EUREF NEWSLETTER

SEASON'S GREETINGS

BY THE EUREF CHAIR MARTIN LIDBERG

Dear colleagues,

If end of 2019 someone would have anticipated that in 2020 there would have been a global crisis that prevents us from visiting each other, from travelling, that our symposium would be cancelled and that many, many people around the globe would die due to this crisis, we would have called him or her, friendly speaking, a very pessimistic person.

Today we know that everything of this happened. And there is only little hope that the situation will dramatically improve with the beginning of next year, despite the news about vaccines. Like other sectors also the geodetic community has been affected: Many of us couldn't go to or were prevented from access their institutes and have to – or have the chance to – work from home, stations facing issues with receivers, antennas or communication could not be visited or only with many problems, planned changes or even large campaigns had to be postponed. Many geodetic events had to be cancelled, some had the chance to perform virtually. Also, our annual symposium could not take place this year. We are going to plan for next year to ensure the exchange of information and news within our EUREF community, see below.

Fortunately, our daily work is to a large extent "digital", so we could continue our projects and the derivation of our products. With this newsletter we would like to give you a brief overview about some activities of our EUREF colleagues in the past year as well as plans for next year.

I wish you, your relatives and friends a merry Christmas and all the best for 2021.

EUREF GOVERNING BOARD 2020

BY THE EUREF GB CHAIR WOLFGANG SÖHNE

After one physical meeting in Munich end of February 2020 – which turned out to be one of the last face-to-face-meetings of this year – the GB met five times virtually. These meeting were much shorter than our physical meetings and, hence, we concentrated much more on information exchange and progress reports of the various entities. The valuable time for discussion was clearly missing.

Beside the reports of the coordinators, the Working Group chairs as well as the EPN Central Bureau and some EUREF governance issues a few topics were discussed, which are either new or intensified. During late summer, a group of colleagues discussed the collaboration and coordination between EUREF, in particular the permanent stations, and the InSAR community. A small "InSAR Geodetic Transponder and Corner Reflector group" has been established, led by former TWG member Hans van der Marel and Ramon Hansson, both from the Netherlands. Of specific interest is the installation of passive reflectors and active transponders at EPN or EPND stations. Anyone who likes to contribute to this group may contact insar_geodesy@googlegroups.com.

Most countries in Europe have implemented EVRS-compatible heights. However, there is no official height reference surface product existing. The GB discussed the proposal by Joachim Schwabe from BKG on a new WG "Unified height reference surface". Actions would include: collect, update and provide information about current official national height reference frames and products, e.g., geoid models, transformation grids and their metadata, etc. In 2021, the concept will be refined and the community will be asked for volunteers to contribute to the group. A formal establishment of such a WG could be verified at the next symposium.

http://www.euref.eu/

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EUREF SYMPOSIUM 2021

BY KLEMEN MEDVED AND SANDI BERK

Although we did our best to keep the plan of a physical EUREF symposium 2020 alive as long as possible, somewhere in April 2020 we had to stop the preparations for the event and to announce the cancellation. Postponing the symposium to a later date in the year was not a realistic option. Therefore we concentrated in the preparation for next year 2021. With the EUREF GB we discussed three different options, from full physical meeting over hybrid to full online meeting. The final decision was to go for a full online symposium in 2021.

Special focus should be put on the National Reports, which traditionally have a fixed place in the symposium. We plan that each country is going to provide a contribution. This could be a written paper or a suite of slides but we prefer to have a talk, which could be recorded prior to the meeting and made available through the symposium's web page.

## THE EUREF PERMANENT NETWORK (EPN)

BY CARINE BRUYNINX

In 2020, the EPN Central Bureau (CB) added 17 new stations to the EPN (indicated in green in the map): eleven stations in Belarus (first EPN stations in Belarus!), one in Great Britain, one in Germany, one in Italy, two in France, and one in Portugal.

Similar to the EPN site log submissions, since November 2020, also the pictures of the EPN stations should now be submitted directly through the "Metadata Management and Distribution System for Multiple GNSS Networks" (M3G; https://gnss-metadata.eu/).

