



EPOS-GNSS Data Gateway User Training

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*with the support of the Geo-INQUIRE communication team
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Geo-INQUIRE is funded by the European Union. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or the European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.



Outline

Welcome and a few words from the Geo-INQUIRE Communication Team

- **Part I:** The EPOS-GNSS Data Gateway
- **Part II:** Discovering and Downloading GNSS Data and Metadata: Demonstration

5-minute break

- **Part III:** Hands-on Exercises (5 practical exercises)
- **Part IV:** Questions & Answers (Q&A)
- **Part V:** Concluding Remarks and Training Satisfaction Survey





EPOS-GNSS Data Gateway User Training

Part I: The EPOS-GNSS Data Gateway

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EPOS-GNSS Goals for GNSS Data Access and Distribution

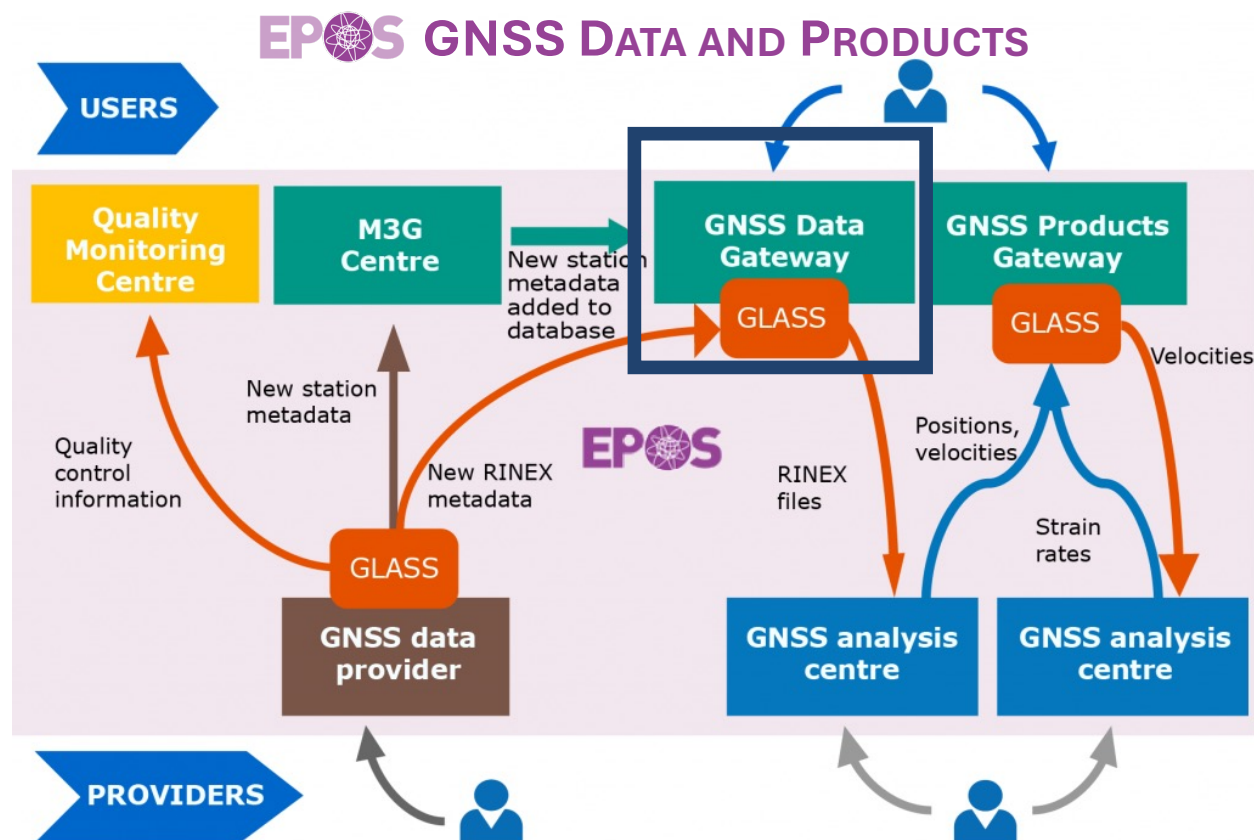
- To provide a **unified access** to metadata and data from **as many permanent GNSS stations across Europe as possible**.
- To integrate these metadata into the EPOS* research infrastructure, enabling **multidisciplinary data discovery and access**.
- To provide European GNSS data providers with a **robust information system** for **verifying and validating** metadata and data **before publication**.
- To simplify FAIR° data publication and distribution for European data providers by providing a **common framework** that encourages harmonized practices, shared expertise, and continuous improvement across Europe.

These goals are achieved through the **EPOS-GNSS Data Gateway** and thanks to an **EPOS-GNSS pan-European Team**&



* EPOS : European Plate Observing System, ° FAIR : Findable, Accessible, Interoperable, and Reusable, & UBI, OCA, ROB, INGV, UGA

The EPOS-GNSS Data Gateway (DGW) within EPOS-GNSS



- The **portal** where users can request for GNSS metadata and data of all the GNSS stations integrated into the EPOS-GNSS infrastructure



