

The EUREF Permanent GNSS Network

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

Update of EUREF Terms of Reference

EUREF Symposium in Wroclaw, Poland, 17-19/05/2017

- EUREF Technical Working Group → **EUREF Governing Board**
- **The EUREF member countries have the right to nominate two official representatives in the EUREF Sub-Commission.** The nomination is done by the National Committee of the IAG/IUGG member countries, and by the National Mapping Authority of other countries.

Countries are urged to keep the **balance between the research organizations and the institution responsible for the national geodetic reference frames.**

Tasks of the National Representatives are to organize the **annual national reports** for EUREF, to be the national contact points from EUREF to the nations, and they have the right to **vote** in such cases – declared by the EUREF Chair – when the voting is restricted to the representatives.

Define, realise, maintain, provide access and promote the

- ETRS89
European Terrestrial Reference System
- EVRS
European Vertical Reference System

<http://ww.euref.eu/>

Access to the ETRS89

Through the EUREF Permanent GNSS Network (EPN)



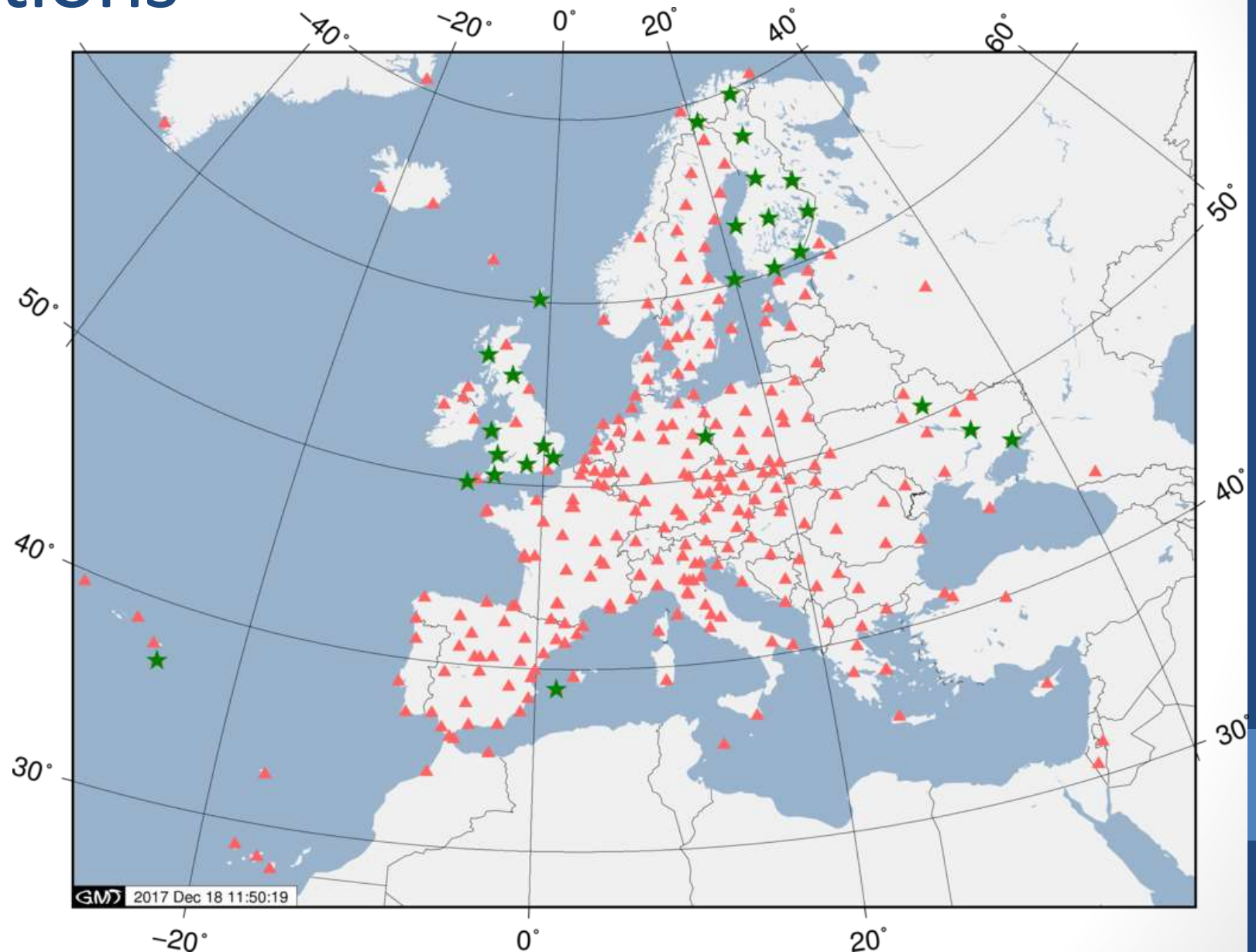
Pre-requisites:

Available GNSS data and
metadata (site logs)

Well-known ETRS89
coordinates (and velocities)

