

Recent Developments within the EUREF Permanent GNSS Network

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EPN Central Bureau, <https://epncb.oma.be/>

The EUREF Permanent GNSS Network consists of

- a network of continuously operating GNSS (Global Navigation Satellite Systems, such as GPS, GLONASS, Galileo, BeiDou, ...) reference stations,
- data centres providing access to the station data,
- analysis centres that analyze the GNSS data,
- product centres or coordinators that generate the EPN products,
- and a Central Bureau that is responsible for the daily monitoring and management of the EPN.

The network is operated under the umbrella of the IAG (International Association of Geodesy) Regional Reference Frame sub-commission for Europe, [EUREF](#).

All contributions to the EPN are provided on a voluntary basis, with more than 100 European agencies/universities involved. The EPN operates under well-defined international standards and [guidelines](#) which are subscribed by its contributors. These guidelines guarantee the long-term quality of the EPN products.

The primary purpose of the EPN is to provide access to the [European Terrestrial Reference System 89](#) (ETRS89) which is the standard precise GNSS coordinate system throughout Europe. Supported by [EuroGeographics](#) and endorsed by the [INSPIRE](#) (D2.8.1.1 Data Specification on Coordinate Reference Systems) the ETRS89 forms the backbone for geolocation data on the European territory, both on a national as on an international level.

The EPN provides access to the ETRS89 by making publicly available for the GNSS tracking data as well as precise positions, velocities and tropospheric parameters of all EPN stations. Based on these products, the EPN contributes also to monitoring of tectonic deformations in Europe, and supports long-term climate monitoring, numerical weather prediction and the monitoring of sea-level variations.

Quick Station Links
Information | Coordinates | Time Series | Data Quality
(select a station)

Next Meetings
2021-05-26 / 2021-05-27 : [Workshop on "Quantum gravimetry in space and on ground" - virtual](#) (registration is mandatory)
2021-05-26 / 2021-05-28 : [EUREF Symposium 2021 - online](#) (Ljubljana, Slovenia)
2021-06-02 / 2021-06-02 : [Tour de l'IGS - ITRF and the outcomes of the activities of the third IGS reprocessing \(repro3\) - virtual workshop](#) (registration free but mandatory)
[More ...](#)

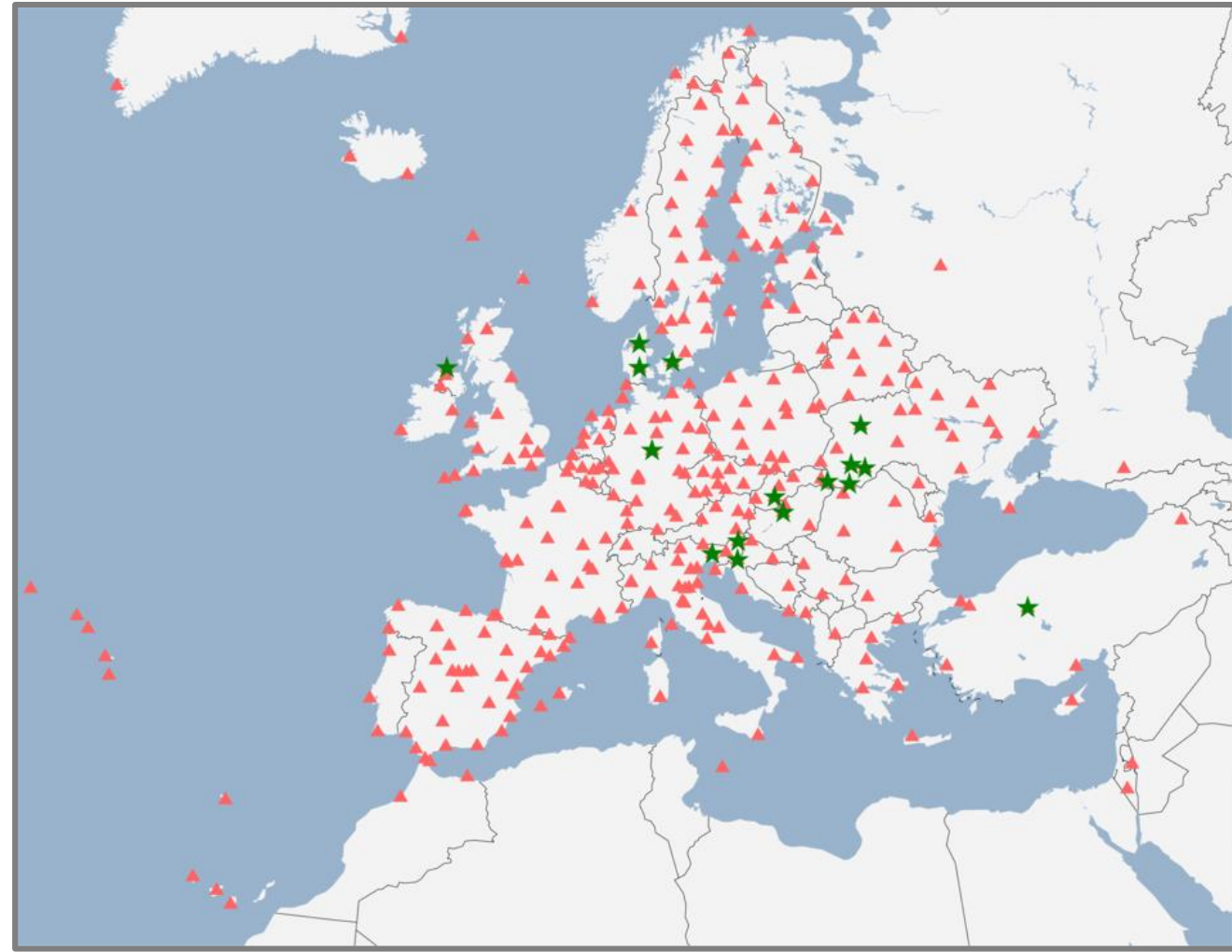
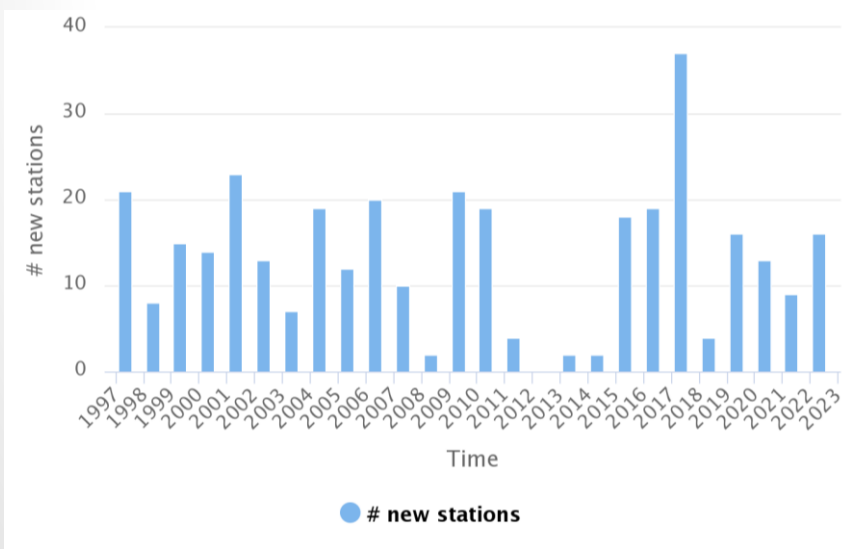
Job Opportunities
2021-05-03 : [Open Position at the Astronomical Institute of the University of Bern](#) (deadline: 2021-07-01)
2021-05-03 : [Pos Doc Position at Unesp de Presidente Prudente](#) (deadline: 2021-05-31)
2021-04-28 : [Open PhD position in GNSS reflectometry at the University of La Rochelle, France](#) (deadline: 2021-05-31)

