Assessment of EPOS' GNSS data

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What is EPOS ? (European Plate Observing System)

- A multidisciplinary, distributed research infrastructure that provides access to data, data products, and services from the solid Earth science community in Europe.

- Identified as a key infrastructure by the **European Strategy Forum on Research Infrastructures**

On October 30th, 2018, the European Commission granted the legal status of European Research Infrastructure Consortium (ERIC) to EPOS.

ERIC provides EPOS with a legal framework recognized in all EU Member States.

Full members:
- Founders: Belgium, Denmark, France, Italy, Norway, Portugal, Netherlands, Slovenia, UK
- 2018: Poland
- 2019: Greece, Iceland
- 2020: Romania
- 2022: Austria, Sweden
- 2023: Bulgaria, Croatia, Spain, Switzerland

Observer:
2022: Germany

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Thematic Core Services

- Seismology
- GNSS Data and Products
- Satellite Data
- Anthropogenic Hazards
- Multi-Scale Laboratories
- Near-Fault Observatories
- Volcano Observations
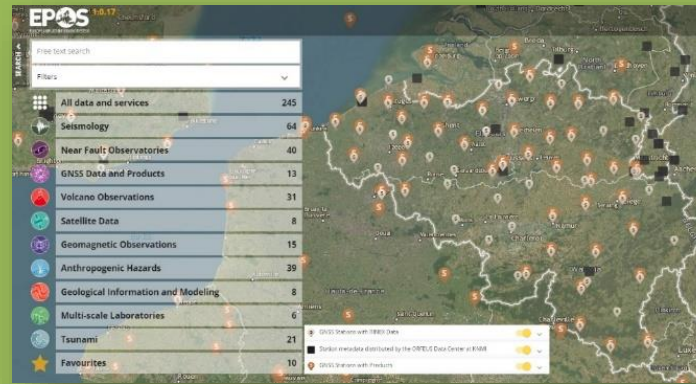- Geomagnetic Observations
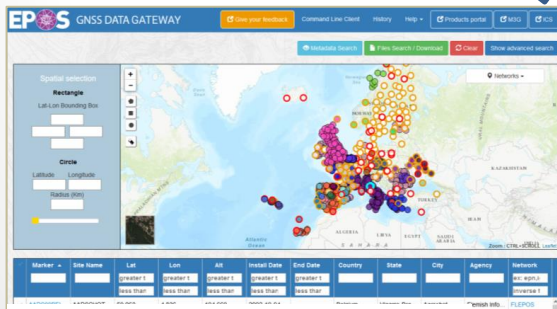- Geological Information and Modeling
- Tsunami ~~(Candidate TCS)~~

MoU EUREF-EPOS !

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EPOS-GNSS : Basic Principles

1) **Daily GNSS data – 30 sec. sampling** (extension to 1-sec under preparation)

2) **GNSS station metadata**

    i.   All GNSS stations must have site logs in M^{3}G which must be kept up to date

    ii.   All GNSS datasets must have a data license

    iii.   All GNSS datasets must have a DOI (in progress!!)

3) **GNSS data quality**

    i.   All GNSS data must undergo data quality control

    ii.   Results of the GNSS data quality control must be provided to the user and the station manager

4) **Centralized access to** GNSS data based on distributed infrastructure of data nodes

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EPOS data portal

EPOS data portal
https://www.epos-eu.org/dataportal

GNSS data gateway
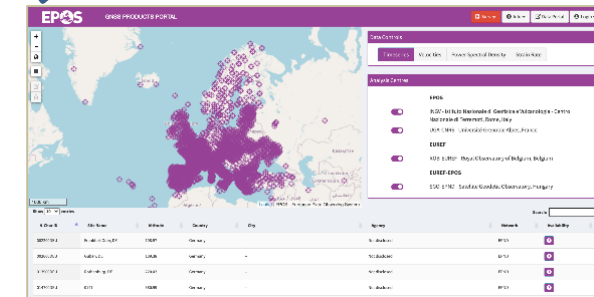
https://gnssdata-epos.oca.eu/

GNSS products portal

https://gnssproducts.epos.ubi.pt/

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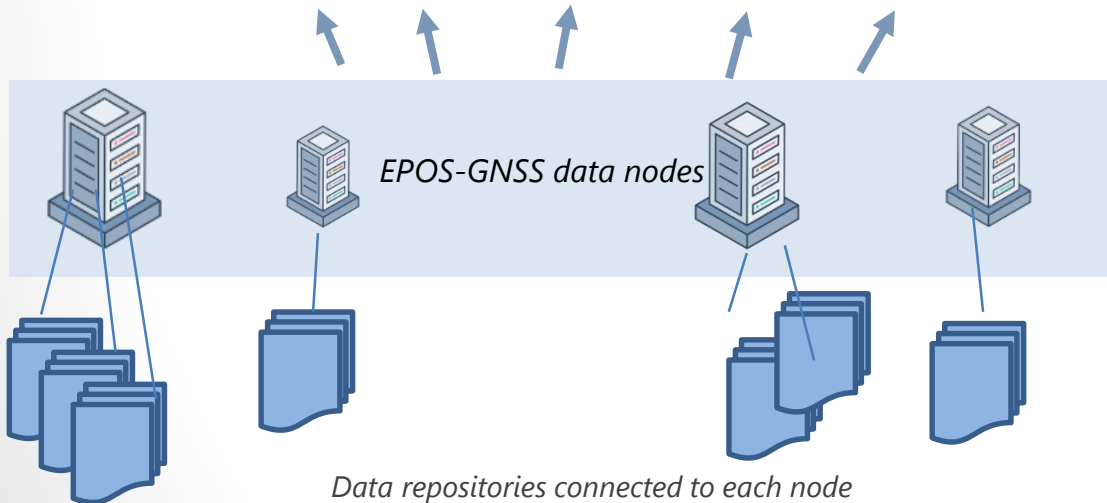
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EPOS-GNSS data dissemination concept

EPOS-GNSS Data Gateway
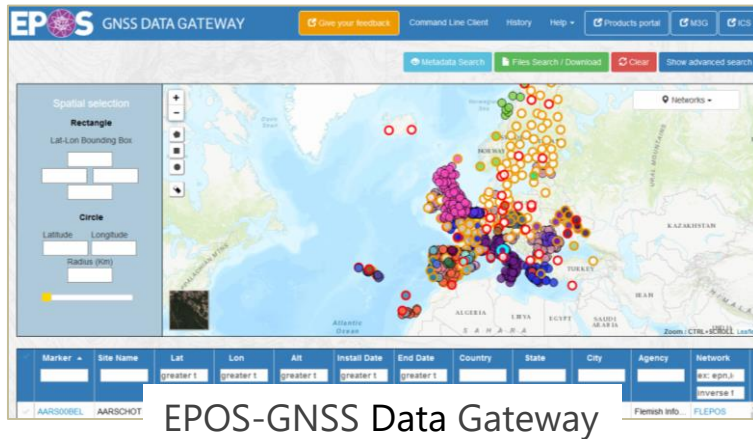
EPOS-GNSS data nodes

Data repositories connected to each node

Distributed Data Access:

Station operators upload their GNSS observation data to a data repository (or data center).

