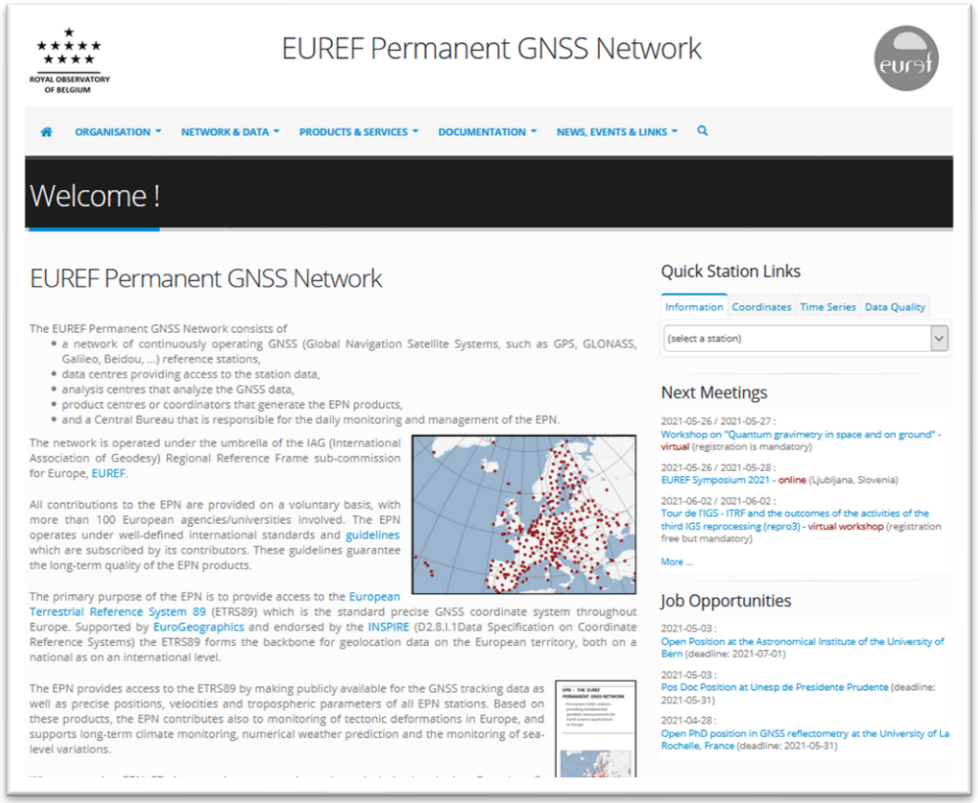
Status of the EUREF Permanent Network

Carine Bruyninx, J. Legrand, A. Fabian, A. Miglio, F. Bamahry

Royal Observatory of Belgium
EPN Central Bureau, https://epncb.oma.be/



Outline

- Status of EPN tracking network
- Changes at EPN Central Bureau
- Follow-up on EUREF resolutions
- General News

Changes in EPN station network since June 2022

405 EPN stations

28 new EPN stations

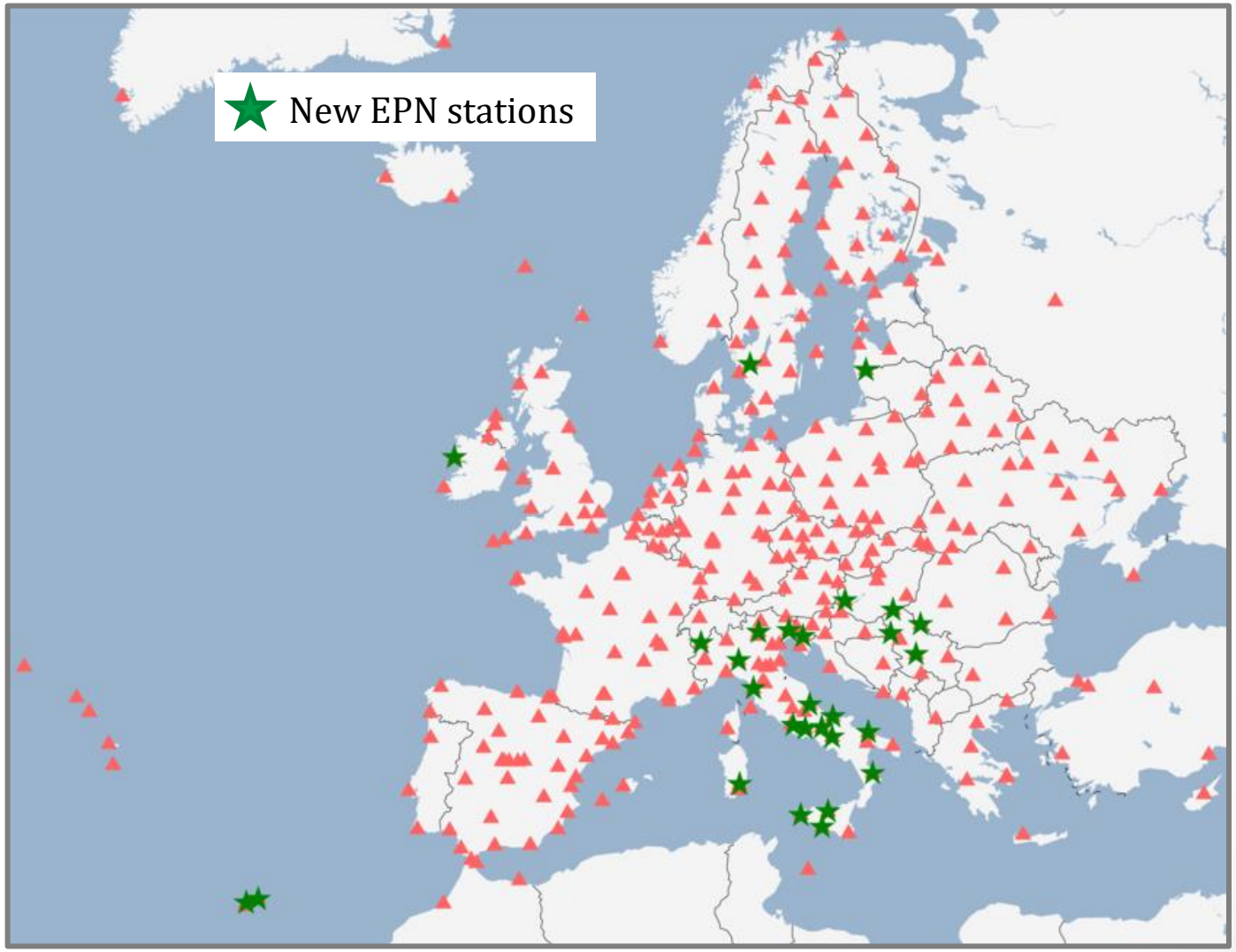
GPS GLO GAL BDS

AGRN00ITA, ASIR00ITA, BIRG00ITA, BSVZ00ITA,
ENZA00ITA, FRNE00ITA, GALH00ITA, GJML00SRB,
ISRN00ITA, LIGN00ITA, MAH100IRL, PLND00SRB,
PSTO00PRT, RIVO00ITA, SART00ITA, SID000SRB,
SNIK00ITA, SPT700SWE, STNB00PRT, SUBO00SRB,
SVLL00ITA, TEOS00ITA, TREU00ITA, TRMI00ITA,
UBEN00ITA, VAIN00LVA, VIRG00ITA, ZZON00HUN

GLO: 97% → 97%

GAL: 88% → 89%

BDS: 76% → 78%



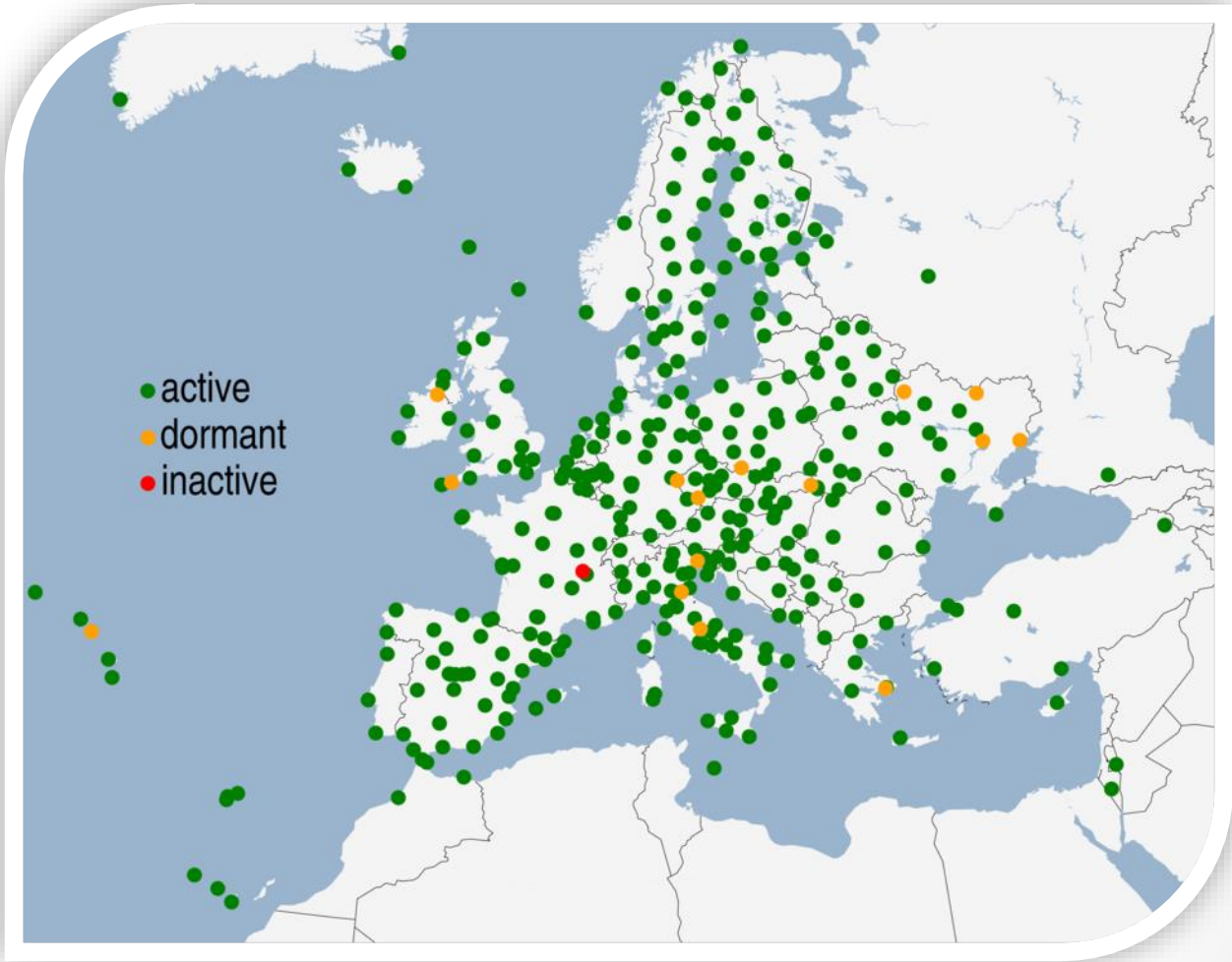
Status May 17, 2023

Commonly encountered problems

A lot of stations not providing recent data

- **405 EPN stations**
  - **dormant stations** (15)
    - No data in last 3 months
  - **Inactive stations** (1)
    - no receiver or antenna currently installed
- 76 former EPN stations

