small on the sub-mm level. WS adds that these differences – or jumps – are much smaller than jumps observed in the past for, e.g., switching from one BSW version to another.

d. EPN real-time (Söhne)

Following an action item from the first webex meeting, WS shows some statistics on the usage of real-time data and products at the BKG broadcasters. He adds some plots showing that a large group of stations are providing RTCM MSM data streams directly from the receiver and no longer converted from raw data streams by the euronet software.

7. Working Groups

a. Multi-GNSS WG (Brockmann)

i. Status of RINEX 3 in operational processing (Brockmann)

EB shows the usage of RINEX 3 files on the example of swisstopo. The increase of Rx3 compared to Rx2 is + 7 % from 2017 to 2018. CB mentions the first Rx3.04 file from POTS which was refused at the CB as well as at BKG GDC. GB agrees on this procedure for the time being as long as this version is not official.

ii. Short note on RINEX 3.04 (Söhne)

WS very shortly shows the draft version of the updated RINEX version, 3.04. It will be discussed at the next RTCM SC104 meeting in Frankfurt on October 18 and 19. EB mentions that the proposed changes, although sounding very easy, have a certain impact on the manufacturers.

iii. Galileo processing at UPA (Caporali)

AC presents the investigations on Galileo processing he and Joaquin Zurutuza did at UPA AC. The impact on percentage of ambiguity

resolution and on the transformation parameters is shown. CV recommends the upload of these solutions to the BKG GDC as is done by the other ACs providing 3G solutions.

- iv. **Galileo PCVs with Robot at ETH Zurich – first results (Brockmann)**
EB reports on a master thesis done at the Swiss university. It deals with the inter system translation parameters (ISTP) and especially with the prototype calibrations using ETH's own calibration robot and own software. GPS and Galileo calibration is possible. There are some differences showing that the usual copy and paste from GPS PCVs to Galileo might imply some errors. EB mentions also some empirical PCCs as a solution for missing Galileo calibrations. LH doubts that this is the right way to introduce the estimation of a parameter where something seems to be not fully understood. PPP results as the testing procedure of the different antenna calibration models and different elevation angles give a large variety of results within 8-10 mm in the three coordinates. EB also mentions the possible effect of satellite PCVs. CV doubts that there is an effect due to the short baseline length. This section is closed with a discussion on the "monument effect" and on the impact of mixing calibrations from different sources.
- b. **WG on EPN Densification (Kenyeres)**
AK reports on the successful comparisons done between his and EB's velocity solutions. The densification web page will be updated soon. The long awaited paper on this topic is under review by the co-authors. The preparations for D2000 solution are started, Joaquin Zurutuza has been preparing a SINEX level cleaning of the Iberian and UPA networks. Critical part of the update is the conversion of SINEX files expressed in IGB08 (before GPS week 1934) to IGS14.
- c. **WG on Dense Velocity Fields (Brockmann)**
EB gives a detailed overview of the recent changes of this WG. Many new contributions are available since the Amsterdam symposium. The gridding results shown were done using gnuplot. He shows a demo of the web page, e.g. with final residuals of the individual solution to the combined solution. Available grids, e.g. from Scandinavia, are getting a ten times higher weight in the combination. WS mentions the locally instable sites which are seen as "outliers" but could be a signal for some interested groups. AK adds that such cases should be kept and stored/provided separately.
- d. **WG on Deformation Models (Lidberg)**
ML gives a detailed overview on the contents of this project. Much progress is coming from EPOS rather than EUREF. Six free available tools for strain rate computation could be used. ML shows preliminary results from two examples, Greece and Upper Rhine valley. The input to the investigations is coming from both WGs. Some open questions remain, e.g. on quality measure or on the geographical extension of a potential product. He explained some excursion to the mathematics behind the collocation, mainly applied by Rebekka Steffen. Next discussion point is on the reference frame for a EUREF deformation model. ML thinks that ETRF2000 is a good choice but to be better understood by other communities an ITRF realization could be better. He proposes ITRF2014 with Eurasia Euler pole removed. ML outlines some further steps, e.g. incorporating experts for each of the deforming region. The question is if, and when if we are aiming for that, EUREF could come up with a EUREF deformation model. RF is in doubt that it makes sense to have two parallel activities in EUREF and EPOS resulting in double work. CB says that there is no input from EPOS for the work of

EUREF in this activity. AC comments on some technical issues, e.g. the standardization in processing and deforming grid on three dimensions. EB adds that also specialists from Spain could be included. One element on the To-Do list is to estimate some more realistic uncertainties for the velocities.

8. EUREF Symposium 2019 (Ellmann, Kollo)

AE presents the status of next year's symposium. Several details are discussed:

Overall schedule and times: the dates are already fixed to May, 22-24, 2019. The GB meeting should start Monday at 12:00, the tutorial at 12:00 on Tuesday.