Recent Evolutions

27 new EPN stations
since Jan. 2017



9-char ID → RINEX3
conventions

9-CHAR ID	LOCATION	TRACKED SATELLITE SYSTEMS	REAL-TIME	ANTENNA CALIBRATION
ADAR00GBR	Aberdaron	GPS GLO	RT	Individual (GEO++)
ARIS00GBR	Arisaig	GPS GLO	RT	Individual (GEO++)
CHIO00GBR	Chilbolton	GPS GLO		Individual (GEO++)
DNMU00UKR	Dnipro	GPS GLO		Type mean
EDIN00GBR	Edinburgh	GPS GLO	RT	Type mean
FINS00FIN	Finstrom	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
IBIZ00ESP	Ibiza	GPS GLO GAL BDS		Type mean
JOE200FIN	Joensuu	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
KEV200FIN	Utsjoki	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
KILP00FIN	Kilpisjärvi	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
KIV200FIN	Aanekoski	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
LDB200DEU	Lindenberg	GPS GLO GAL BDS SBAS		Individual (GEO++)
LERI00GBR	Lerwick	GPS GLO	RT	Individual (GEO++)
MARP00UKR	Mariupol	GPS GLO		Type mean
MET300FIN	Kirkkonummi	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
OUL200FIN	Oulu	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
PMTH00GBR	Plymouth	GPS GLO	RT	Type mean
PRYL00UKR	Pryluky	GPS GLO		Type mean
RAEG00PRT	Sao Pedro	GPS GLO		Type mean
ROM200FIN	Kuhmo	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
SCIL00GBR	Hugh Town	GPS GLO	RT	Type mean
SHOE00GBR	Shoeburyness	GPS GLO	RT	Type mean
SNEO00GBR	St Neots	GPS GLO	RT	Individual (GEO++)
SOD300FIN	Sodankylä	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
SWAS00GBR	Swansea	GPS GLO	RT	Individual (GEO++)
VAA200FIN	Vaasa	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)
VIR200FIN	Virolahti	GPS GLO GAL BDS SBAS	RT	Individual (GEO++)

Multi-GNSS Tracking in EPN

CAPABILITY	APRIL 2016	APRIL 2018
GLONASS	86%	93%
Galileo	27%	56%
Beidou	-	40%
QZSS	-	3%

Standard RINEX v3(.02/03)
format for multi-GNSS

EUREF Permanent Tracking Network

Stations submitting GALILEO data



ROYAL
OBSERVATORY
OF BELGIUM



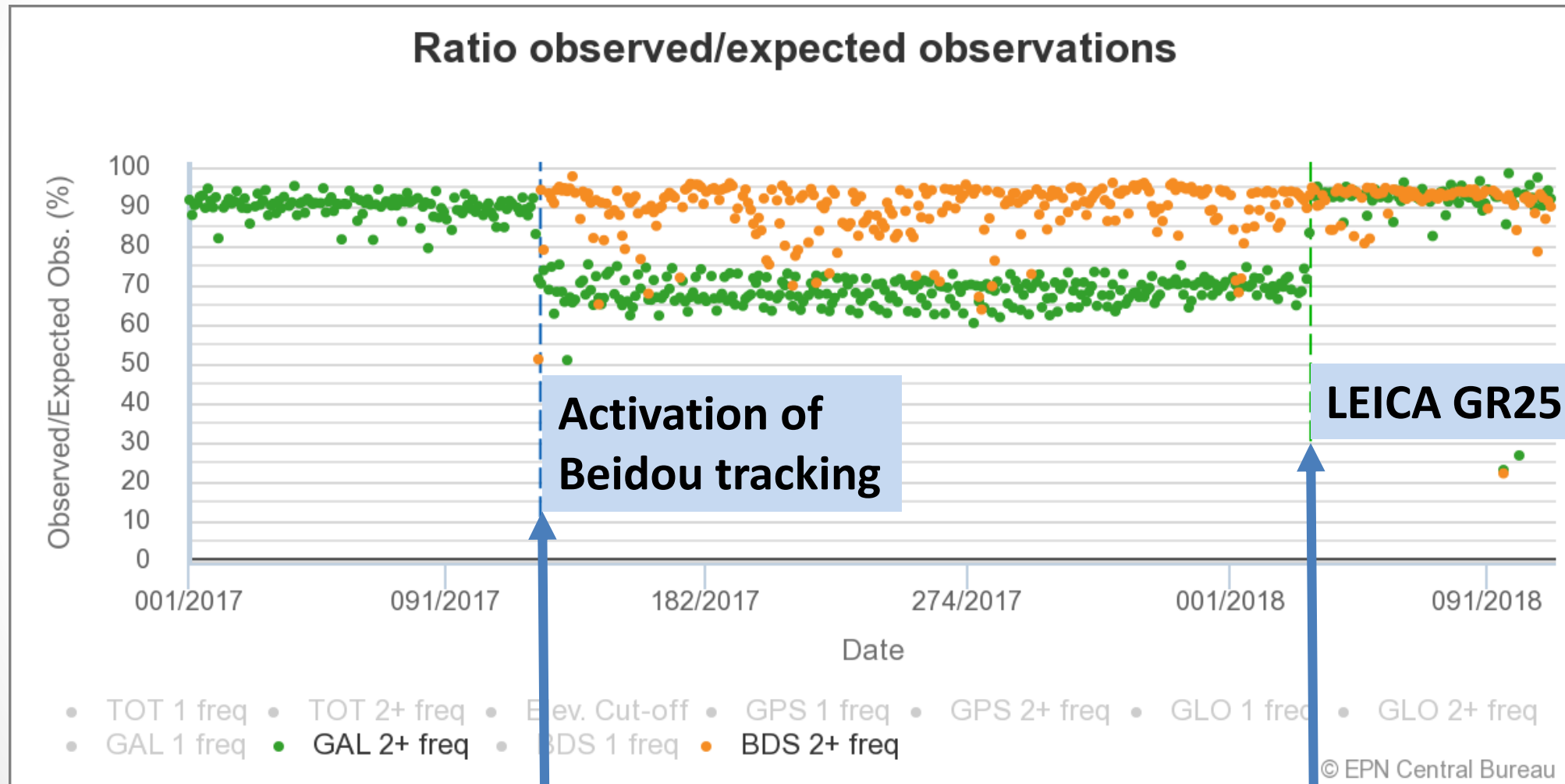
Multi-GNSS Data Quality Monitoring

Running at the EPN Central Bureau since end 2016

Based on G-nut/Anubis (*Václavovic P, Dousa J, 2016*) and self-developed scripts

- % observed/expected observations (single frequency and 2+ frequency)
 - For each constellation + total (mean)
- Max. # of observations
 - For each constellation + total (sum)
- Number of cycle slips (x1000/nr. Obs)
 - For each constellation
- Average RMS of code multipath
 - For each frequency and each constellation