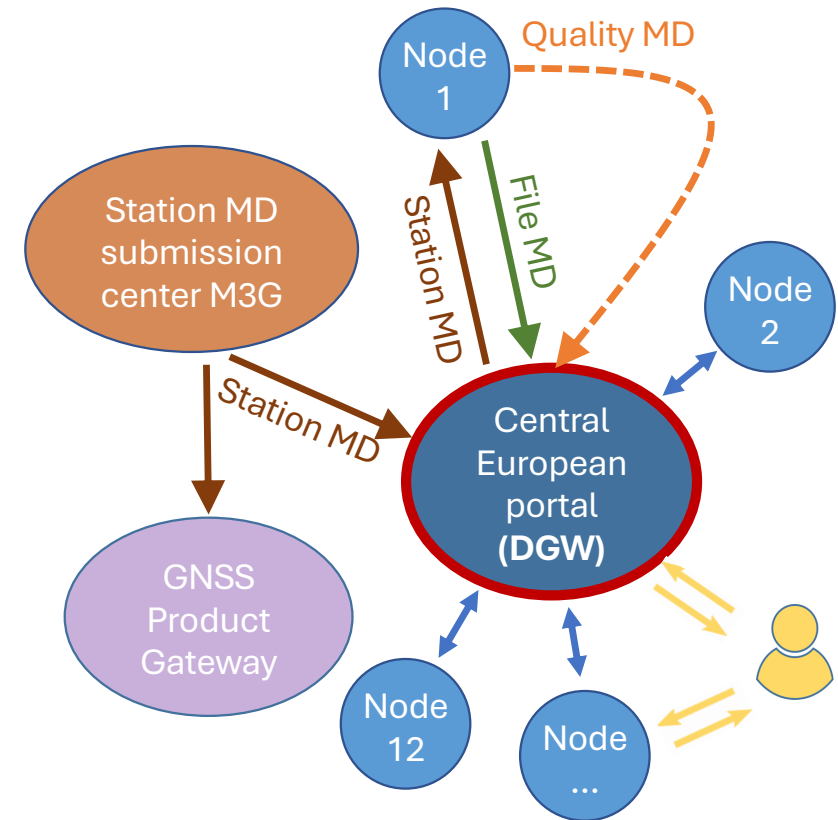
- The **system** supporting the portal, hosted at the Côte d'Azur Observatory (OCA) and maintained by CNRS & OCA, France.



The EPOS-GNSS DGW and Data Infrastructure

➤ The concepts

- A **European portal system** integrating data and metadata from independent local nodes
- A **network of nodes** distributing station, file and QC metadata
- A system of copy and synchronization of these metadata, once **data checked** and **validated**.
- A **central point of access** for the station and file metadata (including sitelogs, urls of the data files) for all the **validated** GNSS stations and files.
- The quality metadata stay at the local node
- The data stay in their repository (i.e. never move)

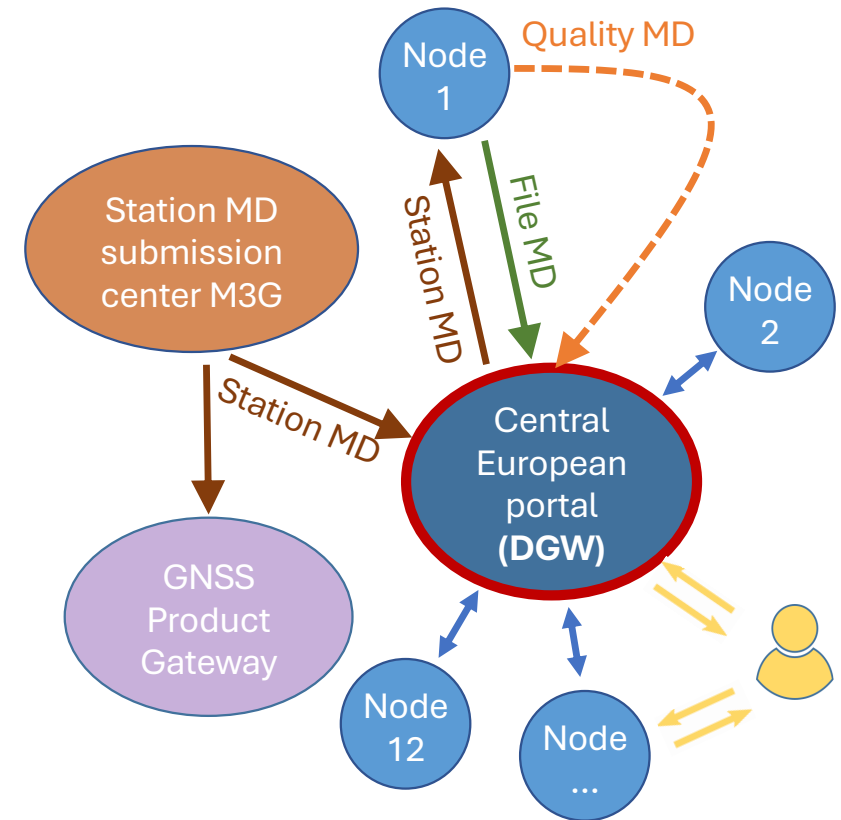


The EPOS-GNSS DGW and Data Infrastructure

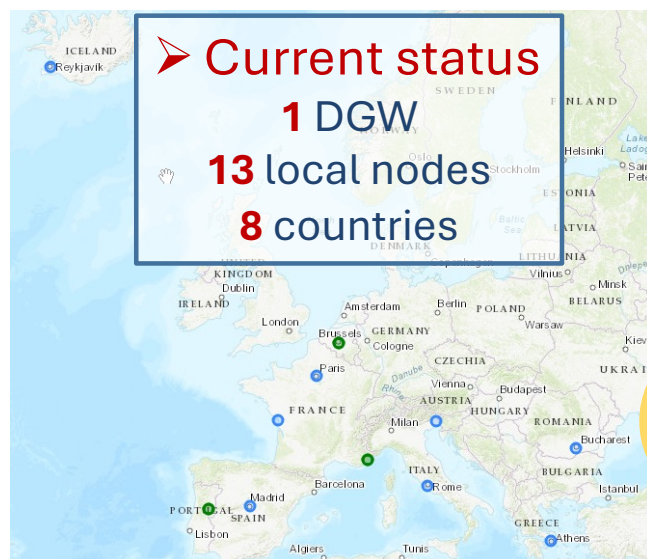
➤ What does this mean?