Changes in station network since May 2021

378 EPN stations

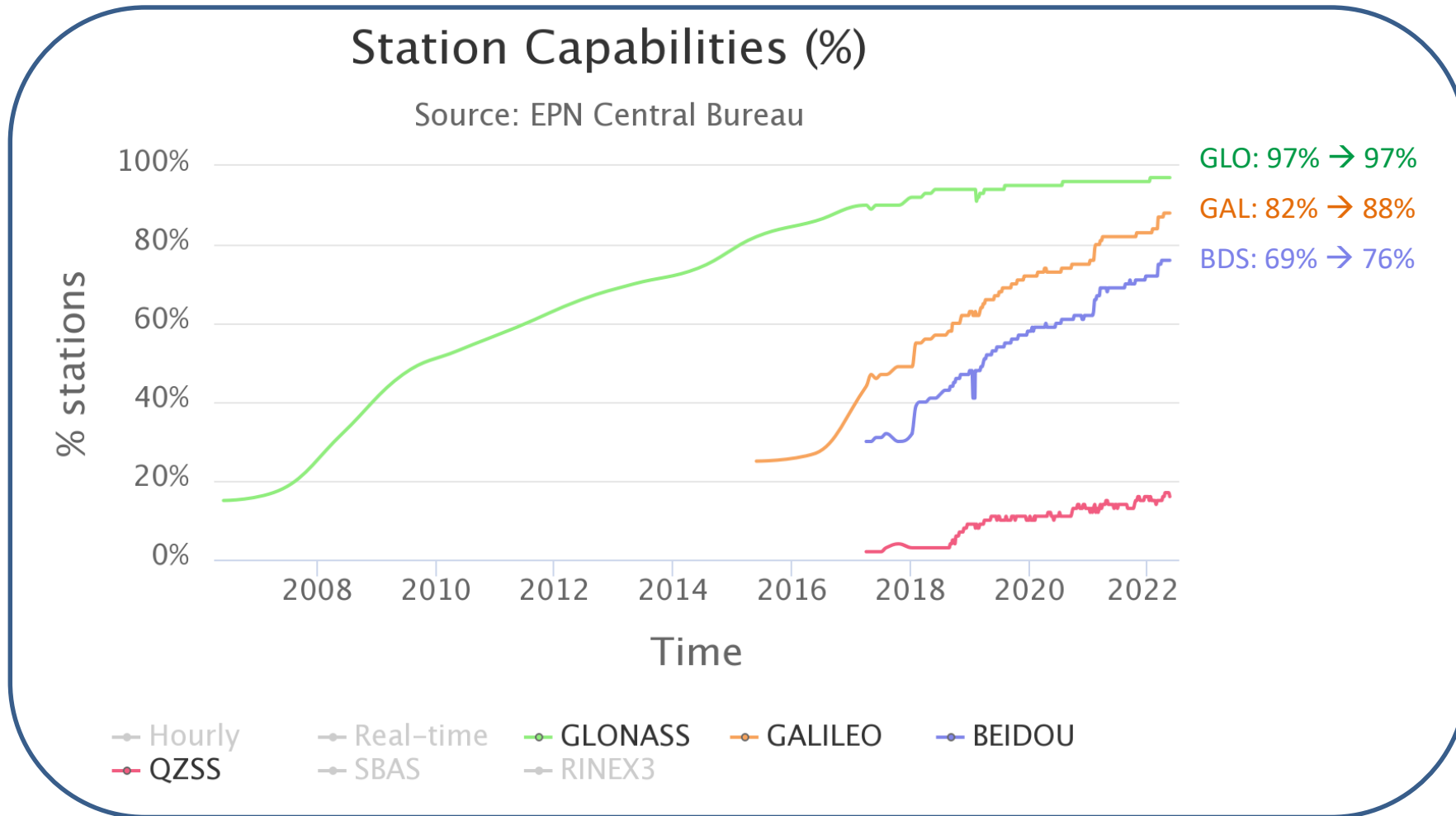
★ 18 new EPN stations

ANK200TUR, ARA200SVN, BME100HUN,
 BUDD00DNK, DVCN00SVK, FRA200UKR,
 GOET00DEU, KDA200SVN, MLHD00IRL,
 MUK200UKR, PPSH00NOR, PZA200SVN,
 RAH100UKR, RVNE00UKR, SMI200DNK,
 SUL500DNK, TER200UKR, WUTH00NOR



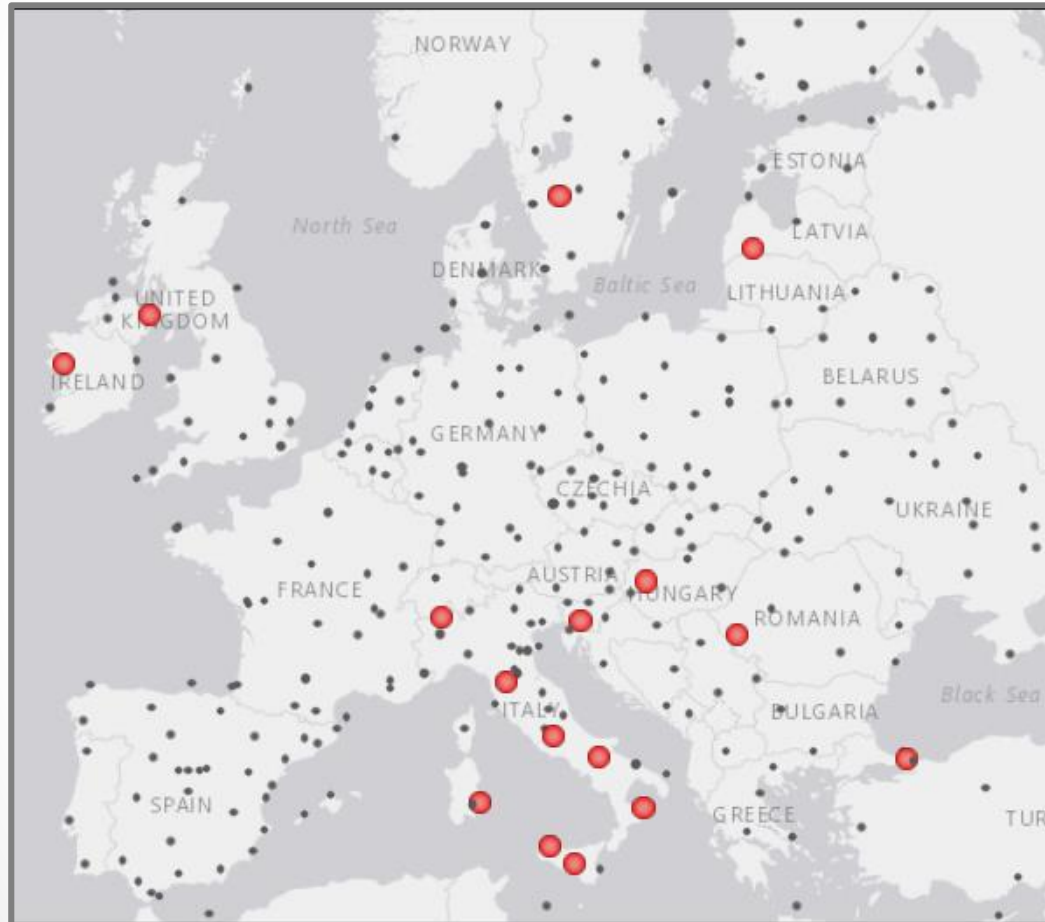
Status May 24, 2022

Tracked Constellations



Last update: May 19, 2022

Stations proposed to the EPN



Delays in integration of new EPN stations

- No response from stations managers
- Data flow problems main reason for not including station in EPN (but problems at RDC)