Conference venue is the "Nordic Hotel Forum". There is a number of discounted rooms (125 €), a special code will be communicated. The GB meeting as well as the tutorial are planned at the Estonian Land Board. Transport from the airport is 2-3 € by public transport, 10 € by taxi. Social events: Icebreaker at the "Restoran Platz" (max. 140 people), dinner at the "House of Blackheads" (west of the Nordic Hotel). Discussion whether lunch break of one hour is too short for expected 120 persons.

Tutorial: the proposal of the local organizers is on "transformations to national coordinate systems"¹, covering e.g. PROJ as a standard software tool. The GB is not in favor of mixing with other topics, e.g. transformation in height. LH is proposing to add other transformations, e.g. in EPSG. AC mentions shape files to be transformed.

Web page and registration: the web page should be available end of January. End of the registration is planned for May, 01 abstract deadline April, 01. GB is in favor of having the same deadline as for the registration.

Fee: the fee is planned to be between 300 and 350 €, the tutorial 50 €. Due to technical restrictions only bank transfer is possible.

Sessions: WS raises the discussion on the change of session chairs and on a joint PosKEN & National Report session. RP will be replaced by CV and AK by LH. KK will be a co-chair of the National Report session.

9. EUREF

a. EUREF campaigns (Söhne, Torres)

WS presents the text and the table for a campaign representation on the EUREF web page that JT and he prepared. The GB agrees on the publication. AC proposes to add a map with the campaigns. WS and CV will figure out whether it is possible to scan some older papers from printed publications in the BEK and BKG series. One additional proposal is to ask some of the presenters of campaigns before 2009 whether they have a digital copy available.

Action Item to JT, WS and Manuela Vasconcelos: prepare a web page for the campaigns.

Action Item to WS and CV: check if and how it possible to scan old publications on the EUREF campaigns.

b. Official National Coordinates – Status Report (Brockmann)

EB gives an update on this product. As a positive example he is presenting Spain where different agencies are providing coordinates. The differences of the combination to the EPN cumulative solution C1995 are below the mm level.

c. GB membership (all)

The GB chair AK announces that he probably is not able to continue as chair after finishing his term in 2019. After a lively discussion it is agreed on starting the procedure for the election of new members at the next symposium. Priority should be given to the expertise rather than the affiliation. Geographical distribution could be a point to consider. CB recalls a discussion she had in Amsterdam that GB should consider to invite young colleagues as potential new members.

¹ There was an after meeting proposal of AA to extend the title to „transformations and projections“

Action Item to all: propose names and justification for their expertise and why their contribution to the GB is of advantage. Propose persons for the EUREF chair in case MP is not continuing.

d. EUREF Strategic Plan (Poutanen et al.)

MP presents some initial thoughts. But there are some open points to be formulated. AK mentions a potential new Working Group on Height modernization (or similar) which could collect in a systematic way different results from our work.

10. AOB

a. General Data Protection Regulation (GDPR) (all)

CB informs about changes in the EPN CB concerning the site logs. Only if explicitly agreed by the individuals, their personal information is transferred into the site log, otherwise only the agency information is given.

b. ICG meeting in Xi'an Nov, 4-9, 2018 (Poutanen)

MP has a ten minutes talk there and would like to collect some slides of the GB members on their most recent activities.

Action Item to all: send some slides on the most recent EUREF activities to MP until October, 31.

c. EGU2019 session 2.3 (Poutanen, Kenyeres, Söhne)

The important deadline for abstract submission is January, 10, 2019. Several contributions should come out of the GB. But also other colleagues should be motivated to submit an abstract.

Action Item to MP, AK, and WS: actively promote EGU2019 session 2.3 on EUREF-related activities to ensure that the session is able to receive at least one slot for oral presentation.

d. Next GB meeting(s) (all)

AK invites the GB to Budapest. Possible date should be in February 2019.

Action Item to WS and AK: set up the necessary steps to schedule the next GB meeting.

11. Action Items (Söhne, Kenyeres)

PARTICIPANTS

Z. Altamimi (ZA)
 E. Brockmann (EB)
 C. Bruyninx (CB)
 A. Caporali (AC)
 R. Dach (RD) excused
 J. Dousa (JD) excused
 R. Fernandes (RF)
 A. Kenyeres (AK)
 J. Legrand (JL)
 M. Lidberg (ML)
 T. Liwosz (TL)
 R. Pacione (RP) excused
 M. Poutanen (MP)
 M. Sacher (MS)
 W. Söhne (WS)
 J. Torres (JT) excused

C. Völksen (CV)

A. Arasziewicz (AA)

A. Ellmann (AE) (on Tuesday)

L. Huisman (LH)

K. Kollo (KK)