Integrating European Research Infrastructures for solid Earth Science

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EPOS – Improving the infrastructure for GNSS data and products in Europe

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10. KOERI, Istanbul, Turkey
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HORIZON 2020

What is EPOS?

EPOS is a **long-term project for the integration**

of research infrastructures for Solid Earth Science in Europe

One of the three priority projects of European Commission within ESFRI

EPOS integrates the **existing (and future)** advanced European facilities into **a single, distributed, sustainable infrastructure** taking full advantage of new **e-science opportunities**

25 COUNTRIES

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Grecee, Hungary, Iceland, Ireland, Italy, Netherland, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom

4 INTERNATIONAL ORGANIZATIONS

Orfeus, Emsc, Euref, Intermagnet

256 NATIONAL RESEARCH INFRASTRUCTURES

4939 SEISMIC STATIONS

2272 GPS RECEIVERS

464 TB SEISMIC DATA

118 LABORATORIES

828 INSTRUMENTS

Several PetaBytes of solid Earth Science data will be available

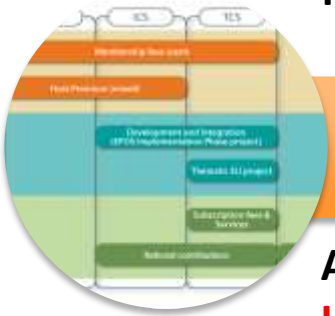
Several thousands of users expected to access the infrastructure

How will EPOS work?

Architecture

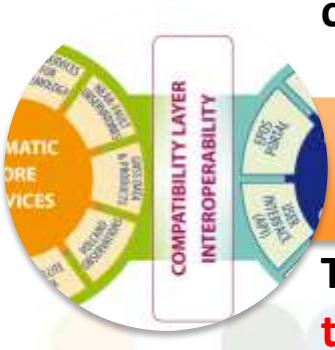
Legal & Governance

The ERIC (European Research Infrastructure Consortium) has been chosen as the legal model for EPOS



Financial

A financial plan has been adopted to guarantee the long-term sustainability of infrastructure – the countries will pay for it



Technical

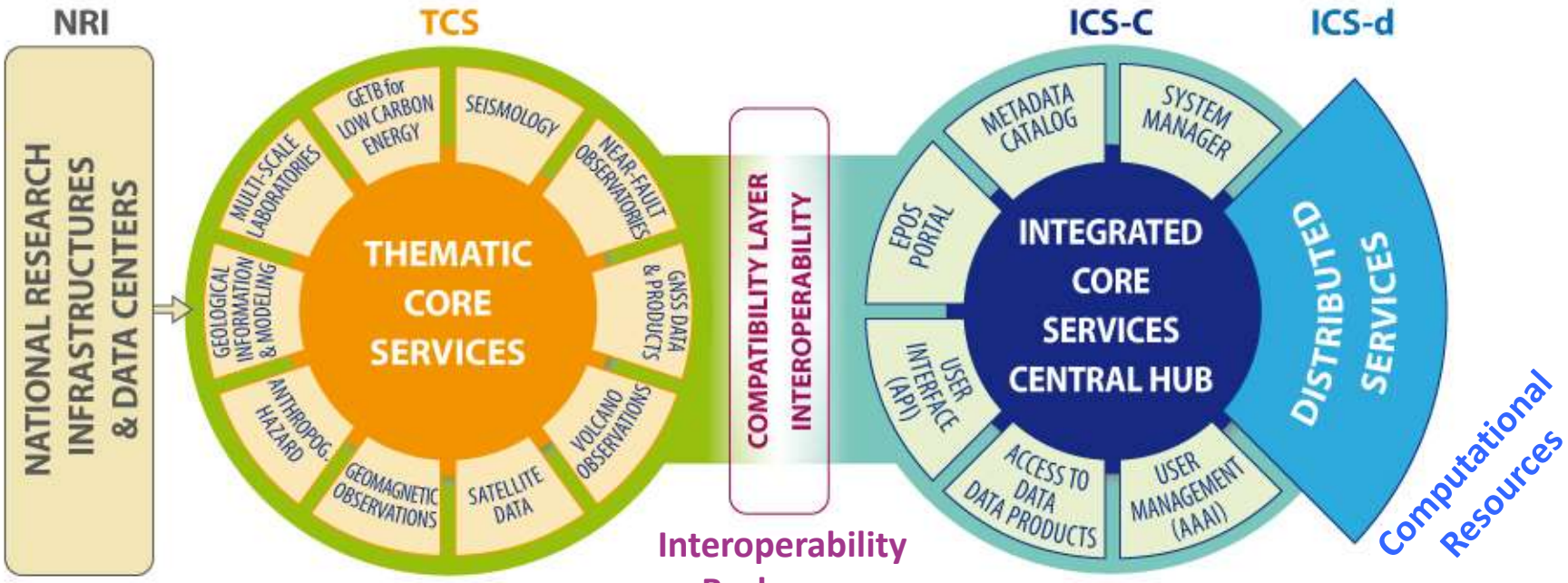
Technical solutions designed and adopted to implement the access to data and services

National Research Infrastructures (**NRI**)
Thematic Core Services (**TCS**)
Integrated Core Services (**ICS**)

How will EPOS work?