Simultaneous Galileo and BeiDou tracking



EPN real-time streams

- ~ 160 EPN stations provide their data in real-time (50% of EPN)

From real-time streams

- 7% GPS-only (4%)*
 - 64% GPS+GLO (27%)*
 - 29% GPS+GLO+GAL+... (69%)*
- *According to receiver capability



63 stations provide RINEX 3 with GAL, but real-time without GAL

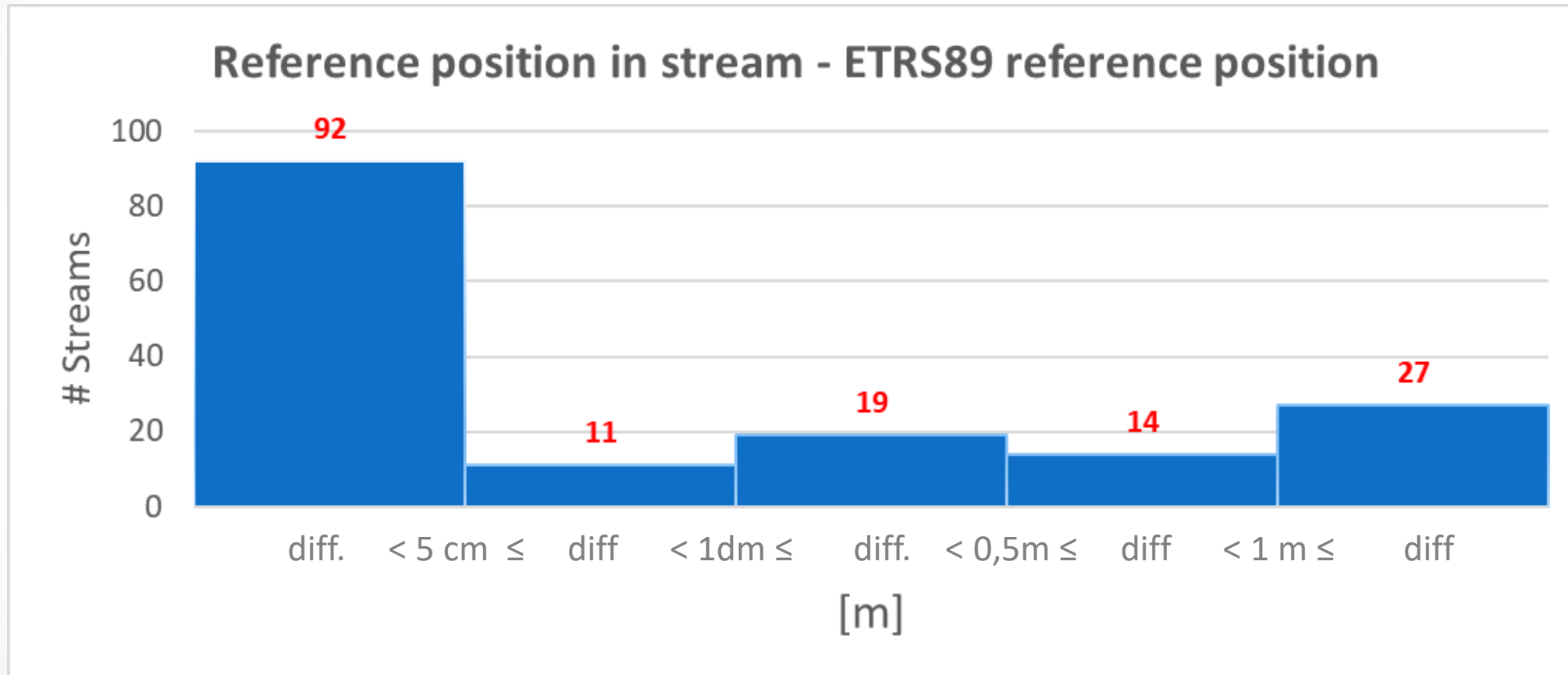
Stream Content

Metadata

- Antenna/radome type
 - necessary for correct application of antenna calibration models
(NULLANTENNA → ± 6 cm position offsets)
 - 29 stations with incorrect/unknown antenna/radome
- Antenna height → to link observables to marker
 - 21 stations with antenna height error > 10 cm
- Reference position in ETRS89 → if RTK, required to compute position of 'rover' in ETRS89

Stream Content

Reference Position



57% of EPN streams → less than 5 cm error

25% of EPN streams → more than 50 cm of error

Release of new ETRS89 realization: ETRF2014

Formally decided at the EUREF Symposium in Wroclaw, Poland, 17-19/05/2017

Transformation formula from and to ETRF2014 available from EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems (<http://etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf>)

On-line transformation available from http://www.epncb.eu/productsservices/coord_trans/

Class A / Class B stations

Following release of ETRF2014, EUREF releases since fall 2017 official ETRS89 position/velocities of EPN stations **in both ETRF2000 and ETRF2014**
Updated each 15 weeks.

