GNSS – EPOS TCS Mission

TCS – Thematic Core Service

Rui Fernandes

EPOS-GNSS Webinar, 18-19 January 2021

GNSS DATA AND PRODUCTS

Outline

- Introduction to EPOS and the TCS GNSS Data & Products
- Advantages of being an EPOS-GNSS stakeholder
- e-Infrastructure:
  - Portals / Nodes / Repositories, FAIR principles, Data Licenses
- Flow of Data & Products
- High quality GNSS Data and Products for Solid Earth sciences
- Connection with other projects:
  - EPN-Densification, EPOS National Projects, EarthScope Consortium

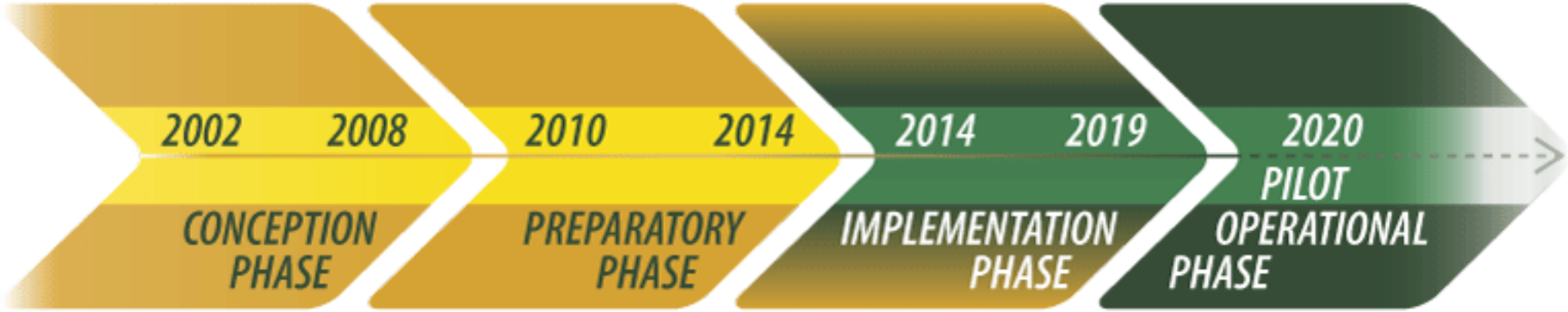
EPOS – European Plate Observing System

When a video is worth 10000 words …

EPOS – European Plate Observing System

EPOS-ERIC is the culmination of a long process that started back in 1999

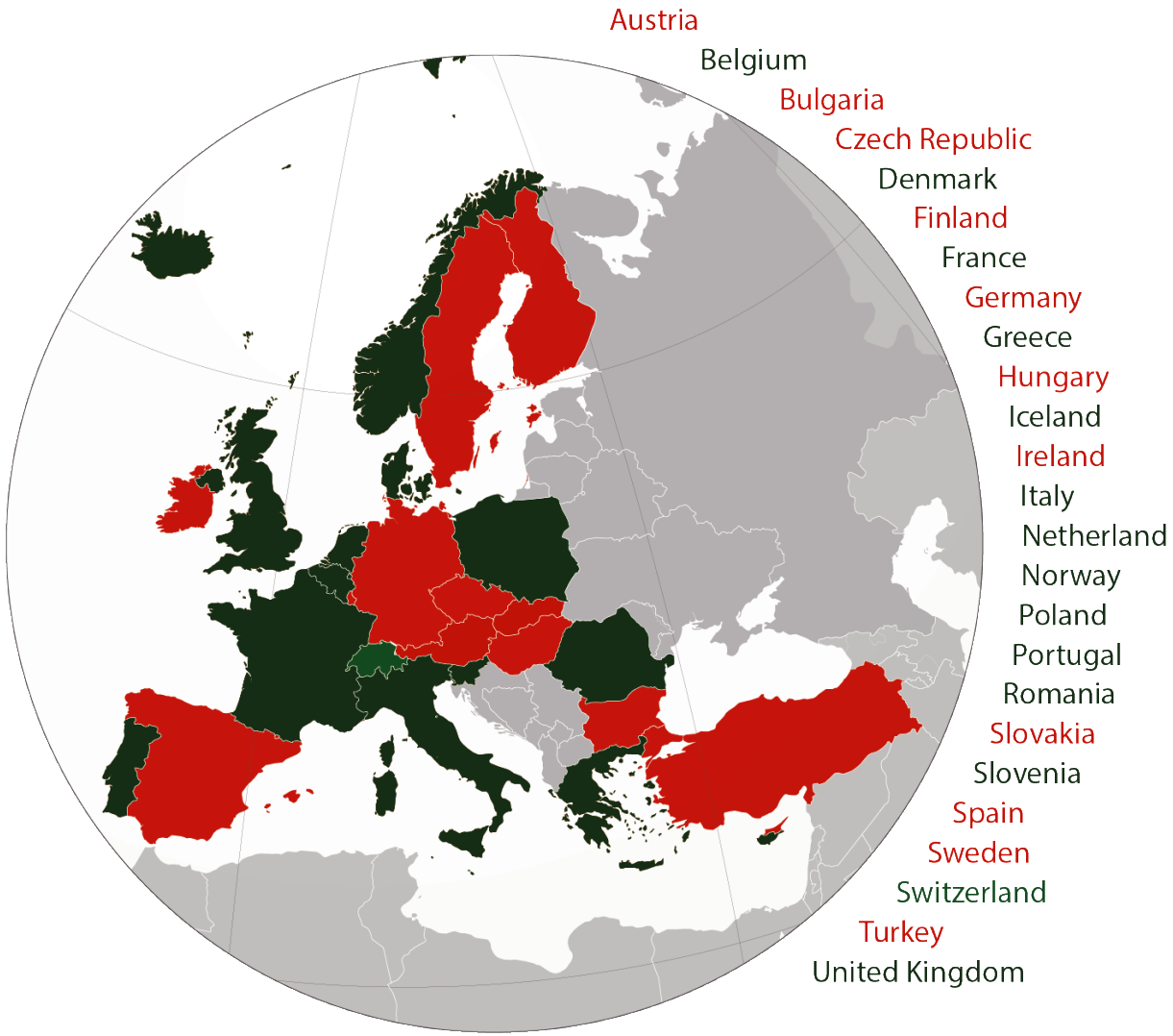
On October the 30th 2018, the European Commission granted the legal status of **European Research Infrastructure Consortium (ERIC)** to **EPOS**.



EPOS Pilot Operational Phase (POP) 2020 – 2022

The EPOS Research Infrastructure (EPOS RI) has completed its Implementation Phase (2015-2019) and it is currently facing the transition from the Implementation to the Operational Phase named "EPOS Pilot Operational Phase".

EPOS ERIC Partnership



14 Countries have already signed the agreement that provides EPOS with legal personality and capacity recognised in all EU Member States.

11 more countries are in several stages of the process to join EPOS-ERIC in the future.