Functional Architecture

community-specific integration | **novel e-infrastructure**



- **Data generation & standardization**
- **Sustainability and operation**
- **Quality checked repositories**

- **Thematic integration**
- **Engagement of communities**
- **Community service provision**

Interoperability Brokerage

- **Metadata registry**
- **Processing**
- **Aggregation**
- **Integrated analyses**
- **Visualization**

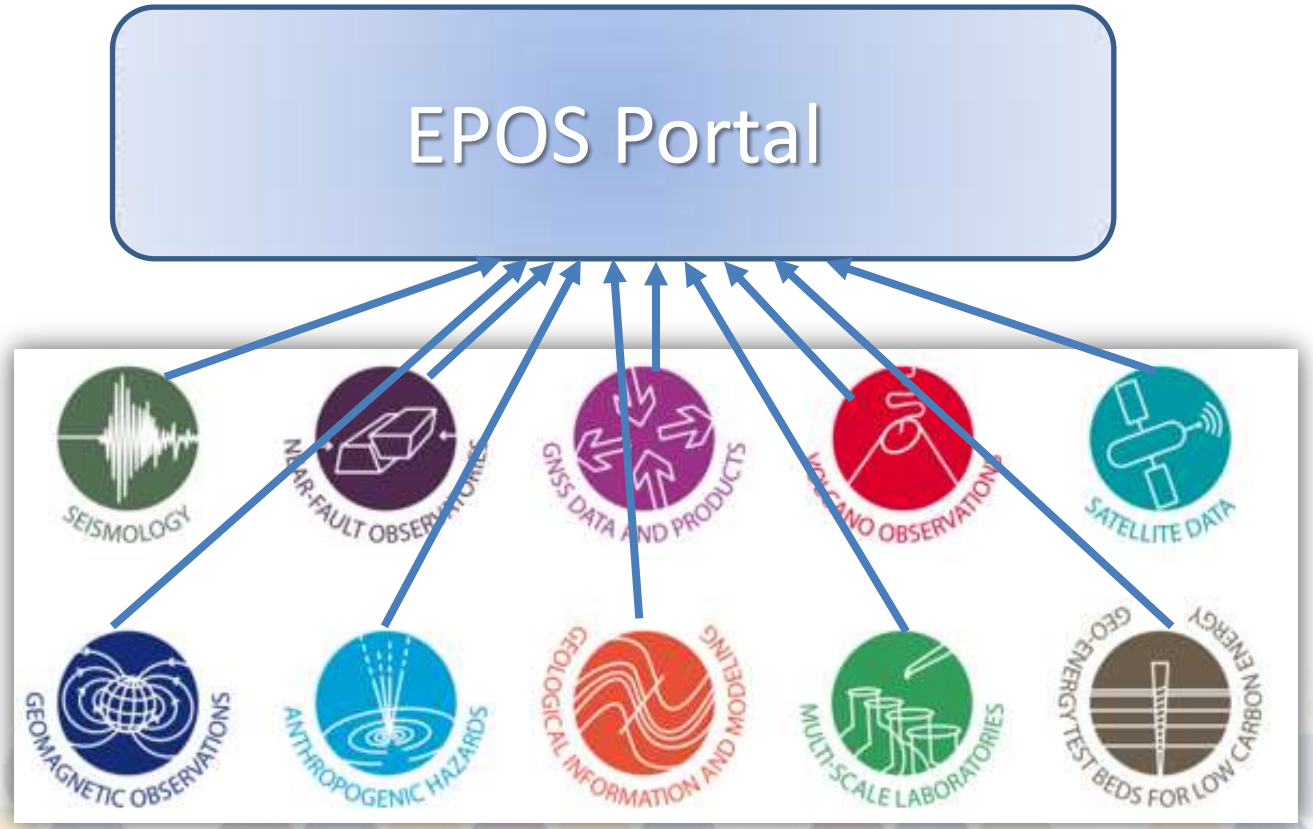
EPOS Timeline

- The preparatory phase ended by November 2014 with the participation of 23 countries.
- 19 of which have already signed a letter of intent (LoI) for joining the EPOS-ERIC to be hosted in Italy (Rome);
- At the completion of the Implementation Phase (started in October 2015), it is expected that most of the EU28 countries will be involved in EPOS.

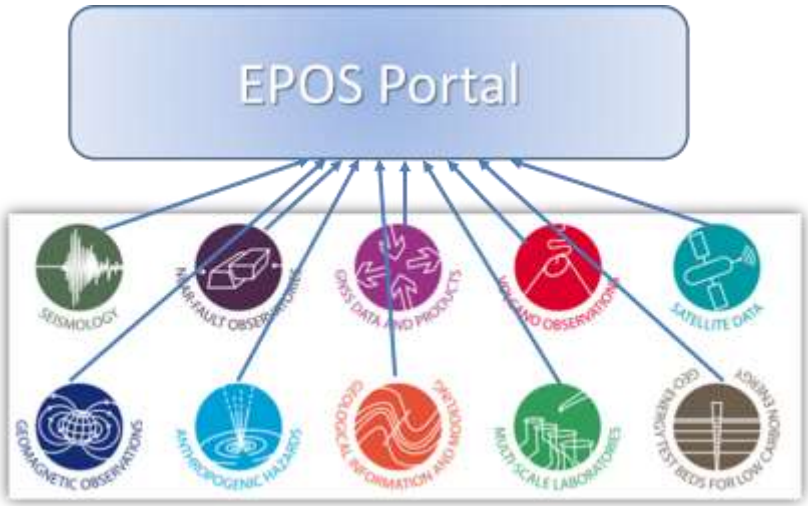
EPOS in Practice

Easy-to-find data and data products **(open access)** as well as tools for visualization, processing and analysis through the EPOS portal

Focus on Solid Earth science the internal structure and dynamics of planet Earth, from the inner core to the surface



EPOS Today



Each of the communities (e.g. GNSS) gets organized:

- Set up their governance (to speak with 'one voice' in EPOS)
- Define the data and data products to provide to the EPOS portal
- Construct the (IT) interfaces between their community and the EPOS portal