On top of the data repositories: virtualization layer (software) => data node

DEDICATED SOFTWARE (harmonization) TO

1. Run GNSS data quality checks

2. Check RINEX header vs site log

3. If data OK: provide https://... location of the GNSS data files in the repository to the GNSS Data Gateway

When users connect to Data Gateway and search for data, they will be redirected to nodes → data repositories

Data Gateway offers centralized access to GNSS (meta)data in all repositories via
-   Web interface
-   APIs

EPOS-GNSS data dissemination concept
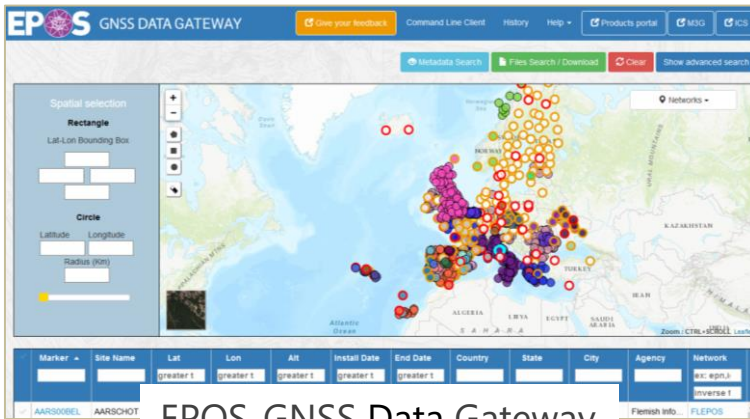
EPOS-GNSS Data Gateway

EPOS-GNSS data nodes

Data repositories connected to each node

EPOS-GNSS data nodes
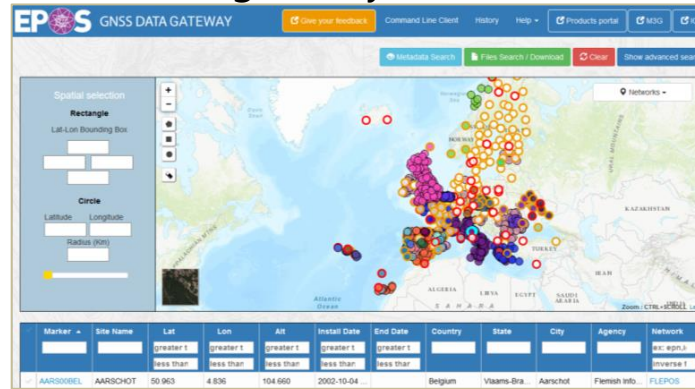
Pre-operational

Pre-operational

National data nodes : Belgium (ROB), France (OCA), Greece (NOA), Portugal (UBI), Romania (NIEP), Spain (IGN)

Thematic or pan-European nodes: Pan-European (UBI), ROB-EUREF (ROB), SONEL (LIENSs), CEGN (CRS), IPGP (IPGP), RING (IRN)
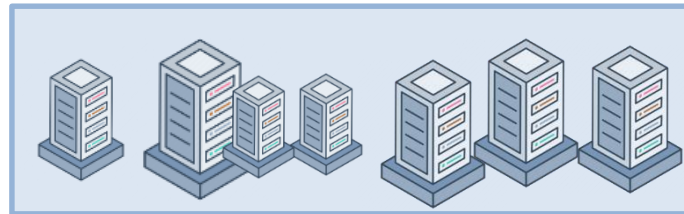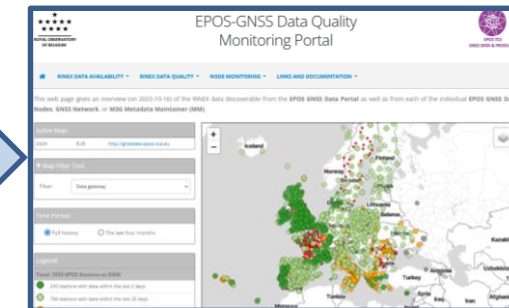
EPOS-GNSS data dissemination concept

GNSS data gateway

France, OCA

GNSS station metadata

Belgium, ROB

GNSS data nodes

GNSS data quality monitoring service

Belgium, ROB
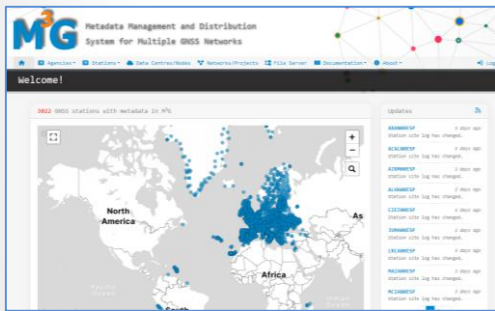
GNSS Data Quality Monitoring Service (DQMS)

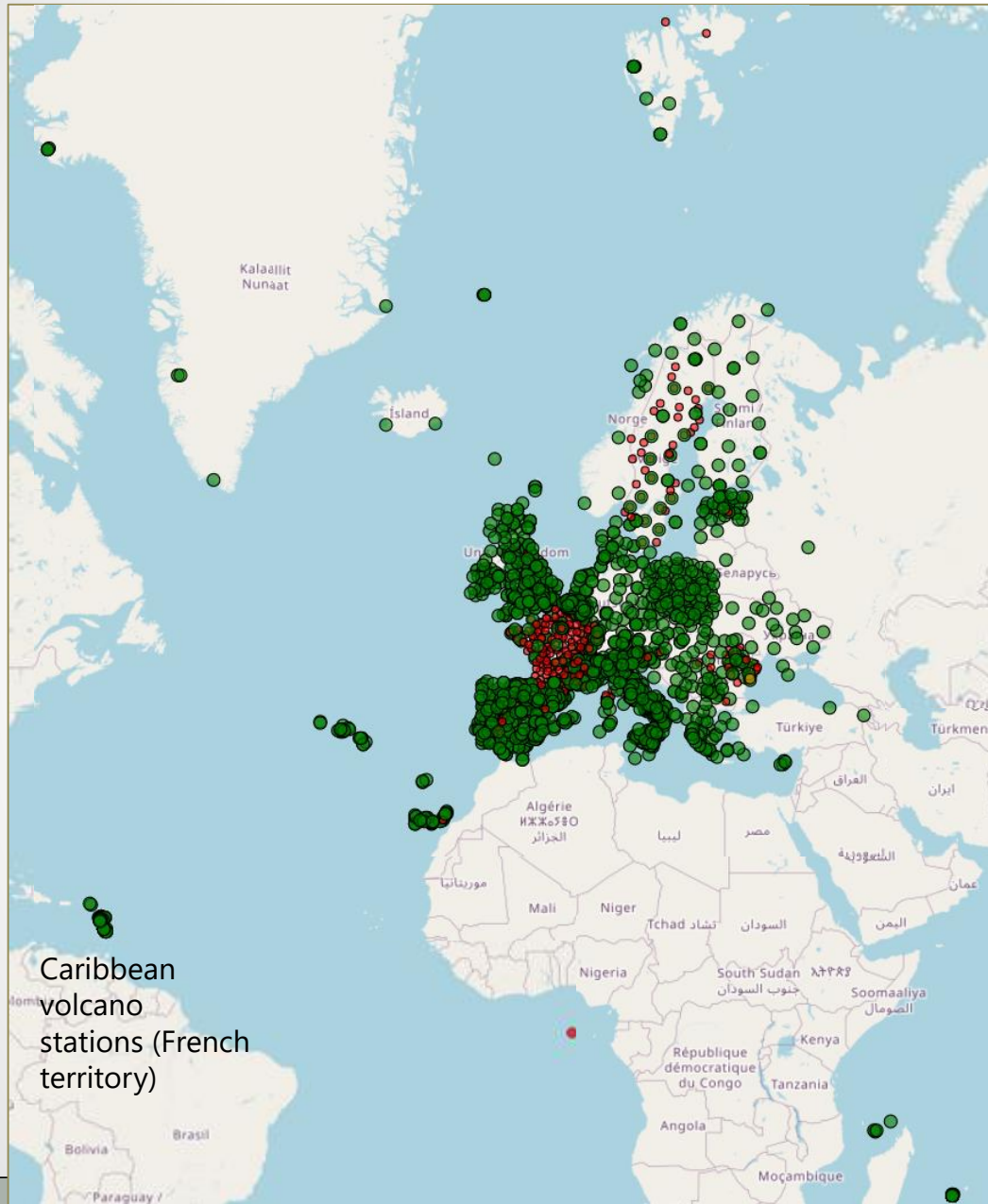https://gnssquality-epos.oma.be/

- Workflow of the DQMS

  - retrieves the Data Quality checks that the nodes are computing for all their GNSS data