- **All validated data and metadata** can be discovered, queried or used for filtering **through the Data Gateway**
- **All “local” data and metadata** can be discovered, queried or used for filtering **through their corresponding local node**

- ➔ **Unique metadata for each station and each data file across the entire system**
- ➔ **Enhanced FAIR data publication**

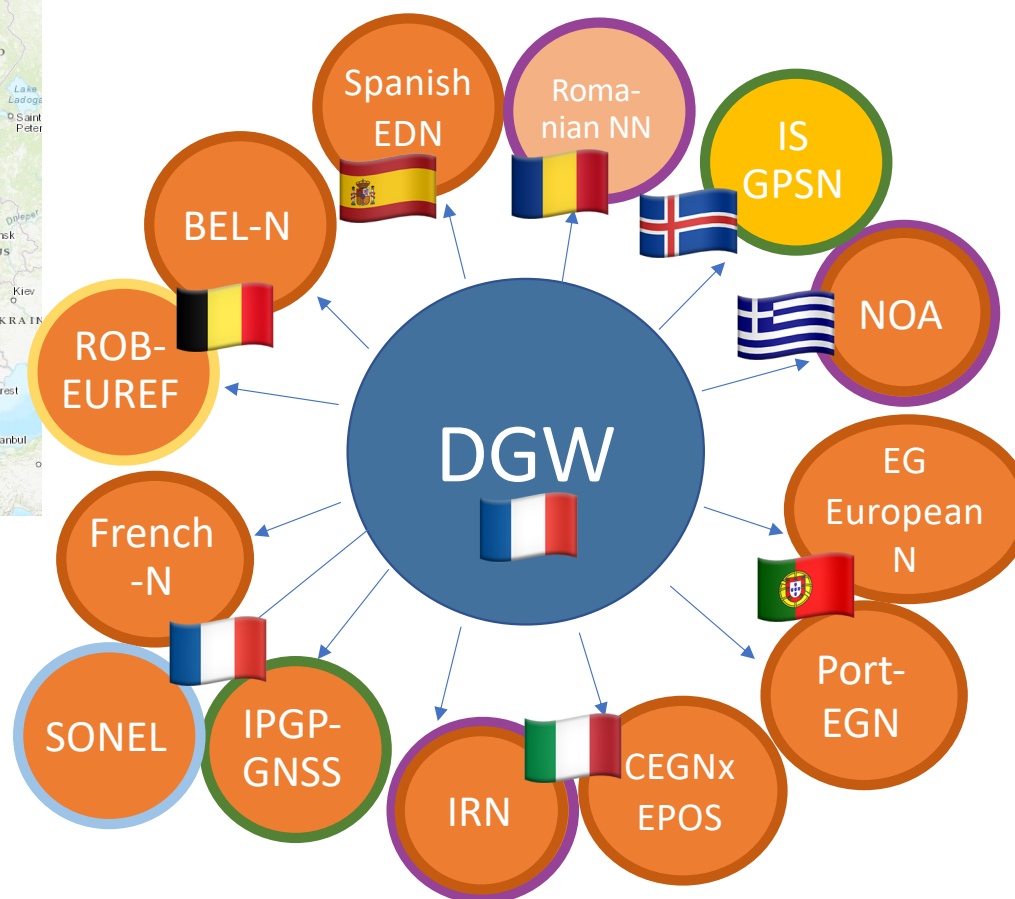


The EPOS-GNSS DGW and Data Infrastructure



Data population

- Operational with daily routine (11)
- Operational (1)
- Pre-operational (1)
- Planned (0)



Main Thematic

- Tectonic deformation
- Reference Frame
- Volcanoes
- Near Fault Obs.
- Sea Level
- Atmosphere