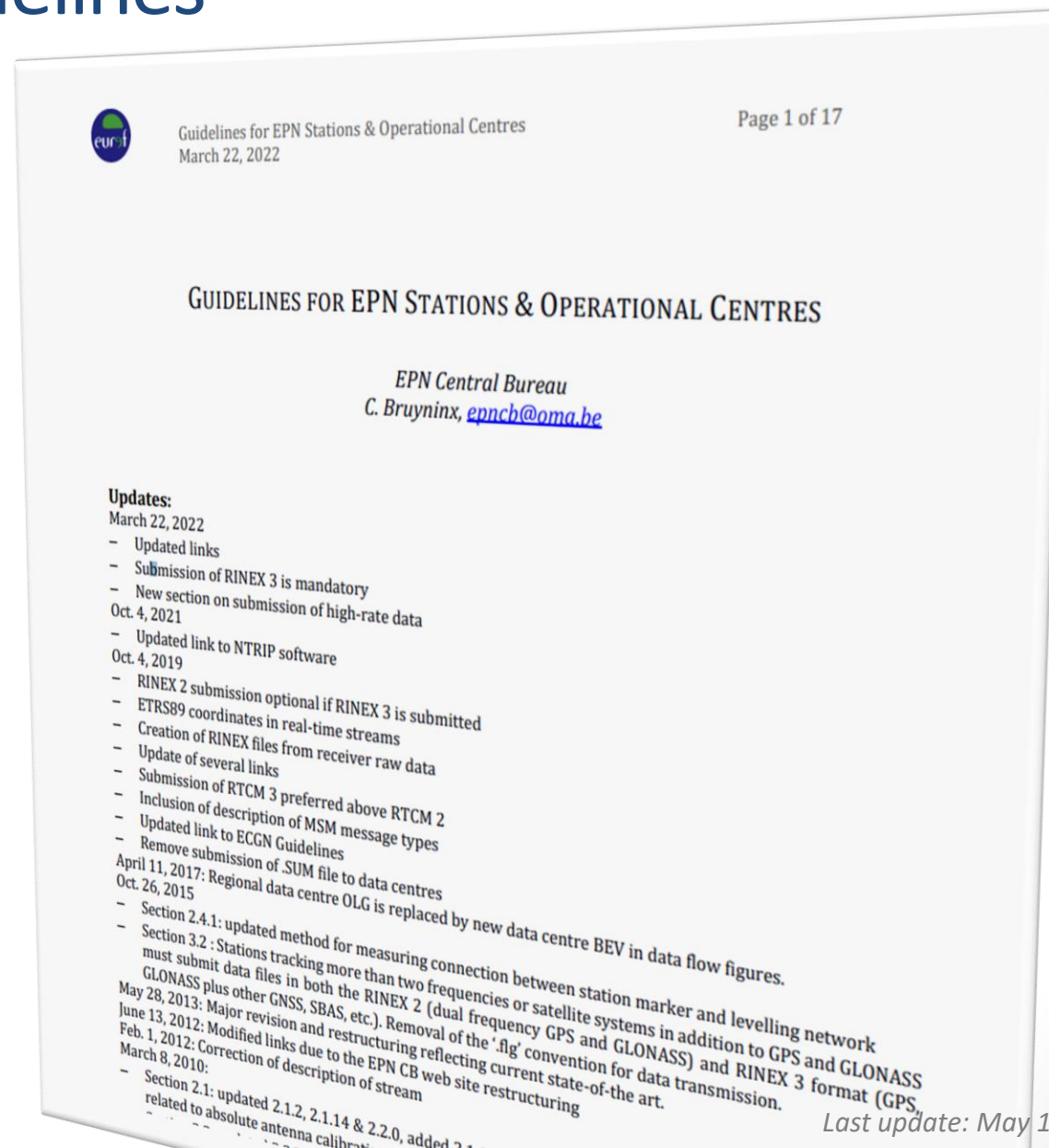
- 9 new ASI stations will be included very soon in EPN

Update of EPN station guidelines

Published on March 22, 2022

https://www.epncb.oma.be/documentation/guidelines/guidelines_station_operationalcentre.pdf