  - computes Data Quality Indicators (DQI)

  - provides DQI plots on DQMS web site

- DQMS web site provides information on

  - GNSS data availability

  - GNSS data quality information
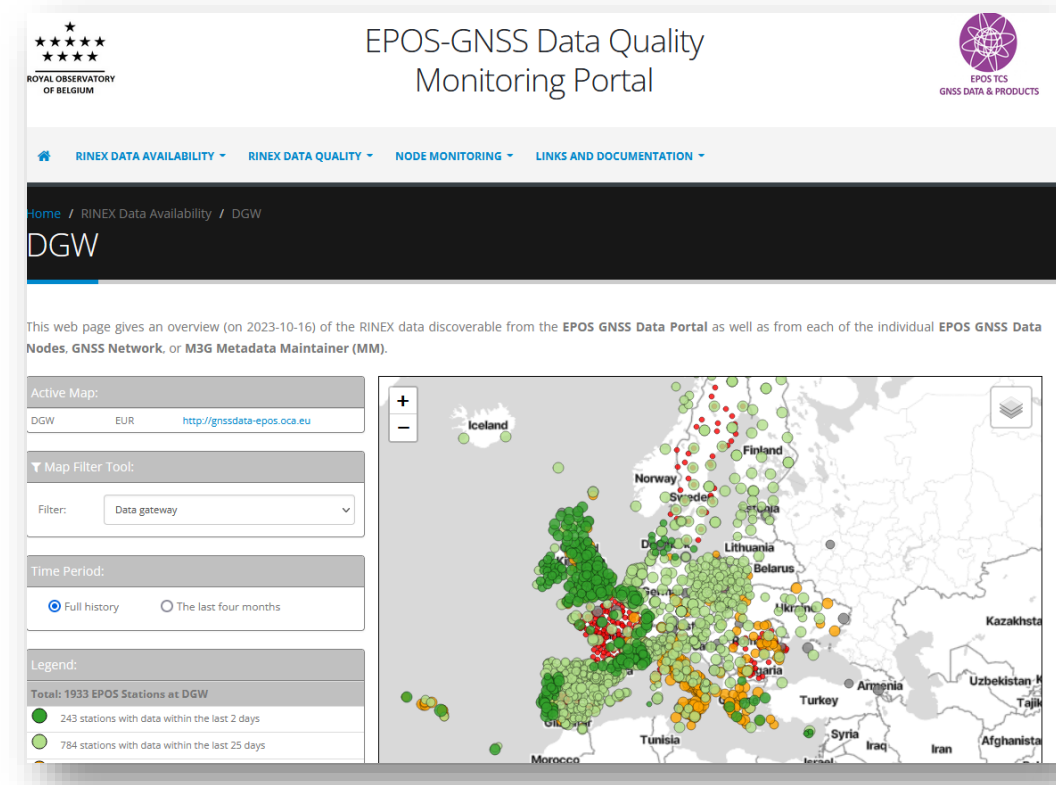
EUREF POSTER: Bamahry et al, **Toward long-term data quality monitoring of EPOS-GNSS stations**

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Current EPOS-GNSS network

Caribbean
volcano
stations (French
territory)

2011 GNSS stations agreed to share data with EPOS

1719 GNSS stations with data

Current EPOS-GNSS network

Data missing because working on

- Completing of site logs for historical data

- Correcting RINEX headers
    - Tools are available!