Class A:

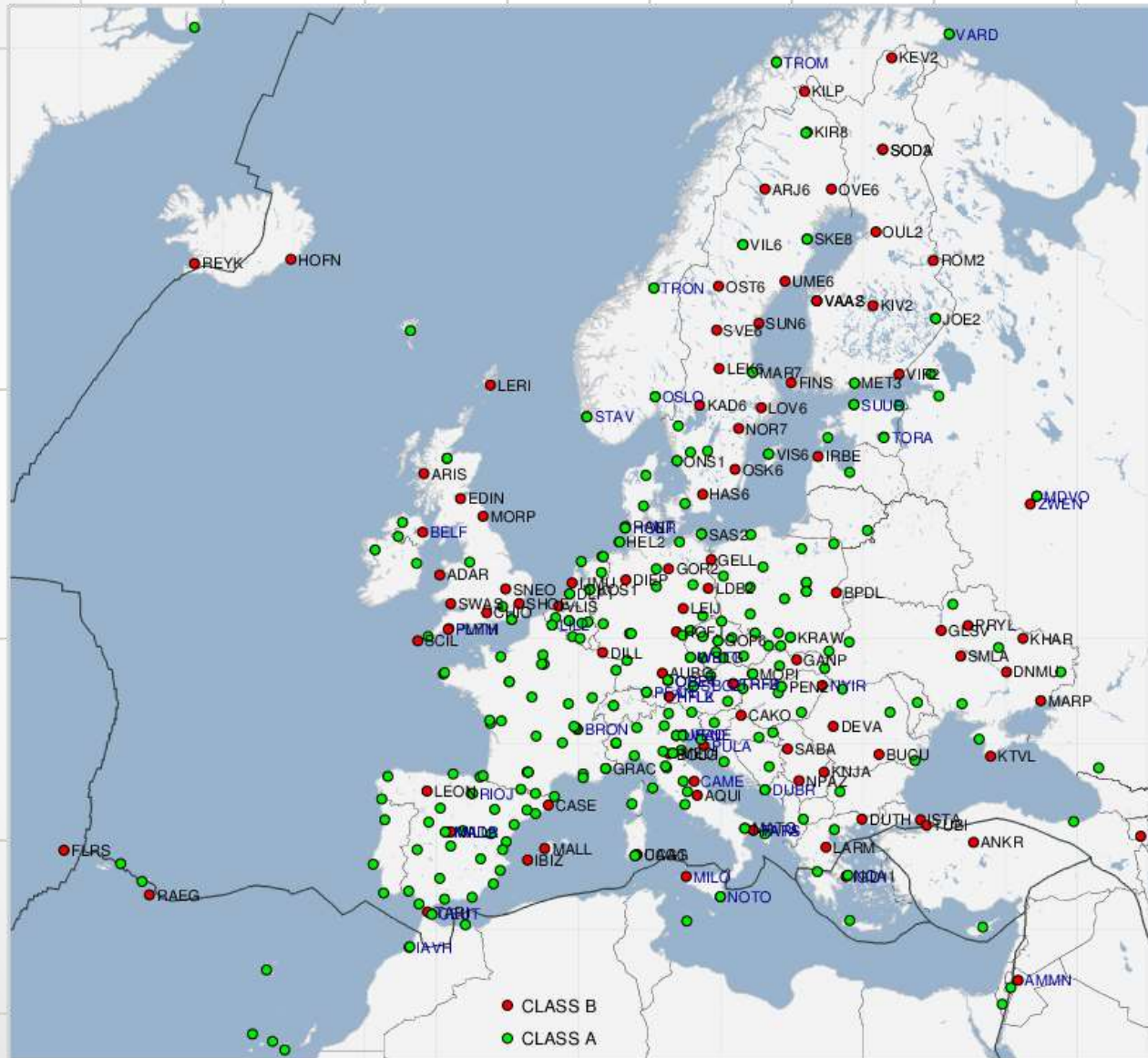
station positions have a 1 cm accuracy at all epochs of the time span of the used observations

→ reference stations for national densifications

Class B:

station positions have a 1 cm accuracy at the epoch of minimal variance. Stations are in Class B because of a short observation time or a higher noise level of the position time series.