- Submission of RINEX 3
- High-rate data



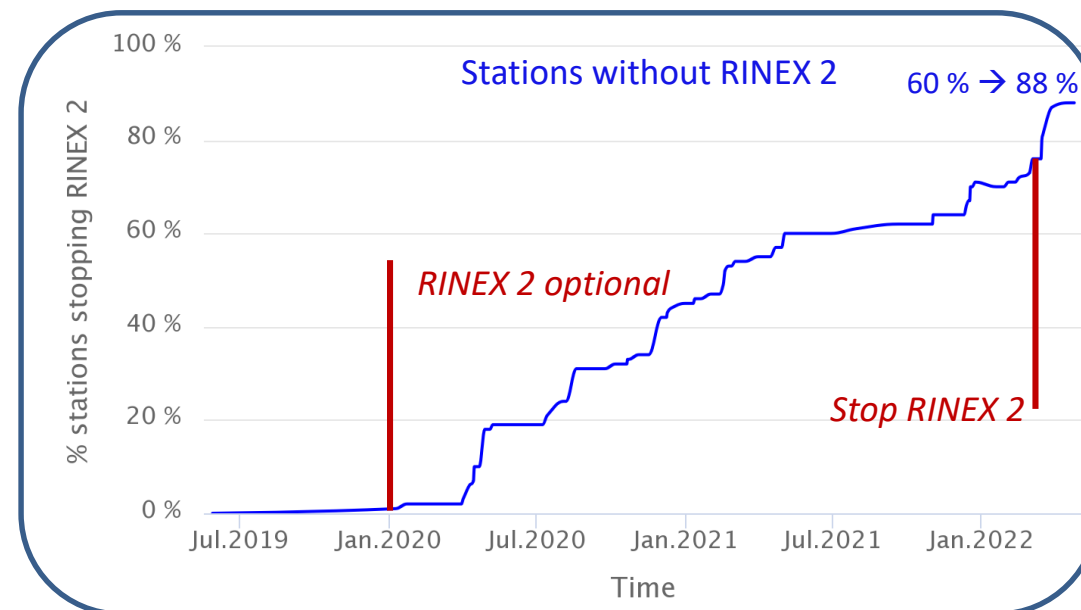
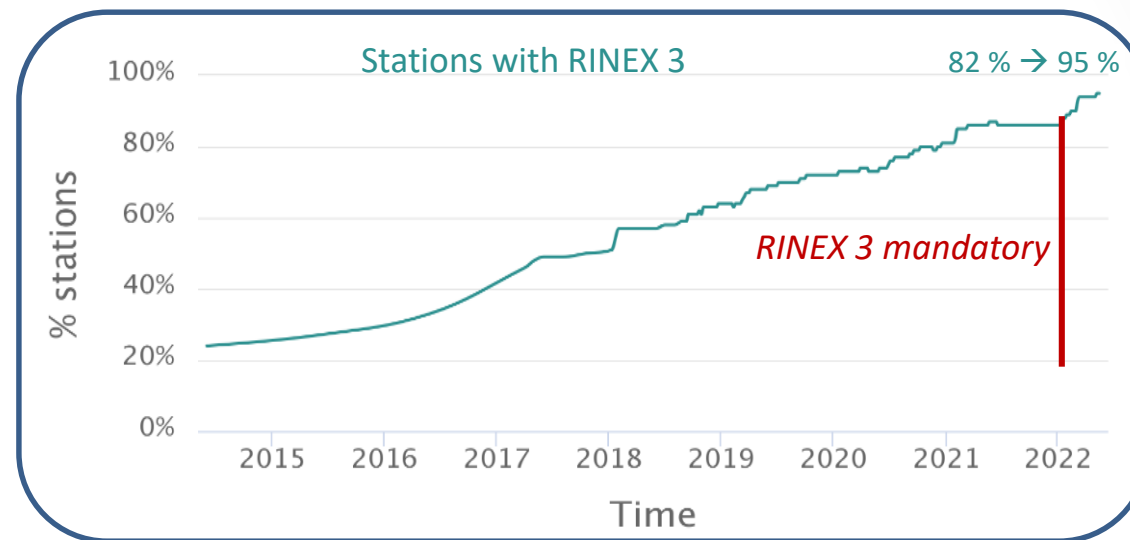
Last update: May 19, 2022

RINEX 3

Update of EPN station guidelines on March 22, 2022

- RINEX 3 data submission is mandatory (long filenames!)
- RINEX 2 data submission can be stopped
- RINEX must be created from RAW receiver data
- RINEX 2 → RINEX 3 not allowed !

Motivation: Upcoming RINEX 4...



High-rate data

High-rate data center (HRDC) = BKG

- 3.4.1 Stations are encouraged to upload 15-min RINEX 3 data with 1 Hz sampling rate to the HRDC. The files should contain the data for mm:ss 00:00-14:59, 15:00-29:59, 30:00-44:59, 45:00-59:59, resp., and they should be sent to the HRDC directly after the closing of the RINEX file to ensure the low latency.
- 3.4.2 These files can be generated as follows (in order of preference):
- 1) directly from the receiver by converting the receiver's binary data to RINEX files. Following the RINEX 3 file naming convention, the data source is "R".
 - 2) by converting the station's real-time data stream in the receiver's native format to RINEX files. Following the RINEX 3 file naming convention, the data source must be set to "S".
 - 3) by converting the station's real-time data stream, available in RTCM MSM format, to RINEX files. Following the RINEX 3 file naming convention, the data source must be set to "S".
- 3.4.3 If the station is not capable of generating high-rate RINEX 3 files, then the HRDC, that is also operating a real-time broadcaster, will convert the station real-time stream to 1-Hz RINEX 3 files with each 15 minutes of data. Following the RINEX 3 file naming convention, the data source must be set to "S". More info in "Guidelines for Data Centres and Broadcasters".

RINEX 4

- New RINEX format 4 published on Dec. 1, 2021
https://files.igs.org/pub/data/format/rinex_4.00.pdf
- **Not to be used at this moment for operational data uploads**
- IGS test period to be started (~6 months):
 - First RINEX 4 data available at BKG, e.g. https://igs.bkg.bund.de/root_ftp/IGS/obs_v4/2022/
 - **Please check if your software is able to read RINEX 4**
- Main changes w.r.t. RINEX 3 are related to the navigation files
- But, changes in header of the RINEX 4 observation files compared to RINEX 3

RINEX 4

MARKER NAME	– Name of antenna marker <i>Note;</i> This is a free text field to identify the station with a name as decided by the station operator. To facilitate the identification of RINEX data in large user communities like IGS, EUREF, APREF, SIRGAS, etc the 9-character station ID is expected; XXXXMRECC (see Table A1)	A60
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4.00	OBSERVATION DATA	M	RINEX VERSION / TYPE
RINEXSOFTWARE V1	User	20210702_000126 UTC	PGM / RUN BY / DATE
REDU00BEL			MARKER NAME
13102M001			MARKER NUMBER
AUTOMATIC	ESA/ESOC		OBSERVER / AGENCY