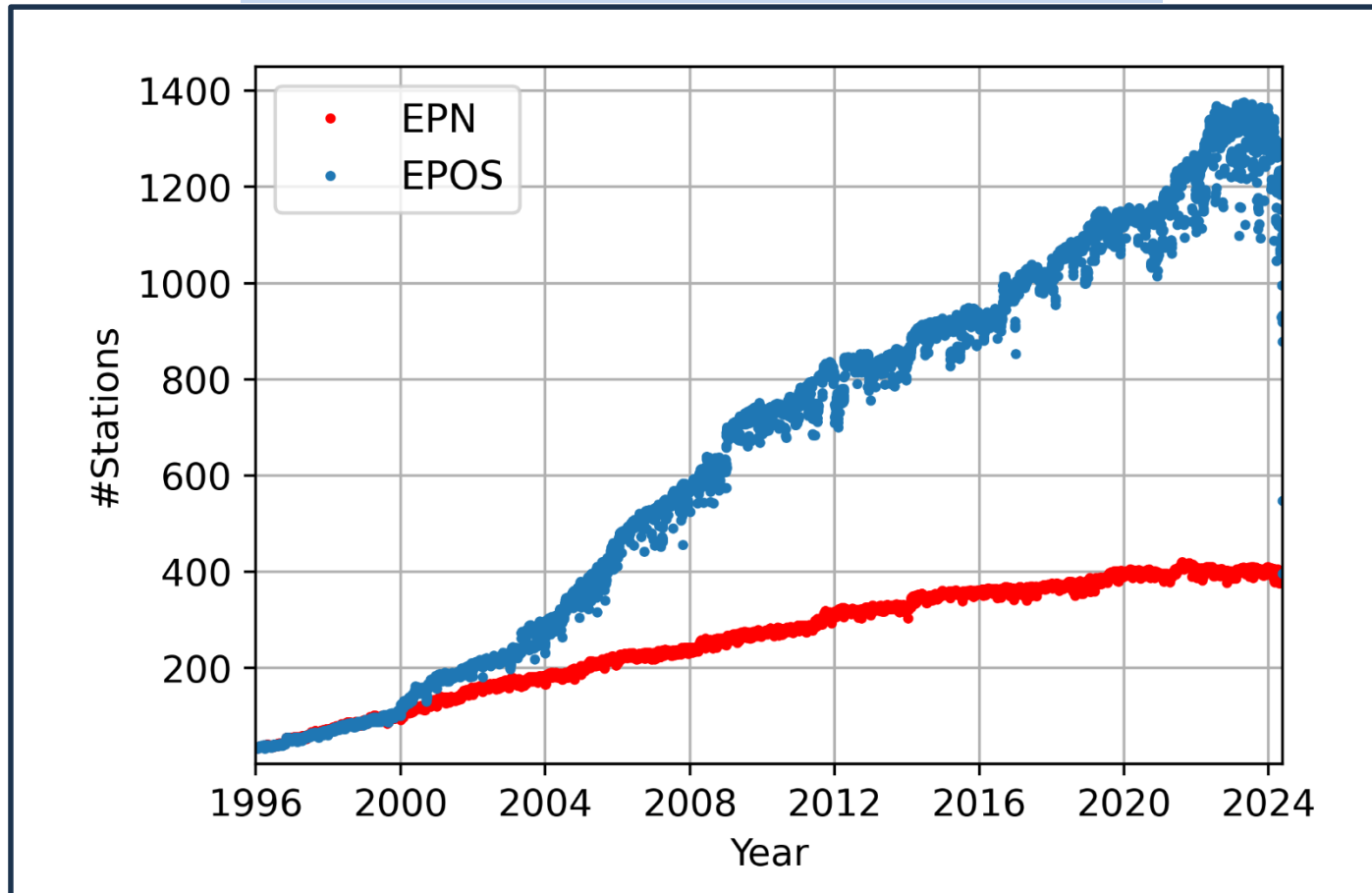- Installing their own EPOS-GNSS data node
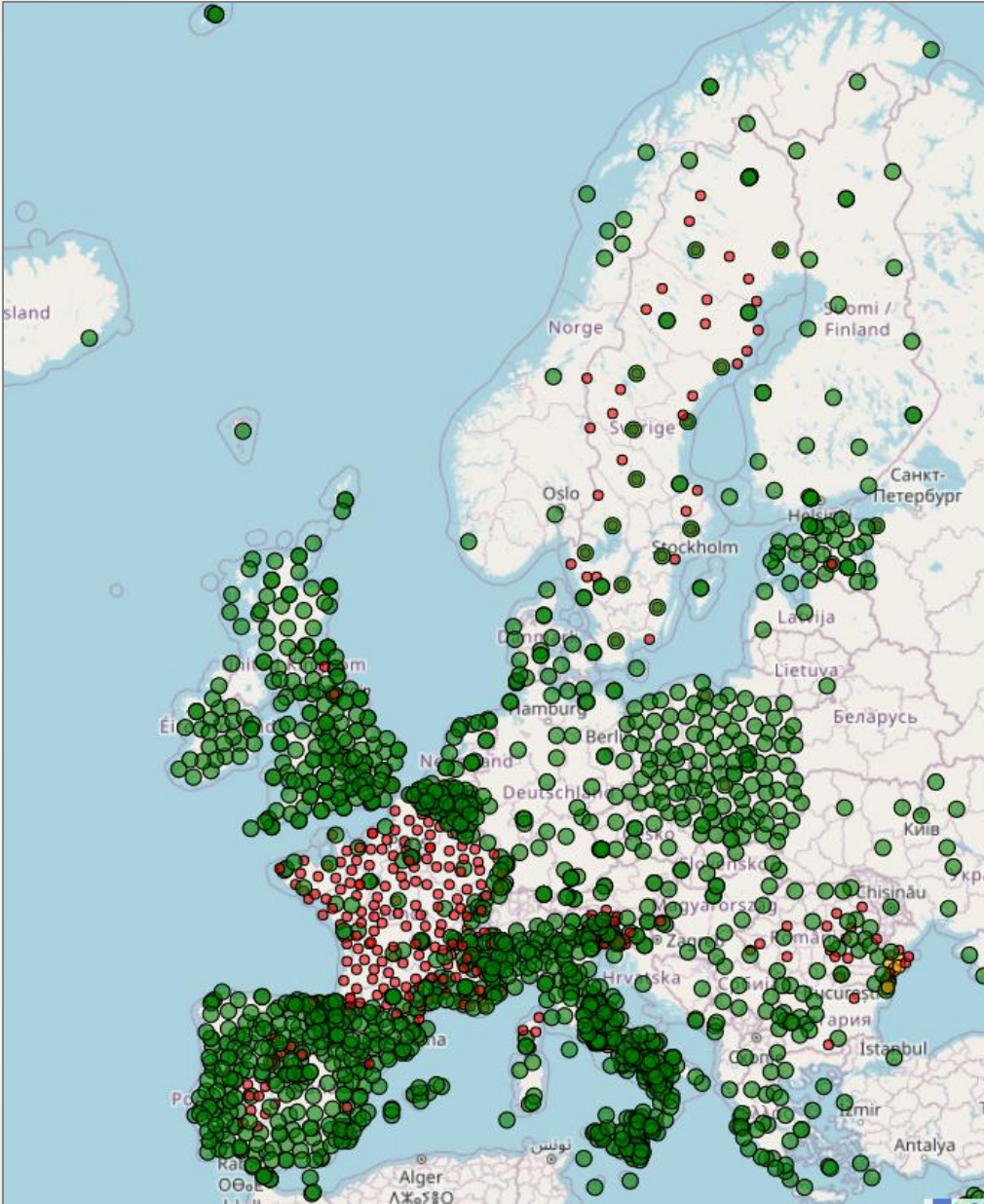