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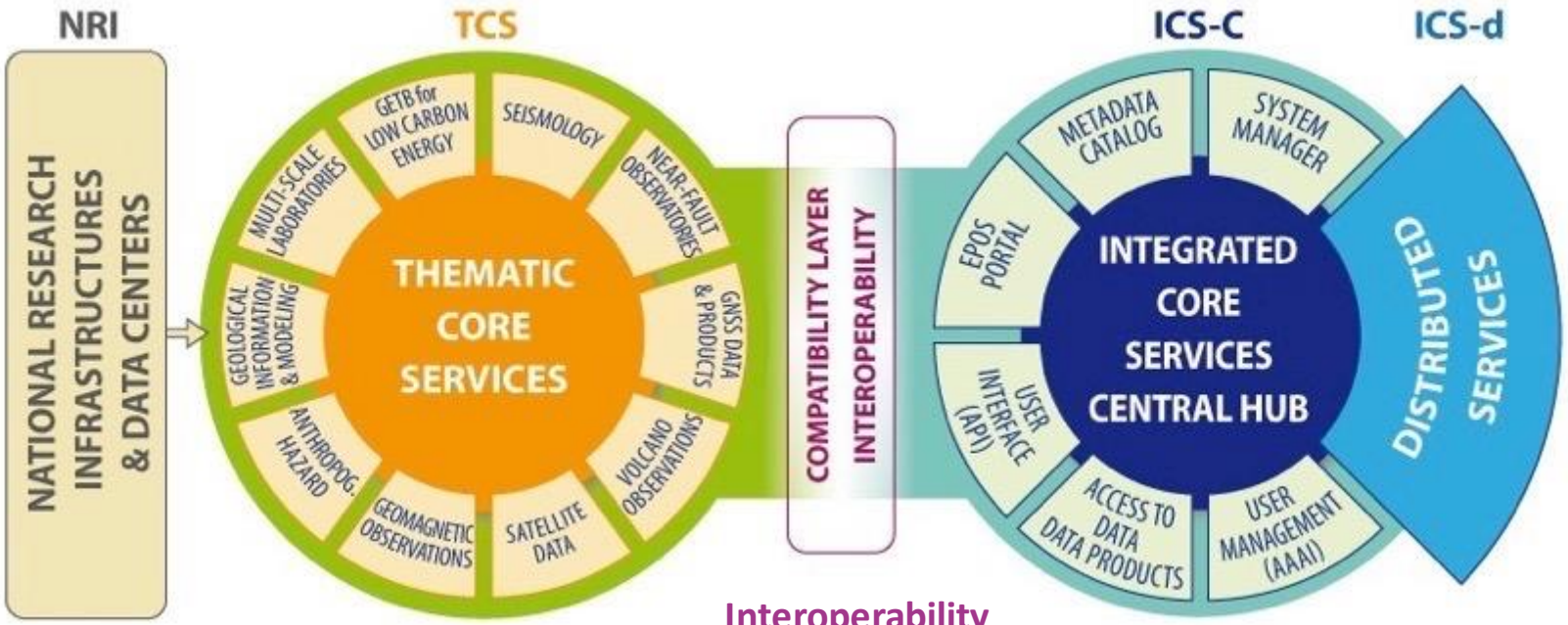
How EPOS works: Functional Architecture

composed of three main connected elements:

Community Layer
community-specific integration

Integration Layer
novel e-infrastructure



Interoperability Layer

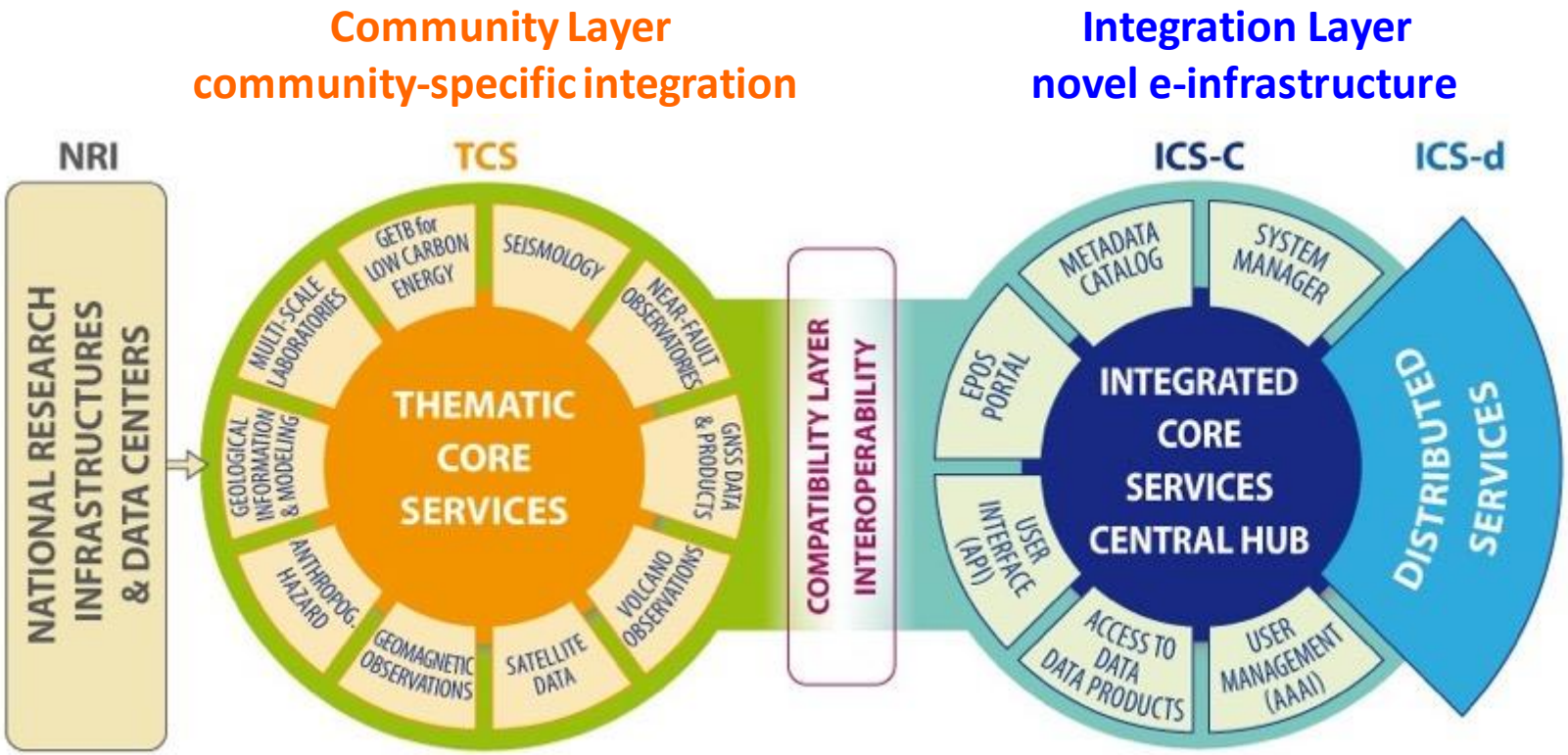
Data generation
Data collection
Responsible of sustainability and operation

The governance framework where data and services are provided by communities

Access to multidisciplinary data, products and tools for different stakeholders

GNSS DATA AND PRODUCTS

How EPOS works: Functional Architecture



EPOS is more than data archiving and data mining

EPOS will guarantee access to data, metadata, and data products, but also to tools and software giving the unique opportunity of processing them to make new data and products