Class A / Class B stations



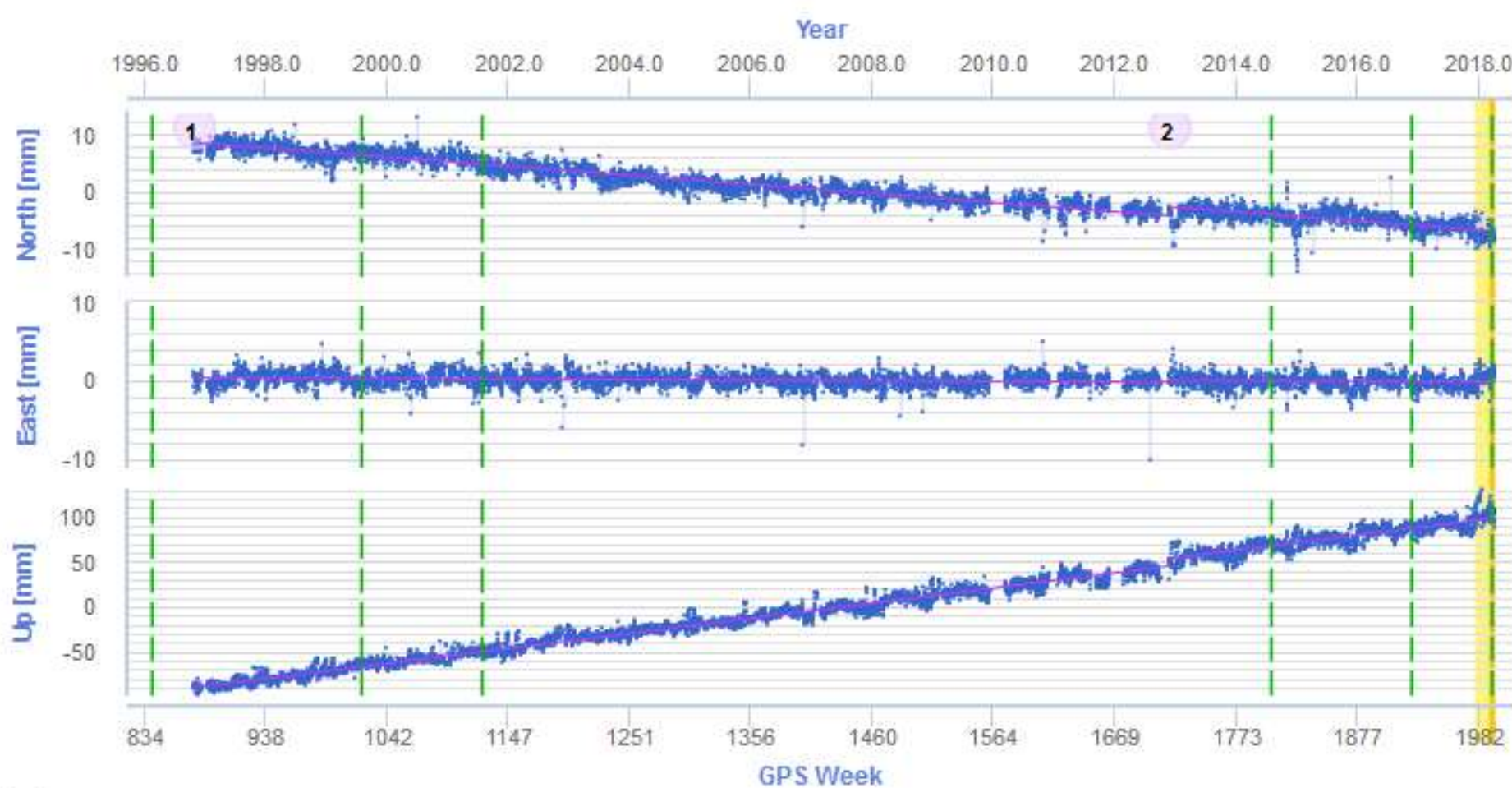
Network of EPN Class
A/Class B stations

234 stations from 320 EPN
stations are Class A

ETRS89 Positions (velocities)
available from
http://www.epncb.eu/_products/services/coordinates/

VAAS00FIN 10511M001

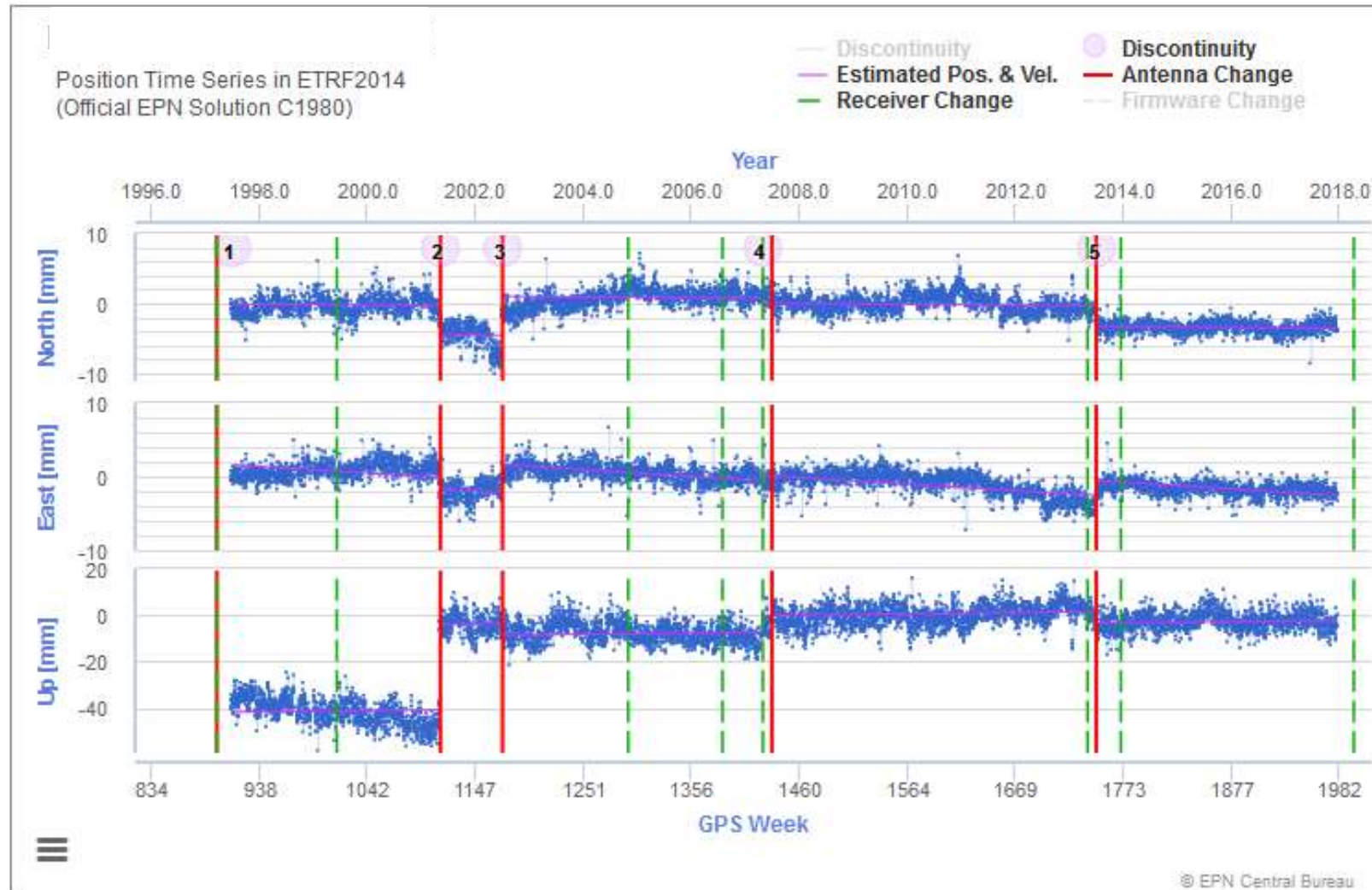
Position Time Series in ETRF2014
(Extended EPN Solution C1980U)