GNSS
Contribution based on collaboration between the geodetic/geophysical community including EUREF

Objectives EPOS-IP (Implementation Phase)
WP10 – GNSS Data & Products

Objective	Status
construct the future governance of TCS GNSS Data & Products in EPOS;	Agreement of Governance Structure
interact with the geodetic community in Europe, at national and Pan-European (EUREF) levels;	Communication channels with Geodetic Community established.
ensure interoperability between EPOS GNSS services (data and products) and EPOS ICS;	Detailed DDSS to be implemented during the EPOS-IP phase defined.
promote multidisciplinary interoperability with other disciplines within EPOS;	Contacts with WP09 (Near-Fault) and WP11 (Volcanos) about GNSS data management
implement distributed dissemination of file-based GNSS data for about 2000 stations (and and derived Products: CRD, VEL, STR) in the first 2 years with the goal of reaching 3000 by the end of the EPOS-IP.	**GLASS software (including Data & Products Portal) being developed. Prototype Products tested.**

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

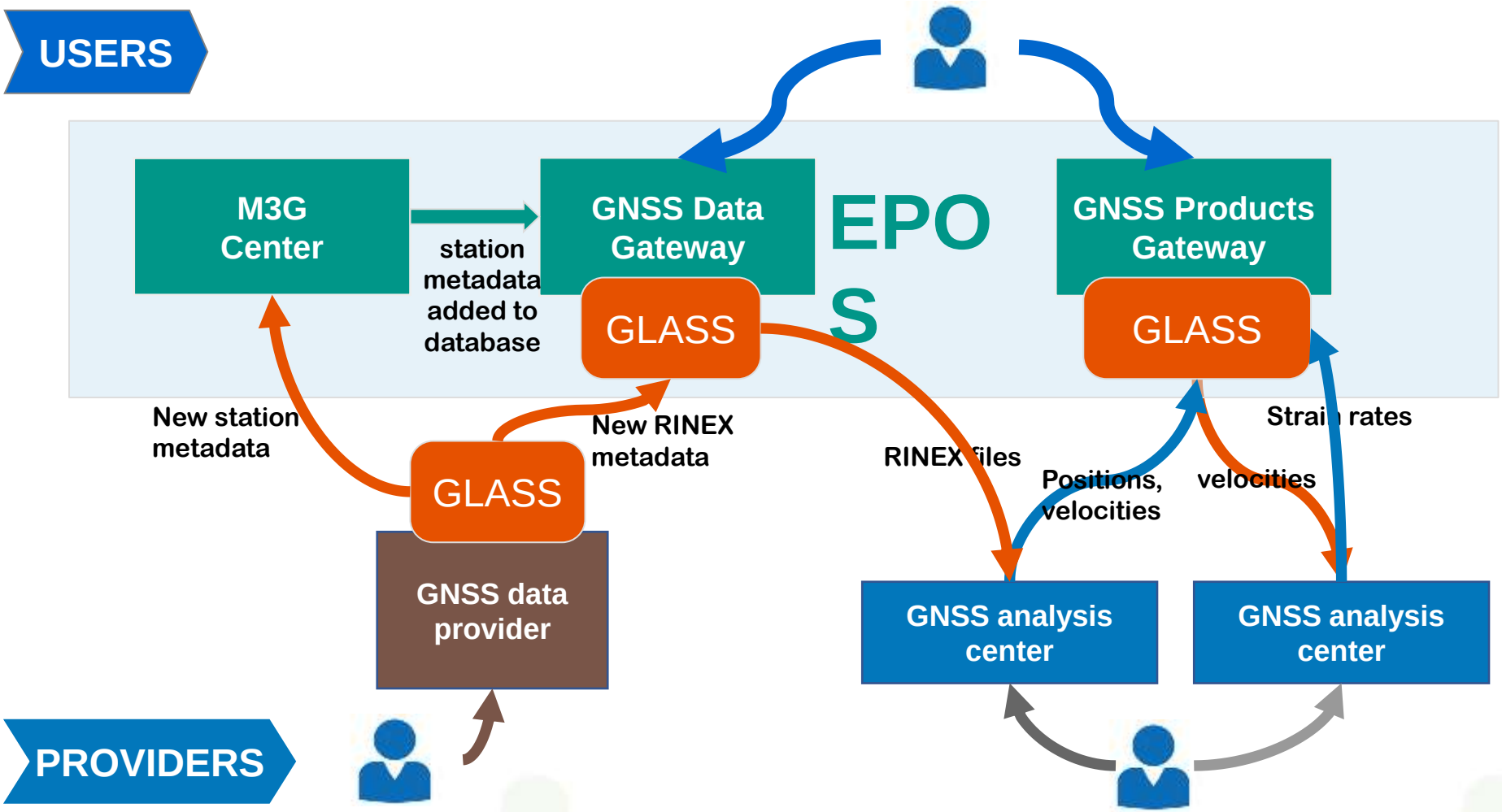
- **Provide GNSS products:**
  - Coordinate Daily and Time Series
  - Velocity Fields
  - Strain Rate Fields

GLASS – components

GLASS encompass the following key elements:

- **Physical components** – repositories/data centers
  - ***Primary*** - default repository, decided by the data provider
  - ***Secondary*** - alternative repository
  - ***Mirror*** - a repository that act as a mirror of another
- **Web services** – portals, monitoring tools, data and products mining solutions
- **Software applications** – managing interactions between repositories and services