RINEX 4

PGM / RUN BY / DATE	<ul style="list-style-type: none"> - Name of program creating current file - Name of agency creating current file - Date and time of file creation (section 5.2.2) <p>Format: <code>yyyymmdd hhmmss zone</code> zone: 3-4 char. code for time zone. 'UTC' recommended! 'LCL' if local time with unknown time code</p> <p><i>Note</i>; This header line must be the second line in the header. Additional lines of this type can appear together after the second line, if needed to preserve the history of previous actions on the file.</p>	<p>A20</p> <p>A20</p> <p>A20</p>
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```

1.00 OBSERVATION DATA M RINEX VERSION / TYPE
RINEXSOFTWARE V1 User 20210702 000126 UTC PGM / RUN BY / DATE
REDU00BEL MARKER NAME
13102M001 MARKER NUMBER
AUTOMATIC ESA/ESOC OBSERVER / AGENCY
    
```

Multiple PGM lines allowed

Information that will be stored at the EPN CB to understand origin of problems with RINEX data

RINEX 4

*DOI	– Digital Object Identifier (DOI) for data citation i.e. <a href="https://doi.org/<DOI-number>">https://doi.org/<DOI-number>	A60
*LICENSE OF USE	– Line(s) with the data license of use. Name of the license plus link to the specific version of the license. Using standard data license as from https://creativecommons.org/licenses/ – i.e. : CC BY 04 ; https://creativecommons.org/licenses/by/4.0/	A60

86% of EPN station managers assigned in M³G data license to their station dataset

IGS recognizes the importance of following FAIR data principles

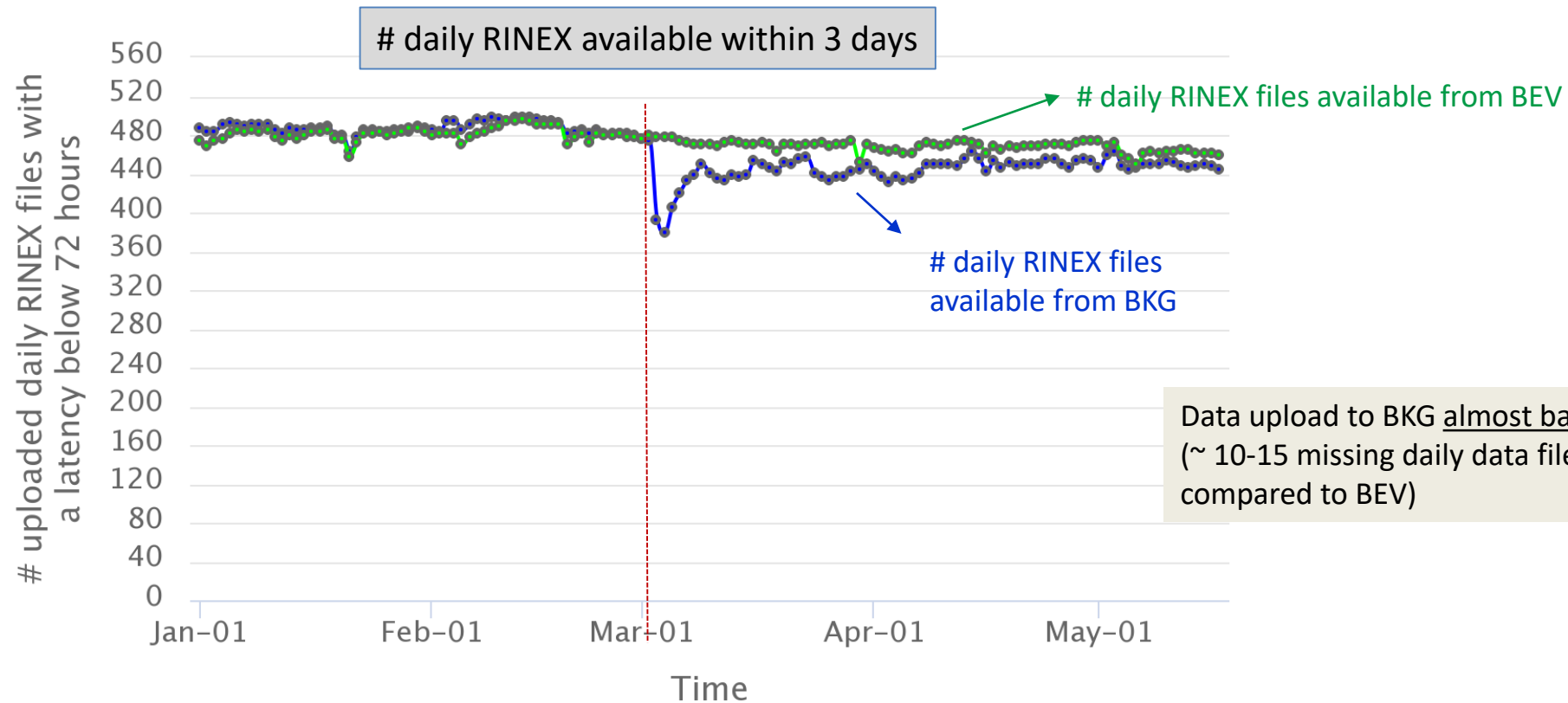
Splinter meeting “Towards FAIR GNSS data”

Thursday June 2 at 14:45 – 15:45

Availability of daily RINEX data

2021

EUREF mail 10552: BKG switch from ftp to **sftp upload** from March 2, 2021



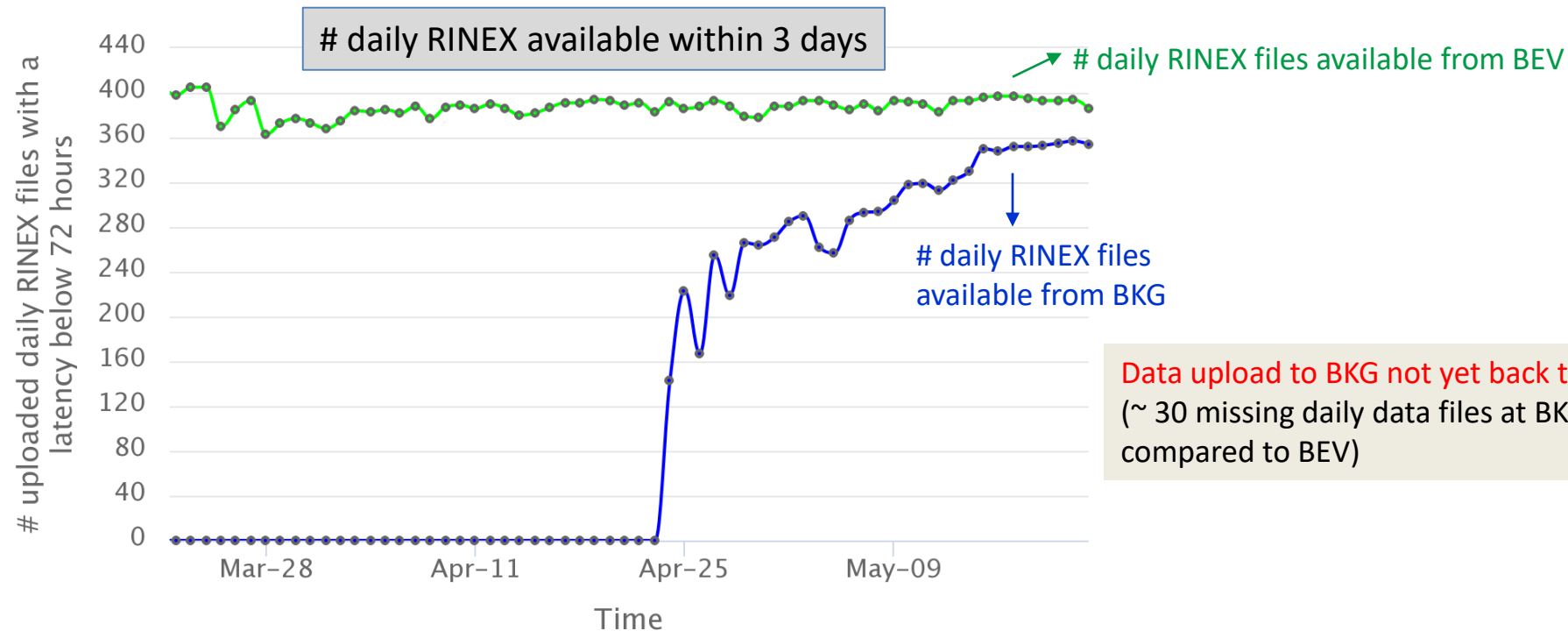
Change at BKG: New address for data upload & download

Sftp data upload (NO ftp):

~~igs.bkg.bund.de~~ → **contact BKG to get instructions**
Action required from station managers to upload to BKG!

Data download:

ftp: igs.bkg.bund.de → ftp: igs-ftp.bkg.bund.de
 https: igs.bkg.bund.de NO CHANGE