© EPN Central Bureau

a link to download Residual Position Time Series data for solution C1979 are available [here](#)

http://epncb.oma.be/_productsservices/timeseries/



a link to download Residual Position Time Series data for solution C1979 are available [here](#)

Official Time Series up to week 1979

Extended Time Series up to week 1997/1

Residual Position Time Series

Position Time Series in ITRS (IGS14)

Position Time Series in ETRS89 (ETRF2014)

Official Station Velocities published by EUREF:

Frame	V_{North} [mm/yr]	V_{East} [mm/yr]	V_{Up} [mm/yr]
ETRF2014	-0.1 ± 0.01	-0.4 ± 0.01	0.3 ± 0.04

New release of EPN Individual Antenna Calibration file

Upon introduction of new ITRF2014 in IGS → new release of IGS type mean antenna calibrations

EPN data analysis: Individual antenna calibrations + IGS type mean calibrations

New release of EPN individual antenna calibration in Jan. 2017

Includes robot or chamber calibrations from antennas/radomes installed at EPN stations.

22 antenna/radome with both robot calibrations and chamber calibrations

Priority given to chamber calibrations (multi-GNSS!)

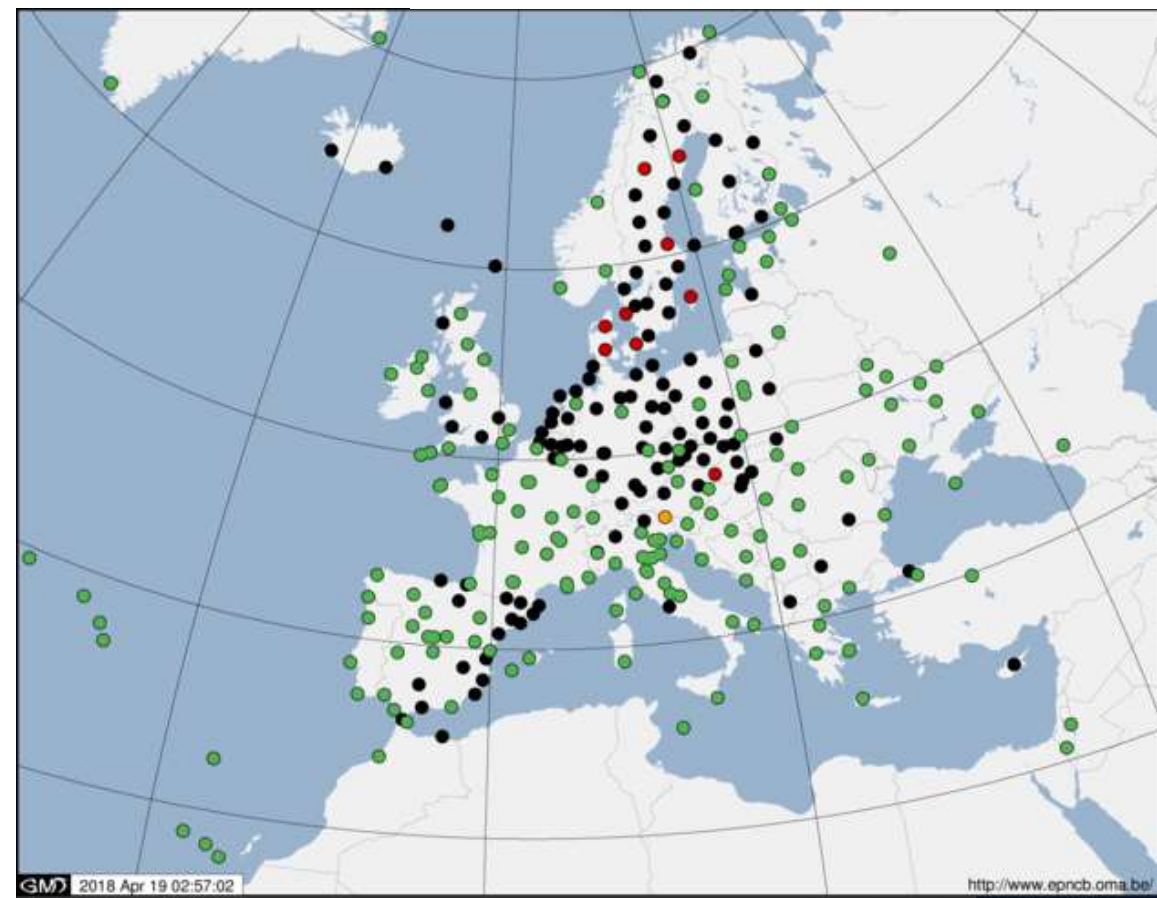
**Lack of antenna calibrations for Galileo signals.
IGS call for additional chamber calibrations including Galileo frequencies, to be submitted to epncb@oma.be**

absolute individual calibrations (42.5%)

absolute type calibrations (54.38%)

absolute calibrations converted from relative values (0.31%)

absolute calibrations (2.81%)