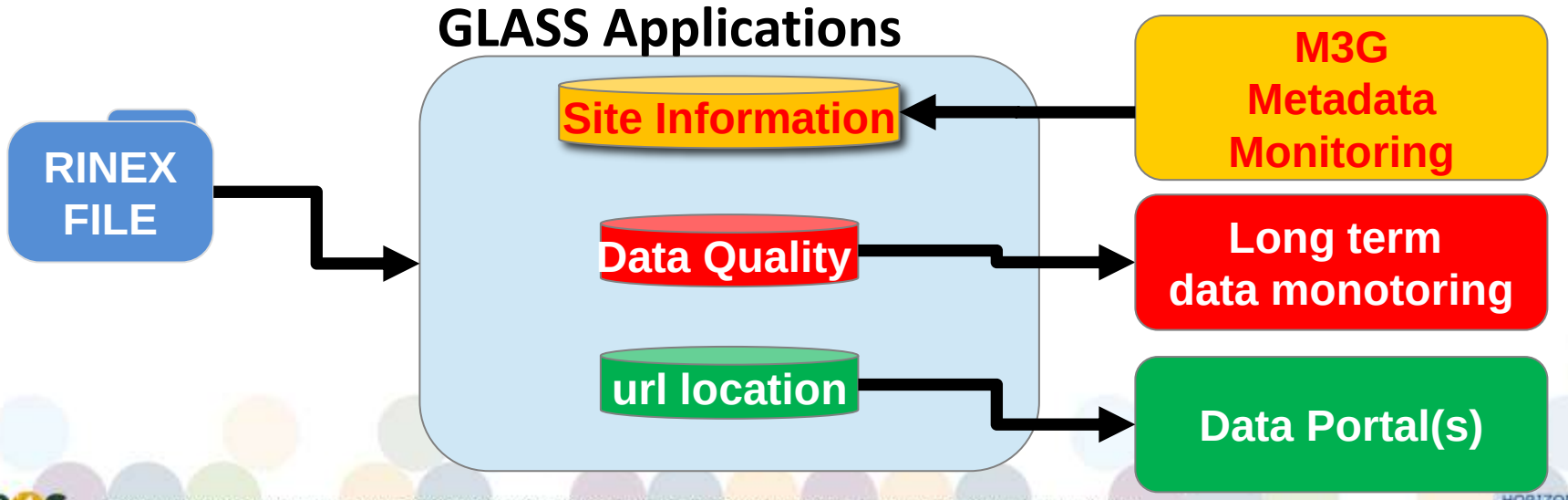
GLASS work flow



RINEX Repositories / Data Centers

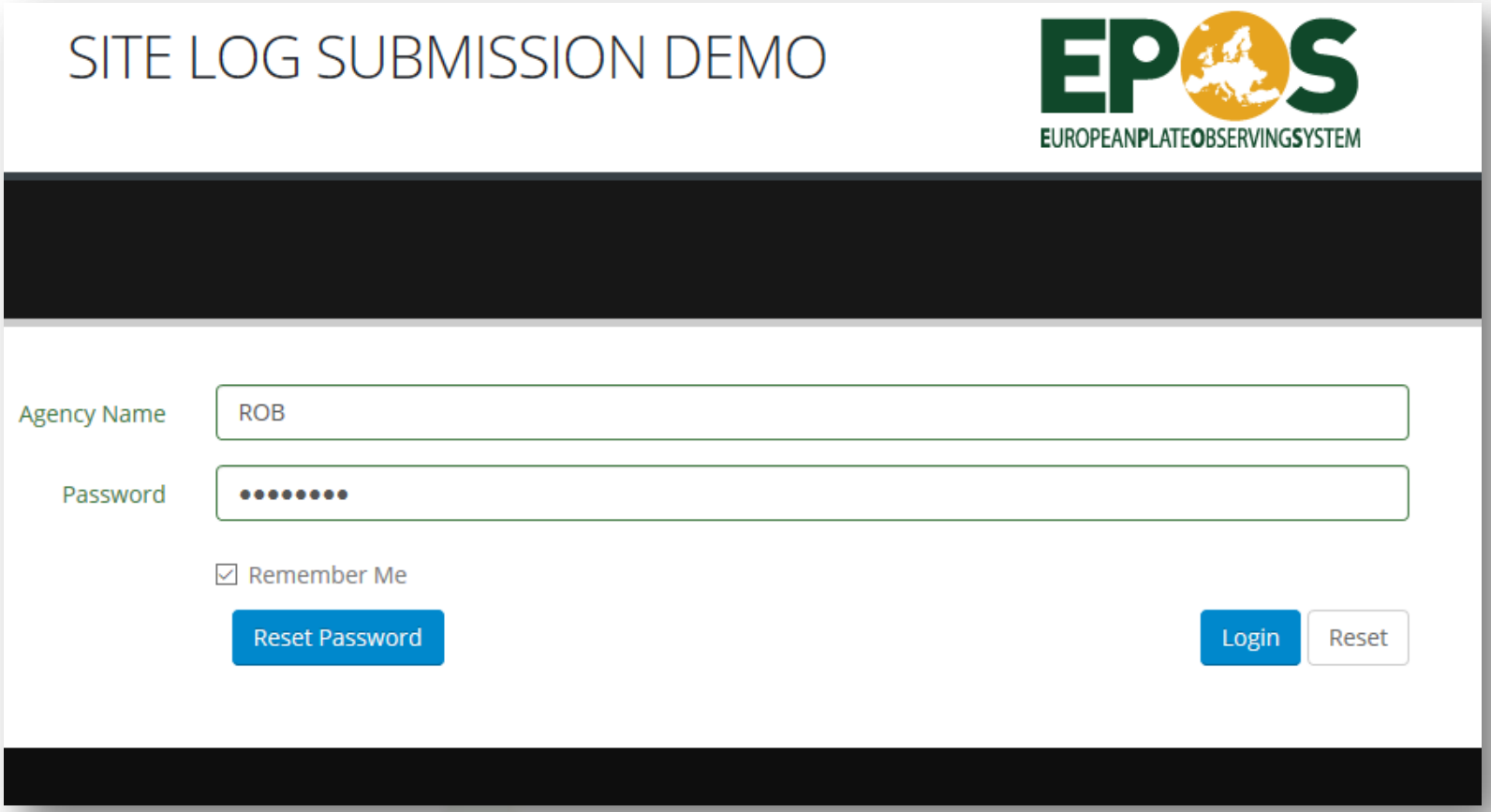
RINEX Data: need to be available (local or external – url link) and GLASS will run on top of it (no need to adapt directory structure).