How EPOS works

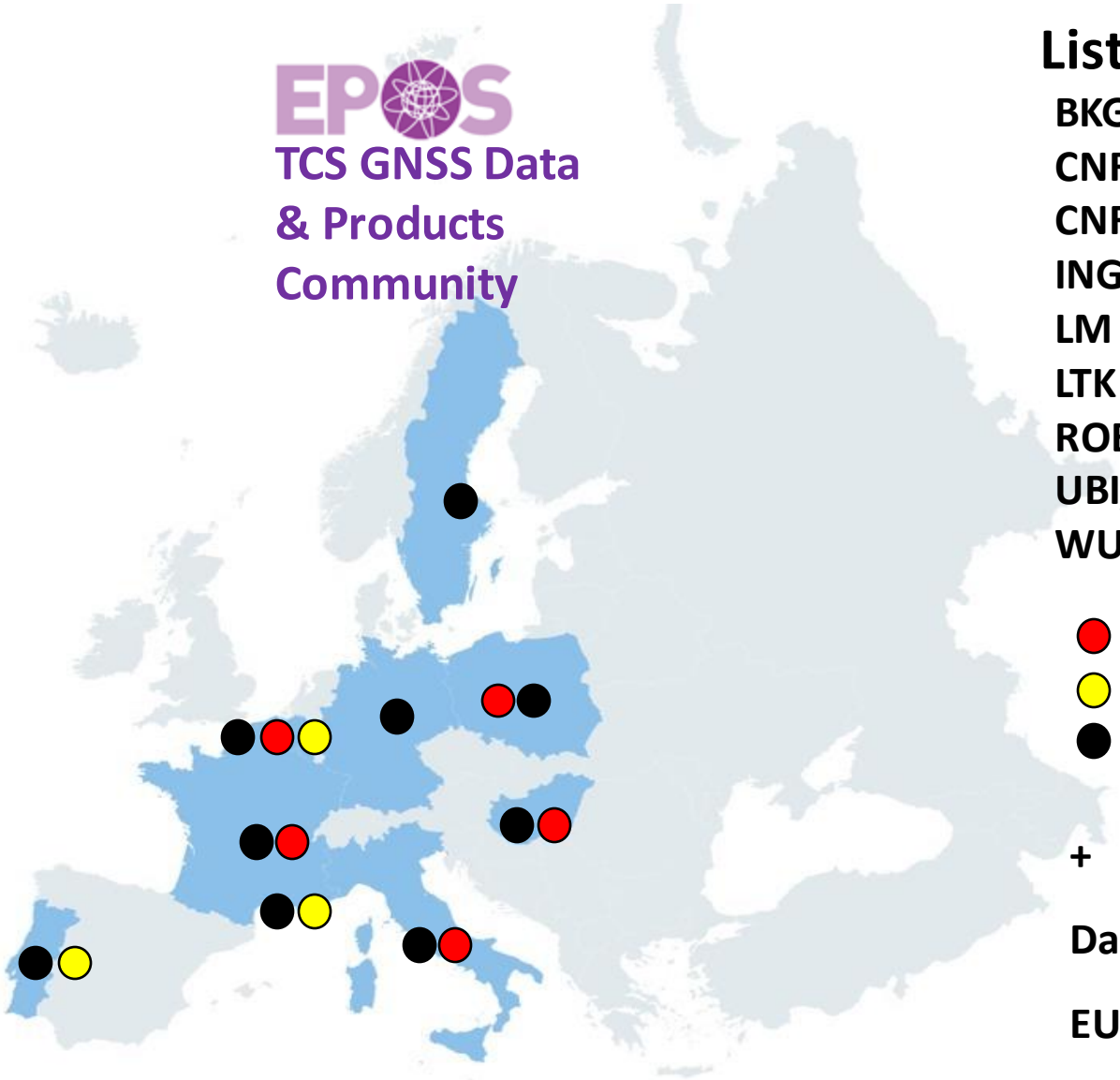
- National RIs generate data for science and society
- Governments maintain the RIs in order to promote understanding (science), monitoring (hazard) and surveillance (alert)
- Each community integrates its data and services: seismology, volcanology, geodesy, experimental laboratories, geology …. → TCS
- TCS guarantee access to standardized, quality-controlled data and services making them interoperable with ICS and other TCS
- ICS allows the access to all these data, products and services for different users and stakeholders through interoperability
- Different users and stakeholders (including Society) benefit of EPOS

Objectives TCS GNSS Data & Products

- Maintain the governance of TCS GNSS Data & Products in EPOS;
- Interact with the geodetic community in Europe, at national and Pan-European (EUREF) levels;
- Ensure interoperability between EPOS GNSS services (data and products) and EPOS ICS;
- Promote multidisciplinary interoperability with other disciplines within EPOS;
- Implement distributed dissemination of file-based GNSS data (currently for ~1150 stations), and derived Products: CRD, VEL, STR (currently ~2700 stations).

EPOS-GNSS

TCS GNSS Data & Products Community



GNSS TCS (EPOS-ERIC) Partners

List of Pan-European Service Providers:

BKG Bundesamt für Kartographie und Geodäsie, DE
CNRS-OCA Observatoire Cote d'Azur, FR
CNRS-UGA Université Grenoble Alpes, FR
INGV Istituto Nazionale di Geofisica e Vulcanologia IT
LM Lantmäteriet, SW
LTK Lechner Knowledge Center, HU
ROB Royal Observatory of Belgium, BE
UBI/C4G U. Beira Interior/Colaboratory for Geosciences, PT
WUT Warsaw University of Technology, PL

5 Product Centers
3 Portals (M3G, Data, Products)
11 Service Providers

+

Data Providers (National Research Infrastructures)

EUREF (Data, Data Products & Services)

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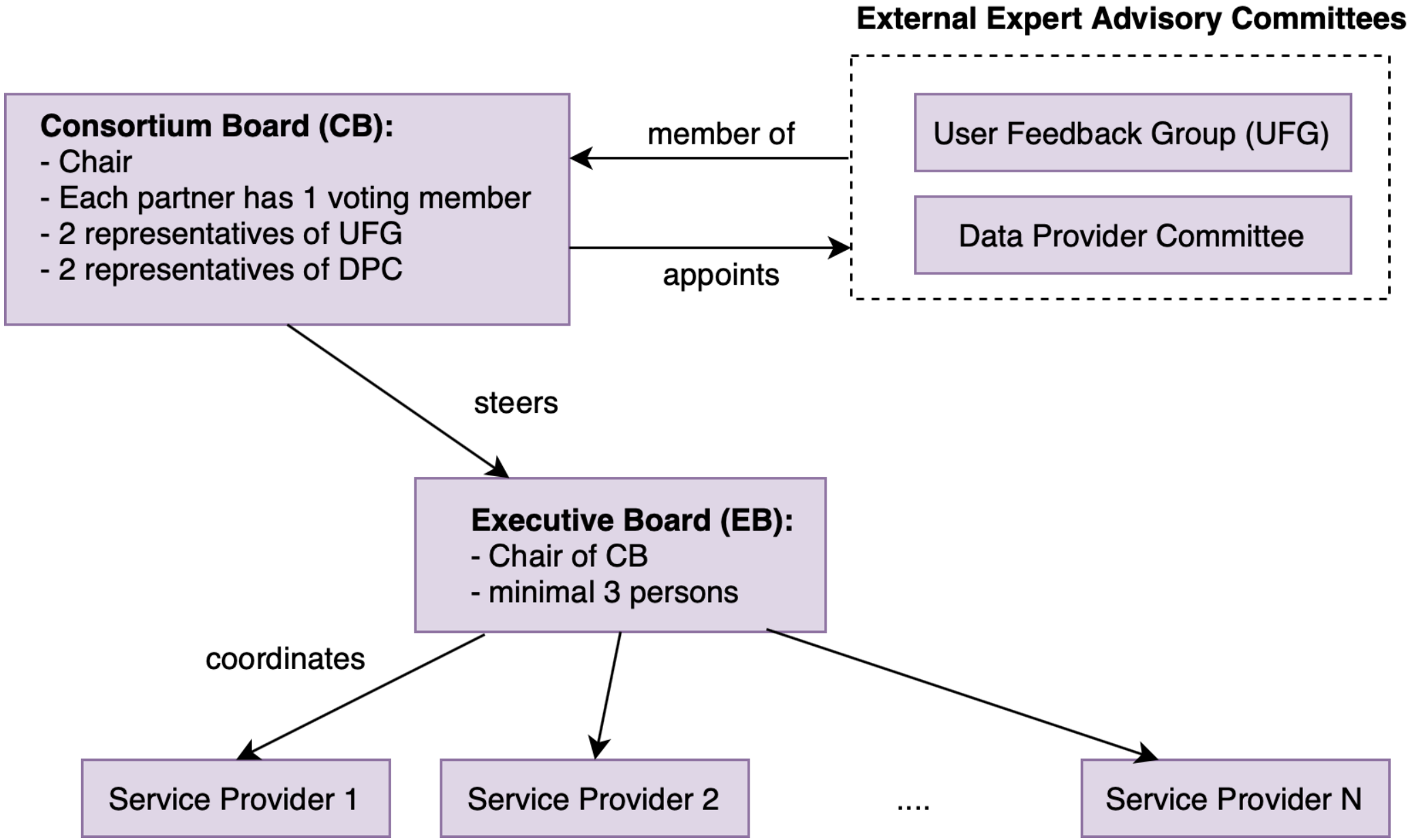
Governance Structure



