



EPND/CEGRN Analysis Hub

J. Zurutuza, A. Kenyeres, M. Ferianc, O. Khoda,
N. Dimitrov, L. Jivall, M. Flueraş, W. Shoene



Agenda

1. Introduction
2. EPND/CEGRN Analysis Hub:
 - level 1: General Information
 - level 2: AC-wise Information
3. Conclusions

Introduction

When we deal with GNSS solutions of different Agencies we need to be sure of:

- Were the solutions computed using the same (or similar) processing standards?
- Were the solutions correctly aligned to the reference frame? Is the correct equipment used (antennas)?
- Is the observation time span long enough to allow for computing velocities?
- How do we get a combined, harmonized and unique solution for all the provided data?

In principle, all the EUREF contributors follow very strict guidelines, so all the solutions can be stacked (variances of the different Analysis Centers (AC) solutions must be scaled). However, the different countries provide data covering different time spans and rates (daily/weekly).

All the solutions are treated as unique AC-wise solutions and only at the end, combine them.

In order to ease the sharing and validation of the different provided solutions, a new portal was created

<https://cegrn.org/TSeries/>

Introduction

The portal is open to any AC willing to validate its solutions (double check) and to share the data in larger networks, such as EPND/CEGRN.

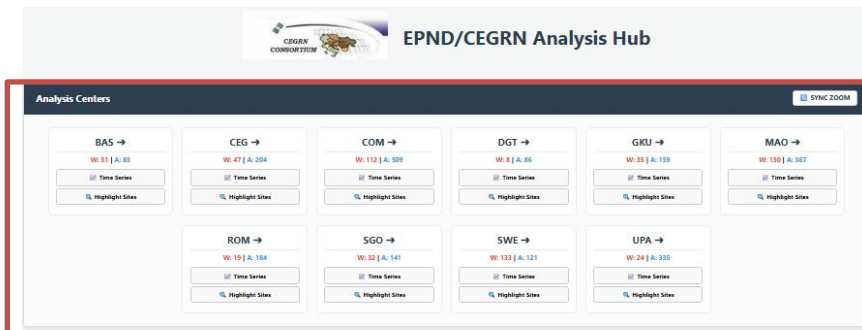
Privacy can be requested: if any AC wants to use the portal for validation of their results, a private area can be provided. Currently we have solutions providing data at different solution rates:

- **Daily:** BAS (Bulgaria), COM (Spain combined solution from IGE, ICC, ARA), DGT (Portugal), GKU (Slovakia), MAO (Ukraine), ROM (Romania), SGO (Hungary), SWE (Sweden)
- **Weekly:** UPA (Italy, University of Padua); [Latest: RDN (Italy)]
- **Random solution rates:** CEG (CEGRN repro3 RNX, 1 week/2 years, currently 2015 to 2023)

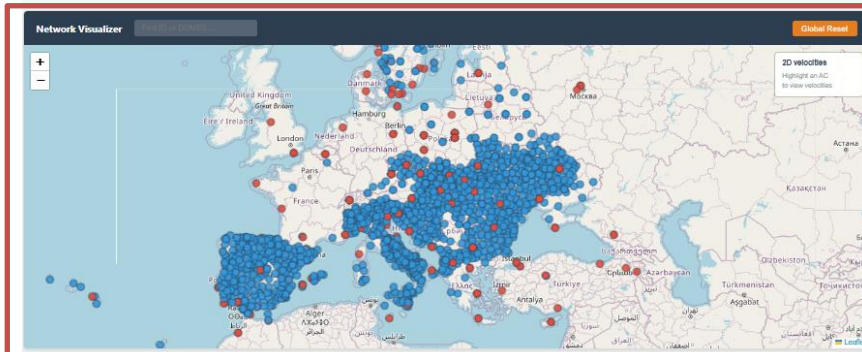
We are waiting for more datasets to come (NKG involved countries have already expressed their interest).