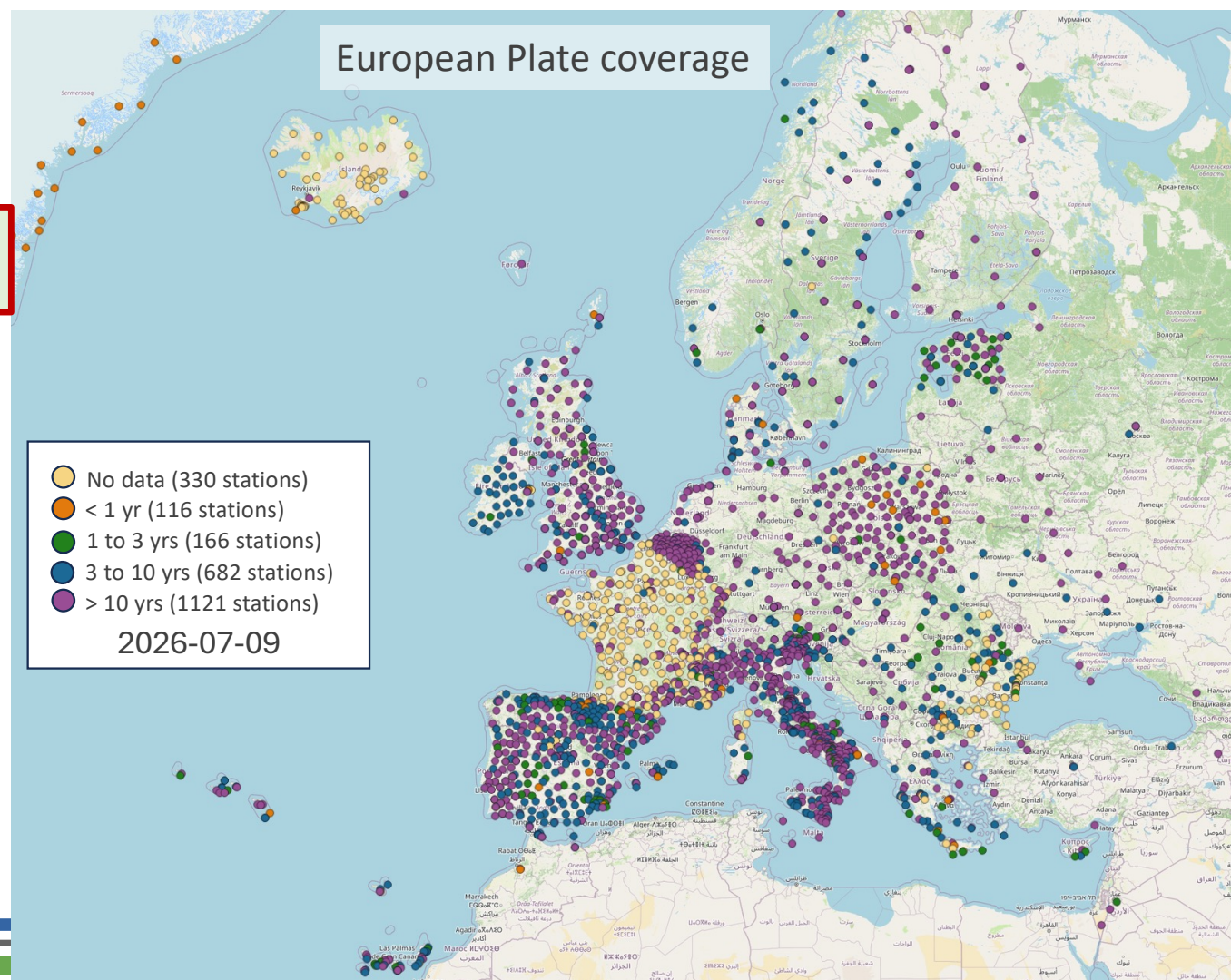
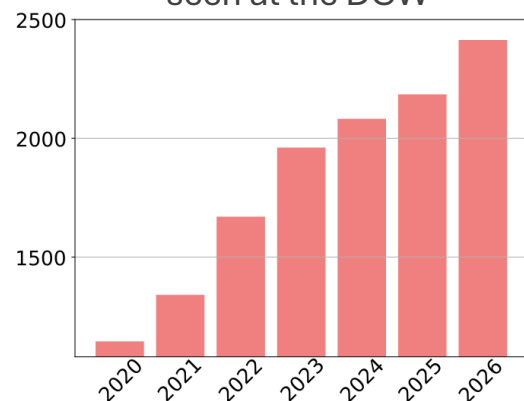
GNSS stations and data available through the DGW

