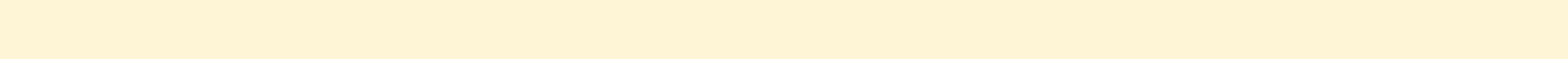




# EPN real-time analysis status report

Wolfgang Söhne

Federal Agency for Cartography and Geodesy





- **AI6: New and updated real-time web pages at EPN CB**
- **Valuable and detailed input by Jan Dousa has been introduced as much as possible in to the text (word doc sent to EPN CB mid October)**

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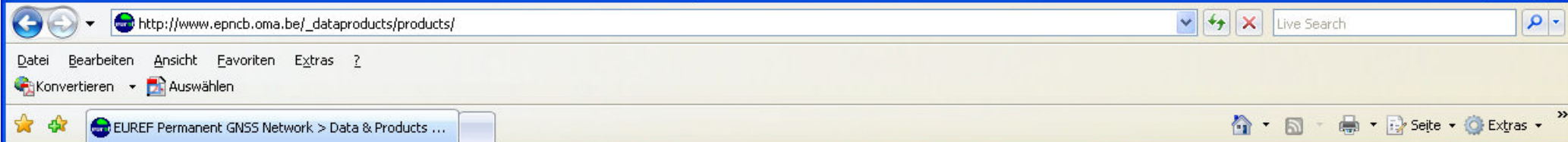
- **Update of the existing web pages**
- [http://www.epncb.oma.be/organisation/projects/RTanalysis/index\\_new.php](http://www.epncb.oma.be/organisation/projects/RTanalysis/index_new.php)
- [http://www.epncb.oma.be/organisation/projects/RTanalysis/clocks\\_orbits\\_new.php](http://www.epncb.oma.be/organisation/projects/RTanalysis/clocks_orbits_new.php)
- 

Federal Agency for Cartography and Geodesy



- **‘DATA & PRODUCTS’ → ‘PRODUCTS’:**  
Introduce new (5<sup>th</sup>) section about ‘Satellite Orbit and Clock Correction Streams’, which links to a
- **New page:**  
[http://www.epncb.oma.be/ dataproducts/products/realtimecorrections](http://www.epncb.oma.be/dataproducts/products/realtimecorrections)  
Description of ‘What’, ‘How’, ‘Where’, ‘Tools’ and ‘Performance’

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EUREF HOME

# EUREF Permanent Network



EPN CB HOME

## ORGANISATION

Creation, Management, Structure,  
Relation to IGS, Projects, Guidelines,  
FAQ

## TRACKING NETWORK

Site maps, Site list, Proposed sites,  
Equipment & calibration, Site  
coordinates, Site log submission, Site  
picture submission

## DATA & PRODUCTS

Data access, Analysis centres,  
Products, Time series, ETRS89/ITRS  
transformation, Formats

## NEWS & MAIL S

News, Mails, Calendar, Papers,  
Workshops, Web site history

## FTP & WEB ACCESS

Anonymous FTP, Web site index,  
Related links

[DATA & PRODUCTS](#) > [PRODUCTS](#)

## PRODUCTS

### Weekly EPN Solutions

The core product of the EUREF Permanent Network is the weekly coordinate estimates for the EPN tracking stations and their covariance information in the SINEX format. These coordinates are outcome from the so-called "combined EPN solution" which is based on the subnetwork solutions submitted by the EPN Analysis Centres.

### Station Coordinates and Velocities *(new results including EPN-REPRO1 soon available!!)*

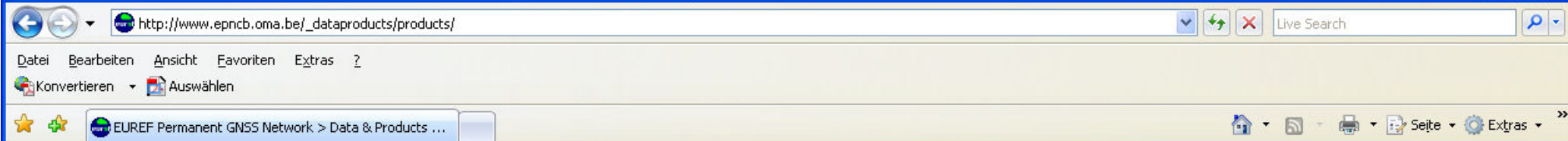
The coordinates and velocities of the EPN tracking sites are available with an accuracy of a cm or better in the different realizations of the ITRS and ETRS89. In addition, regularly updated coordinates using the latest tracking data as well as coordinates for recent sites not yet included in the ITRS are also given.

### Time Series Analysis *(new results including EPN-REPRO1 soon available!!)*

By stacking the weekly EPN solutions (available since the start of the EPN until today), precise station coordinates/velocities, as well as information on the non-linear behaviour of the coordinates and their noise type is obtained.  
The raw and cleaned coordinate times series show how the site coordinates change with time.