DDSS – Data, Data Products, Services, Software

TYPE	SERVICE NAME	SERVICE DESCRIPTION	PROVIDER	COUNTRY
Governance				
GOV	**TCS Governance**	**Secretariat, Consortium board activities**	**UBI/C4G**	**PT**
SERVICE	**TCS Harmonisation**	**Harmonisation with GNSS Federated Data Providers**	**ROB**	**BE**
SERVICE	**TCS Outreach**	**Promotion of TCS data and products**	**UBI/C4G**	**PT**
Data Dissemination				
SERVICE	**Management of data services**	**Management of Node Infrastructure**	**CNRS-OCA**	**FR**
SERVICE	M3G	M3G GNSS Station metadata management service	ROB	BE
SERVICE	Data Gateway	Maintenance & Operation of GNSS Data Gateway	CNRS-OCA	FR
SERVICE	GNSS data validation	Long-term data quality monitoring	ROB	BE
Product Dissemination				
SERVICE	**Management of product services**	**Management of Product Services**	**CNRS-UGA**	**FR**
SERVICE	Products Portal	M&O of GNSS Products Gateway; Internal validation of GNSS-derived products	UBI/C4G	PT
SERVICE	PP Products	Daily solutions for EPOS stations using PP approach; Velocity Field from Combined EPOS Solutions	INGV	IT
SERVICE	DD Products	Daily solutions for EPOS stations using DD approach	CNRS-UGA	FR
SERVICE	Combined Products	Daily Combined time-series solutions using EPOS and EUREF solutions; Velocity Field from Combined (EPOS + EUREF) Solutions	LTK	HU
SERVICE	Strain Rates	Strain rates derived from velocity fields	LM	SE
Software Provision				
SERVICE	**Management of software services**	**Management of Software Services**	**UBI/C4G**	**PT**
SERVICE	GLASS @ UBI	M&O of GLASS databases, tools & webservices	UBI/C4G	PT
SERVICE	GLASS @ INGV	M&O of GLASS tools	INGV	IT
SERVICE	GLASS @ OCA	M&O of GLASS tools	CNRS-OCA	FR
EUREF				
SERVICE	EUREF Permanent Network Central Bureau	EUREF Permanent Network Central Bureau	ROB	BE
SERVICE	EUREF-ROB data node	EUREF-ROB GNSS data archive	ROB	BE
SERVICE	EUREF-WUT Products	Weekly combined positions of EUREF stations	WUT	PL
SERVICE	EUREF Reference Frame	Positions, velocities, and time series of EPN stations	ROB	BE
SERVICE	EUREF-LTK Products	Velocity field from combined EUREF densified solutions	LTK	HU
SERVICE	EUREF-BKG data node	EUREF-BKG GNSS data archive	BKG	DE

Added value of EPOS TCS GNSS Data & Products for the GNSS community

- **Sustainability within EPOS:**
  - **Countries that join EPOS-ERIC commit to maintain their GNSS infrastructure integrated in EPOS (stations, operation).**
  - **Pan-European Service Providers needed the commitment of their countries to sustain them on long-term (EPOS-ERIC operation).**

- **Provision of software tools (GLASS):**
  - **Standardized data quality check and visualization**
  - **Standardized exchange of metadata**
  - **Seamless data access**
  - **To be made globally available**

GLASS – What and Why?

GNSS **L**inkage **A**dvanced **S**oftware **S**ystem

GLASS intends to be an integrated software package to be deployed in a GNSS infrastructure to:

- **Manage GNSS data (RINEX & metadata) from distributed repositories/data centers:**
  - Collect data
  - Validate data
  - Disseminate data
- **Provide GNSS products:**
  - Coordinate Daily and Time Series
  - Velocity Fields
  - Strain Rate Fields

GLASS – components

GLASS encompass the following key elements:

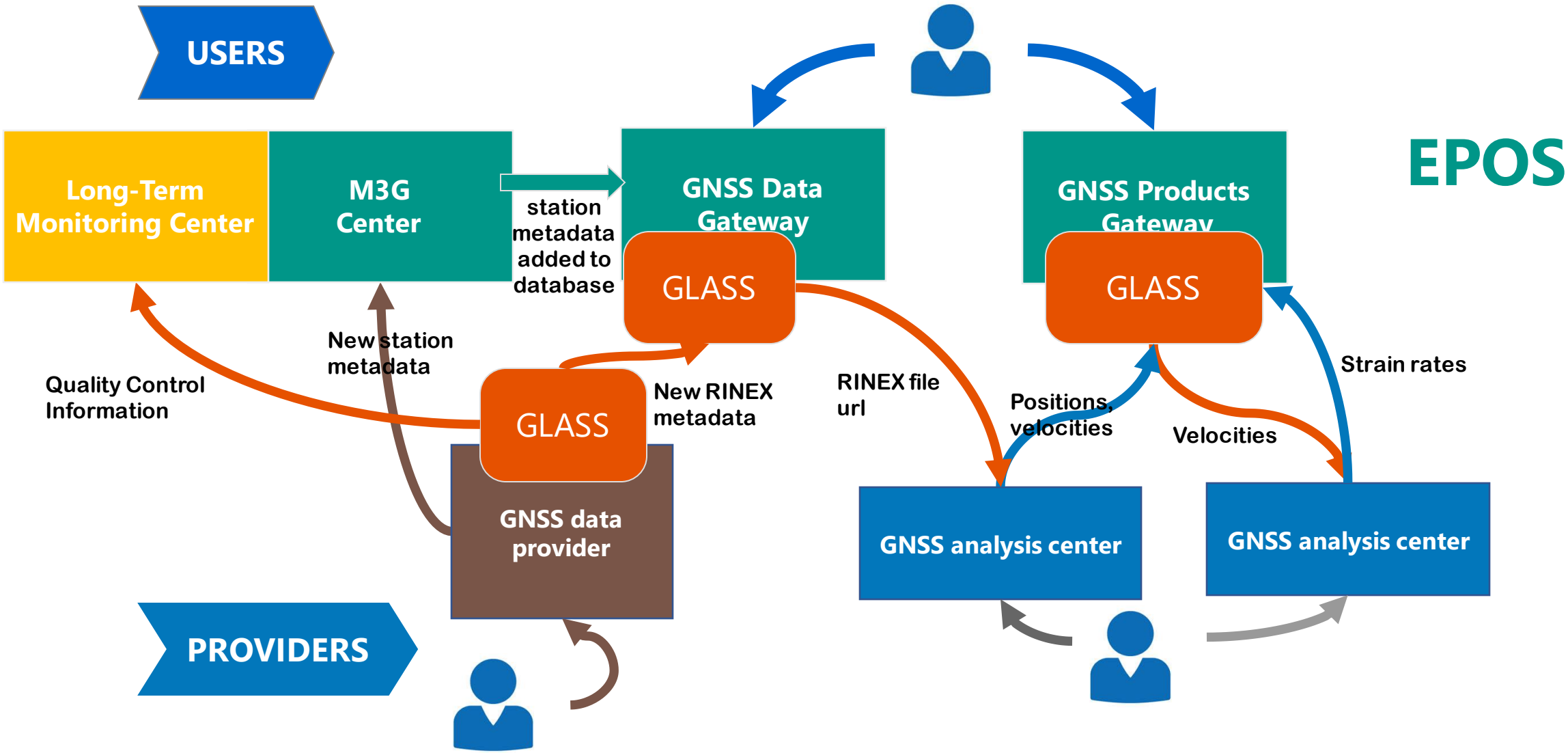
- **Physical components** – repositories/data centers

- **Web services** – portals, monitoring tools, data and products mining solutions

- **Software applications** – managing interactions between repositories and services