Station managers are strongly encouraged to stop submitting RINEX 2 and provide instead RINEX 3 data using the long file naming convention, as it is the case within the IGS. EPN station managers have done a large effort in 2020 with 80 % of the EPN stations now providing RINEX 3 data. In addition, also to stay in-line with IGS, from December 1st, 2020, the EPN data centers started using .gz (instead of compress .Z) for publishing RINEX 2 data files.

The team managing the EPN Central Bureau set up a twitter account https://twitter.com/be_gnss where among other, the latest news about the EPN can be followed.

GNSS@ROB @be_GNSS

EUREF Permanent Network
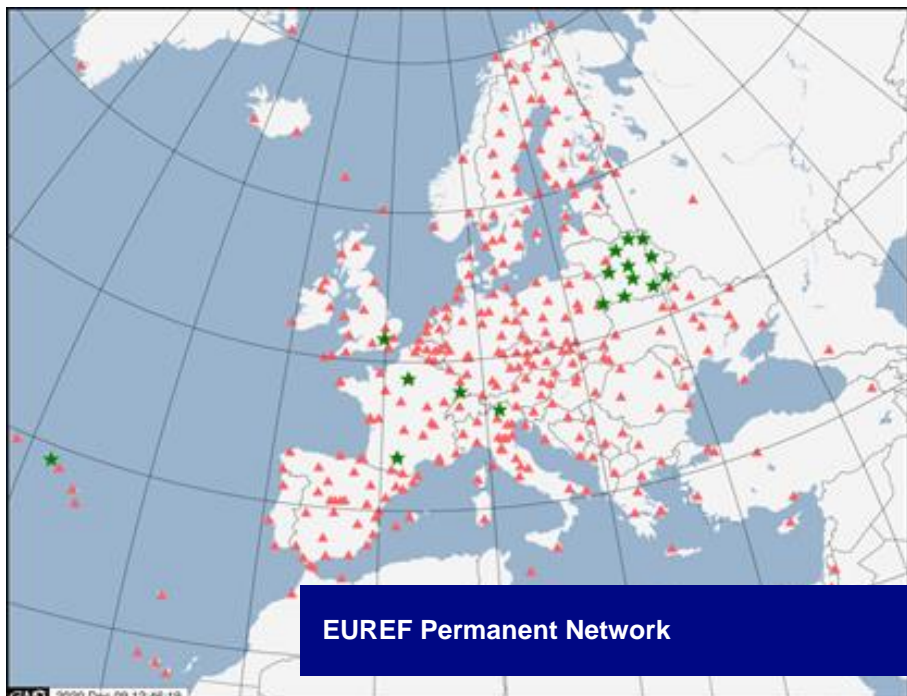
EVRF2019 UPDATE

BY MARTINA SACHER

The EVRF2019 was successfully released during our 2019 symposium.

EUREF 2019 RESOLUTION NO. 3.

The IAG reference frame sub-commission for Europe (EUREF)

Considering the availability of the new realisation of the european vertical reference system (EVRS)

Recommends to adopt this new realisation under the name EVRF2019

And encourages all the participating countries to agree to the publishing of their EVRF2019 heights on the EUREF website

During the summer this year we noticed a bug in the computation. As the result of the re-computation the values in the North-East of Europe differ maximally by approx. 15 mm in the Baltic States and a removed north-south tilt in Poland. The new solution has been distributed to the contributing organizations and is available at: https://evrs.bkg.bund.de/Subsites/EVRS/EN/EVRF2019/evrf2019.html.