### Site Zenith Path Delays *(new results including EPN-REPRO1 soon available!!)*

Within the routine analysis of a network of ground-based GPS receivers, such as the EPN, the tropospheric parameters are a by-product of the parameter estimation. The EPN makes available the tropospheric zenith path delays at all of its stations based on the estimates of all its Local Analysis Centres.



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### Satellite Orbit and Clock Correction Streams

Real-time orbit and clock corrections are estimated by the IGS and its real-time Analysis Centres in the IGS-Real Time Pilot Project. The EPN gives access to the real-time satellite orbit and clock correction streams for GPS and GLONASS satellites which are related to ETRS89.



EUREF Permanent GNSS Network > Data & Products > Products - Mozilla Firefox

DateiBearbeitenAnsichtChronikLesezeichenExtrasHilfe

EUREF Permanent GNSS Network > Data & ...

www.epncb.oma.be/\_dataproduts/products/realtimecorrections/

Google

FAQcoordinates, site log submission, site transformation, Formatspicture submission

DATA & PRODUCTS > PRODUCTS > REAL-TIME ORBIT AND CLOCK CORRECTIONS

REAL-TIME ORBIT AND CLOCK CORRECTIONS

Background

To step forwards from real-time single point positioning (SPP - code-only analysis, with position precision of the meter level and below) to precise point positioning (PPP - code+phase analysis, with position precision of the dm or even cm level) it is necessary to have real-time access to several correction streams allowing to take full advantage of the high precision phase observables. An example of such corrections are real-time corrections to the GPS and GLONASS broadcast ephemeris enabling availability to high precision satellite orbit and clock information in real-time. In 2009 the IGS launched a pilot project to estimate and distribute such corrections in real-time, see IGS Real-Time Pilot Project ([IGS-RT PP](#)) for more details. Whereas IGS is currently focusing on satellite orbit and clock corrections for GPS which are related to ITRF2008 (or its IGS08 realization), EUREF is distributing corrections for GPS and GLONASS which are related to ETRS89.

Procedure

The IGS-RT PP Analysis Centres (AC) are estimating GPS and partly also GPS & GLONASS satellite orbit and clock corrections. These corrections are uploaded to the IGS NTRIP broadcaster. The IGS-RT PP Analysis Coordinator is then combining the individual contributions to make available a clearly specified product to the users. These corrections are referred to the IGS realization of ITRF2008.

For EUREF, a clearly specified product is made available as well. 14 parameter transformations between ITRF2008 and various regional datums are introduced in the program BNC to additionally derive the corrections related to these regional datums. For EUREF, the values for the transformation between ITRF2008 and ETRF2000, epoch 2000.0, are introduced using the values from <http://etrs89.ensg.ign.fr/memo-V7.pdf> and extrapolated to the current epoch.

Note that in the current version of BNC only the satellite orbits are transformed. With regard to the large number of possible transformations, only a few transformations are hard-coded in the software, whereas individual ("custom") parameters could be introduced by the user.

Access

The EUREF real-time product streams can be accessed using so-called mountpoints from one of the three [regional Ntrip broadcasters](#). To get free access to the broadcasters you simply have to register, use column [Operator & Registration Link](#) for the details.

It is planned to establish unambiguous mountpoints for the EUREF-related corrections streams. Currently, the following mountpoints are opened or will be established in near future for the ETRS89-related orbit & clock corrections:

- mountpoint EUREF01 is the combined solution including GPS-only (currently the combination of the individual contributions CLK11 and CLK21);
- mountpoint EUREF02 is the combined solution including GPS & GLONASS (currently the combination of the individual contributions CLK11 and CLK21);
- mountpoint EUREF03 is the solution including GPS & GLONASS & Galileo IOV (not available yet);

Other mountpoints with individual solutions, e.g. mountpoint CLK41 as the individual GPS & GLONASS solution of BKG/CTU are still available as well.

Note that the correction streams given here are related to the antenna phase centre (APC) reference point because of in order to provide the necessary consistency between orbits and clocks required by the PPP procedure they will be used for.

Tools

One of the open source programs to analyze GNSS real-time data is [BNC](#), an NTRIP client for precise point positioning. For a complete list of various corrections you may go to [Broadcast Ephemeris Corrections](#) to see the details.

Performance

The accuracy of the IGS real-time clock corrections is well below 0.3 ns with respect to the IGS rapid clocks. Using the IGS real-time orbit and clock correctors in the PPP gives accuracies of a few decimeters after 20 to 30 minutes convergence time. Permanent positioning using the various individual and combined clock & orbit corrections can be found on the [real-time PPP monitoring](#) page. Tests showed that the coordinate differences between the two sets of coordinates using either the transformed orbits & clocks or using the original orbits & clocks and transforming the coordinates afterwards below one centimeter for the ETRS89 transformation (Söhne, 2010).

EPN Central Bureau - Royal Observatory of Belgium

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Feb 13, 2012



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