Idea behind the hub: we compute the solutions in parallel to the AC, discuss the results and agree the solutions. Then we proceed to the final stacking of all the available AC agreed solutions.

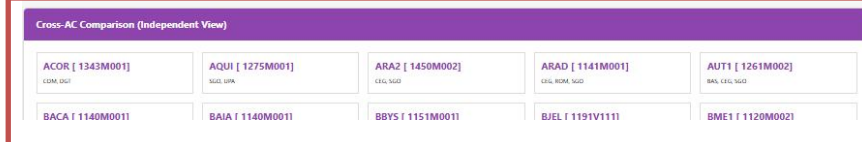
The EPND/CEGRN Analysis Hub (level 1: General Information)



AC-wise information

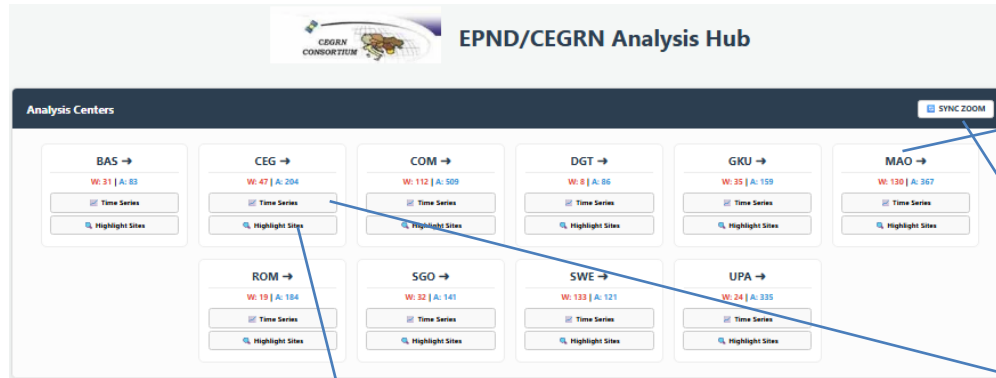


Map of available sites



Cross-AC Comparison (overlapping sites)

The EPND/CEGRN Analysis Hub (level 1: General Information)

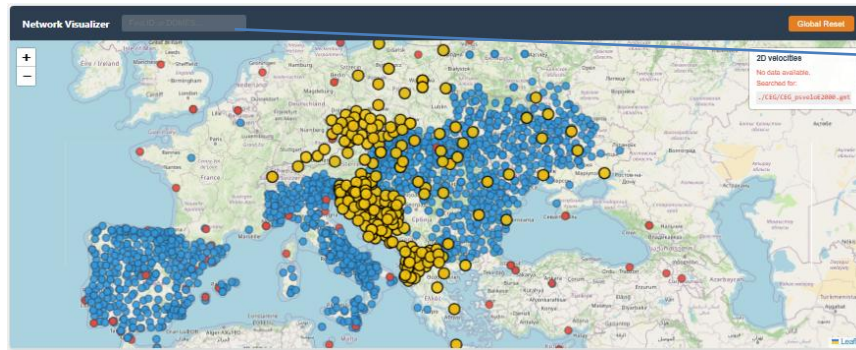


3CHARS: AC-dedicated portal (**opens new tab**)
(**W**: reference sites, IGS20; **A**: Adjusted sites)

“Sync ZOOM” all the plots with same time span and scale of the axis

“Time Series” opens the general time series plots (no detailed information)

“Highlight Sites”: Shows all the sites available for this AC



“Search tool”: DOMES, 4chars,...