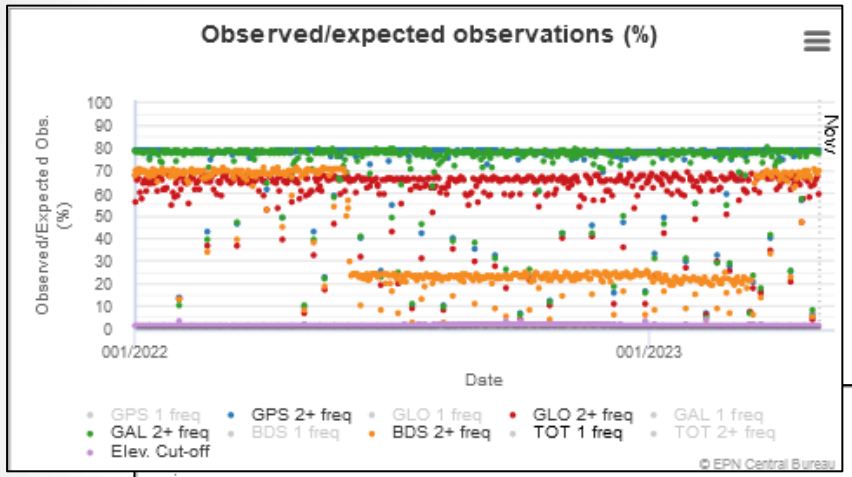
Total of 481 EPN stations to be included in EPN reprocessing

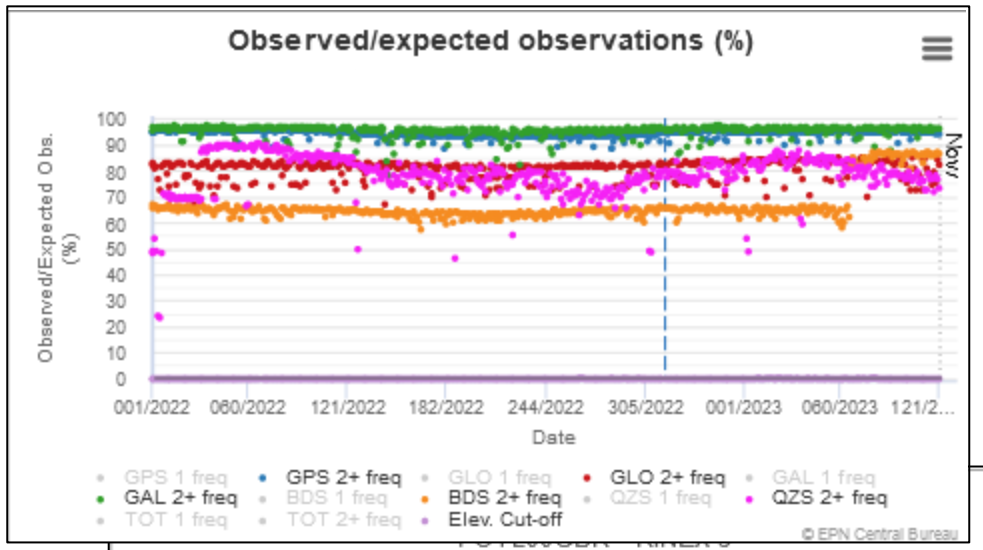


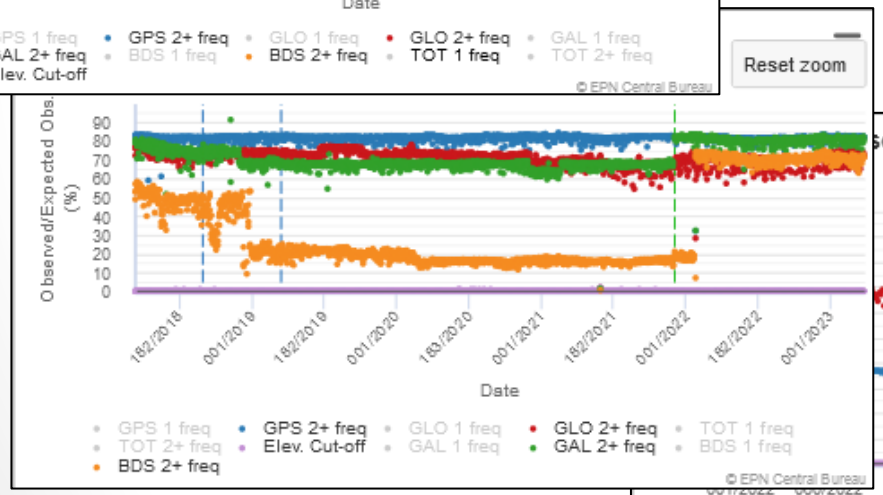
Status May 17, 2023

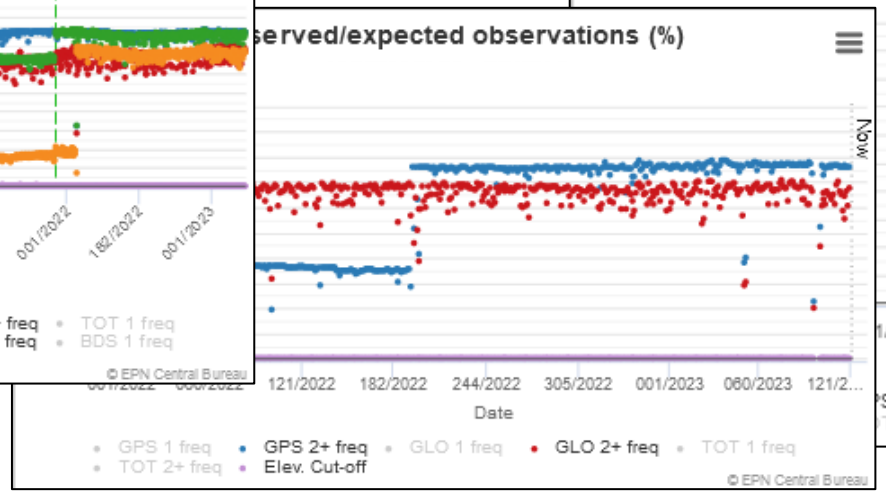
Commonly encountered problems

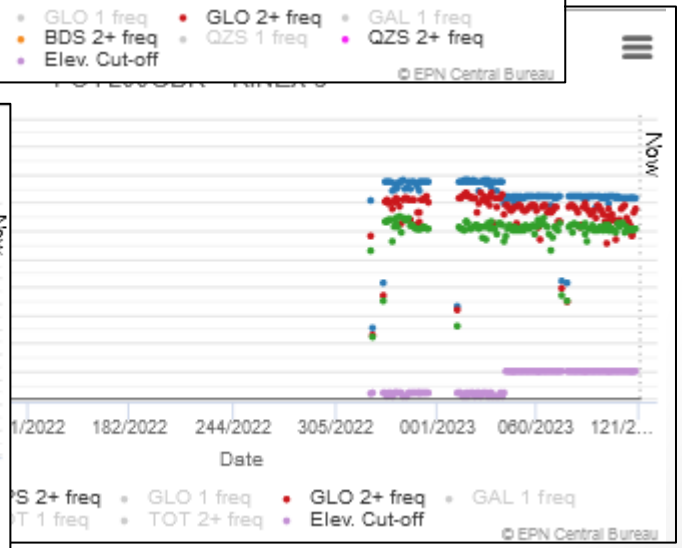
Changes at receiver not documented in site log







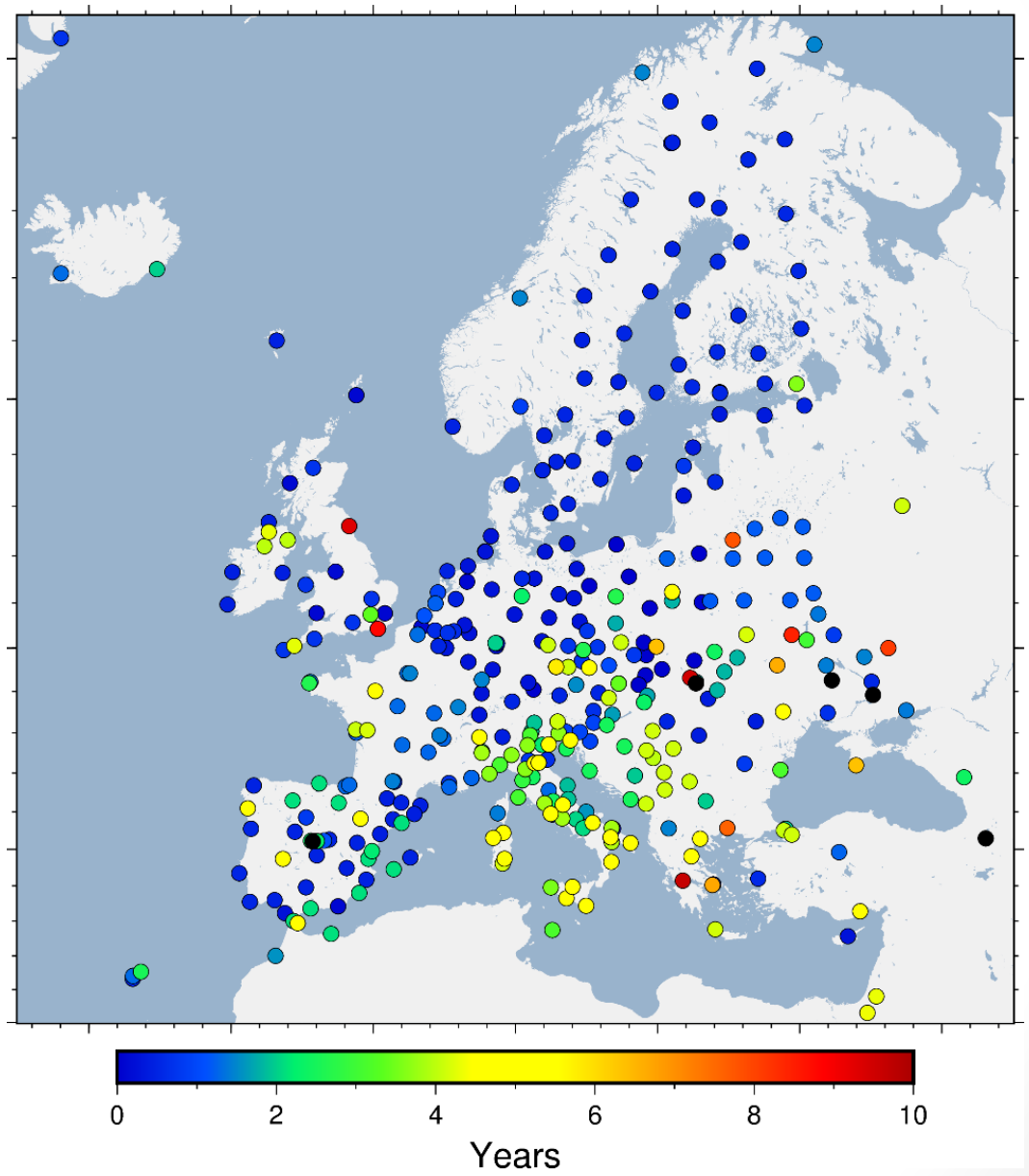




Commonly encountered problems

Number of years since last firmware/receiver update?