Data available from the EPOS-GNSS nodes
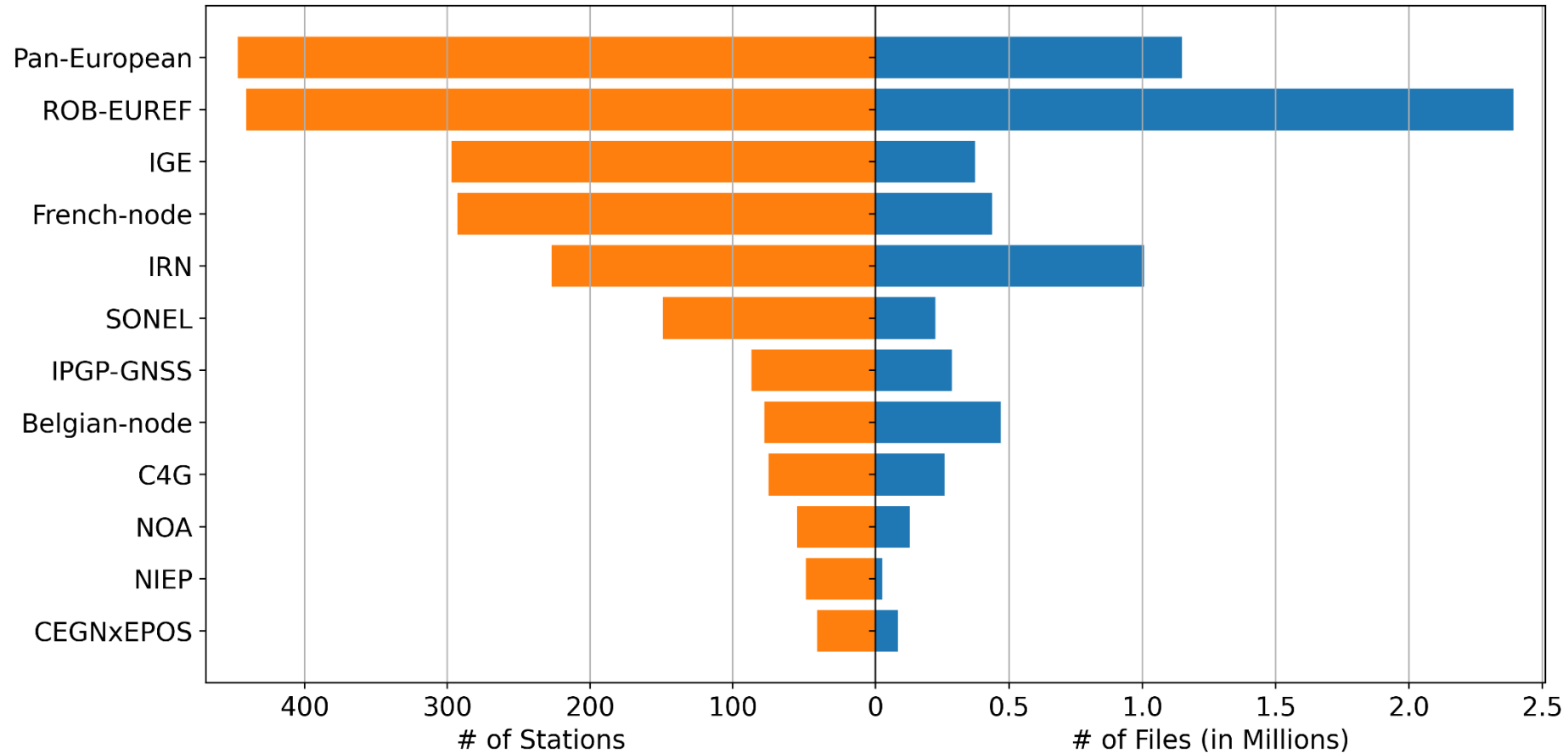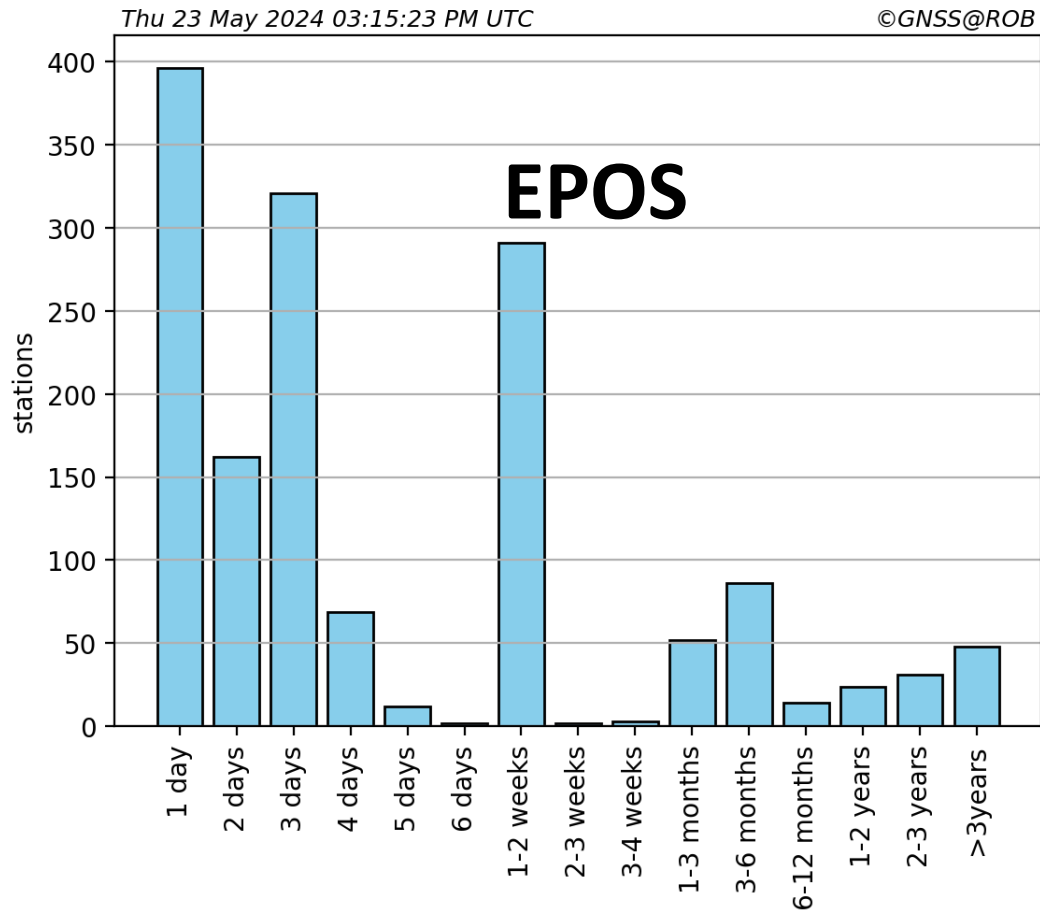
Increase of available RINEX files