Metadata Management and distribution system for Multiple GNSS Networks

EPN is presently switching from on-line site log submission to M3G

NEW system, developed at ROB:

- Unique submission of site log of stations belonging to several international GNSS networks
- After validation, site logs are distributed to the portals of the international network (not necessary at ROB)
- Handles the different site log requirements of different networks

Migration to new system is presently ongoing

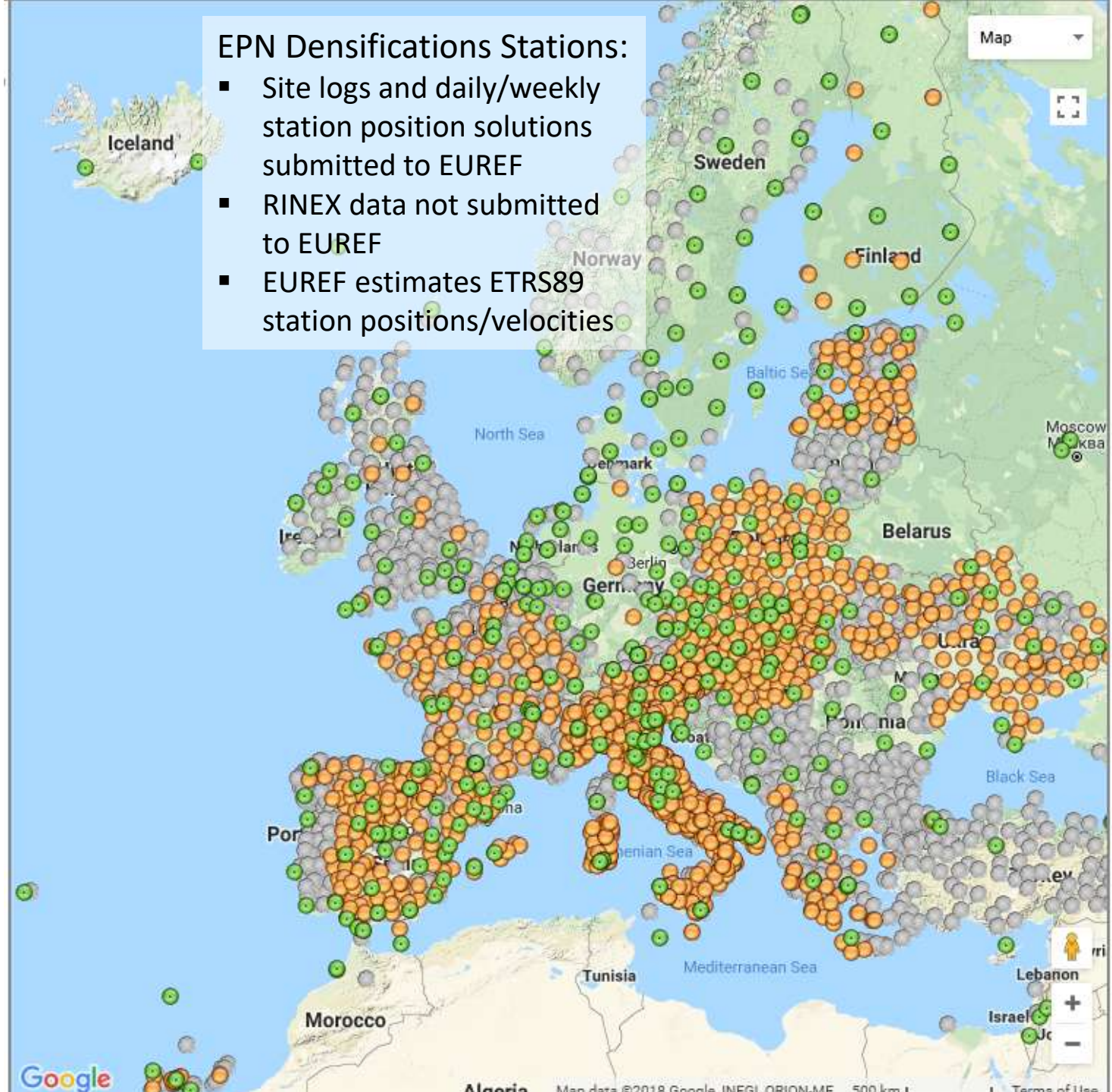
Management of site logs for several networks:

- EPN
- EPN Densification
- EPOS
-

+/- 1840 site logs available

<https://www.gnss-metadata.eu/>

More info m3g@oma.be



New EUREF Collaboration with EPOS (European Plate Observing System)

European Research Infrastructures (RI) = facilities, resources and services used by the science community to conduct research and foster innovation.



www.epos-ip.org

EPOS is expected to be operational from 2019 when it will become a European Research Infrastructure Consortium (ERIC) and thus a legal entity. Members are countries.