Only showing presently active EPN stations



Commonly encountered problems

Historical info lost when updating site log

```
3.14 Receiver Type            : SEPT POLARX4
     Satellite System         : GPS+GLO+GAL
     Serial Number            : 3009592
     Firmware Version         : 2.9.6
     Elevation Cutoff Setting : 0 deg
     Date Installed           : 2018-03-30T09:00Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)
```

Commonly encountered problems

Historical info lost when updating site log

```
3.14 Receiver Type            : SEPT POLARX4
     Satellite System         : GPS+GLO+GAL
     Serial Number            : 3009592
     Firmware Version         : 2.9.6
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     Date Installed           : 2018-03-30T09:00Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)
```
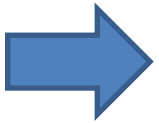
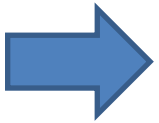



```
3.14 Receiver Type            : SEPT POLARX4
     Satellite System         : GPS+GLO+GAL
     Serial Number            : 3009592
     Firmware Version         : 2.9.6patch2
     Elevation Cutoff Setting : 0 deg
     Date Installed           : 2018-11-12T09:35Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)
```

Commonly encountered problems

Historical info lost when updating site log

```
3.14 Receiver Type            : SEPT POLARX4
     Satellite System         : GPS+GLO+GAL
     Serial Number            : 3009592
     Firmware Version         : 2.9.6
     Elevation Cutoff Setting : 0 deg
     Date Installed           : 2018-03-30T09:00Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)
```



```
3.14 Receiver Type            : SEPT POLARX4
     Satellite System         : GPS+GLO+GAL
     Serial Number            : 3009592
     Firmware Version         : 2.9.6patch2
     Elevation Cutoff Setting : 0 deg
     Date Installed           : 2018-11-12T09:35Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)
```

Commonly encountered problems

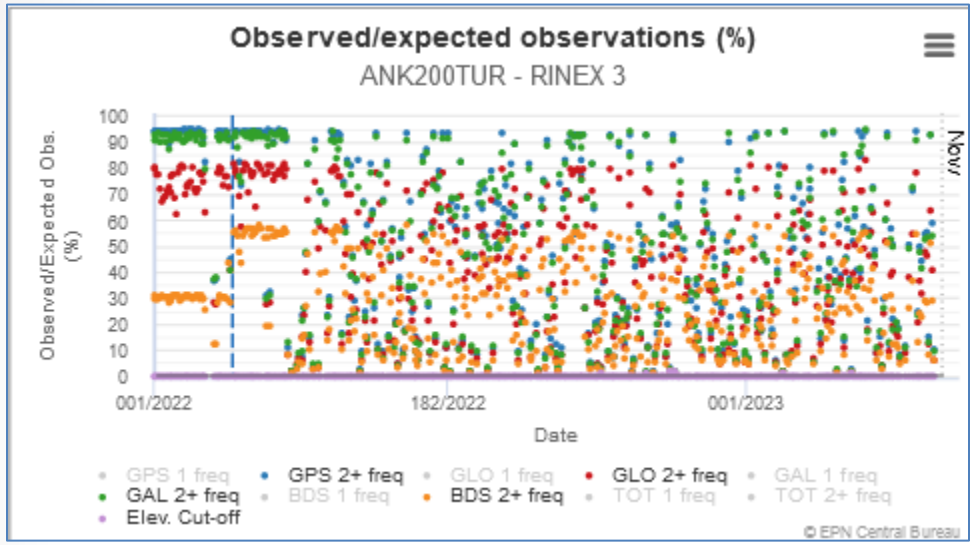
Historical info lost when updating site log

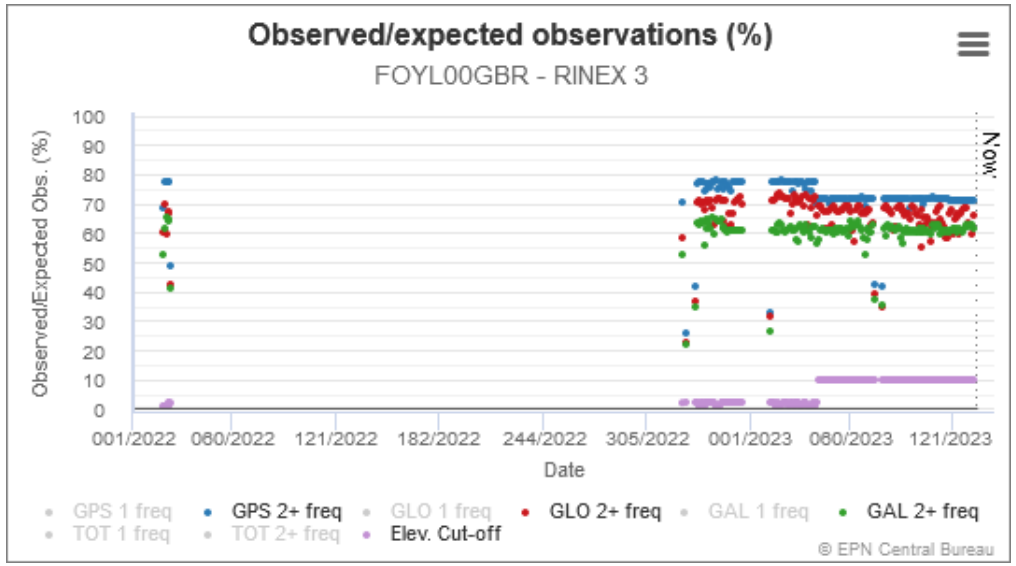
```
3.14 Receiver Type            : SEPT POLARX4
     Satellite System         : GPS+GLO+GAL
     Serial Number            : 3009592
     Firmware Version         : 2.9.6
     Elevation Cutoff Setting : 0 deg
     Date Installed           : 2018-03-30T09:00Z
     Date Removed             : 2018-11-12T09:30Z
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)


3.15 Receiver Type            : SEPT POLARX4
     Satellite System         : GPS+GLO+GAL
     Serial Number            : 3009592
     Firmware Version         : 2.9.6-patch2
     Elevation Cutoff Setting : 0 deg
     Date Installed           : 2018-11-12T09:35Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)
```

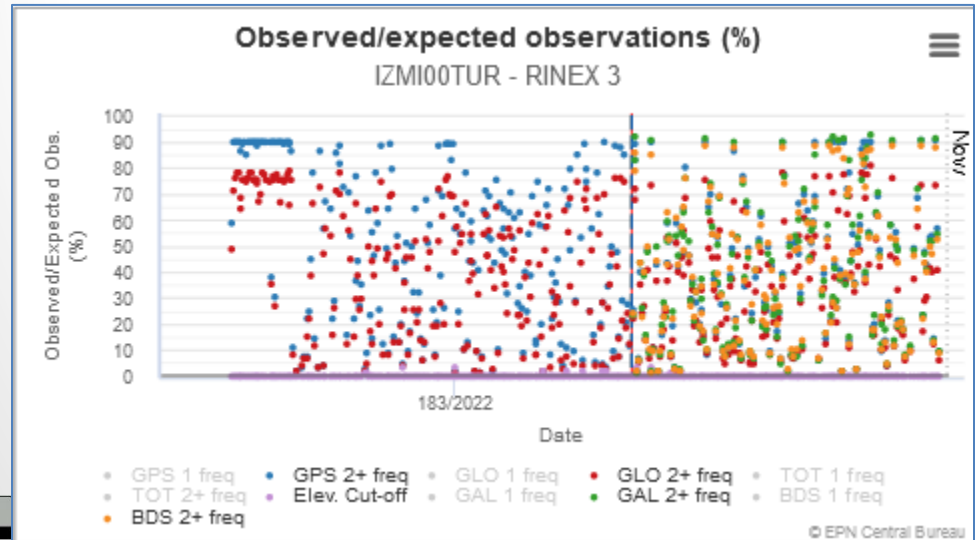
Keeping historical information is important for EPN reprocessing !

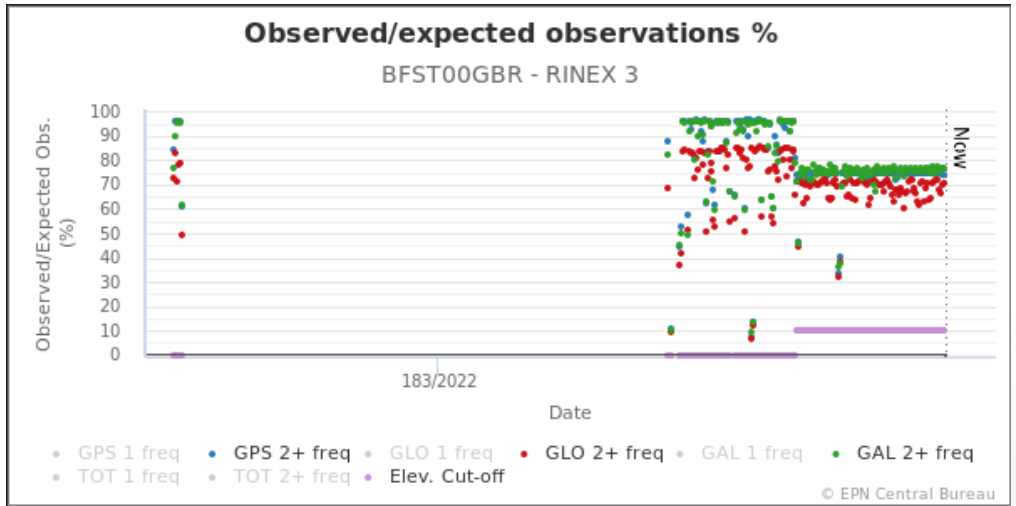
Commonly encountered problems

Tracking problems - Incorrect elevation cut off









Commonly encountered problems

SNR missing in RINEX files

10/05/2023: EUREF mail 11391 (https://epncb.oma.be/ftp/mail/EUREF/eurefmail.11391)

In 2002 (21 years ago): general request from IGS to add SNR in RINEX obs. files

```
C   20 C1X C2X C5X C6X C7X D1X D2X D5X D6X D7X L1X L2X L5X  SYS / # / OBS TYPES
       L6X L7X S1X S2X S5X S6X S7X                          SYS / # / OBS TYPES
E   16 C1X C5X C7X C8X D1X D5X D7X D8X L1X L5X L7X L8X S1X  SYS / # / OBS TYPES
       S5X S7X S8X                                          SYS / # / OBS TYPES
G   16 C1C C2W C2X C5X D1C D2W D2X D5X L1C L2W L2X L5X S1C  SYS / # / OBS TYPES
       S2W S2X S5X                                          SYS / # / OBS TYPES
J   20 C1C C1X C1Z C2X C5X D1C D1X D1Z D2X D5X L1C L1X L1Z  SYS / # / OBS TYPES
       L2X L5X S1C S1X S1Z S2X S5X                          SYS / # / OBS TYPES
R   16 C1C C1P C2C C2P D1C D1P D2C D2P L1C L1P L2C L2P S1C  SYS / # / OBS TYPES
       S1P S2C S2P
```