Number of stations with RINEX files

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Days since last data available for a station

days since last available data (2024-05-23)
EPOS

Thu 23 May 2024 03:15:23 PM UTC   ©GNSS@ROB

EPOS

days since last available data (2024-05-23)
EPN

Thu 23 May 2024 03:15:04 PM UTC   ©GNSS@ROB

EPN
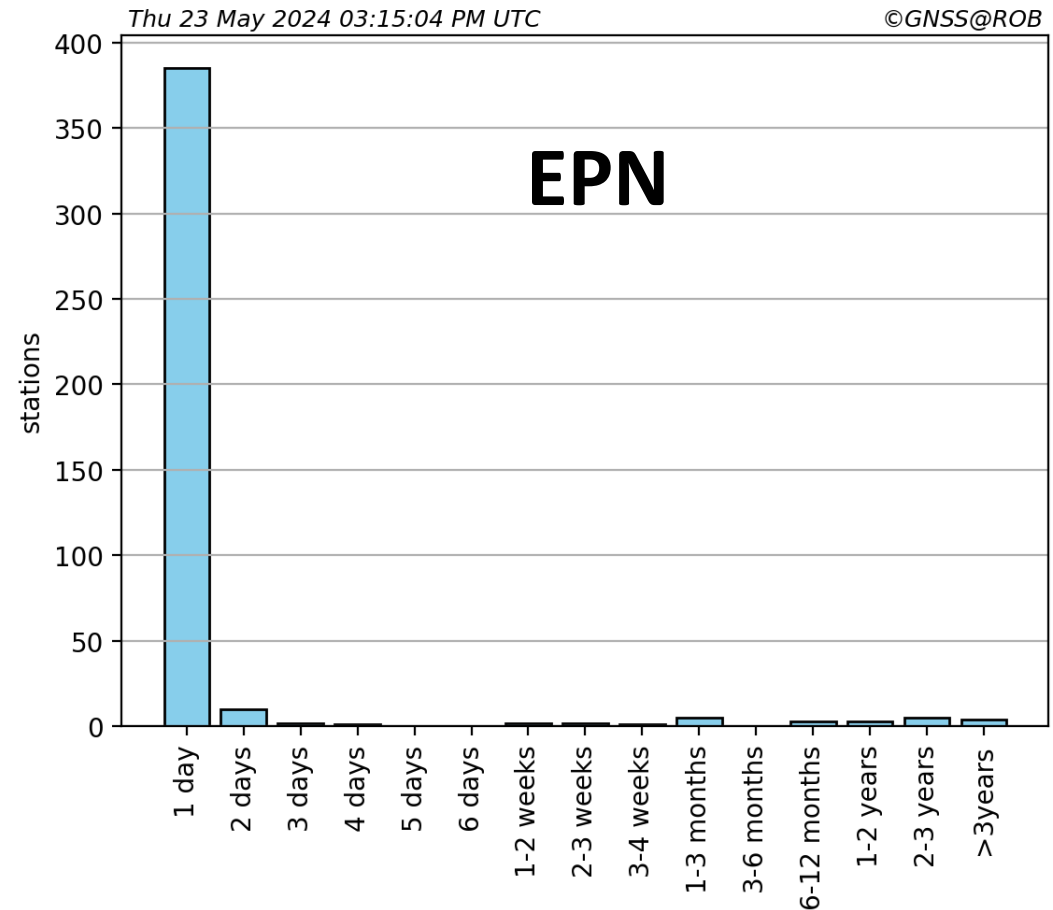
Multi-GNSS capabilities

EPN

GLO: 97%
GAL: 91%
BDS: 81%

EPOS

GLO: 93%
GAL: 82%
BDS: 59%

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GNSS data quality

Observed/Expected GPS Observations
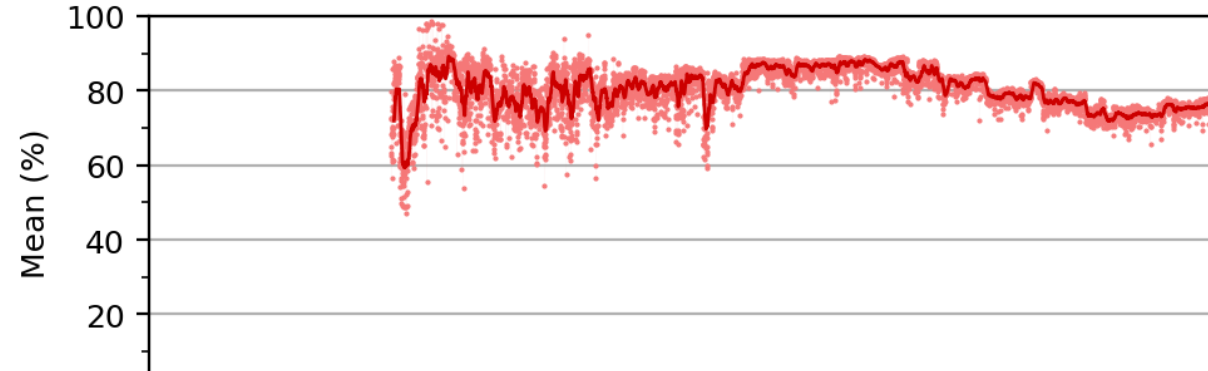EPN
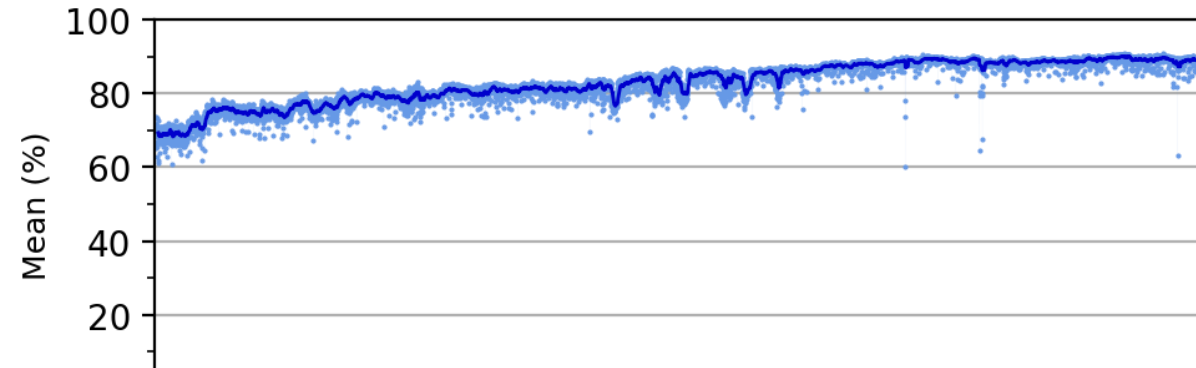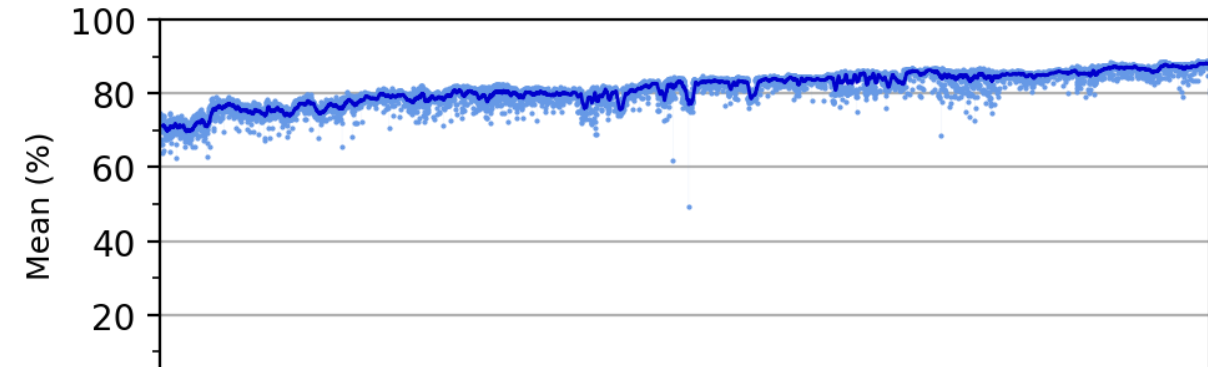
Observed/Expected GPS Observations
EPOS