- **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)**



M3G – Metadata Management system for Multiple GNSS Networks

to be maintained by ROB - Belgium



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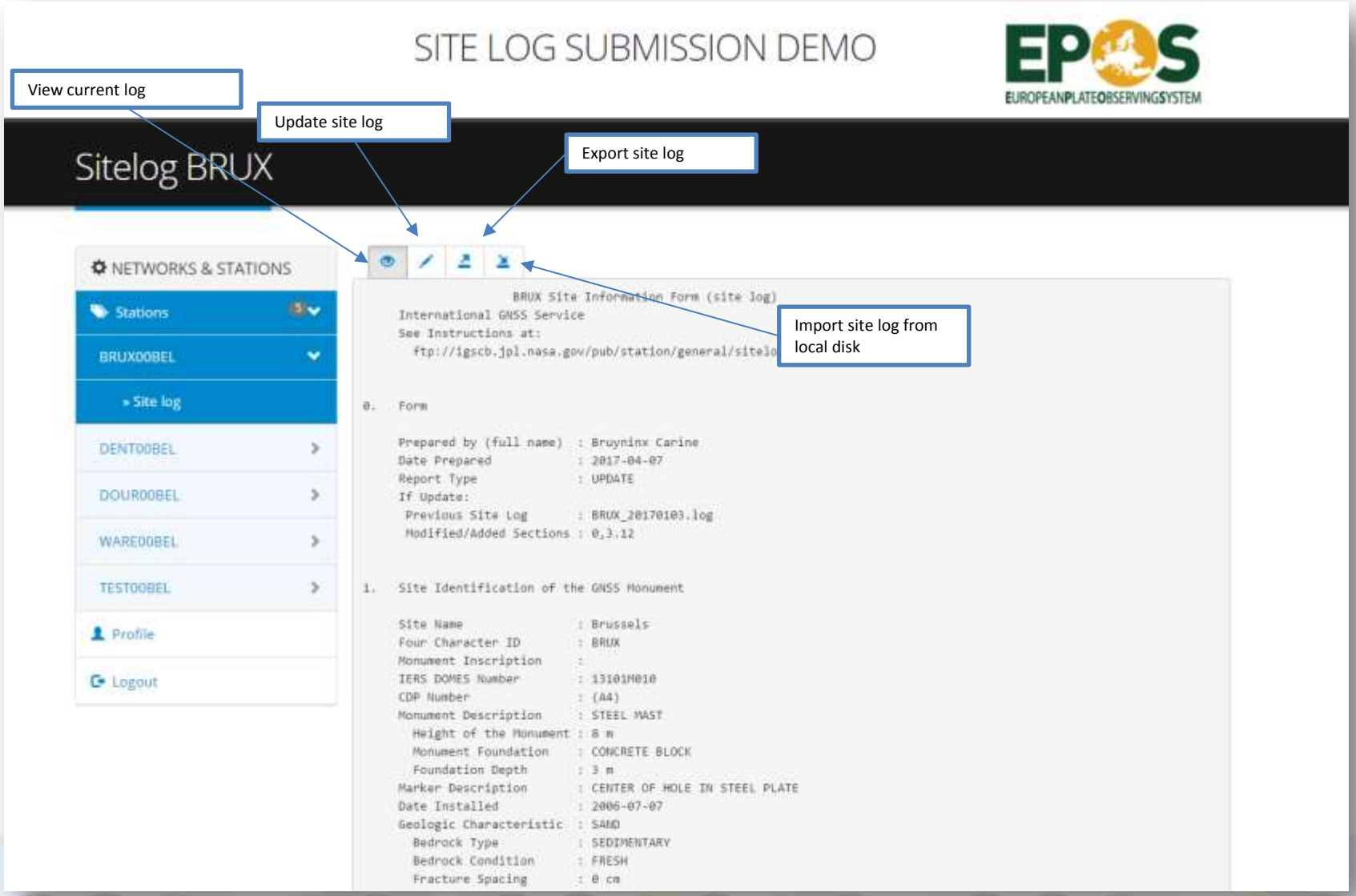
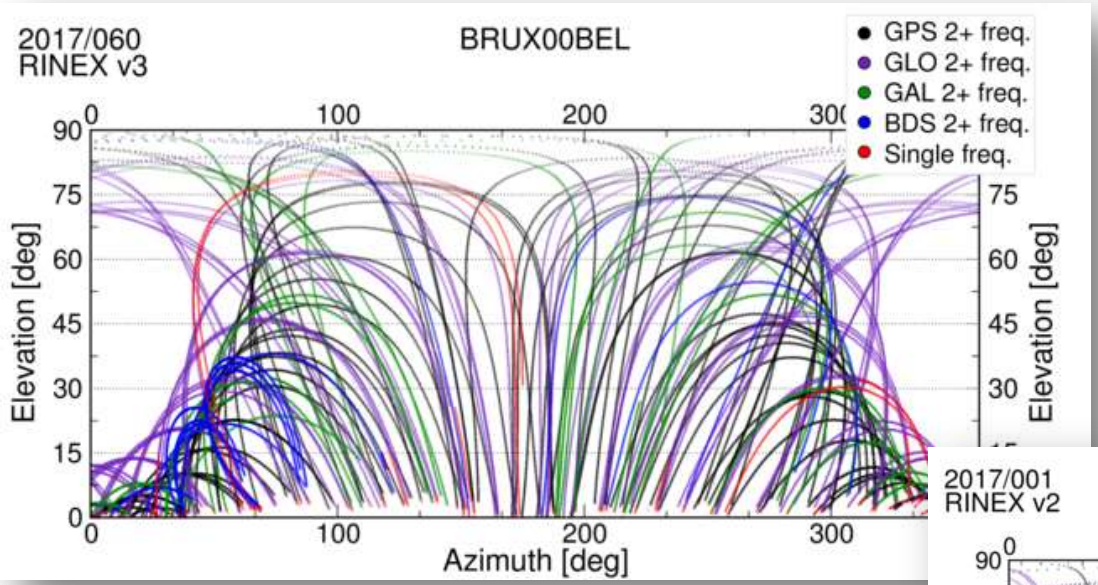
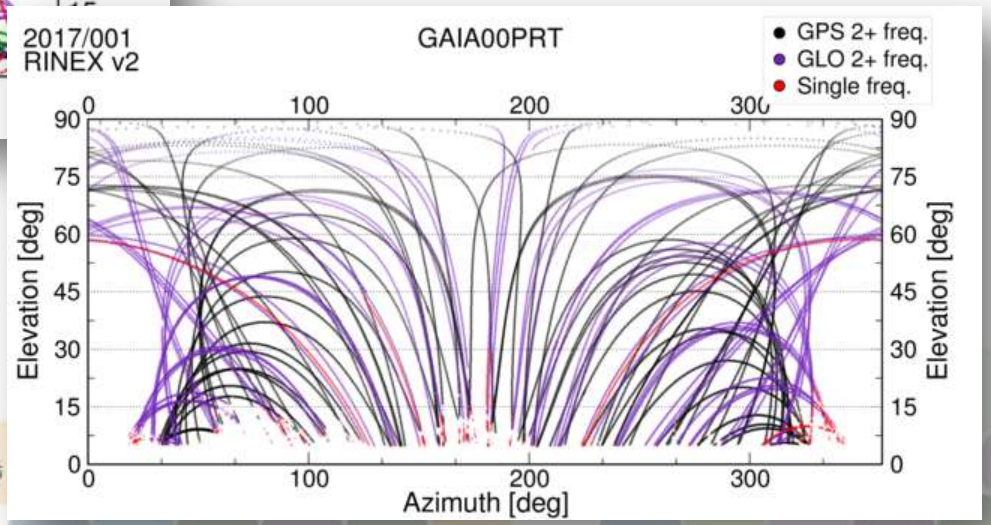