Current status - stations

2414 stations

2084 stations with at least 1 file

Evolution of the number of stations seen at the DGW



GNSS DATA AND PRODUCTS

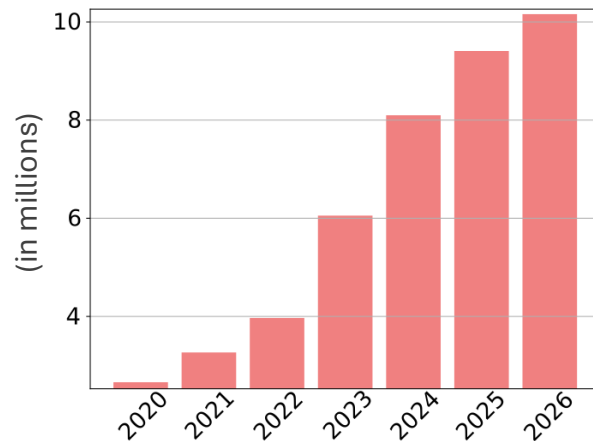


GNSS stations and data available through the DGW

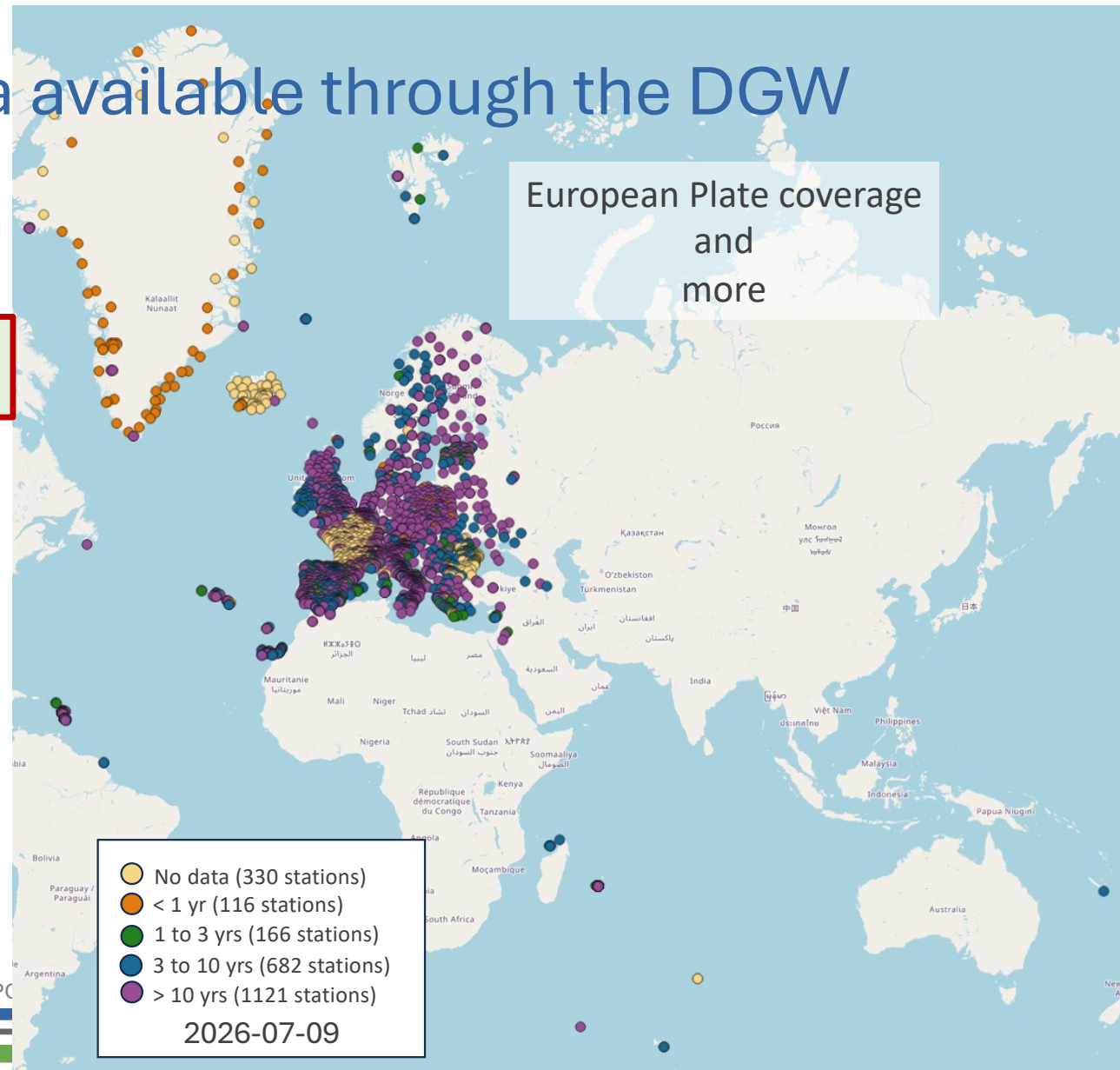
Current status - files

10.17 M daily RINEX files
1.2 M high-rate hourly RINEX files

Evolution of the number of files
seen at the DGW



Geo-Inquire - EPC



GNSS stations and data available through the nodes

3 pan-European nodes
ROB-EUREF, EPOS-GNSS, SONEL

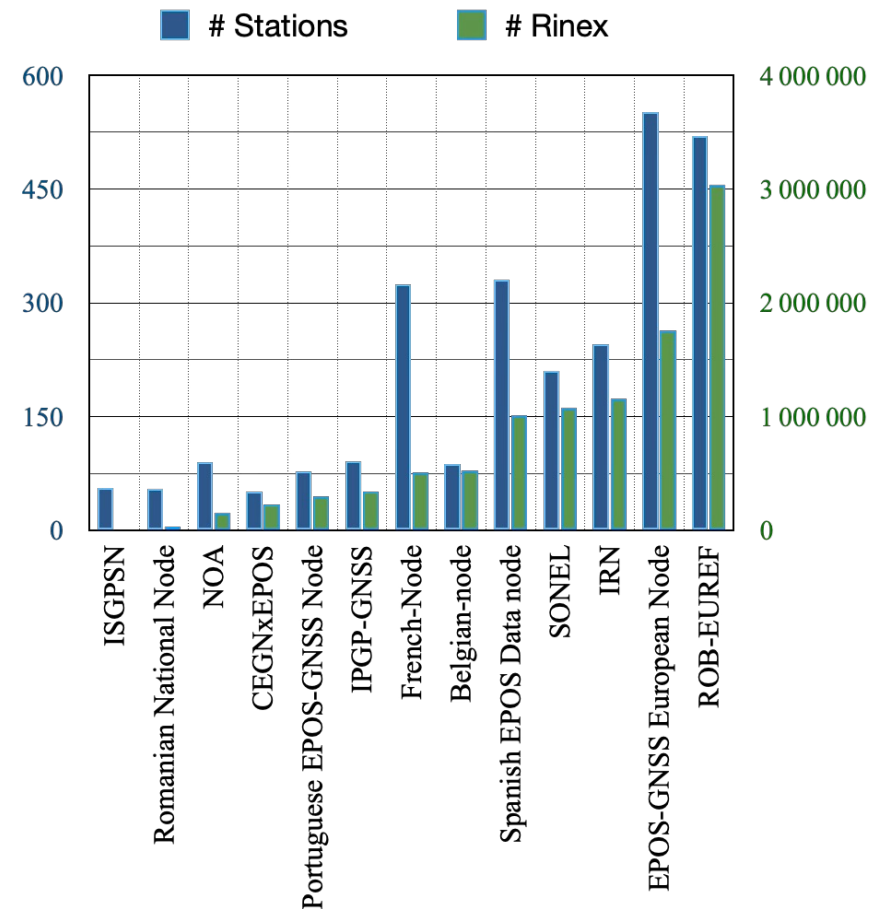
+

8 national nodes
*Italy, Spain, Belgium, France,
Portugal, Greece, Romania, Iceland*