Observed/Expected GLONASS Observations
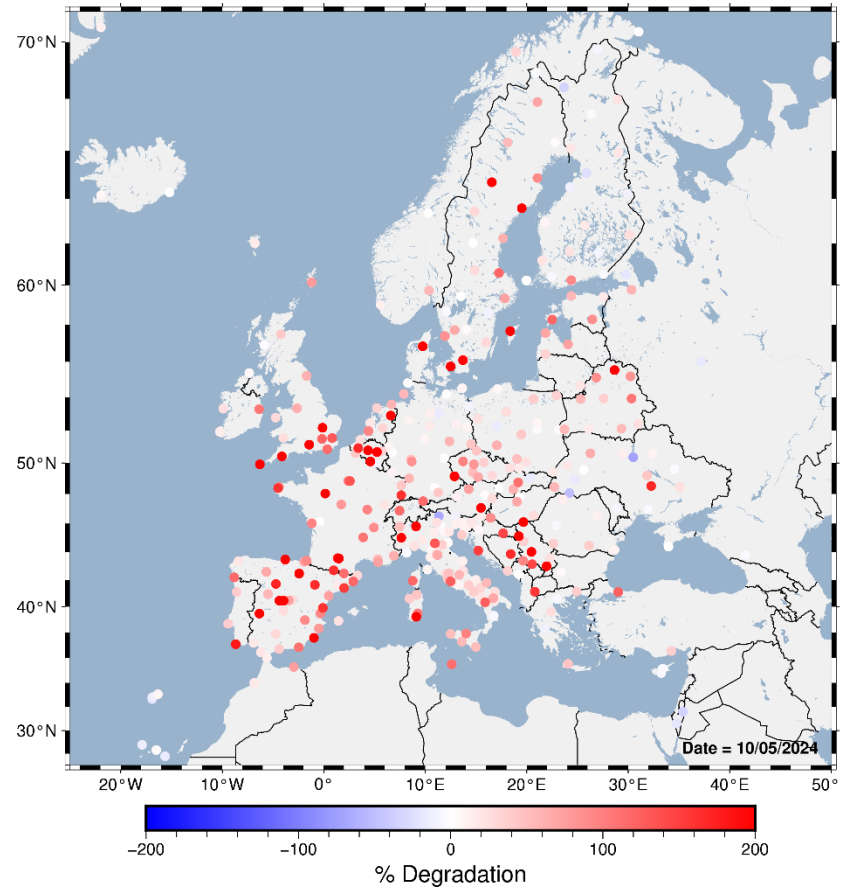EPN
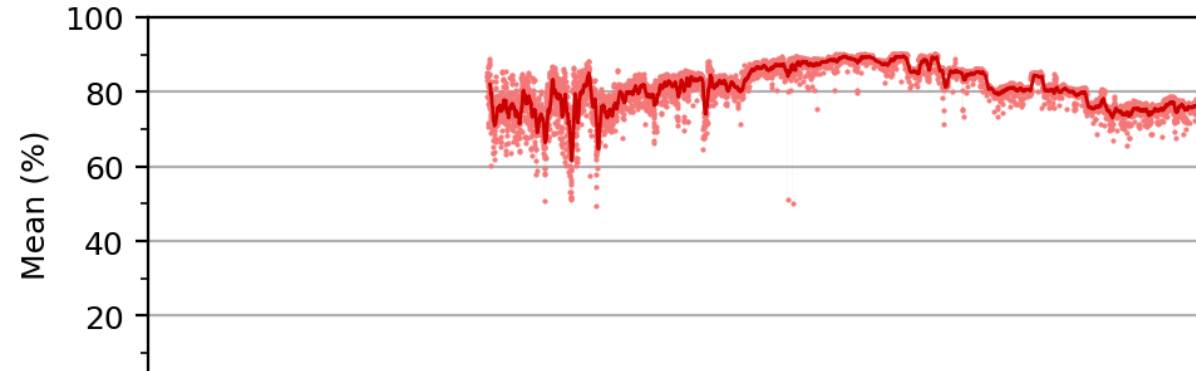
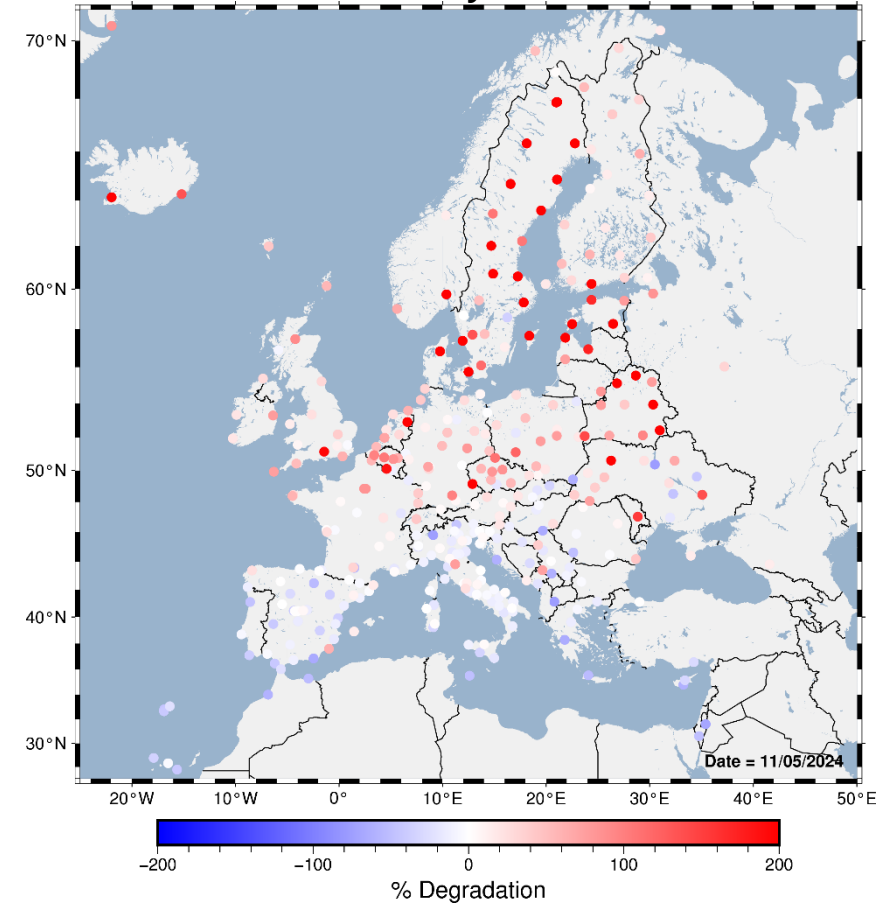**Observed/Expected GLONASS Observations**
EPOS

Solar storms of May 2024
series of powerful solar storms with extreme solar flares and geomagnetic storm components that
from 10–13 May 2024   *https://www.sidc.be/article/gnss-impacts-10-11-may-extreme-storm*

% degradation of
number of cycle slips
wrt baseline (28-04-
2024 to 05-05-2024)

May 10

May 11

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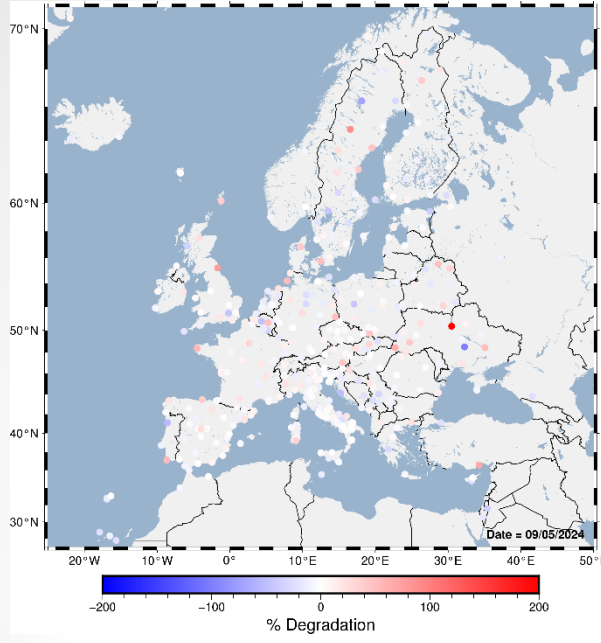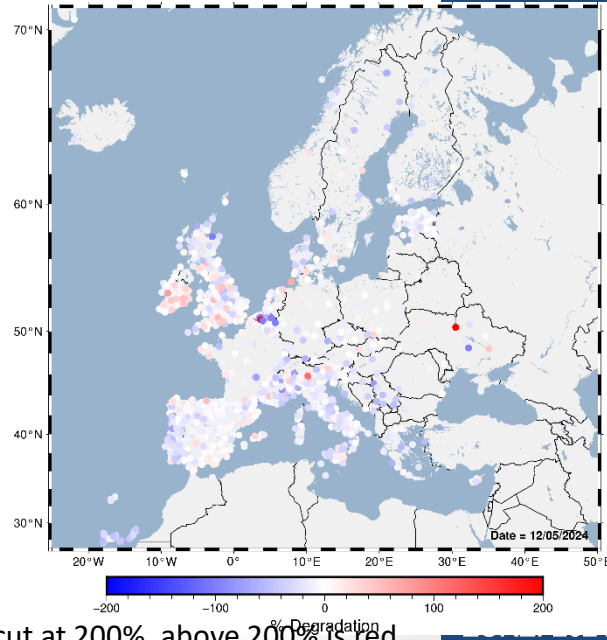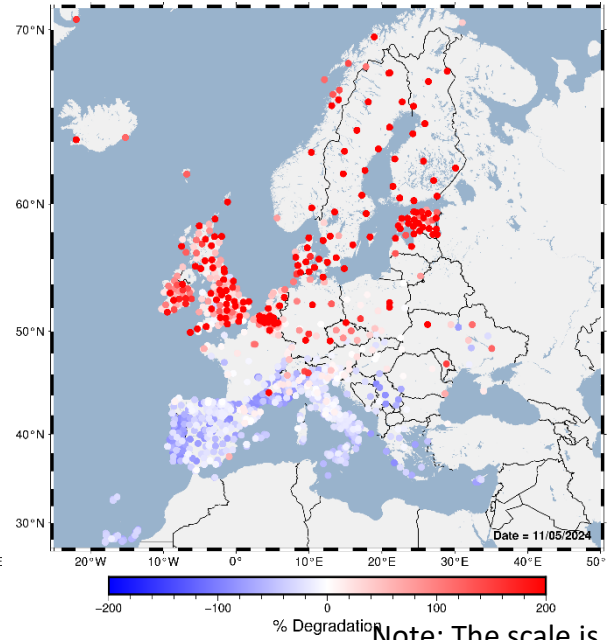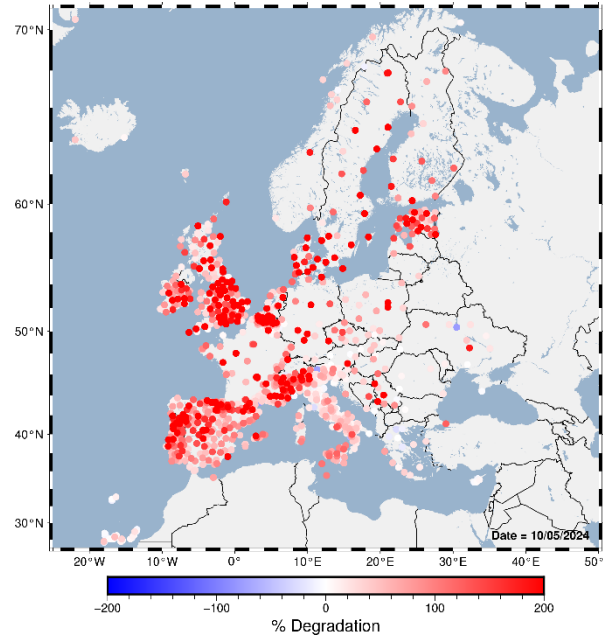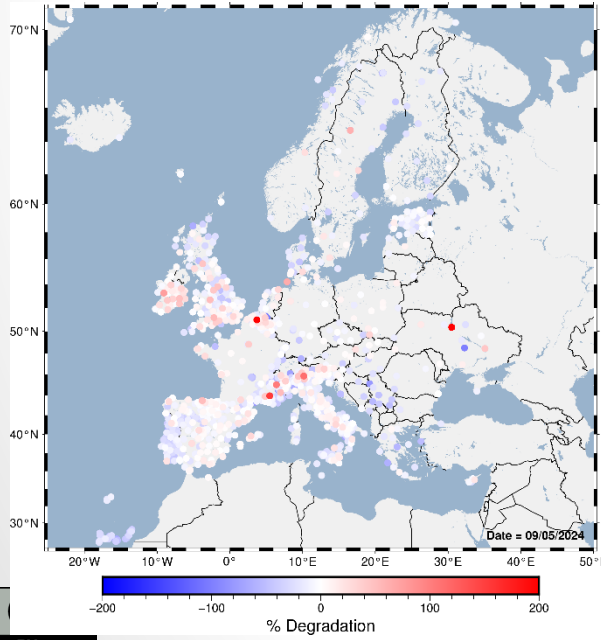
May 9   May 10   May 11   May 12   2024