Today: SNR observables are missing in the RINEX files of 2% of the EPN stations

Outline

- Status of EPN tracking network
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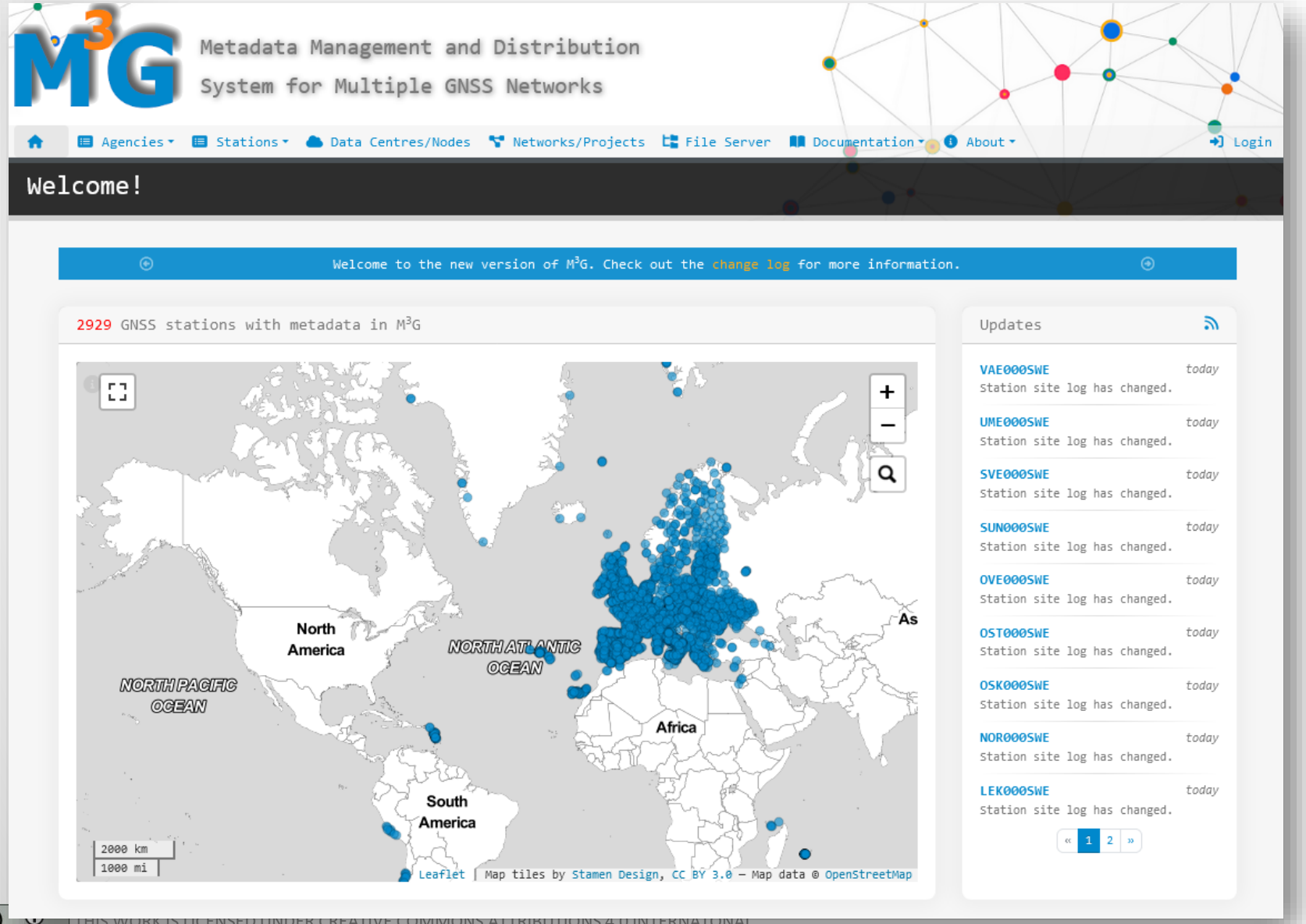
- General News

Update of M³G



NEW

V5.0 released on March 9, 2023

One year of development

Update announced through EUREF mail

https://gnss-metadata.eu/

Update of M³G

Extended "Edit all metadata" page

Home / ROB / Station Metadata

Edit all Station Metadata

9-CHAR ID	ALERT(S)	NETWORK(S)	STATUS	METADATA	LAST UPDATE OF SITE LOG	RESPONSIBLE AGENCY	DATA LICENSE	DATA EMBARGO PERIOD	DOI	STATION PICTURE(S)	UPDATE SITE LOG
(all)		(all)	(all)	(all)	(from-to)	(all)	(all)	(all)			
AARS00BEL	2	EPOS(P), FLEPOS	A	I	2022-10-05	DV	CC0 1.0	no embargo period	not set	0	
ANTW00BEL	2	EPOS(P), FLEPOS	D	I	2021-09-10	DV	CC0 1.0	no embargo period	not set	0	
ARLO00BEL	2	EPOS(P), WALCORS	A	I	2022-11-17	SPW	CC BY 4.0	no embargo period	not set	0	
ATWR00BEL	2	EPOS(P), FLEPOS	A	I	2022-10-05	DV	CC0 1.0	no embargo period	not set	0	
BATT00BEL	2	EPOS(P), WALCORS	A	I	2022-11-17	SPW	CC BY 4.0	no embargo period	not set	0	
BERL00BEL	2	EPOS(P), WALCORS	A	I	2022-11-17	SPW	CC BY 4.0	no embargo period	not set	0	
BERT00BEL	2	EPOS(P), FLEPOS	A	I	2022-09-13	DV	CC0 1.0	no embargo period	not set	0	
BEZA00BEL	2	EPOS(P), FLEPOS	A	I	2022-10-05	DV	CC0 1.0	no embargo period	not set	0	

Update of M³G

New alert messages

Home / ROB / Station Metadata

Edit all Station Metadata

9-CHAR ID	ALERT(S)	NETWORK(S)	STATUS	METADATA	LAST UPDATE OF SITE LOG	RESPONSIBLE AGENCY	DATA LICENSE	DATA EMBARGO PERIOD	DOI	STATION PICTURE(S)	UPDATE SITE LOG
(all)		(all)	(all)	(all)	(from-to)	(all)	(all)	(all)			
AARS00BEL	2	EPOS(P), FLEPOS	A	I	2022-10-05	DV	CC0 1.0	no embargo period	not set	0	
ANTW00BEL	2	EPOS(P), FLEPOS	D	I	2021-09-10	DV	CC0 1.0	no embargo period	not set	0	
ARLO00BEL	2	EPOS(P), WALCORS	A	I	2022-11-17	SPW	CC BY 4.0	no embargo period	not set	0	
ATWR00BEL	2	EPOS(P), FLEPOS	A	I	2022-10-05	DV	CC0 1.0	no embargo period	not set	0	

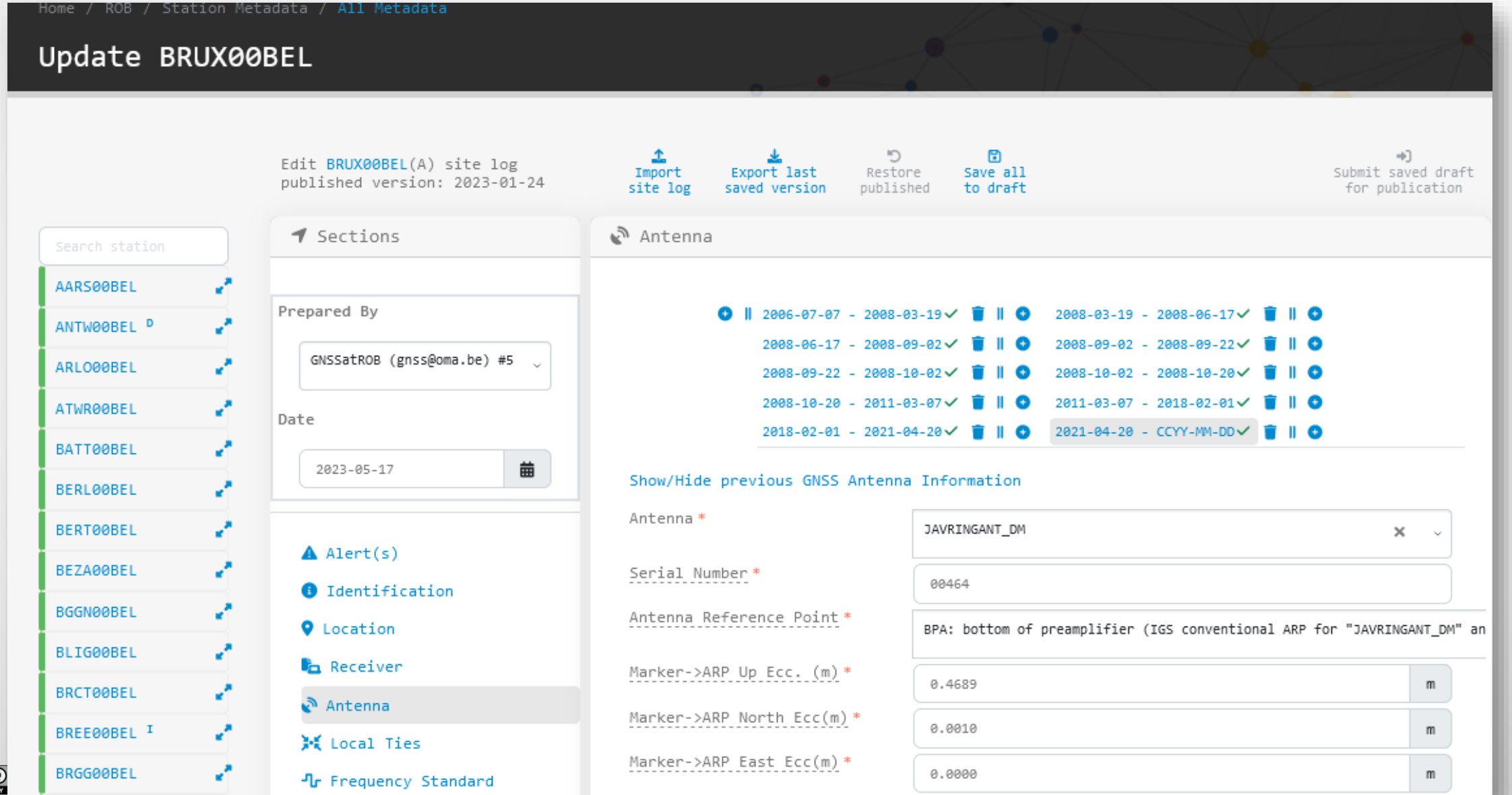
SITE PICTURE Missing site pictures: Upload pictures (Click on + in column STATION PICTURE(S)) of the antenna surroundings in the 4 cardinal directions at least.

DOI Missing DOI. It is recommended to insert in this table (column DOI) the Digital Object Identifier (DOI) of the station's RINEX data set.