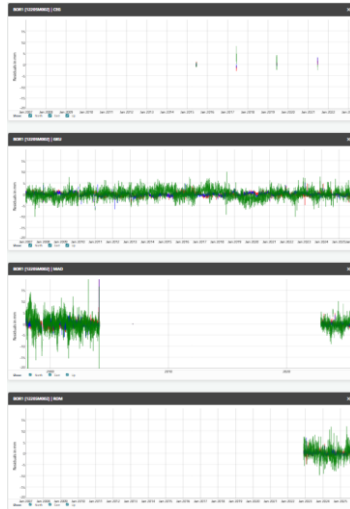
The CEGRN Collaborative Portal (level 1: General Information)

Cross-AC Comparison (Independent View)

ACOR [1343M001] CON DOT	AQUI [1275M001] SIO UPA	ARAZ [1450M002] CIS SIO	ARAD [1141M001] CIS ROM SIO	AUT1 [1261M002] BAG CIS SIO
BACA [1140M001] CIS MAC ROM SIO	BAIA [1140M001] CIS OIU MAC ROM SIO	BBYS [1151M001] CIS OIU MAC SIO	BJEL [1191V111] CIS SIO	BME1 [1120M002] CIS MAC SIO
BODO [1450M001] CIS SIO	BOGE [1220M004] CIS MAC	BOGI [1220M003] CIS MAC	BOGO [1220M002] CIS MAC	BOR1 [1220M002] CIS MAC ROM
BPD1 [1222M001] CIS MAC	BRTS [1480M001] MAC SIO	BRUX [1310M010] SIO SWE	BSVZ [1271M004] SIO UPA	BUCU [1140M001] BAG CIS MAC ROM SIO
BUTE [1120M001] CIS MAC SIO	BYDG [1222M001] CIS MAC	BZR2 [1275M003] MAC UPA	CACE [1150M001] CON VCU	CAHU [1510M001] MAC ROM
CAKO [1190M001] CIS SIO	CASC [1390S001] CON DOT	CAUE [1510M001] MAC ROM	CFRM [1152M001] CIS OIU	CHOD [1156M001] CIS OIU

Cross-AC: sites available in 1+ solution

Help



If we click on any box, we see general plots with basic information to check solutions, issues, tendencies,...

The following interactions are available on the plots: zoom in, zoom out, reset zoom (double-click), and pan/move to specific areas (Alt + left-click).

The CEGRN Collaborative Portal (level 1: General Information)

Zooming:

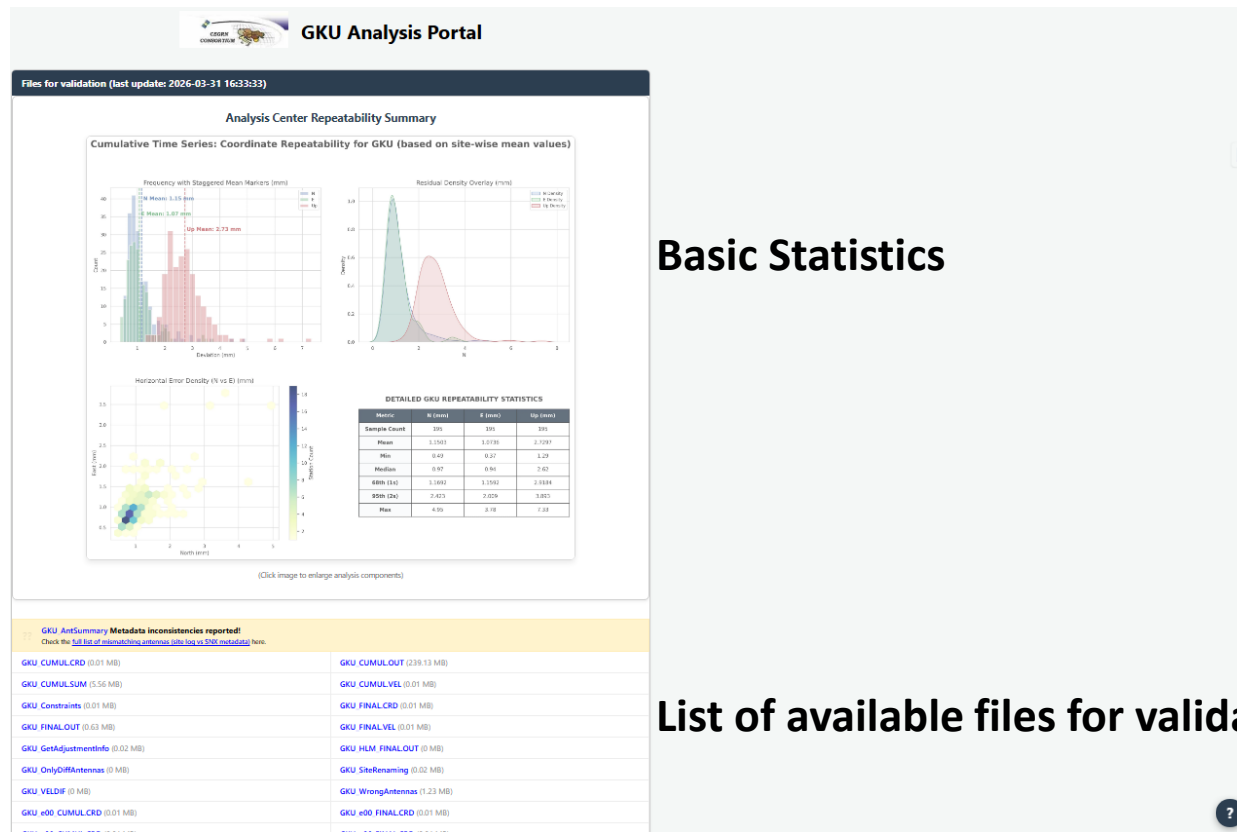


Click on:

The CEGRN Collaborative Portal (level 2: AC-wise Information)



Opens:

<https://cegrn.org/TSeries/GKU/>


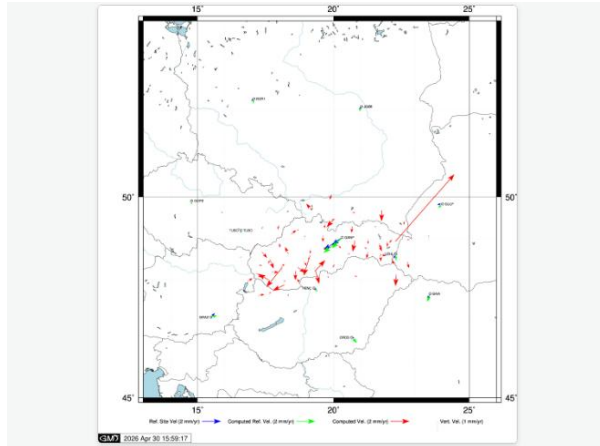
Basic Statistics

List of available files for validation



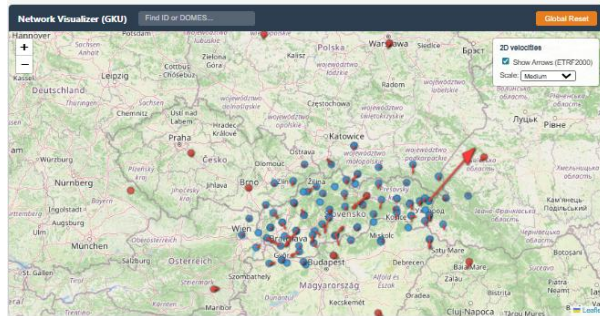
Help

The CEGRN Collaborative Portal (level 2: AC-wise Information)



Static Map: 3D Velocities (ETRF2000)

To avoid duplicated information: plot time length using colors



Dynamic Map with zoom capabilities (sites are selectable)

The CEGRN Collaborative Portal (level 2: AC-wise Information)

Station Grid (Detrended Time Series Frame: IGx20)