EPN
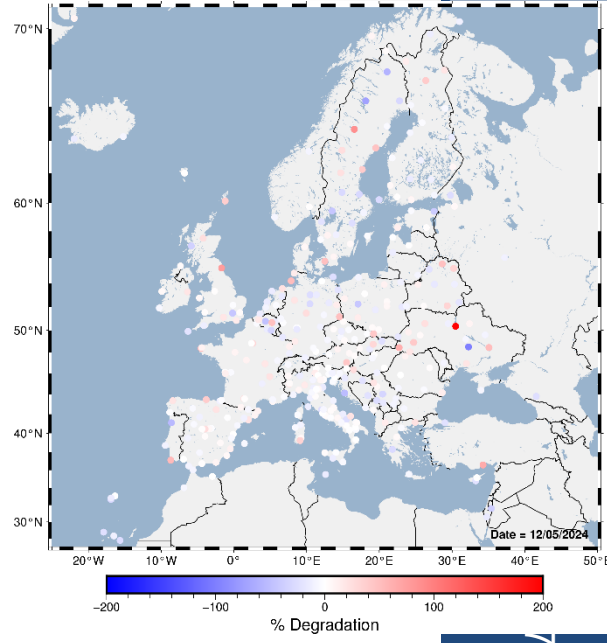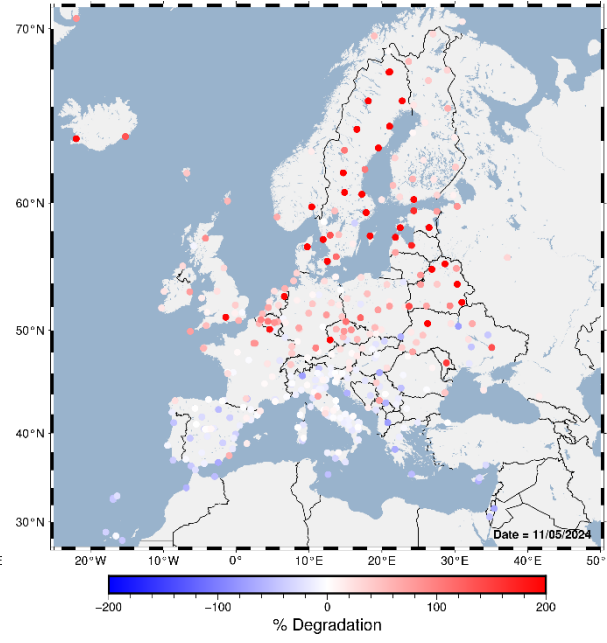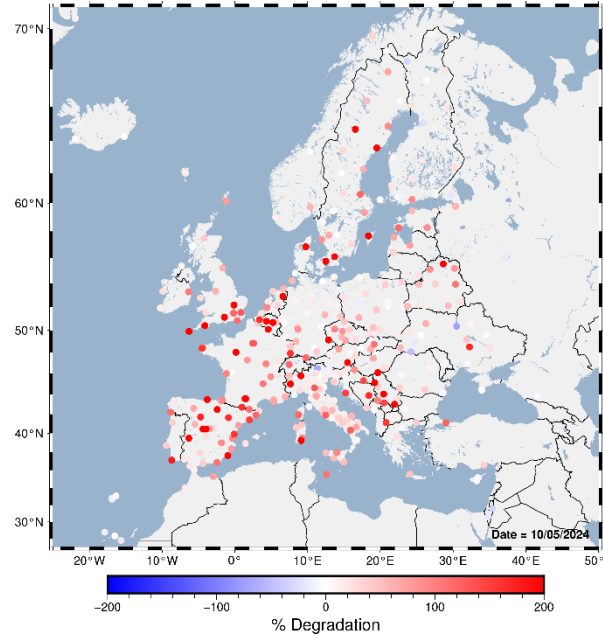
EPOS

Note: The scale is cut at 200%, above 200% is red

Conclusions

- GNSS component of EPOS provides now access to daily RINEX data of 1700's GNSS stations

- Less historical data in EPOS than in EPN, because EPOS GNSS nodes are currently in process of populating data bases with historical data

- EPN data are available faster than EPOS data because EPOS is not targeting low latencies (core business are long-term deformations)

- EPN is more multi-GNSS driven than EPOS

- EPOS and EPN GNSS data quality are comparable

- EPOS provides access to a denser network of stations which offers potential to see interesting scientific phenomena that are harder to see if only using EPN data

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Thank you for your attention

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