ROYAL OBSERVATORY OF BELGIUM

Update of M³G

Updated layout for site log editor



Update of M³G

GDPR-related changes

Already announced at previous symposium, but now in use

M³G version 5.0 released in March 2023

- Site Log Section 0 → no personal contact information allowed
- Site Log Section 11, 12 → primary contact: no personal contact information allowed
- Not only because of GDPR, but also because contact info is easier to maintain

Possible to register multiple central personal contacts

Impossible to update site logs if your agency has not set up at least one public central email

Still 179 EPN site logs that are not OK!

```
 BRUX00BEL Site Information Form (site log)
     International GNSS Service
     See Instructions at:

https://files.igscb.org/pub/station/general/sitelog_instr.txt

0.   Form

     Prepared by (full name)  : GNSS team (gnss@oma.be)
     Date Prepared            : 2022-04-05
     Report Type              : UPDATE
     If Update:
      Previous Site Log       : brux00bel_20210420.log
      Modified/Added Sections : 6.11, 6.12, 11
```

```
11.  On-Site, Point of Contact Agency Information

     Agency                   : Royal Observatory of Belgium
     Preferred Abbreviation   : ROB
     Mailing Address          : Av. Circulaire 3
                              : 1180 Brussels
                              : Belgium
     Primary Contact
       Contact Name           : GNSSatROB
       Telephone (primary)    :
       Telephone (secondary)  :
       Fax                    :
       E-mail                 : gnss@oma.be
```

(Upcoming) Changes to EPN CB web and ftp portal

Monitoring availability of products

Taking new long product names into account

https://epncb.oma.be/ftp/product/availability/CHECK_DAILY_BKG_2023.SNXX

```
*********  A  B  B  B  C  G  I  I  L  M  N  R  R  S  S  U  W    E
BKG SNX    S  E  E  K  O  F  G  G  P  U  K  G  O  G  U  P  U    U
*********  I  K  V  G  D  Z  E  N  T  T  G  A  B  O  T  A  T    R
R = RAPID; F = FINAL
0 = 0-6days; 1 = 7-13days; 2 = 14-20days; 3 = 21-27days...
******************** Last Update : 12-MAY-23 10:40 (DOY 132)
2261-0 -  R0 R0  . R0  .  . R0 R0 R0 R0 R0  . R0  . R0 R0 R0    R0
2260-6 -  R0 R0  . R0  .  . R0 R0 R0 R0 R0  . R0  . R0 R0 R0    R0
2260-5 -  R0 R0  . R0  .  . R0 R0 R0 R0 R0  . R0  . R0 R0 R0    R0
2260-4 -  R0 R0  . R0  .  . R0 R0 R0 R0 R0  . R0  . R0 R0 R0    R0
2260-3 -  R0 R0  . R0  .  . R0 R0 R0 R0 R0  . R0  . R0 R0 R0    R0
2260-2 -  R0 R0  . R0  .  . R0 R0 R0 R0 R0  . R0  . R0 R0 R0    R0
2260-1 -  R0 R0  . R0  .  . R0 R0 R0 R1 R0  . R0  . R0 R0 R0    R0
2260-0 -  R0 R0  . R0  .  . R0 R0 R0 R1 R0  . R0  . R0 R0 R0    R0
2259-6 -  R0 F1  . R0 F1  . R0 R0 F1 R0 F1  . F1  . R0 R0 R0    R0
2259-5 -  R0 R0  . R0 F1  . R0 R0 F1 R1 F1  . F1  . R0 R0 R0    R0
2259-4 -  R0 R0  . R0 F2  . R0 R0 F1 R1 F1  . F1  . R0 R0 R0    R0
2259-3 -  R0 R0  . R0 F2  . R0 R0 F1 R1 F1  . F1  . R0 R0 R0    R0
2259-2 -  R0 R0  . R0 F2  . R0 R0 F1 R1 F1  . F1  . R0 R0 R0    R0
2259-1 -  R0 R0  . R0 F2  . R0 R0 F2 R1 F2  . F2  . R0 R0 R0    R0
2259-0 -  R0 R0  . R0 F2  . R0  . F2 R1 F2  . F2  . R0 R0 R0    R0
2258-6 -  F2 F2 F1 R0 F1  . F2 R0 F1 F2 F1  . F1  . R0 F2 R0    R0
2258-5 -  F2  . F1 R0 F2  . F2 R0 F1 F2 F1  . F1  . R0 F2 R0    R0
2258-4 -  F2  . F1 R0 F2  . F2 R0 F1 F2 F2  . F1  . R0 F2 R0    R0
2258-3 -  F2  . F1 R0 F2  . F2 R0 F1 F2 F2  . F1  . R0 F2 R0    R0
2258-2 -  F2  . F2 R0 F2  . F3 R0 F2 F2 F2  . F2  . R0 F2 R0    R0
2258-1 -  F3  . F2 R0 F2  . F3 R0 F2 F3 F2  . F2  . R0 F2 R0    R0
2258-0 -  F3  . F2 R0 F2  . F3 R0 F2 F3 F2  . F2  . R0 F3 R0    R0
2257-6 -  F2 F2 F2 R0 F1  . F2 R0 F0 F3 F1  . F1  . R0 F2 R0    R0
2257-5 -  F2  . F2 R0 F2  . F2 R0 F1 F3 F1  . F1  . R0 F2 R0    R0
2257-4 -  F2  . F2 R0 F2  . F2 R0 F1 F3 F1  . F1  . R0 F2 R0    R0
2257-3 -  F2 R1 F2 R0 F2  . F3 R0 F1 F3 F1  . F2  .  . F2 R0    R0
2257-2 -  F3 R0 F3 R0 F2  . F3 R0 F1 F4 F1  . F2  .  . F2 R0    R0
2257-1 -  F3 R0 F3 R0 F2  . F3 R0 F1 F4 F2  . F2  . R0 F2 R0    R0
2257-0 -  F3 R0 F3 R0 F2  . F3 R0 F1 F4 F2  . F2  . R0 F3 R0    R0
```

(Upcoming) Changes to EPN CB web and ftp portal

Dedicated metadata files for EPN REPRO3

EPN 3rd reprocessing will start soon

Need to have ATX and site log information that does not change during the reprocessing

→ to avoid coordinate jumps caused by ATX and changes of historical content in site logs

Snapshot taken on May 11, 2023 NEW

- ✓ ATX files: https://epncb.oma.be/ftp/station/general/epnc_20_r3.atx
  https://epncb.oma.be/ftp/station/general/epn_20_r3.atx
- ✓ Site log files: https://epncb.oma.be/ftp/station/log_9char_R3
- ✓ Bernese "STA file": https://epncb.oma.be/ftp/station/general/EUREF54_R3.STA

(Upcoming) Changes to EPN CB web and ftp portal

Replacement of files on ftp by API

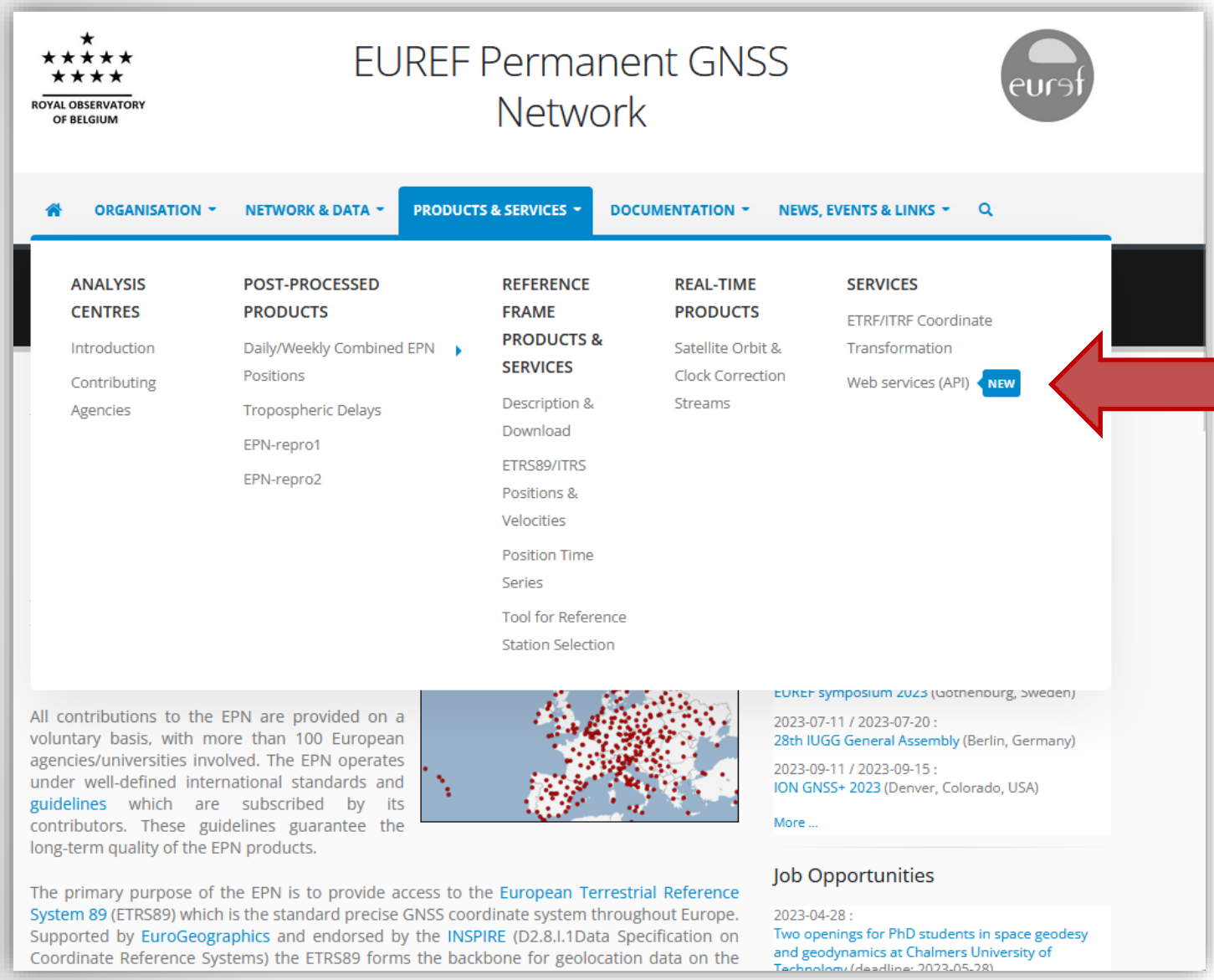
```
********************************************************************************
EPN LAC Electronic Mail      02-May-2023 13:55:08 UTC      Message Number 2904
********************************************************************************

Author: EPN CB/C. Bruyninx
Subject: Removal of station exclusion lists from EPN CB server

Dear colleagues,

On July 01, 2023, the EPN Central Bureau will remove (from its FTP server) the
directory https://epncb.oma.be/ftp/station/general/excluded/ containing the
files excluded.WWWW (weekly station exclusion lists) and excluded.WWWWD (daily
station exclusion lists).

The information given by these files will still be available using the API
https://epncb.oma.be/api/production/ExcludedStations/ which is also usable from
the following Swagger tool https://epncb.oma.be/api/.

By doing so, the station exclusion lists will be generated dynamically taking
the most recent EPN information, also for historical data, into account.

Please adapt your procedures and scripts accordingly.

Best regards,

Dominique and Carine
EUREF Permanent Network (EPN) Central Bureau
Royal Observatory of Belgium
https://epncb.oma.be/
epncb@oma.be

EPN LAC Mailing list maintained by the EPN Central Bureau (epncb@oma.be)
```

Static list of stations to be excluded
excluded.wwww
excluded.wwwwd

API currently under test by EPN AC

More info: .....