5 nodes with more than 225 stations

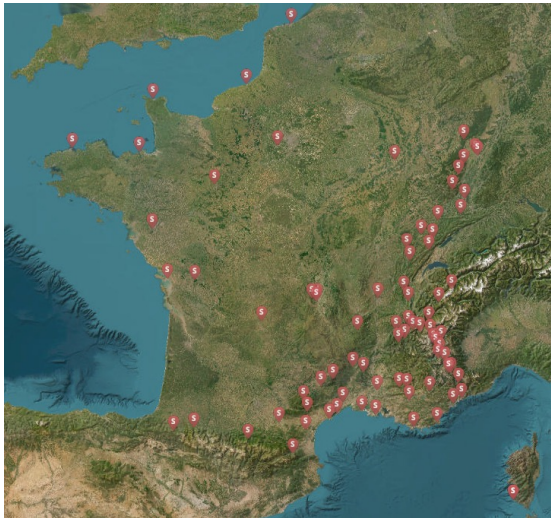
5 nodes with more than 1 million files

Ex : ROB-EUREF : ~16-yr of data per station



High-rate GNSS data (1 Hz) available at DGW

81 stations (Rénag)
864k hourly files
Since 01/03/2025



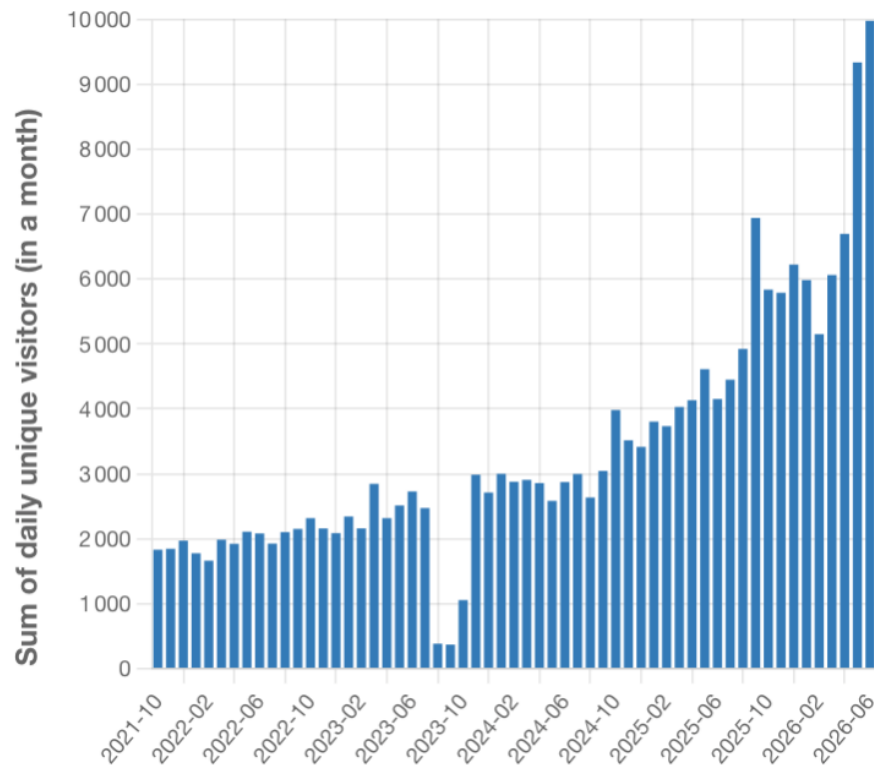
10 stations (RING)
196k hourly files
Since 01/01/2024



19 stations (NOA)
180k hourly files
Variable date range



Data Gateway webservice traffic – user statistics



Monitoring the number of unique visitor per day

- It includes connections to the REST API, the web and command line clients
- One visitor is defined with the combination of IP / date / user agent (~browser) - reset everyday
- Bots are removed from the statistics as well as our internal connections

About 2 000 to more than 6 000 daily unique visitors per month since late 2021



Discovering and downloading the GNSS metadata and data

Four ways are provided :

- A web user interface on the EPOS-GNSS DGW

<https://gnssdata-epos.oca.eu>

Demonstration
Hands-on exercises
Training documentation

- A command line client on the EPOS-GNSS DGW

<https://gitlab.com/gpseurope/pyglass/-/releases>

- A REST-API on the EPOS-GNSS DGW

<https://gnssdata-epos.oca.eu/GlassFramework/>

- The EPOS multidisciplinary platform

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

Demonstration
Training documentation



The web interface : Quick & interactive

- Easy to use, no installation required
- Interactive map and metadata exploration
- Apply filters and preview results before downloading
- Ideal for occasional users and first-time users
- Useful for teaching classes
- Ideal to check some metadata (DOI, License, ...)

EPOS-GNSS DATA GATEWAY

Issue with Safari Browsers | Documentation | Command Line Client | API | Product Portal | M3G | EPOS | Feedback

Metadata Search | Files Search / Download | Clear | Show advanced search | Export table as CSV

Spatial selection

Rectangle
Lat-Lon Bounding Box

North
West | East
South

Circle
Latitude | Longitude
Radius (Km)
0

All stations | **High-rate stations**

Networks

Marker	Site Name	Latitude (°D)	Longitude (...)	Altitude (m)	Install Date	End Date	Country	Nodes	Datacenters	City	Agency	Network
☐	AAERO0FRA	Aérodrome ...	49.7825	4.6426	199.27	2025-01-30...	France	FRENCH-NOD	EPN HDC	Charleville-...	Institut Nati...	RGP & EPN
☐	AARS00BEL	AARSCHOT	50.9633	4.8361	104.66	2002-10-04...	Belgium	BELGIAN-NOI	Belgian DC	Aarschot	Royal Obser...	FLEPOS



Concept of the **web user interface** on the EPOS-GNSS DGW

- 1) To provide the users **the core information about the GNSS stations** and allow to filter **quickly and interactively** based on these core information
“Simple search” → Fast answer that fit main searches
 - 2) To provide the users **additional information on stations, files, QC** on which they can filter
“Advanced search” → Long-lasting answer that fit complex and multiple parameter type searches
- All answers allow for discovering & downloading the stations or file metadata (*and thus files*) that fit the filter and parameter searches

A wide range of functionalities but high efficiency for common queries



The command line interface

It provides a convenient way :

- to filter and download stations and file **metadata**
- to download the **data**.

Similar **functionalities** as with the web client, **and more!**

Ideal for/to :

- Fast access from a terminal
- Download **large or multiple** datasets efficiently
- **Easily automate recurring downloads** with scripts
- Integrate into processing workflows

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Rectangle

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North | West | East | South

Circle

Latitude | Longitude

Radius (Km)

0

All stations | High-rate stations

Networks

Marker

Download the command line client

The python command line client allows to mass download RINEX files and station metadata (in JSON and GeodesyML formats).