Long-Term Monitoring Center

to be maintained by ROB - Belgium

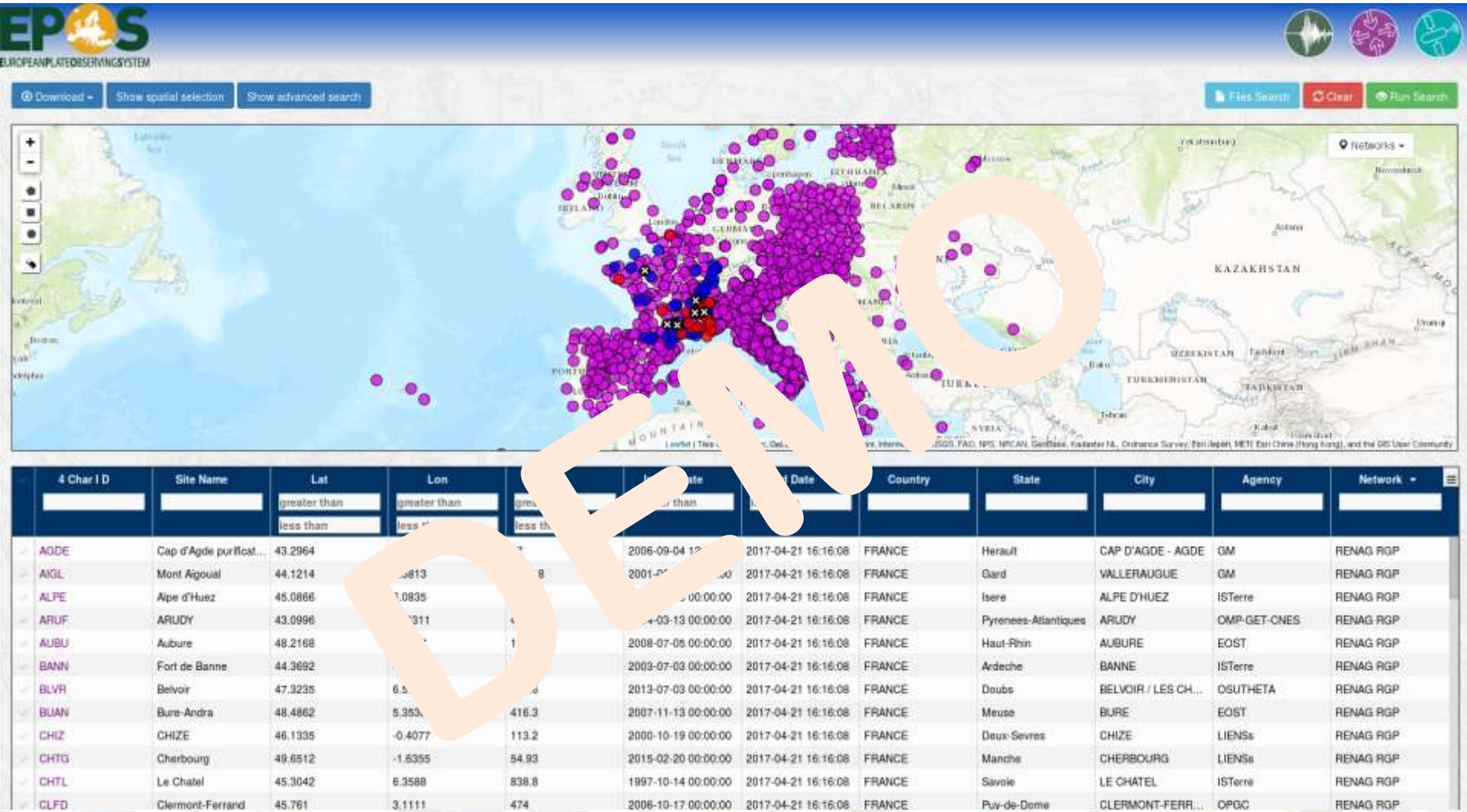
Observed phase data for all constellations. Input are the station daily RINEX 2/3 observation files. The graphs give a snapshot of the station tracking for a specific date.