(Upcoming) Changes to EPN CB web and ftp portal



API documentation NEW

Presently 2 APIs :

- Stations with configuration changes
- Stations to be included in EPN AC processing

- Several other API under internal testing

(Upcoming) Changes to EPN CB web and ftp portal

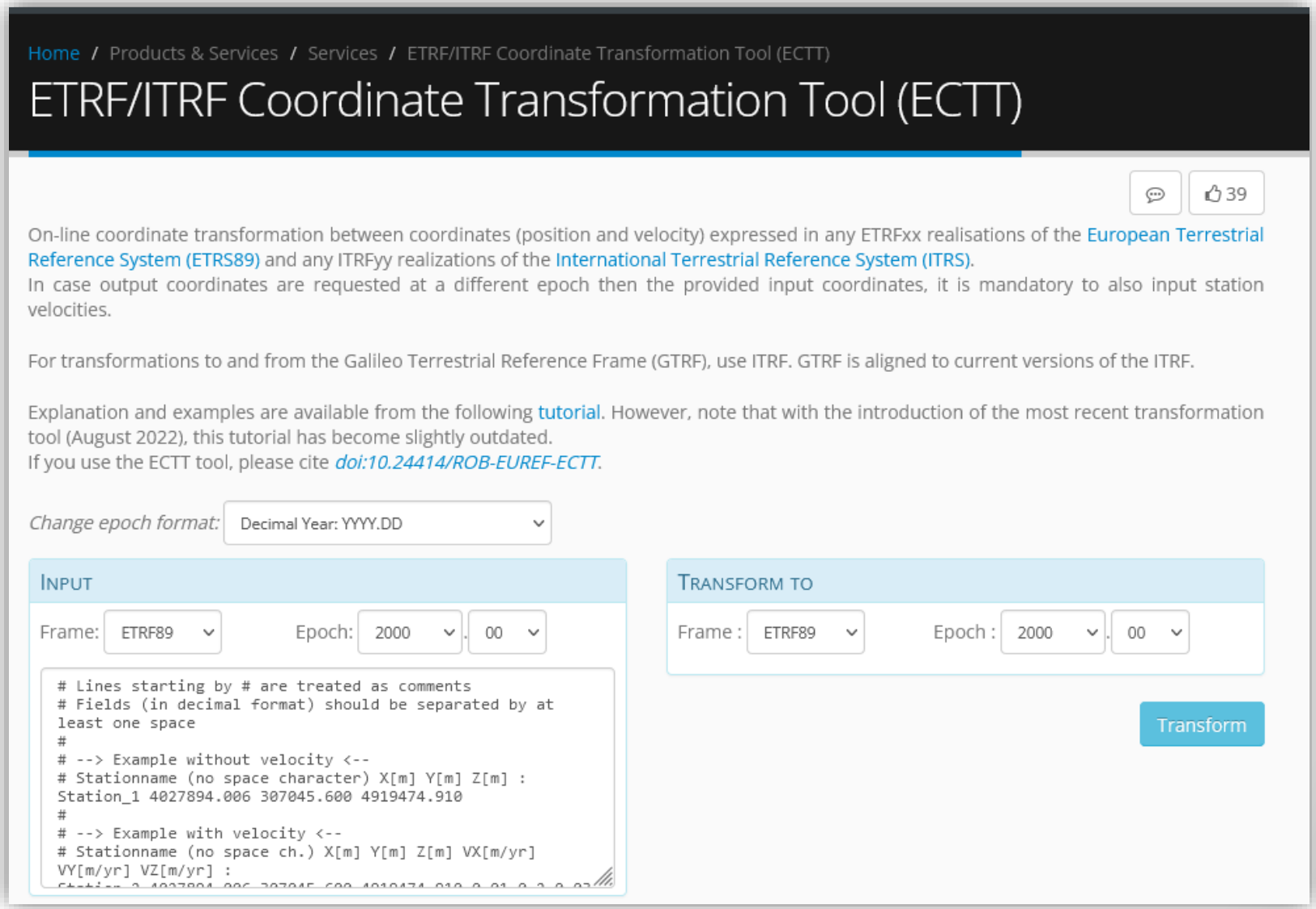
ECTT V2.0

https://epncb.oma.be/_productsservices/coord_trans/

29 Aug. 2022:

Release of V2.0 of on-line ETRF/ITRF Coordinate Transformation Tool (ECTT) including transformations from and to ITRF2020

+ API



(Upcoming) Changes to EPN CB web and ftp portal

Discontinuation of http (fall 2023)

http://epncb.oma.be → https://epncb.oma.be

- Automatic redirection from web browsers
- API → no automatic adjustment

Outline

- Status of EPN tracking network
- Changes at EPN Central Bureau
- Follow-up on EUREF resolutions
- General News

Follow up on EUREF resolutions: EPOS

Encourage contribution to the European Plate Observing System

Tallinn, 22-24/05/2019

Resolution No. 2.

The IAG Reference Frame Sub-commission for Europe (EUREF)

recognising that that the European Plate Observing System (EPOS) will maintain a sustainable European infrastructure for solid Earth studies from 2020 onwards, including a GNSS infrastructure and related GNSS-based products

and noting the efforts of the EUREF community towards the derivation of a European deformation model in order to improve cross-boundary positioning

and considering that many European countries active in EUREF are a member (or planning to become a member) of the EPOS European Research Infrastructure Consortium (ERIC)

encourages the EUREF community to also contribute to EPOS especially to its GNSS component

Follow up on EUREF resolutions: EPOS

Encourage contribution to the European Plate Observing System

EPOS EUROPEANPLATEOBSERVINGSYSTEM

Memorandum of Understanding

between

The European Plate Observing System European Research Infrastructures Consortium (hereinafter referred to as "EPOS ERIC"), established by Commission Implementing Decision (EU) 2018/1732 of 30 October 2018 (Official Journal of the European Journal, L288/10), having its headquarter and statutory seat at Via di Vigna Murata, 605 - 00143 Rome, Italy which is represented for the purpose of signature of this Memorandum of Understanding by its Executive Director

on the one hand,

and

The Reference Frame Sub-commission 1.3a for Europe of the International Association of Geodesy (IAG), (hereinafter referred to as "EUREF"), established in 1988, which is represented for the purpose of signature of this Memorandum of Understanding by its Chairperson

on the other hand.

EPOS ERIC and EUREF (hereinafter referred to individually as 'the Party" or collectively as "the Parties") have expressed their mutual desire to co-operate on a range of issues in the field of Solid Earth science and on the implementation of the activities specified in this Memorandum of Understanding (hereinafter referred to as "MoU").

EPOS-EUREF MoU signed on12/09/2022

Date and signatures

EPOS ERIC The Executive Director

Firmato digitalmente da Carmela Freda
Data: 2022.07.01 19:31:23 +02'00'

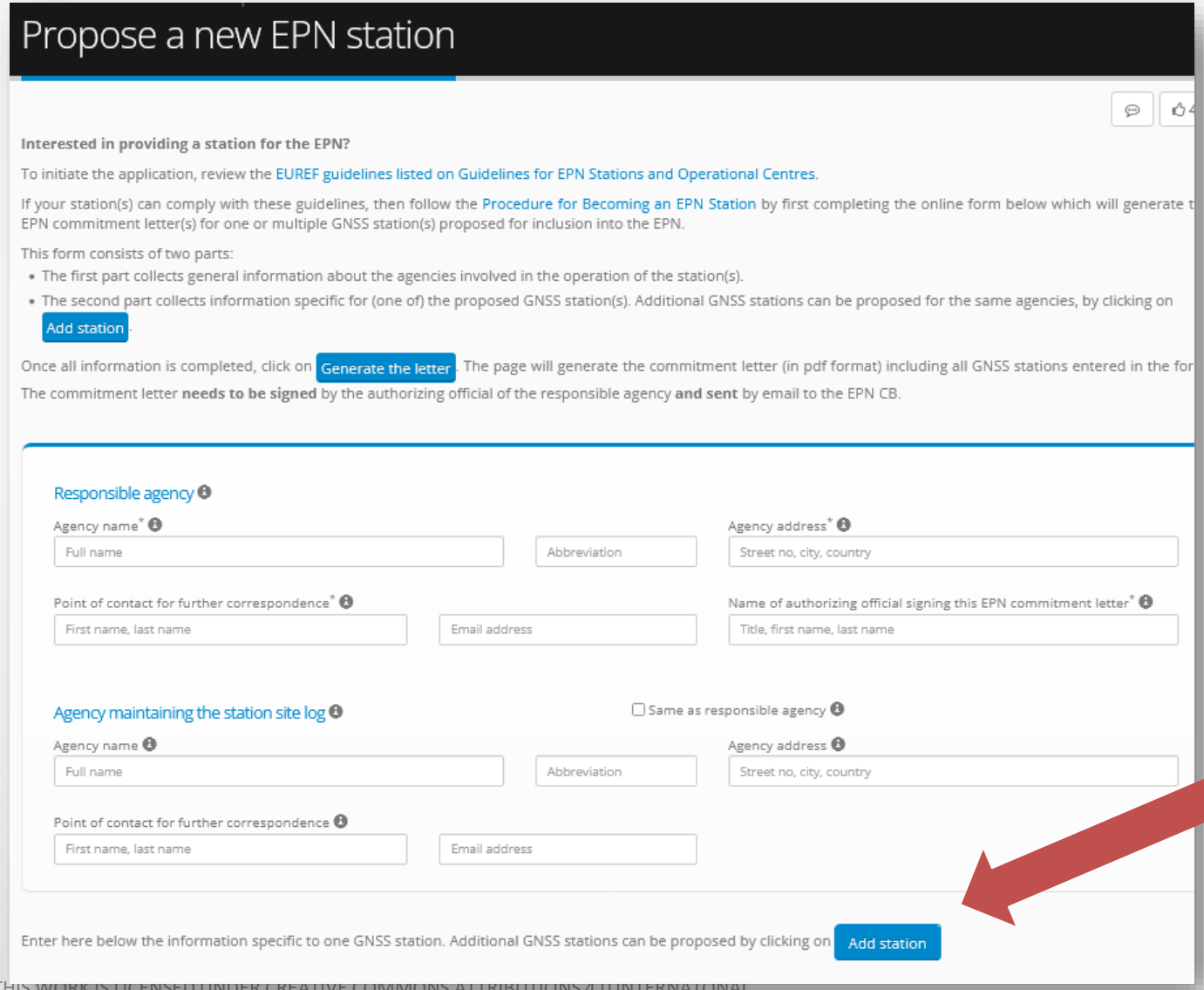
For and on behalf of EPOS ERIC **Date**

Dr Martin Lidberg, Chairman of EUREF. Gävle 2022-09-12

For and on behalf of EUREF **Date**

Follow up on EUREF resolutions: EPOS

New on-line form to create commitment letter for new EPN stations



Propose a new EPN station

Interested in providing a station for the EPN?

To initiate the application, review the EUREF guidelines listed on Guidelines for EPN Stations and Operational Centres.

If your station(s) can comply with these guidelines, then follow the Procedure for Becoming an EPN Station by first completing the online form below which will generate t
EPN commitment letter(s) for one or multiple GNSS station(s) proposed for inclusion into the EPN.

This form consists of two parts:

- The first part collects general information about the agencies involved in the operation of the station(s).
- The second part collects information specific for (one of) the proposed GNSS station(s). Additional GNSS stations can be proposed for the same agencies, by clicking on Add station.

Once all information is completed, click on Generate the letter. The page will generate the commitment letter (in pdf format) including all GNSS stations entered in the for
The commitment letter **needs to be signed** by the authorizing official of the responsible agency **and sent** by email to the EPN CB.