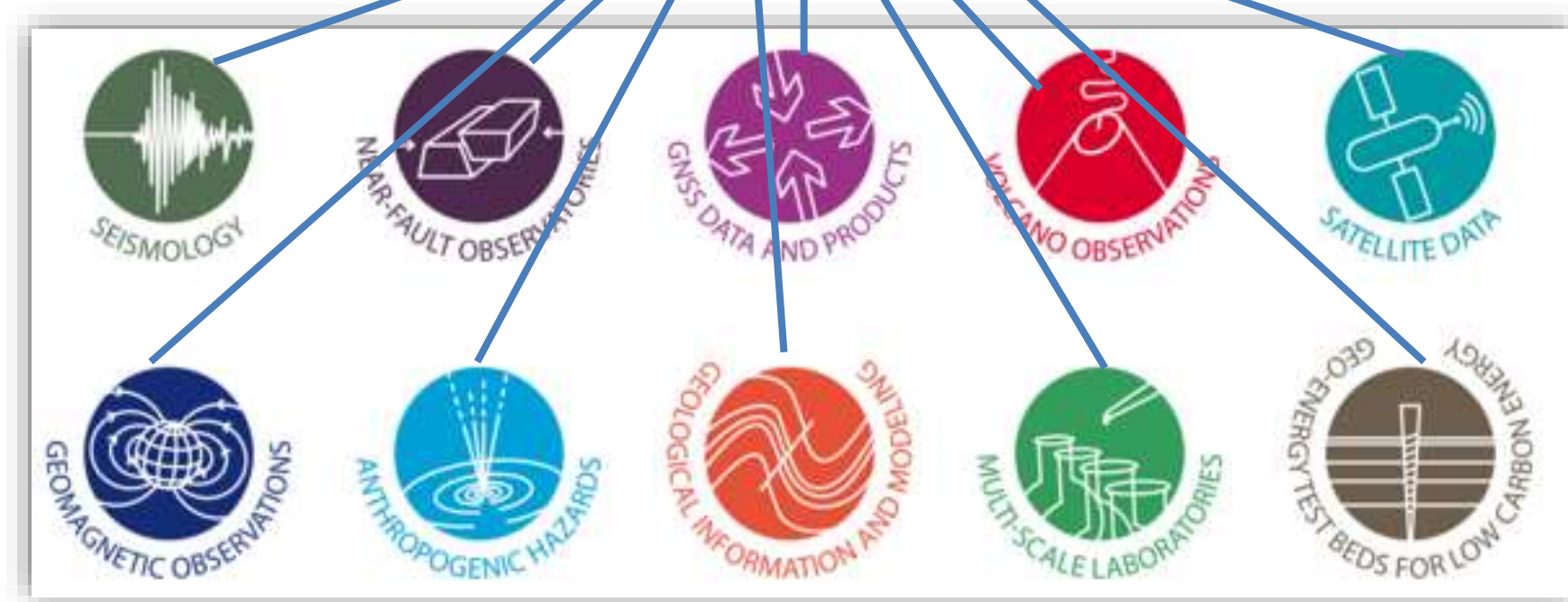
EPOS in Practice

Discovery and access of data and data products (~~open access~~) as well as tools for visualization, processing, etc.

Focus on Solid Earth
the internal
surface

EPOS Portal

core to the



EUREF data and product provision to EPOS

- EUREF products will flow to EPOS
- EPOS would like that EPN stations also make their data available to EPOS
- EPN stations will not become automatically EPOS stations
- For an EPN station to become an EPOS station: sign an EPOS Data Supplier Letter
 - [full ownership rights](#) and/or it has [full rights to data](#) or to allow their distribution by a EPOS
 - Allow [EPOS to distribute the data](#) and affix the [Creative Commons 4.0 CC:BY license](#) on any data provided with no license information (on behalf of data provider).



EUREF 2018 Symposium

Amsterdam 30 May - 1 June, 2018

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General information

On behalf of the Netherlands partnership for geodetic infrastructure (NSGI) we invite you to attend the EUREF 2018 Symposium, which will take place from Wednesday, May 30 to Friday, June 1 in Amsterdam, the Netherlands. Following the success of the tutorials held in the previous years, a one day tutorial will be held on Tuesday, May 29.



About EUREF

EUREF is the International Association of Geodesy (IAG) Reference Frame Sub-Commission for Europe. The Sub-Commission EUREF was founded in 1987 at the International Union of Geodesy and Geophysics (IUGG) General Assembly held in Vancouver.

The scope of the symposium covers the EUREF activities, such as the realisation, maintenance, and usage of ETRS89, EVRS and the EUREF Permanent Network.

Location

EUREF 2018 will take place in Amsterdam, the capital of the Netherlands and the reference point of the Normaal Amsterdams Peil (NAP). The symposium venue will be a spectacular location; **the Science Museum NEMO**, next to Amsterdam Central Station.

Thank you

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EUREF Permanent GNSS Network



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Welcome !

EUREF Permanent GNSS Network

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 routinely 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

Quick Station Links

[Information](#) [Coordinates](#) [Time Series](#)

[Data Quality](#)

(select a station)

Next Meetings

2018-05-06 / 2018-05-11 :
[FIG XXVI Congress and General Assembly](#) (Istanbul, Turkey)

2018-05-14 / 2018-05-17 :
[The European Navigation Conference 2018](#) (Gothenburg, Sweden)

2018-05-30 / 2018-06-01 :
[EUREF 2018 Symposium](#) (Amsterdam, Netherlands)

[More ...](#)

Job Opportunities



ROYAL
OBSERVATORY
OF BELGIUM