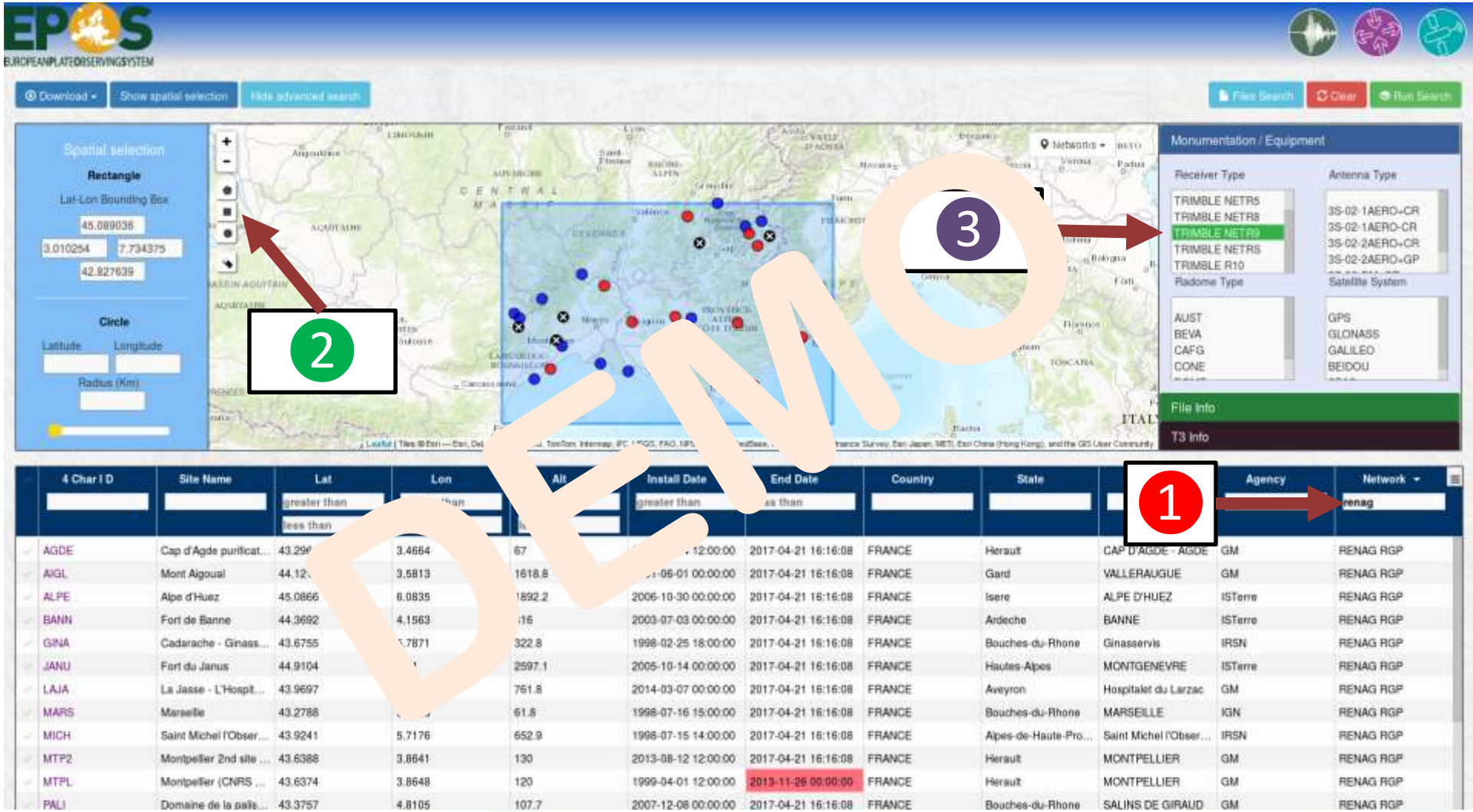


Data Portal

to be maintained by CNRS - France



Data Portal



4 Char I D	Site Name	Lat	Lon	Alt	Install Date	End Date	Country	State		Agency	Network
		greater than less than			greater than	s than					renag
AGDE	Cap d'Agde purificat...	43.29	3.4664	67	12:00:00	2017-04-21 16:16:08	FRANCE	Herault	CAP D'AGDE - AGDE	GM	RENAG RGP
AIGL	Mont Aigoual	44.12	3.5813	1618.8	-06-01 00:00:00	2017-04-21 16:16:08	FRANCE	Gard	VALLERAUGUE	GM	RENAG RGP
ALPE	Alpe d'Huez	45.0866	6.0835	1892.2	2006-10-30 00:00:00	2017-04-21 16:16:08	FRANCE	Isere	ALPE D'HUEZ	ISTerre	RENAG RGP
BANN	Fort de Banne	44.3692	4.1563	16	2003-07-03 00:00:00	2017-04-21 16:16:08	FRANCE	Ardeche	BANNE	ISTerre	RENAG RGP
GINA	Cadarache - Ginass...	43.6755	5.7871	322.8	1998-02-25 18:00:00	2017-04-21 16:16:08	FRANCE	Bouches-du-Rhone	Ginasservis	IRSN	RENAG RGP
JANU	Fort du Janus	44.9104		2597.1	2005-10-14 00:00:00	2017-04-21 16:16:08	FRANCE	Hautes-Alpes	MONTGENEVRE	ISTerre	RENAG RGP