Responsible agency

Agency name* — Full name | Abbreviation

Agency address* — Street no, city, country

Point of contact for further correspondence* — First name, last name | Email address

Name of authorizing official signing this EPN commitment letter* — Title, first name, last name

Agency maintaining the station site log — Same as responsible agency

Agency name — Full name | Abbreviation

Agency address — Street no, city, country

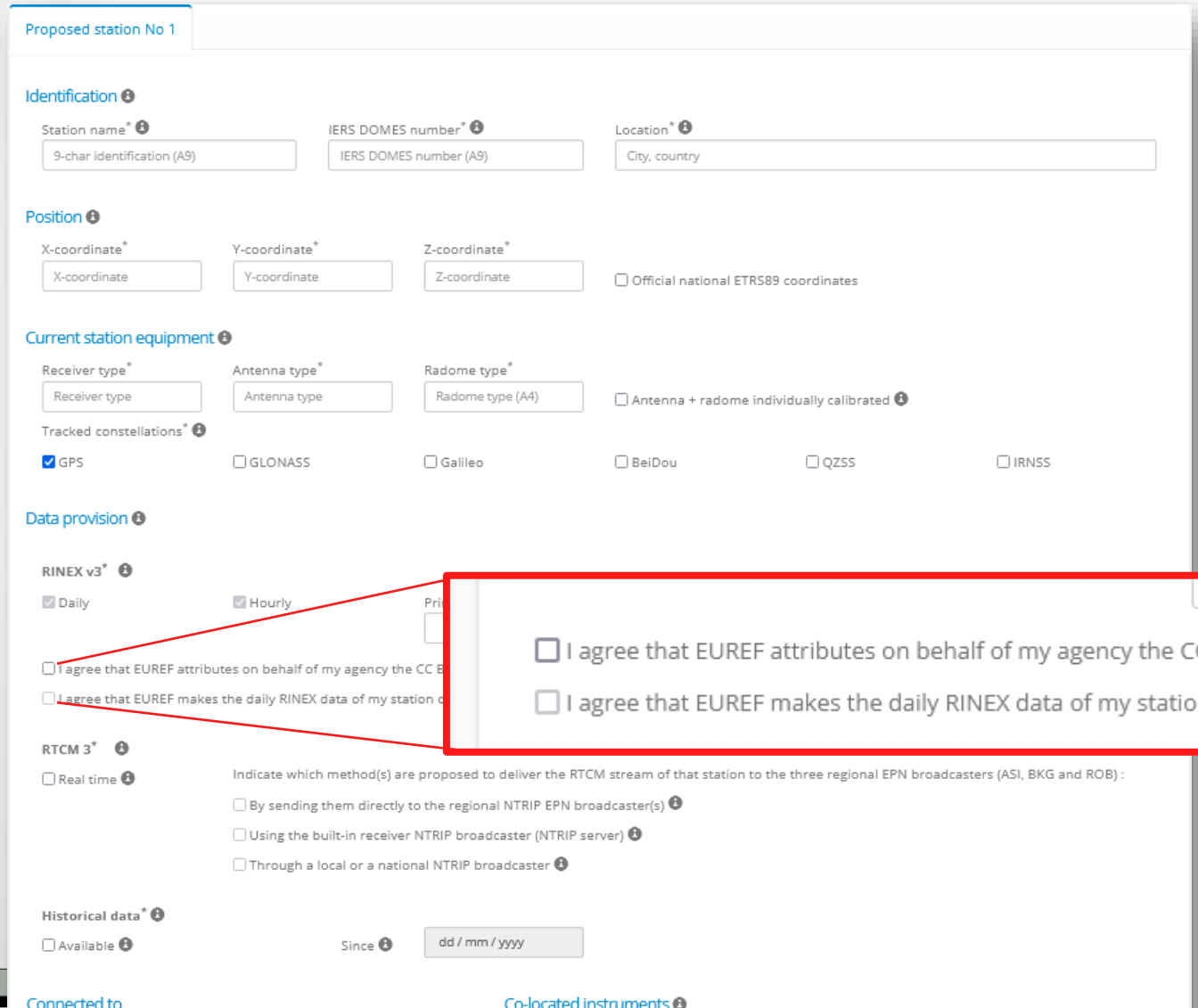
Point of contact for further correspondence — First name, last name | Email address

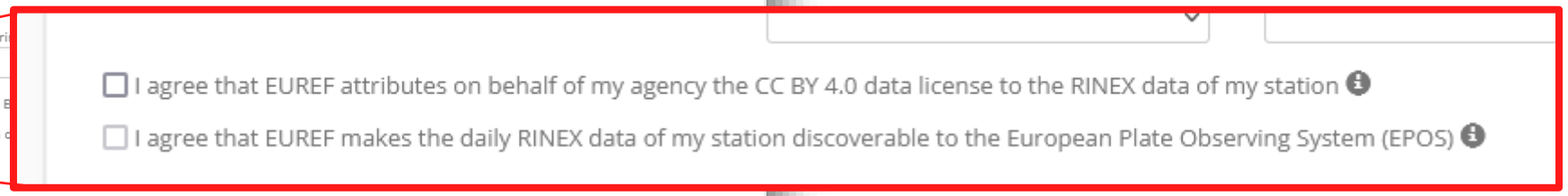
Enter here below the information specific to one GNSS station. Additional GNSS stations can be proposed by clicking on Add station