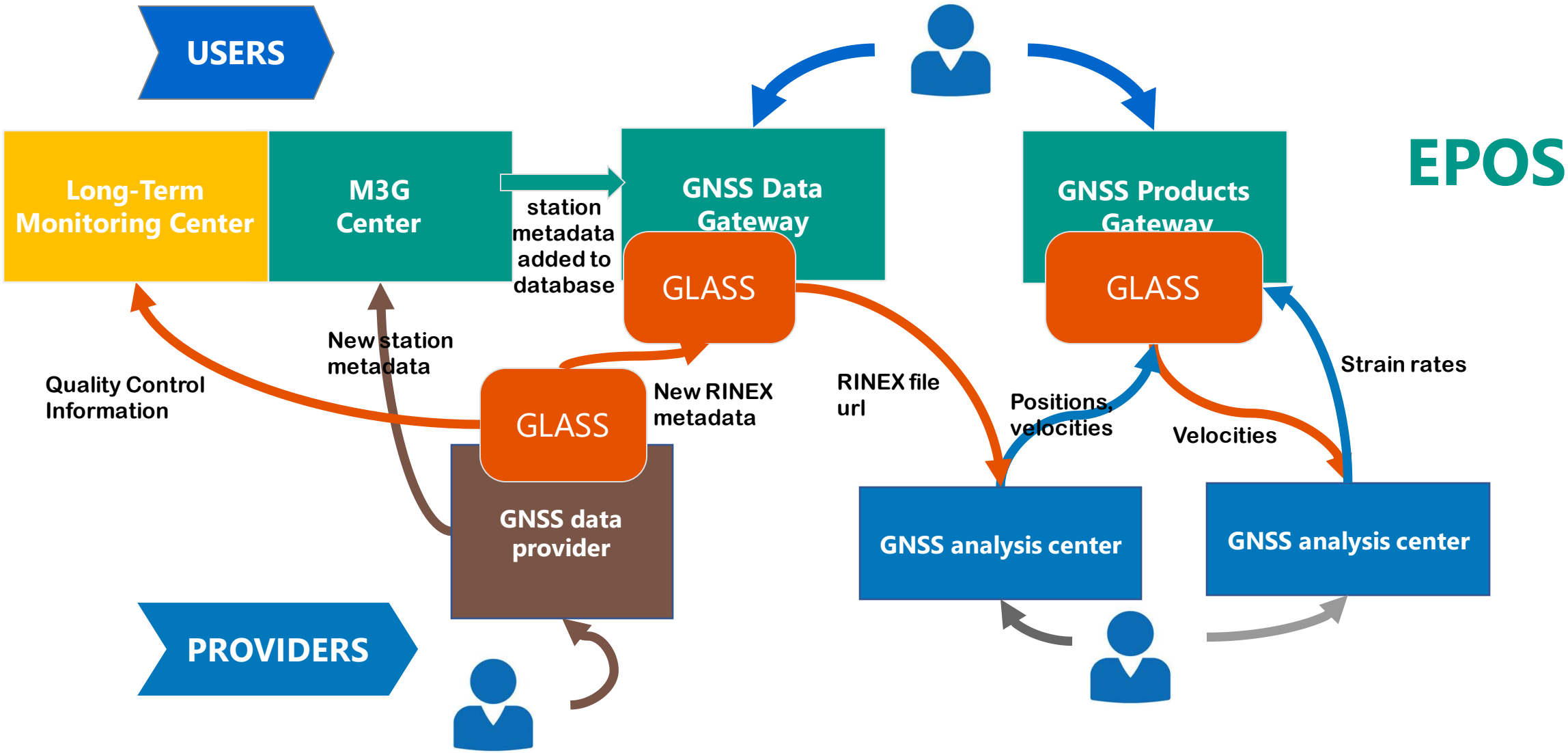
More Details: GLASS - HOW TO INSTALL AND USE IT, Paul Crocker & José Manteigueiro