Transformation grids between national heights and EVRF2019 have been calculated and provided to the countries. By the end of the year 21 countries agreed to publish these transformation grids on http://www.crs-geo.eu/homepage.htm.
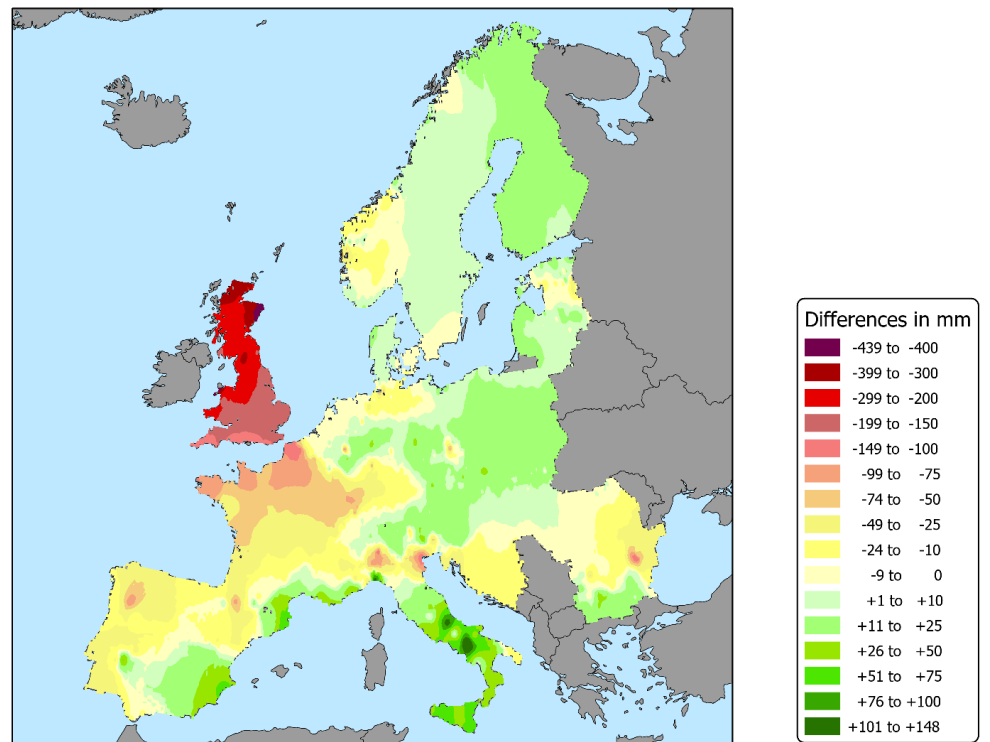
DIFFERENCES EVRF2019 - EVRF2007

EPN real-time activities

BY WOLFGANG SÖHNE

Concerning EPN real-time activities, the EPN is mainly following the activities in the IGS and the standardization efforts in RTCM and in the IGS. Within the EPN, the number of stations providing real-time data was growing to more than 190. Big improvement was made concerning the source of the data: only three stations are left which provide the data using an intermediate software. All other streams are coming (directly) from the receiver. More and more EPN stations switched to RTCM MSM, resulting in many Galileo and BeiDou data streams available. Within the IGS, for the first-time so-called broadcaster guidelines will be published soon, which follow to a large extent the strategy we have with our EPN guidelines. The IGS is also pushing the development of the SSR format. A special task force has been created, which published a first version of the modified format.

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The Coordinators

Analysis Center Coordinator

BY TOMASZ LIWOSZ AND ANDRZEJ ARASZKIEWICZ

In 2020 EPN Analysis Centres Coordinator (ACC) continued to combine GNSS coordinate solutions provided by 16 EPN Analysis Centres (AC). Since week 2106 (May 17, 2020) the daily and weekly combined solutions have been aligned to the new IGS reference frame – IGb14, which is an updated version of the previously used IGS14. The IGb14 reference frame contains 15 more EPN reference stations (49 stations in total) that can be used for the alignment of EPN combined solutions. After the switch, a slightly better agreement of EPN combined solutions with the IGS reference frame was observed, especially for the vertical component.

In 2019 11 EPN ACs started using Galileo observations (in addition to GPS and GLONASS) for the generation of the official products. Since August 2020 also SGO AC (Lechner Knowledge Center, Hungary) has started including Galileo observations in its final and rapid solutions.

The ASI AC (Centro di Geodesia Spaziale G. Colombo, Italy) prepared test solutions using new software - GipsyX, based on observations of three GNSS (GPS, GLONASS, Galileo). The new solutions have been tested by ACC and showed good agreement with the combined solution. The solutions computed using GipsyX are going to replace the present ASI solutions (GPS-only) computed with older GIPSY-OASIS software.

Troposphere Coordinator

BY ROSA PACIONE

In 2020 the new EPN stations have been have successfully included in the tropospheric combined products.