<https://igs.bkg.bund.de/access>



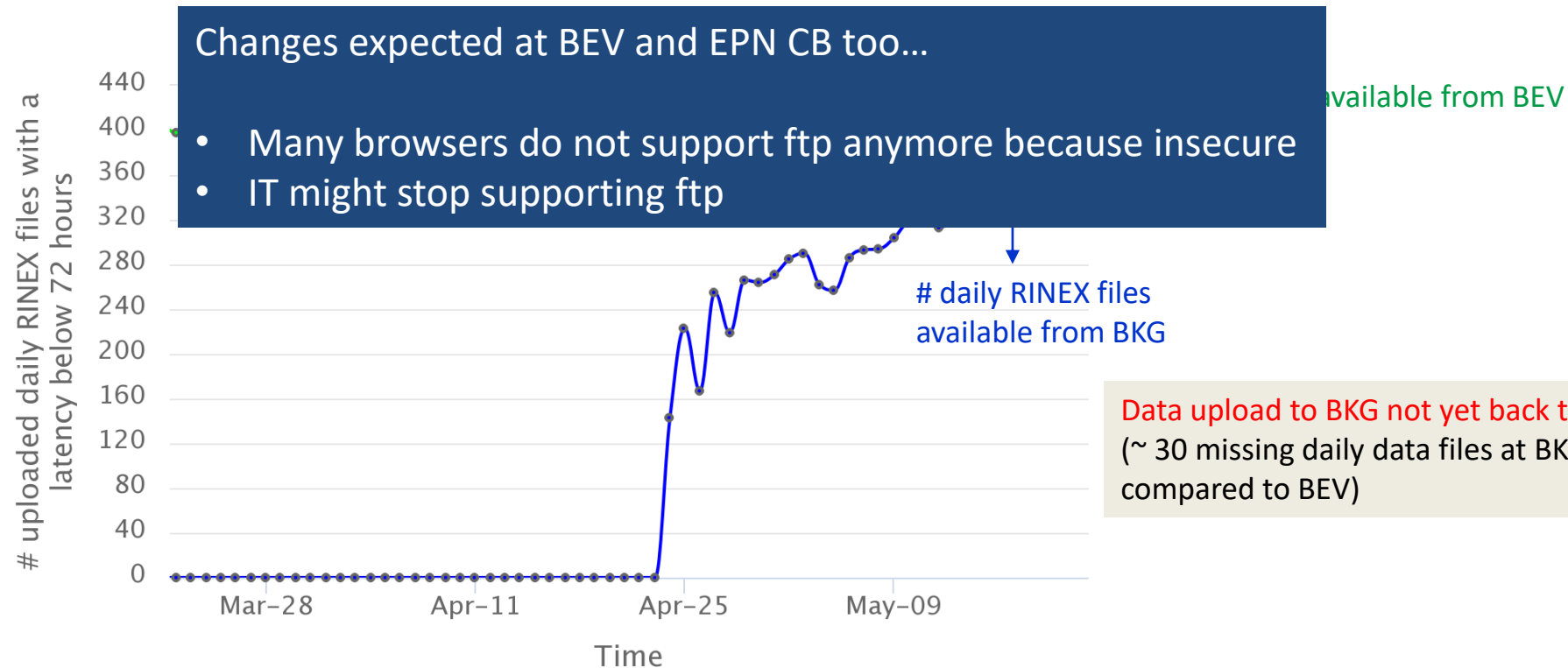
Change at BKG: New address for data upload

Sftp data upload (NO ftp):

~~igs.bkg.bund.de~~ → **contact BKG to get instructions**
Action required from station managers to upload to BKG!

Data download:

ftp: igs.bkg.bund.de → ftp: igs-ftp.bkg.bund.de
 https: igs.bkg.bund.de NO CHANGE



GDPR changes at EPN CB

- Removed EUREF mail, LAC mail, EUREF IP mail archives from EPN CB web site
- Preparing removal of personal data from RINEX observation files (more in HDC presentation)
- Planning to remove our archive of EPN products from public-facing ftp (products are now available from BKG and BEV anyway).
- Site logs:
 - IGS strategy concerning site logs:
 - no personal data (no names of persons and no personal emails).
 - Only generic team emails allowed for primary contacts
 - EPN CB started to contact all station managers to ask for generic email for team → done for 88% of Operational Centers!
 - GNSS team gnss@agency.com

Site logs and GDPR