GLASS workflow



GNSS DATA AND PRODUCTS

GLASS workflow

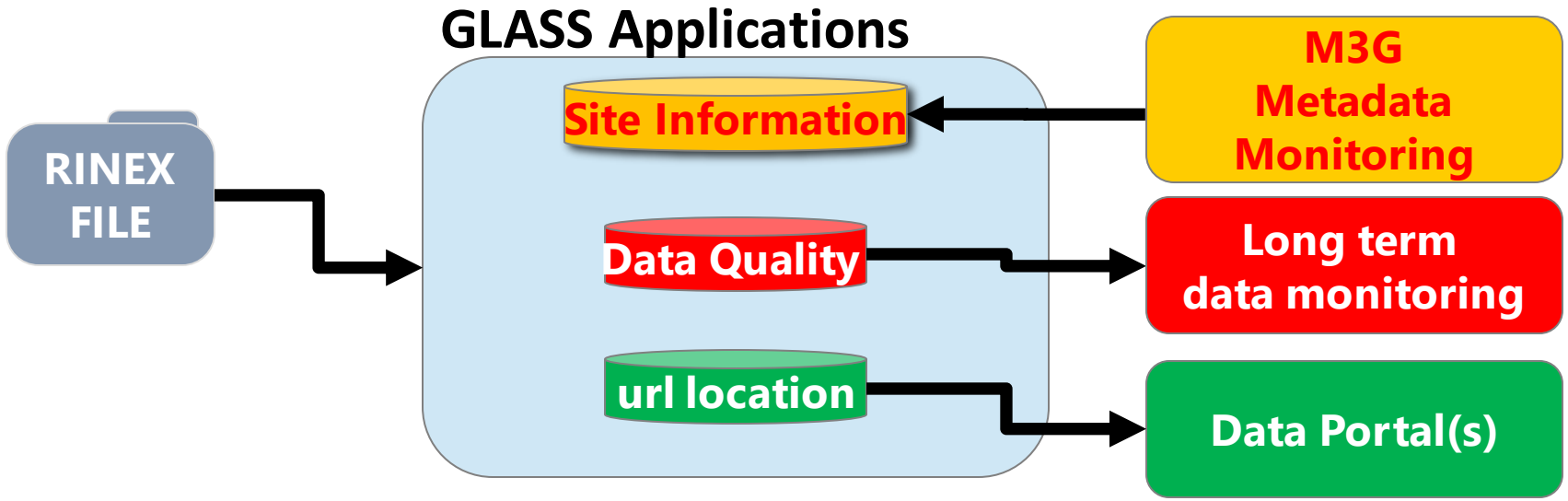


GNSS DATA AND PRODUCTS

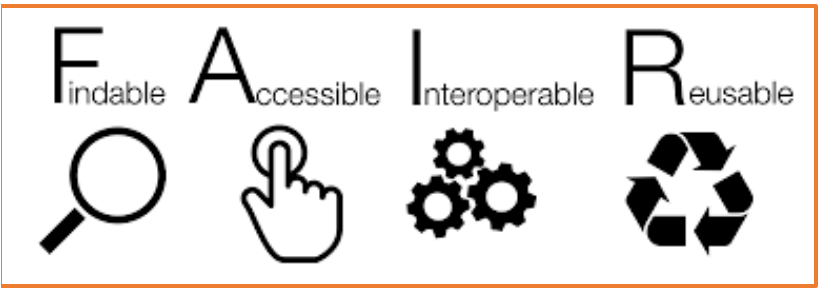
RINEX Repositories / Data Centers

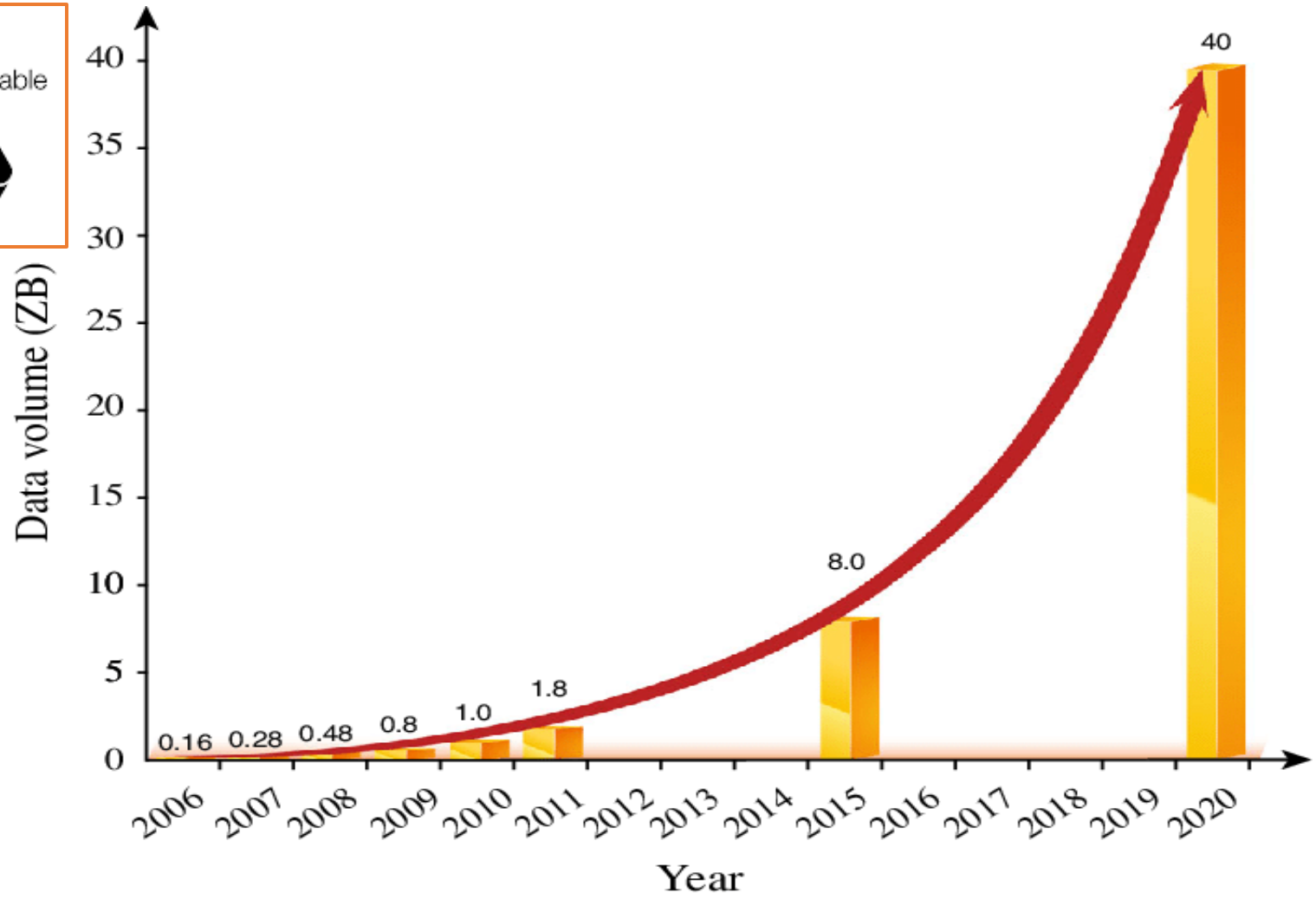
RINEX Data: need to be available (local or external – url link) and GLASS will run on top of it (no need to adapt directory structure).

- GLASS software will act when a new file become available by:
  - Checking the file metadata (Header) against the the Site metadata (Anubis)
  - Run additional checks on file contents (Anubis)
  - Provides the url location to the data portal (local and externals)



FAIR Principles / Data Licenses



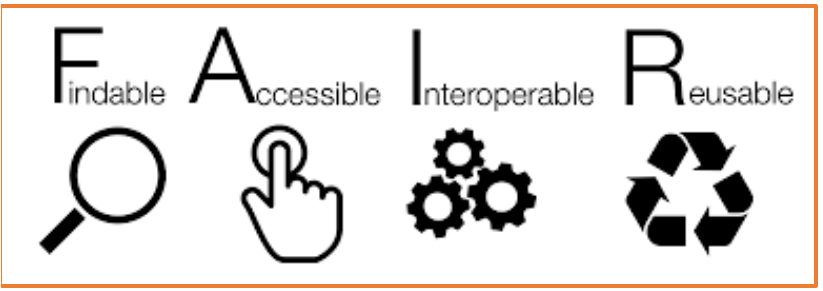


The amount of data in the world doubles every two years

Effectively a "Moore's Law"

1 ZB (zettabyte) = 10^{21} or 1, 000, 000, 000, 000, 000, 000, 000 bytes

FAIR Principles / Data Licenses



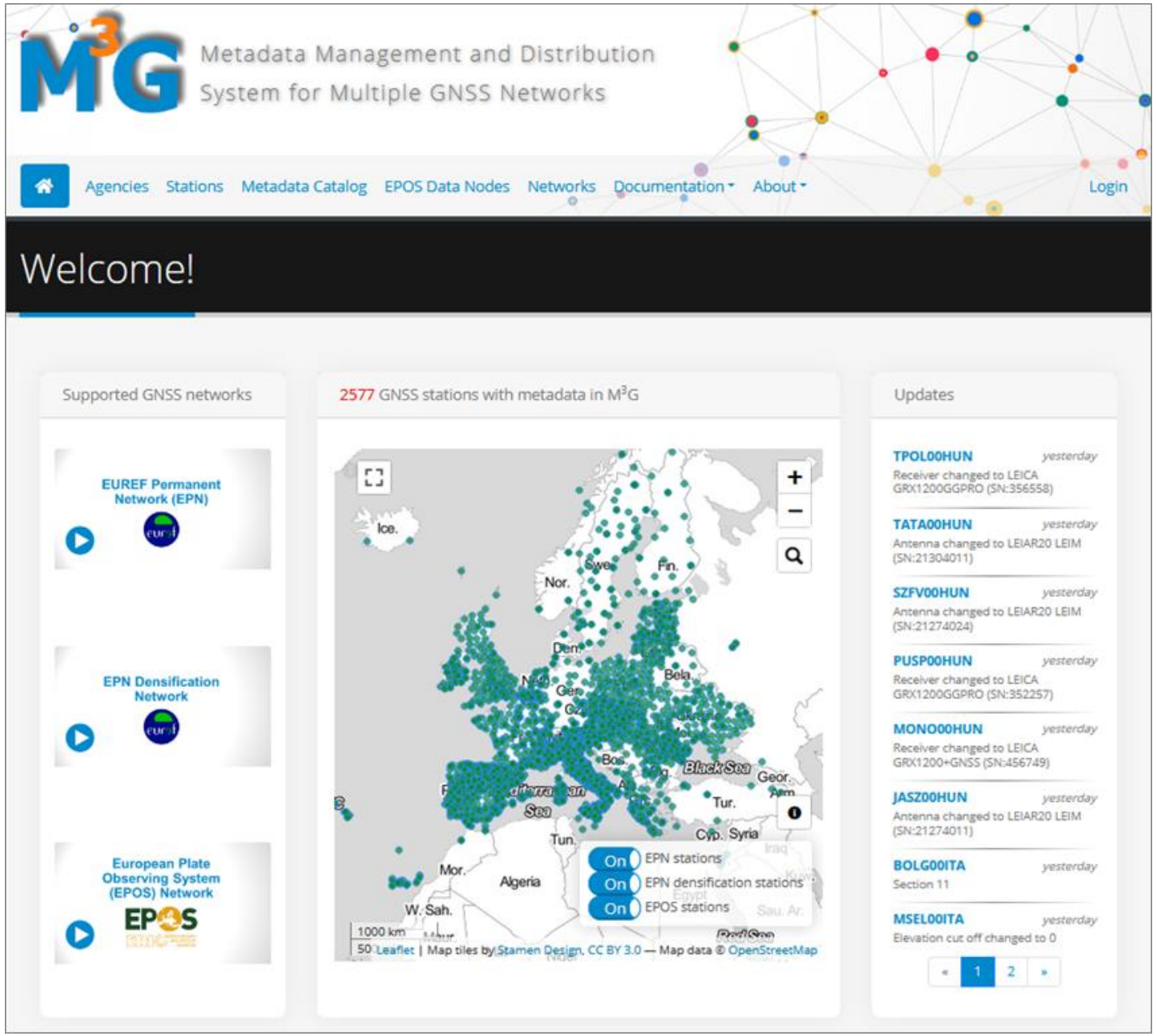
FINDABLE	Searchable & appropriately tagged (key: Metadata)
ACCESSIBLE	Open source, useable, interoperable formats
INTEROPERABLE	Labeled with clearly defined vocabulary (GeodesyML)
REUSABLE	Licensed, high quality, unique entries, data curation

CC - CREATIVE COMMONS - Attribution (BY): This license lets others distribute, remix, tweak, and build upon your work, even commercially, as long as they credit you for the original creation. This is the most accommodating of licenses offered. Recommended for maximum dissemination and use of licensed materials.