We implemented the conversion of the combined ZTD estimates to Integrated Water Vapour (IWV) following the classical two-step approach. The necessary auxiliary information, surface air pressure and weighed mean temperature of the atmosphere, are obtained from ECMWF operational products provided by the Technical University of Vienna. The data are distributed on global grid with a horizontal resolution of 2° latitude and 2.5° longitude, and 6-hourly temporal resolution, and are valid on the model orography. A linear interpolation in time and a bilinear interpolation in space are applied to derive the surface air pressure and weighed mean temperature of the atmosphere at the station location with a sampling rate of one hour. We plan to disseminate the combined ZTD along with the derived IWV in SINEX_TRO v2.0 format starting from the beginning of 2021.

Reference Frame Coordinator

BY JULIETTE LEGRAND

In May 2020, the IGS published a revision of the IGS14, namely the IGb14. The first EPN multi-year solution in IGb14 (C2115) has been published in November 2020. Thanks to the five more years of input data in IGb14 compared to IGS14, the agreement between the EPN and IGS multi-year solutions has been improved when using IGb14.

To help the identification of the best EPN reference stations, a new station classification was developed and is under evaluation. In addition of the classification, we also developed a web tool to help with the selection of the optimal EPN reference stations for a given observation time frame. The web tool is available at the EPN CB website:
http://epncb.oma.be/_productsservices/ReferenceFrame/.

The web tool can also be useful to monitor the stations in the EPN multi-year solution. It gives additional results compared to the time series web pages like the behavior of the station as a function of the different station classification criteria and the velocity variability plots. These web pages are updated at each release of EPN multi-year solution.

The Working Groups

WG on Dense Velocities

BY ELMAR BROCKMANN

Within the Working Group on Dense Velocities a number of new solutions could be added. Especially, for central Europe (mainly Germany and Benelux) the US researcher from Nevada contributed a velocity estimation with more than 700 not yet analyzed stations. Totally, more than 7000 individual station velocities are available for Europe. The website of the project, http://pnac.swisstopo.admin.ch/divers/dens_vel/index.html has been extended by an additional "wind animation" visualization.

WG on EPN Densification

BY AMBRUS KENYERES

While publishing the EPN Densification solution D2050 and preparing the next release, D2100, a completely new web page has been designed for the project. The most important improvement has been made for the analysis part. A tool called velociRAPTOR is providing a new velocity filtering solution. For each station pure time series, expressed in ETRF2014, and de-trended residual time series are available. Finally, the download of the SNX files of the most recent release is possible, making this project much more useable for the geodetic community – and other disciplines as well, of course.

Multi-GNSS WG

BY ELMAR BROCKMANN

The majority of ACs are operationally using GPS, GLONASS, and Galileo in their operational solutions. Also, the transition for RINEX 2 to RINEX 3 continuously improves. Nevertheless, the inclusion of BeiDou is still pending in the processing and analysis.

WG on Reprocessing

BY CHRISTOF VÖLKSEN

New IGS repro products shall be available in spring 2021. In 2019 the IGS started its third reanalysis of the full history of GNSS data collected by the IGS global network since 1994. The main focus was the analysis of the data in a consistent way by applying the latest models for the analysis. The availability of correction models including Galileo signals for the antennas on board the satellites and on the ground represents a major breakthrough. The new products of the IGS Repro3 campaign will enable the EPN analysis center to start a third EPN reprocessing campaign. Nevertheless, the third reprocessing of the entire EPN must be prepared very carefully. In particular, the consistency between the reprocessed data and the operational data must be guaranteed. The use of Galileo signals calls for consistent correction models for the ground antennas, which track the Galileo Signals. However, these are not widely available. Especially since many stations use individual calibration models that are not designed for Galileo signals. Therefore, we will have an intensive discussion during the preparation of the third EPN reprocessing campaign.

WG on Deformation Modeling

BY MARTIN LIDBERG

Colleagues from Lantmateriet, in particular Rebekka Steffen, made some effort in deriving a gridded velocity field for Europe using the collocation method, showing some nice examples for Poland, Hungary, and Latvia during the last EUREF GB meeting. To increase the effectiveness of the velocity modeling process, for 2021 some re-organization of this Working Group is under consideration, e.g., merging it with another Working Group.