SYNC ZOOM

Select All

☐ BAJA	☐ BASV	☐ BBYS	☐ BDRV	☐ BOR1	☐ BREZ	☐ CFRM	☐ CHOD	☐ CKRO	☐ CSOR	☐ CVSE	☐ DOPL
☐ DVCN	☐ GAN1	☐ GANP	☐ GKU4	☐ GOPE	☐ GRAZ	☐ GYFC	☐ GYFH	☐ HUVO	☐ JABO	☐ JASL	☐ JOZ2
☐ JOZE	☐ KAME	☐ KOLS	☐ KOSE	☐ KRA1	☐ KRAW	☐ KROS	☐ KSED	☐ KUBI	☐ KUKE	☐ KUZA	☐ LIE1
☐ MAEG	☐ MISC	☐ MJOS	☐ MMIS	☐ MOP2	☐ MOPI	☐ MPER	☐ MSAT	☐ MSTB	☐ MTAT	☐ MUK2	☐ MVAS
☐ NSDL	☐ NTRA	☐ NWSC	☐ NWT1	☐ NWTG	☐ OROS	☐ PAR2	☐ PEMB	☐ PEN2	☐ PENC	☐ PRES	☐ PRSV
☐ RISA	☐ SALG	☐ SKDS	☐ SKGA	☐ SKLM	☐ SKLV	☐ SKMT	☐ SKNR	☐ SKNZ	☐ SKOL	☐ SKPB	☐ SKPU
☐ SKRS	☐ SKRV	☐ SKSE	☐ SKSK	☐ SKSL	☐ SKSO	☐ SKSV	☐ SKTN	☐ SKTV	☐ SKVK	☐ SKVT	☐ SKZV
☐ SPVL	☐ SULP	☐ TATA	☐ TELG	☐ TRCN	☐ TREB	☐ TUBO	☐ USDL	☐ UZHL	☐ UZNU	☐ VASA	☐ VEL5
☐ VOLO	☐ VRAN	☐ WIEN	☐ WTZR	☐ ZAKO	☐ ZELI	☐ ZVOL	☐ ZYWI				

Detected Antenna Changes

Select All

☐ BREZ	☐ DOPL	☐ GANP	☐ GRAZ	☐ KOLS	☐ KOSE	☐ LIE1	☐ NTRA	☐ OROS	☐ PRSV	☐ SKMT	☐ SKRV
☐ SKSE	☐ SKSK	☐ SKSL	☐ UZHL	☐ VEL5							

Time Series (SYNC ZOOM available)

Detected Antenna Changes (no discontinuity)

?

The CEGRN Collaborative Portal (level 2: AC-wise Information)

Examples of Inconsistency summaries (different antenna in site log vs SNX):

Summary of the antenna inconsistencies found (used vs site log)

CSOR 11214M001	ANTENNA TYPE: TRM41249.00	NONE -> LEIAT504GG	LEIS (source: csor00hun_20221012.log)
DOPL 11707M001	ANTENNA TYPE: TRM115000.00	NONE -> TRM115000.10	NONE (source: dopl00svk_20260123.log)
GYFC 11216M002	ANTENNA TYPE: TRM41249.00	NONE -> LEIAT504GG	LEIS (source: gyfc00hun_20220622.log)
MSTB 11065M001	ANTENNA TYPE: TRM41249.00	TZGD -> LEIAR25.R3	LEIT (source: mstb00aut_20250916.log)
NTRA 11573M002	ANTENNA TYPE: TRM115000.00	NONE -> TRM115000.10	NONE (source: ntra00svk_20260123.log)
NWSC 12231M001	ANTENNA TYPE: ASH701945B_M	SNOW -> ASH701945C_M	SNOW (source: nwsc00pol_20250416.log)
NWTG 12232M001	ANTENNA TYPE: TRM57971.00	TZGD -> TRM57971.00	TZGD (source: nwtg00pol_20250218.log)
PRSV 11713M001	ANTENNA TYPE: TRM115000.00	NONE -> TRM115000.10	NONE (source: prsv00svk_20260123.log)
SULP 12366M001	ANTENNA TYPE: TRM41249.00	NONE -> TPSCR.G5	TPSH (source: sulp00ukr_20250415.log)
TREB 00000M000	ANTENNA TYPE: TRM55971.00	NONE -> TPSCR.G3	CONE (source: treb00cze_20200219.log)
TREB 00000M000	ANTENNA TYPE: TRM55971.00	NONE -> TPSCR.G5	TPSH (source: treb00cze_20200219.log)