A DOI (Digital Object Identifier) identifies an object **permanently**, even if the object changes its location, its owner or other characteristics

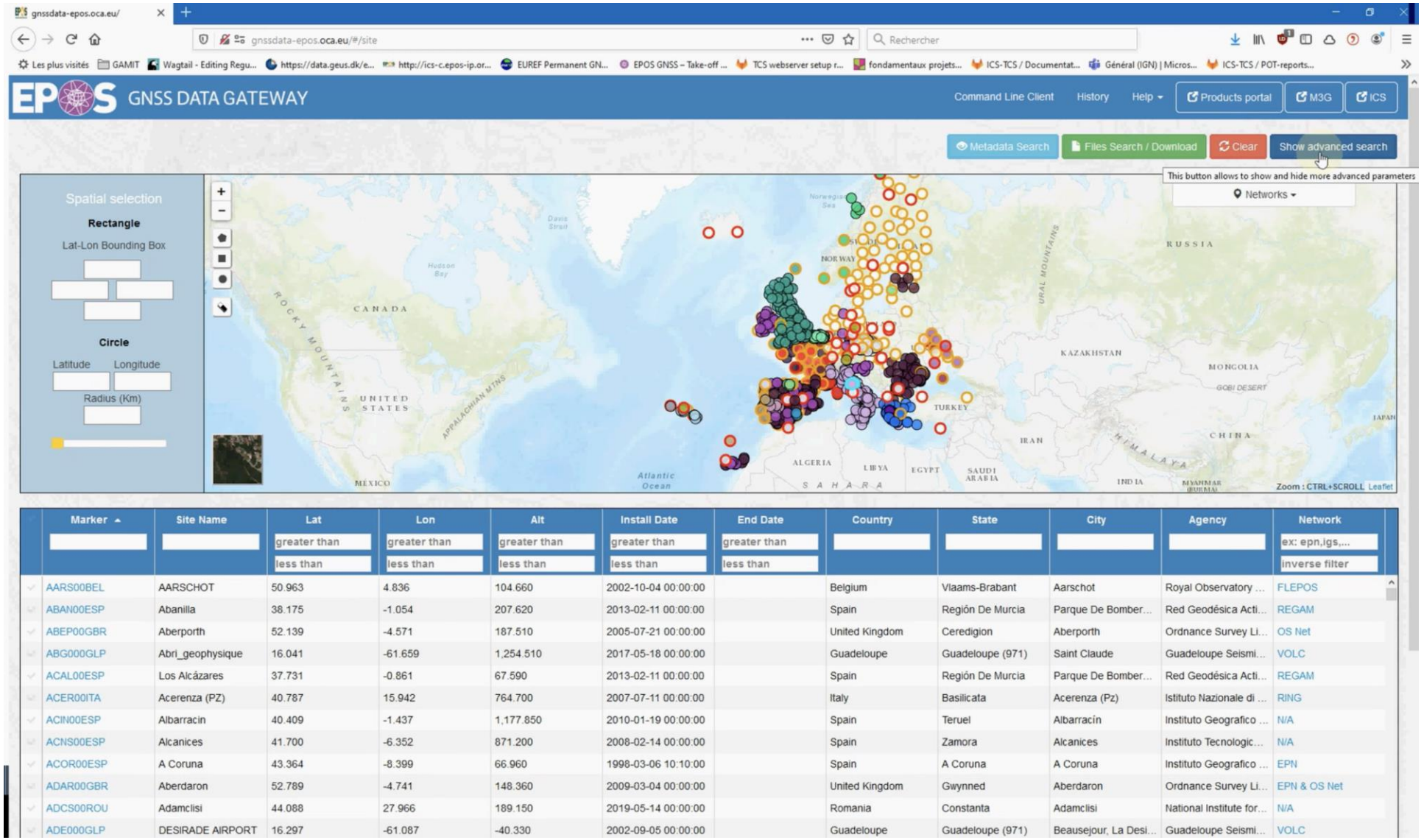
M3G CENTER

https://gnss-metadata.eu/



More Details: HOW TO INTEGRATE A GNSS STATION IN EPOS?, Carine Bruyninx

DATA PORTAL



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AARS00BEL	AARSCHOT	50.963	4.836	104.660	2002-10-04 00:00:00		Belgium	Vlaams-Brabant	Aarschot	Royal Observatory ...	FLEPOS
ABAN00ESP	Abanilla	38.175	-1.054	207.620	2013-02-11 00:00:00		Spain	Región De Murcia	Parque De Bomber...	Red Geodésica Acti...	REGAM
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ACAL00ESP	Los Alcázares	37.731	-0.861	67.590	2013-02-11 00:00:00		Spain	Región De Murcia	Parque De Bomber...	Red Geodésica Acti...	REGAM
ACER00ITA	Acerenza (PZ)	40.787	15.942	764.700	2007-07-11 00:00:00		Italy	Basilicata	Acerenza (Pz)	Istituto Nazionale di ...	RING
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ADCS00ROU	Adamclisi	44.088	27.966	189.150	2019-05-14 00:00:00		Romania	Constanta	Adamclisi	National Institute for...	N/A
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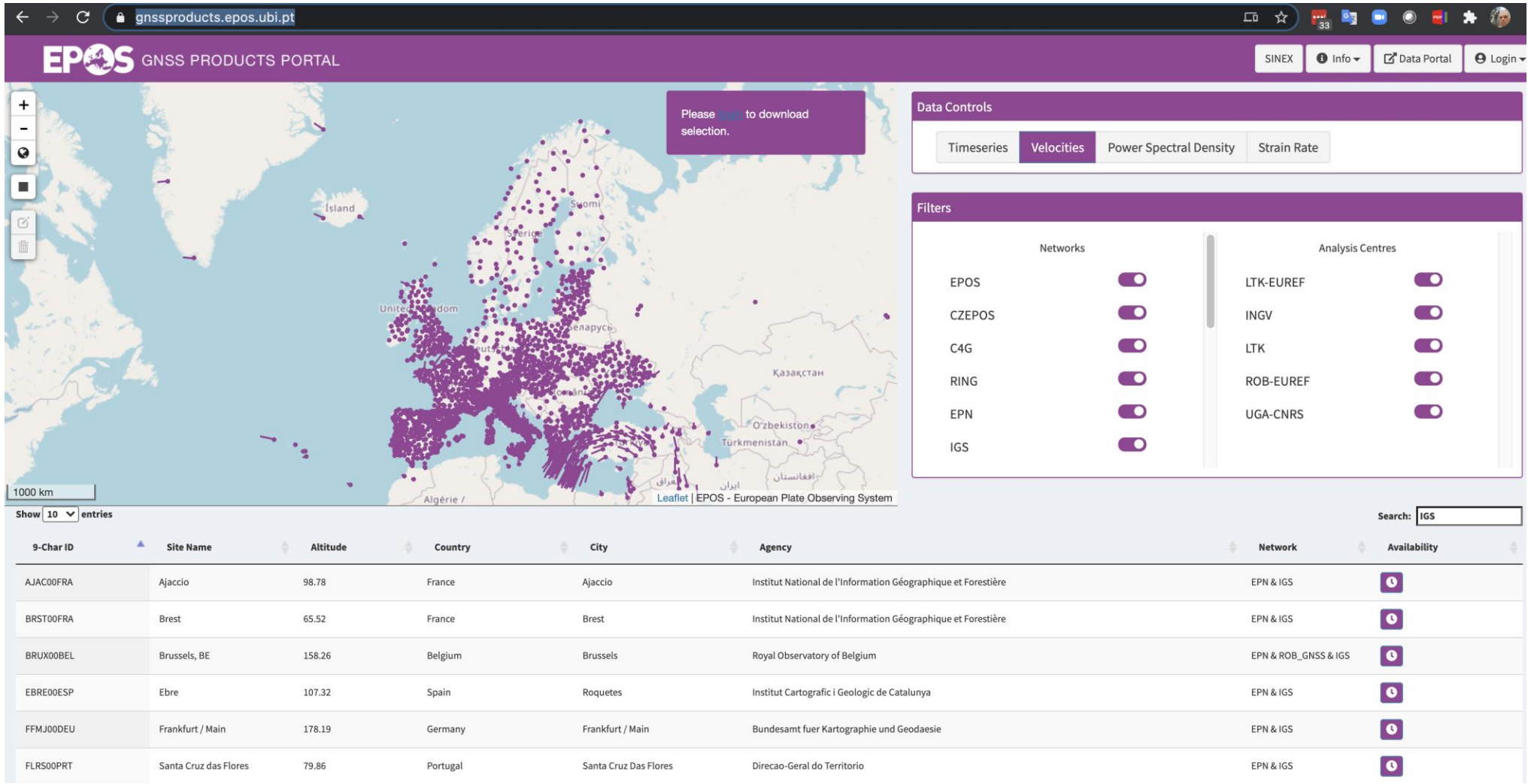
http://gnssdata-epos.oca.eu/