ROYAL OBSERVATORY OF BELGIUM

Follow up on EUREF resolutions: EPOS

New on-line form to create commitment letter for new EPN stations



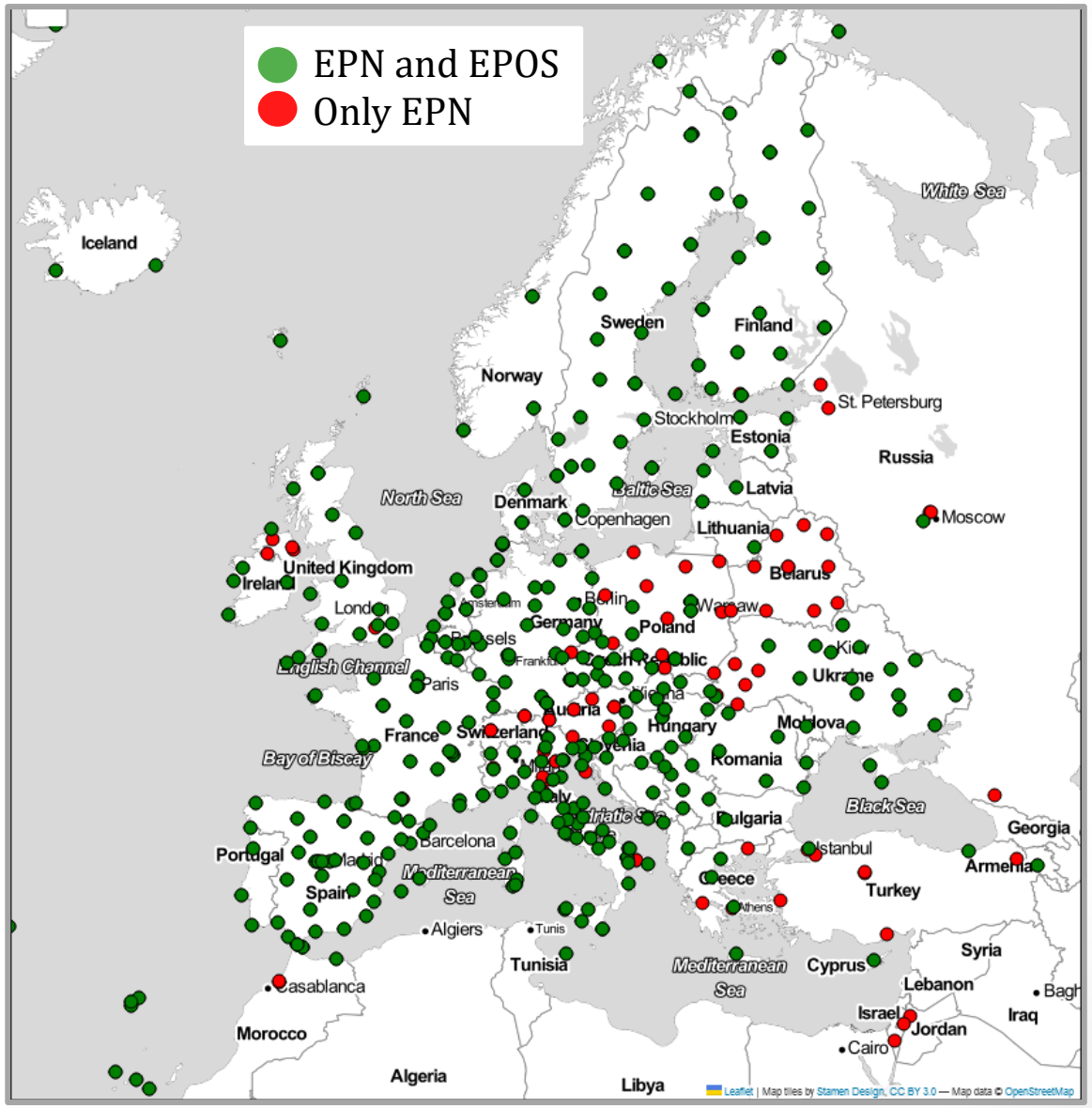


After saving, pdf letter is created, ready to be signed

Follow up on EUREF resolutions: EPOS

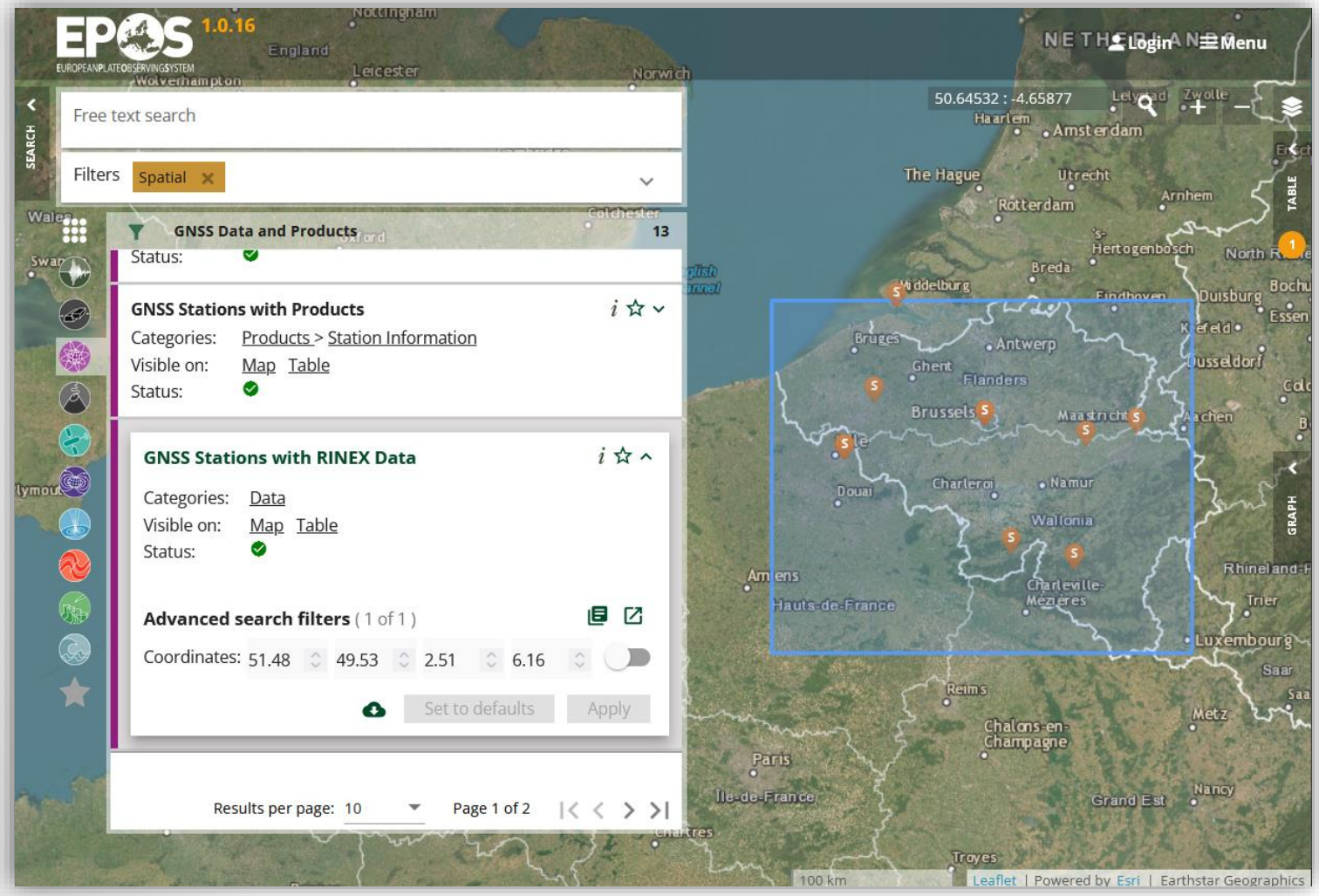
EPN stations in EPOS

81% of EPN stations in EPOS



Follow up on EUREF resolutions: EPOS

EPN data providers at EPOS data portal

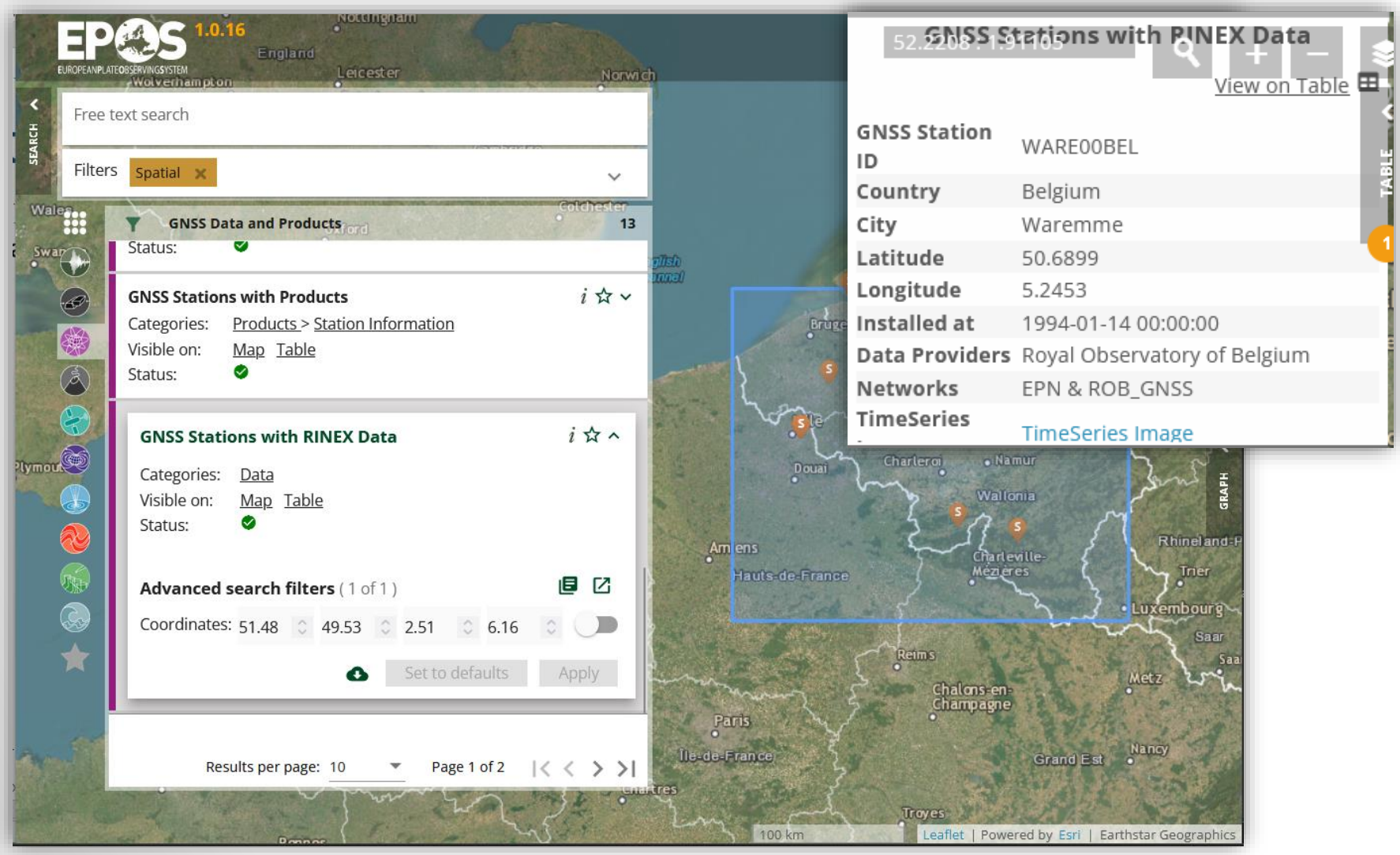


https://www.ics-c.epos-eu.org/

Opened officially during EGU meeting (April 2023)

Follow up on EUREF resolutions: EPOS

EPN data providers at EPOS data portal site



Follow up on EUREF resolutions: FAIR

Encourage adoption of FAIR data principles

Ljubljana, 26-28/05/2021

Resolution No. 2.

The IAG Reference Frame Sub-commission for Europe (EUREF)

considering that major funding bodies, including the European Commission, promote and require the implementation of FAIR (Findable, Accessible, Interoperable, and Reusable) data principles

and recognising that FAIR data principles increase the value and the reuse of digital resources, by humans as well as machines

encourages the EUREF community to adopt these principles in all aspects of data management

Splinter meetings 'Toward FAIR GNSS data ' at EUREF 2021 and 2022 symposia

No splinter meeting this year

Webinar"Putting the FAIR principles into practice: the journey of a GNSS data repository" on October 11th, 2022 → EPN Historical Data Center

Recordings are available from https://fair-gnss.oma.be/webinar.php

Follow up on EUREF resolutions: FAIR

Encourage adoption of FAIR data principles

Steps towards FAIR

A. Attach rich metadata to the GNSS data

B. Attach a PID (DOI) to the GNSS data

C. Make GNSS (meta)data available through API

First: Collection of rich metadata to be associated with RINEX data files

- **100% site log info**
- **100% data quality information**
- **97%** of the EPN stations have assigned a **data license** to the RINEX data they distribute through EUREF

```
Missing:
DRAG00ISR MDVJ00RUS PADO00ITA PAT000GRC PULK00RUS RABT00MAR RAMO00ISR
ROVE00ITA SVTL00RUS TUBI00TUR UPAD00ITA YLDZ00TUR ZECK00RUS ZIM200CHE
ZIMM00CHE
```

- RINEX file provenance "where do they come from, what changes were made to the data":
  - ✓ Historical EPN Data Center: **Since Jan. 1st 2023** collection of "provenance" of all new incoming RINEX data files
  - ✓ In support -> Update of EPN DC guidelines (April 25, 2023) to encourage EPN RDC to collect information of file provenance

Follow up on EUREF resolutions: FAIR

Encourage adoption of FAIR data principles

GGOS Global Geodetic Observing System

Working Group on DOI for geodetic datasets

Steps towards FAIR

A. Attach rich metadata to the GNSS data

B. Attach a PID (DOI) to the GNSS data

C. Make GNSS (meta)data available through API

DOI (Digital Object Identifier) for GNSS data

- In collaboration with GGOS
- Assign DOI to the GNSS data originating from a GNSS station (or network)
- DOI info closely linked with the information in the station site log

M³G V5.0

→ Allows to insert station and network DOI

→ Few DOI inserted up to now

Digital Object Identifiers (DOIs) for data

DOI is a character string (standardized by ISO) used to uniquely identify a data set, e.g

https://doi.org/10.24414/FST8-P256 → landing page

Prefix

Suffix

Follow up on EUREF resolutions: FAIR

Encourage adoption of FAIR data principles

Steps towards FAIR

A. Attach rich metadata to the GNSS data

B. Attach a PID (DOI) to the GNSS data

C. Make GNSS (meta)data available through API

Work in progress

Outline

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RINEX 4

- Accepted now in IGS
- No data yet

Antenna (mis)alignment in site log

```
4.9  Antenna Type             : JAVRINGANT_DM    NONE
     Serial Number            : 00464
     Antenna Reference Point  : BPA
     Marker->ARP Up Ecc. (m)  :   0.4689
     Marker->ARP North Ecc(m) :   0.0010
     Marker->ARP East Ecc(m)  :   0.0000
     Alignment from True N    : 0 deg
     Antenna Radome Type      : NONE
     Radome Serial Number     :
     Antenna Cable Type       : ANDREW heliax LDF2-50A
     Antenna Cable Length     : 60 m
     Date Installed           : 2018-02-01T08:15Z
     Date Removed             : 2021-04-20T07:35Z
     Additional Information   :
```

EPN data analysis now takes into account the antenna alignment from true north !

When changing site log for currently installed antenna
→ jumps in time series

```
4.9  Antenna Type             : JAVRINGANT_DM    NONE
     Serial Number            : 00464
     Antenna Reference Point  : BPA
     Marker->ARP Up Ecc. (m)  :   0.4689
     Marker->ARP North Ecc(m) :   0.0010
     Marker->ARP East Ecc(m)  :   0.0000
     Alignment from True N    : 15 deg
     Antenna Radome Type      : NONE
     Radome Serial Number     :
     Antenna Cable Type       : ANDREW heliax LDF2-50A
     Antenna Cable Length     : 60 m
     Date Installed           : 2018-02-01T08:15Z
     Date Removed             : 2021-04-20T07:35Z
     Additional Information   :
```

Summary

- ✓ 28 new EPN stations → 405 EPN stations
- ✓ 16 EPN stations not providing data since several months
- ✓ Receiver firmware updates (or other changes at receiver) not always reported in site log
- ✓ M^{3}G v5.0 released in March 2023 : faster and (hopefully) easier to use + new functionalities
- ✓ EUREF resolution on EPOS
  - ✓ 81% of EPN stations in EPOS
  - ✓ EPN data providers properly acknowledged at EPOS data portal
- ✓ EUREF resolution on FAIR data
  - ✓ Collection of rich metadata → Nice progress: site log OK , data quality OK, 97% of EPN stations with data license
  - ✓ Collection of DOI : station DOI now accepted in M^{3}G → Station manager can insert it (EPN CB can help to assign DOI)

Contact
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Brussels
BELGIUM

Thank you for your attention

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