Antenna Offsets (igs20.atx file) in SNX format

*DESCRIPTION	S/N	L1->ARP(M)	L2->ARP(M)
ASH701945B_M	SNOW	----- 0.0890 0.0000 0.0000 0.1190 -.0000 0.0000	
ASH701945C_M	SNOW	----- 0.0890 0.0000 0.0000 0.1190 -.0000 0.0000	
LEIAR25.R3	LEIT	----- 0.1600 -.0000 0.0000 0.1570 -.0000 0.0000	
LEIAT504GG	LEIS	----- 0.0870 0.0000 0.0010 0.1170 0.0000 -.0000	
TPSCR.G5	TPSH	----- 0.0910 0.0000 0.0000 0.1170 0.0000 0.0000	
TRM115000.00	NONE	----- 0.0650 0.0000 0.0000 0.0570 0.0000 0.0000	
TRM115000.10	NONE	----- 0.0660 0.0000 0.0000 0.0570 0.0000 0.0000	
TRM41249.00	NONE	----- 0.0550 0.0000 0.0000 0.0580 0.0000 0.0000	
TRM41249.00	TZGD	----- 0.0550 0.0000 0.0000 0.0570 0.0000 0.0000	
TRM55971.00	NONE	----- 0.0640 0.0000 0.0000 0.0580 0.0000 0.0000	
TRM55971.00	TZGD	----- 0.0630 0.0010 0.0000 0.0560 0.0000 0.0000	
TRM57971.00	TZGD	----- 0.0640 0.0000 0.0000 0.0570 -.0000 0.0010	

**** WARNING ****

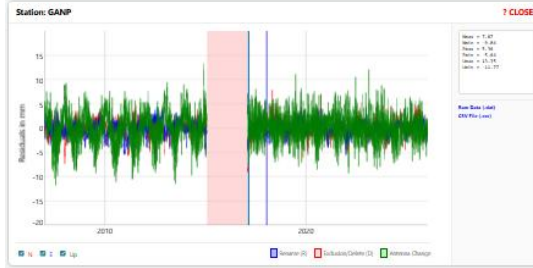
Found antennas with no calibration values in the igs20.atx file

TPSCR.G3 CONE

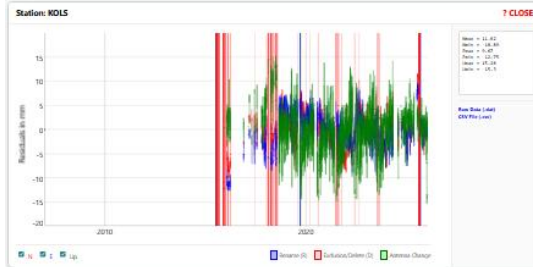
The CEGRN Collaborative Portal (level 2: AC-wise Information)



Discuss antenna changes and discontinuities



Discuss NOISY PERIODS



Remove outliers after discussion with AC

Conclusions

A new portal to share, distribute and validate GNSS cumulative solutions is presented.

The user experience, at both ends, has been very positive and the discussions were very fruitful (THANKS!)

It is very important that we can see, at a glance, all the solutions of all the sites computed by several ACs and isolate/detect problems (wrong equipment impact, noisy data, jumps,...).

At the data-provider level, all the BSW-style files (inputs, outputs, summaries,...) are provided so that the combination procedure is always clear and can be replicated by them.

More capabilities will be implemented according to the needs of the users.

Thank you to all the ACs that provided the data and tested the Portal for the feedback and suggestions.

Thanks!

Questions/Comments/Suggestions