For example, to download RINEX files from the station AGDE00FRA, between the dates 2020-01-01 and 2020-01-10 :

```
./pyglass.py files -m AGDE -dds 2020-01-01 -dde 2020-01-10 -o download --download-dir ./RINEX
```

Please note 2 important points:

1. - The command line client needs python 3.10+ to run
2. - The clients (both command line and web) can only download RINEX files which have been indexed in the database and in the case of the EPOS-GNSS Data Gateway, validated at the node

[Download pyglass here](#)

Do not hesitate to send any question or comment at: gnss-dgw_at_oca.eu

Close

```
python pyglass.py files -dds 2016-08-21 -dde 2016-08-24 -cs 42.7 13.24 50 -o download --download-dir AMATRICE
nb of rinex files: 48
Total size: 14.917666 Mb
Do you want to continue ? (y/n)
```



The REST API

- It allows to **programmatically** search and download the metadata without using one of the client.
- Direct access from your own software or scripts - **Machine-to-machine access**
- It is the **best way** to integrate the DGW with another computer program

The screenshot shows the Swagger UI for the GNSS GLASS Framework API. At the top, there's a Swagger logo and a search bar containing the URL `https://gnssdata-epos.oca.eu/GlassFramework/swagger.json` with an 'Explore' button. Below this, the title 'GNSS GLASS Framework' is displayed with version indicators '3.4.1' and 'OAS 3.1'. A description states 'Glass API for GNSS Queries' and provides a link to 'Find out more Glass API'. A 'Servers' dropdown menu is set to 'https://gnssdata-epos.oca.eu/GlassFramework/webresources - API Data GateWay'. The main section is divided into two parts: 'Station Metadata (EPOS-GNSS)' and 'Station Metadata (EPOS-ICS)'. Each part lists several GET endpoints with their descriptions and a 'Find out more' link. For EPOS-GNSS, endpoints include: `/stations/station/{size}/{format}` (Returns all stations in the expected format), `/stations/marker/{station-marker}/{size}/{format}` (Get station by marker), `/stations/coordinates/{area}/{size}/{format}` (Get the station(s) that are inside the specified perimeter), `/stations/location/{type}/{instance}/{size}/{format}` (Get station by Location), `/stations/agency/{agency}/{size}/{format}` (Get station by agency), `/stations/network/{network}/{size}/{format}` (Get station by network), and `/stations/combination/{size}/{format}` (Get station by filters). For EPOS-ICS, endpoints include: `/stations/station/bbox/{minLon}/{minLat}/{maxLon}/{maxLat}` (Get station by bounding box) and `/stations/station/geojson/{format}/{geoJSON}` (Returns all the stations that are inside the geometry of geoJSON input).



At the EPOS multidisciplinary platform (ICS)

The screenshot shows the EPOS 1.0.55 web interface. The top navigation bar includes 'Free text search', 'Filters', 'Scientific Examples', 'Share', 'Login', and 'Menu'. The left sidebar contains icons for 'DATA', 'FACILITIES', 'SOFTWARE', and 'ANALYSIS'. The main content area is titled 'GNSS Data and Products' with 18 items. It shows a filter tree with 'All Categories (18)', 'Data (5)', 'Products (12)', and 'GNSS Station Information (1)'. Below this, there are five service entries, each with a green checkmark, an 'i' icon, and a star icon. The services are: 'GNSS Stations with Highrate RINEX Data', 'GNSS Stations with RINEX Data', 'List RINEX Files search parameters', 'Metadata and URL of Highrate RINEX files', and 'Metadata and URL of RINEX files'. All services are categorized under 'Data > GNSS RINEX data' and provided by 'OCA - Observatoire de la Côte d'Azur'. At the bottom, it shows 'Results per page: 10' and 'Page 1 of 1'.

Five services for GNSS Data at ICS:

- The list of stations with daily RINEX files or High-Rate data RINEX files from the services “**GNSS Stations with RINEX Data**” and “**GNSS Stations with Highrate RINEX Data**”.
- The list of parameters to filter and select the stations from the service “**List RINEX Files search parameters**”. Currently, *station name* and *station network* are proposed as parameter to filter in the next two services.
- The list of RINEX files, standard [daily] or High-Rate, either for a *station* or a *network* from the services “**Metadata and URL of RINEX files**” and “**Metadata and URL of Highrate RINEX files**”.

At the EPOS multidisciplinary platform (ICS) -

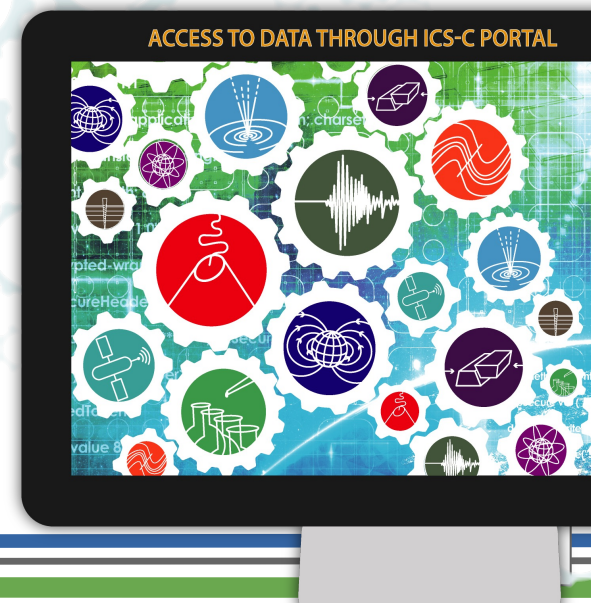


Limited services for GNSS Data at ICS **but** :