```
BRUX00BEL Site Information Form (site log)
International GNSS Service
See Instructions at:
  https://files.igsb.org/pub/station/general/sitelog_instr.txt
```

0. Form

```
Prepared by (full name) : Carine Bruyninx
Date Prepared           : 2022-04-05
Report Type            : UPDATE
If Update:
  Previous Site Log     : brux00bel_20210420.10
  Modified/Added Sections : 6.11, 6.12, 11
```

```
BRUX00BEL Site Information Form (site log)
International GNSS Service
See Instructions at:
  https://files.igsb.org/pub/station/general/sitelog_instr.txt
```

0. Form

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


Site logs and GDPR

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           : Carine Bruyninx
Telephone (primary)    :
Telephone (secondary) :
Fax                    :
E-mail                 : CB@oma.be

```

Same for section 12

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

```

Expected site log change

Decision of IGS Governing Board

2. Site Location Information

```

City or Town           : Brussels
State or Province     : Brabant
Country                : Belgium
Tectonic Plate        : EURASIAN
Approximate Position (ITRF)
X coordinate (m)      : 4027881.628
Y coordinate (m)      : 306998.537
Z coordinate (m)      : 4919498.984
Latitude (N is +)    : +504753.03
Longitude (E is +)   : +0042130.83
Elevation (m,ellips.) : 158.3
Additional Information : (multiple lines)

```

2. Site Location Information

```

City or Town           : Brussels
State or Province     : Brabant
Country or region     : BEL
Tectonic Plate        : EURASIAN
Approximate Position (ITRF)
X coordinate (m)      : 4027881.628
Y coordinate (m)      : 306998.537
Z coordinate (m)      : 4919498.984
Latitude (N is +)    : +504753.03
Longitude (E is +)   : +0042130.83
Elevation (m,ellips.) : 158.3
Additional Information : (multiple lines)

```

Antenna Alignment

```

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  :
  
```

Future EPN reprocessing will take into account the antenna alignment from true north !

So please **check the site logs of your stations and make sure this information is correct.**

```

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 – Messages to station managers

- ✓ EPN continues to grow, but presently some delays with integration of new EPN stations
- ✓ Regional data centers undergoing many changes, data availability (and EPN CB monitoring) is affected
 - ✓ Prepare for the gradually stop of ftp
 - ✓ Upload to BKG AND BEV
- ✓ Update of EPN station guidelines
 - ✓ RINEX 3 submission is mandatory
 - ✓ High-rate data submission encouraged
- ✓ Verify if your software is able to read the new RINEX 4 files
- ✓ Verify and correct (if necessary) antenna alignment to north in site logs
- ✓ Answer email of EPN CB with the request to provide a generic team name/email (GDPR)
 - ✓ Use it in site log
 - ✓ Use it in RINEX header

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OF BELGIUM

EUREF Symposium, 01-03/06/2022, Zagreb, Croatia



EUREF2022

Contact

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<https://www.epncb.eu/>

Brussels

BELGIUM

Twitter: [@be_GNSS](https://twitter.com/be_GNSS)

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