More Details: DATA PORTAL - HOW TO DOWNLOAD DATA & METADATA, M. Vergnolle & J-L Menut

PRODUCTS PORTAL



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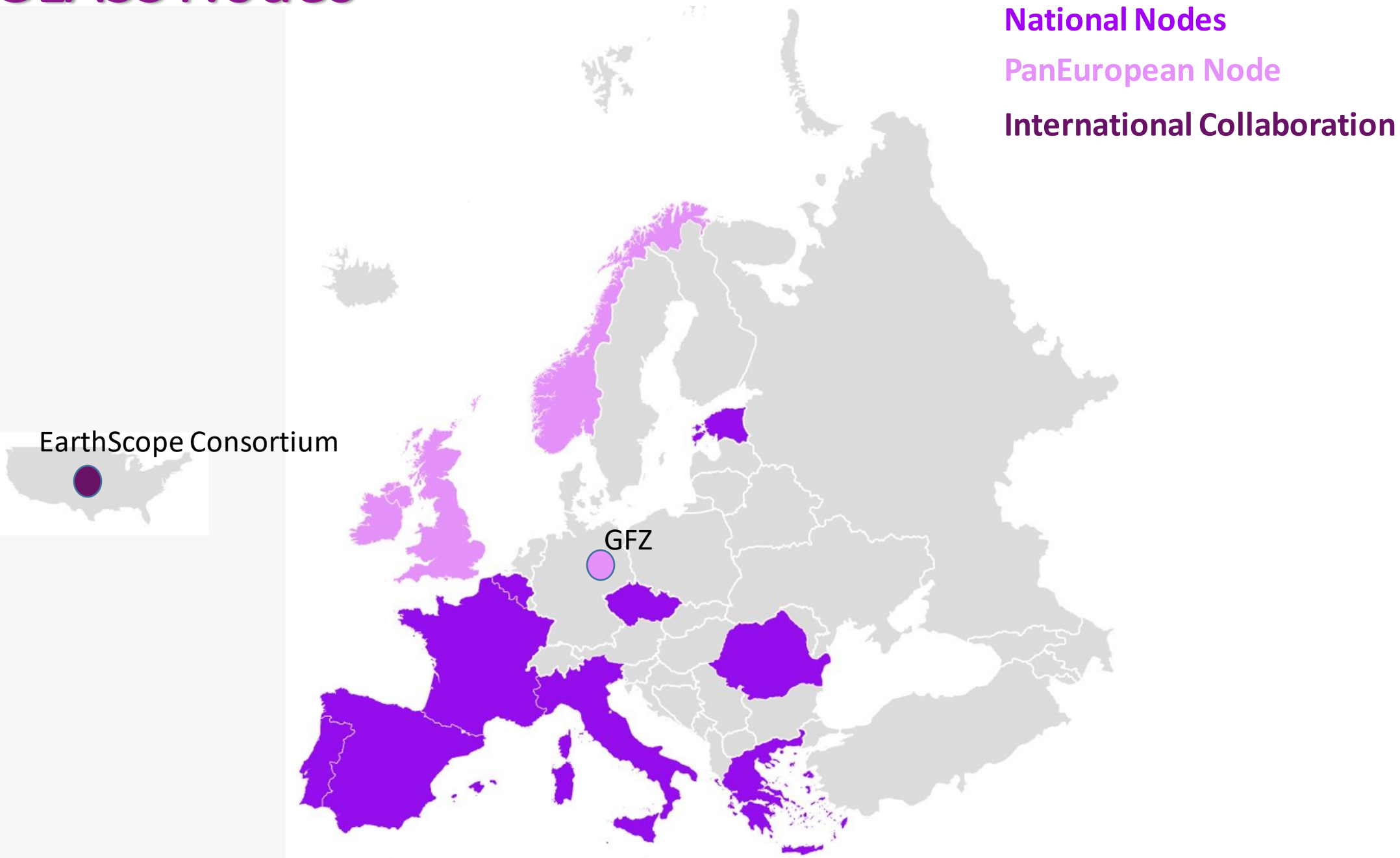
AJAC00FRA	Ajaccio	98.78	France	Ajaccio	Institut National de l'Information Géographique et Forestière	EPN & IGS	
BRST00FRA	Brest	65.52	France	Brest	Institut National de l'Information Géographique et Forestière	EPN & IGS	
BRUX00BEL	Brussels, BE	158.26	Belgium	Brussels	Royal Observatory of Belgium	EPN & ROB_GNSS & IGS	
EBRE00ESP	Ebre	107.32	Spain	Roquetes	Institut Cartografic i Geologic de Catalunya	EPN & IGS	
FFMJ00DEU	Frankfurt / Main	178.19	Germany	Frankfurt / Main	Bundesamt fuer Kartographie und Geodaesie	EPN & IGS	
FLRS00PRT	Santa Cruz das Flores	79.86	Portugal	Santa Cruz Das Flores	Direcao-Geral do Territorio	EPN & IGS	

http://gnssproducts.epos.ubi.pt/

More Details: *PRODUCTS - WHAT PRODUCT FOR WHAT USAGE?, Anne Socquet*
PRODUCTS PORTAL - HOW TO DOWNLOAD PRODUCTS, M. Bos & J. Manteigueiro

GLASS Nodes


National Nodes
PanEuropean Node
International Collaboration
EarthScope Consortium
GFZ

GNSS TCS - MORE INFORMATION

contact@gnss-epos.eu

LANDING PAGE:

EPOS https://www.epos-eu.org/

GNSS https://gnss-epos.eu/

PORTALS:

M3G https://gnss-metadata.eu/

DATA http://gnssdata-epos.oca.eu/

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

DISSEMINATION:

https://www.youtube.com/watch?v=NqlnMhkCgMI

(GNSS-EPOS explained by children)