- **Unified access** : Access datasets using common metadata standards
- **Cross-domain search** : Discover GNSS data alongside other EPOS data types
- **Ideal for multidisciplinary studies** : Explore multiple geoscience communities and data through a single entry point

→ *ICS-C training and documentation*

Geo-Inquire - EPOS-GNSS Data Gateway User Training, July 10th 2026



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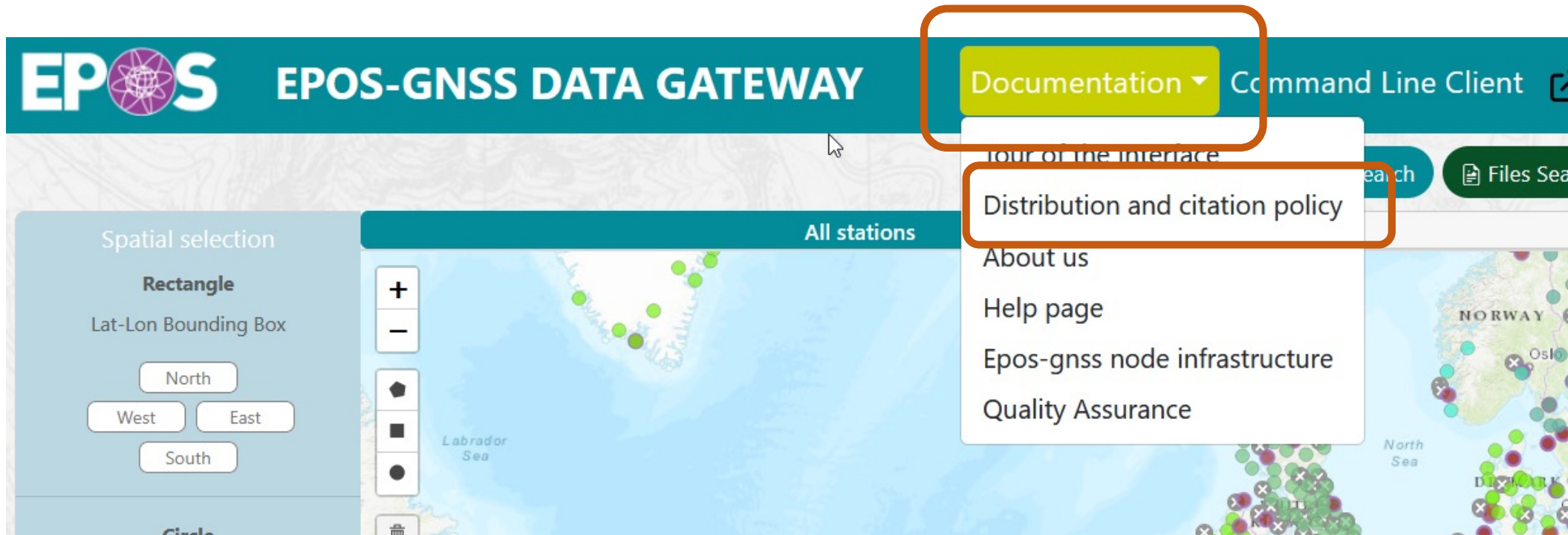
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The EPOS-GNSS DGW to facilitate citations

1. Read the citation policy
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<https://doi.org/10.4401/ag-8776>

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(*) You can use the EPOS-GNSS data Gateway (station metadata request).



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EPOS-GNSS Data Nodes

Node Name	Node Acronym	Country	DOI	Agency
Belgian EPOS-GNSS node	Belgian-node	Belgium	https://doi.org/10.60888/EPOS-GNSS-BE-NODE	Royal Observatory of Belgium
Central and East European GNSS Node for EPOS	CEGNxEPOS	Italy	https://doi.org/10.13120/29f7-bp54	National Institute of Oceanography and Applied Geophysics - OGS
EPOS-GNSS Pan-European Node	Pan-European	Portugal	https://doi.org/10.25768/ubi-epos-gnss-eu	EPOS-GNSS Pan-European Consortium
French National Node	French-Node	France		Observatoire de la Côte d'Azur
GNSS Permanent IGP Network	IPGP-GNSS	France		Institut de physique du globe de Paris
Icelandic EPOS-GNSS Node	ISGPSN	Iceland		Icelandic Meteorological Office
INGV RING NODE	IRN	Italy		National Institute of Geophysics and Volcanology
National Observatory of Athens (NOA)	NOA	Greece	https://doi.org/10.60888/EPOS-GNSS-NOA-NODE	National Observatory of Athens
Portuguese EPOS National Node	C4G	Portugal	https://doi.org/10.25768/ubi-epos-gnss-pt	Collaboratory for Geosciences - C4G
ROB-EUREF	ROB-EUREF	Belgium	https://doi.org/10.60888/EPOS-GNSS-EUREF-NODE	Royal Observatory of Belgium
SONEL EPOS-GNSS at tide gauges node (SONEL)	SONEL	France	https://doi.org/10.60888/EPOS-GNSS-SONEL-NODE	LIENSs lab, La Rochelle University & CNRS
Spanish EPOS Data node	IGE	Spain		Instituto Geografico Nacional de España
Romanian National Node (NIEP GNSS)	ROGNSS	Romania	https://doi.org/10.60888/epos-gnss-rognss-node	National Institute for Earth Physics

**[node service list*]
[DOIs/PIDs*]**



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[provider list*]
[DOIs/PIDs*]

Use the web interface or the command line interface
→ *See Jean-Luc Menut's demonstration & presentation*

Geo-Inquire - EPOS-GNSS Data Gateway User Training, July 10th 2026



A single point of contact:

gnss-dgw@oca.eu

Thank you for your attention!

Geo-INQUIRE is a joint effort of 51 institutions



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