LAJA	La Jasse - L'Hospit...	43.9697		761.8	2014-03-07 00:00:00	2017-04-21 16:16:08	FRANCE	Aveyron	Hospitalet du Larzac	GM	RENAG RGP
MARS	Marseille	43.2788		61.8	1998-07-16 15:00:00	2017-04-21 16:16:08	FRANCE	Bouches-du-Rhone	MARSEILLE	IGN	RENAG RGP
MICH	Saint Michel l'Obser...	43.9241	5.7176	652.9	1998-07-15 14:00:00	2017-04-21 16:16:08	FRANCE	Alpes-de-Haute-Pro...	Saint Michel l'Obser...	IRSN	RENAG RGP
MTP2	Montpellier 2nd site ...	43.6388	3.8641	130	2013-08-12 12:00:00	2017-04-21 16:16:08	FRANCE	Herault	MONTPELLIER	GM	RENAG RGP
MTPL	Montpellier (CNRS ...	43.6374	3.8648	120	1999-04-01 12:00:00	2013-11-26 00:00:00	FRANCE	Herault	MONTPELLIER	GM	RENAG RGP
PALI	Domaine de la paiis...	43.3757	4.8105	107.7	2007-12-08 00:00:00	2017-04-21 16:16:08	FRANCE	Bouches-du-Rhone	SALINS DE GIRAUD	GM	RENAG RGP

EPOS-GNSS Products

Current status: Prototype Products already generated

Daily solutions + metadata

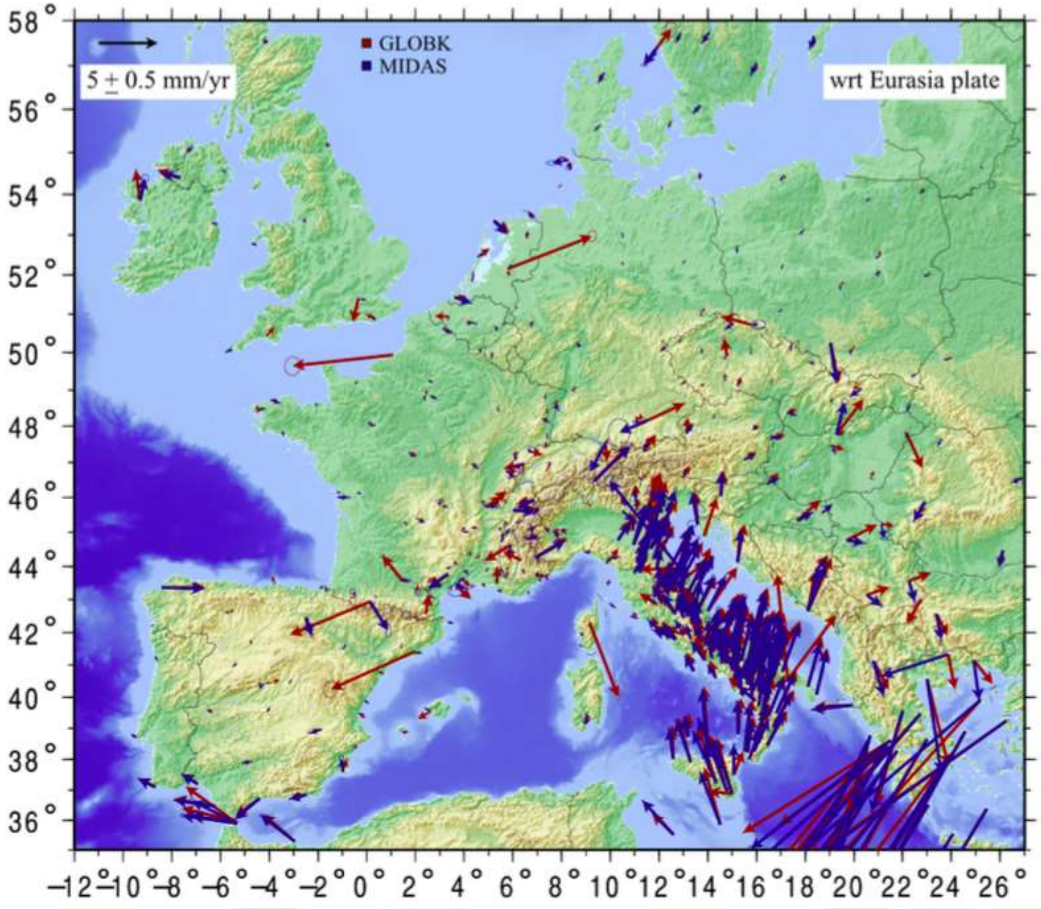
- run by 2 Pan-European processing centers (INGV, UGA-CNRS)
- densified solution EUREF (BFKH)

Daily time-series & velocity fields + metadata

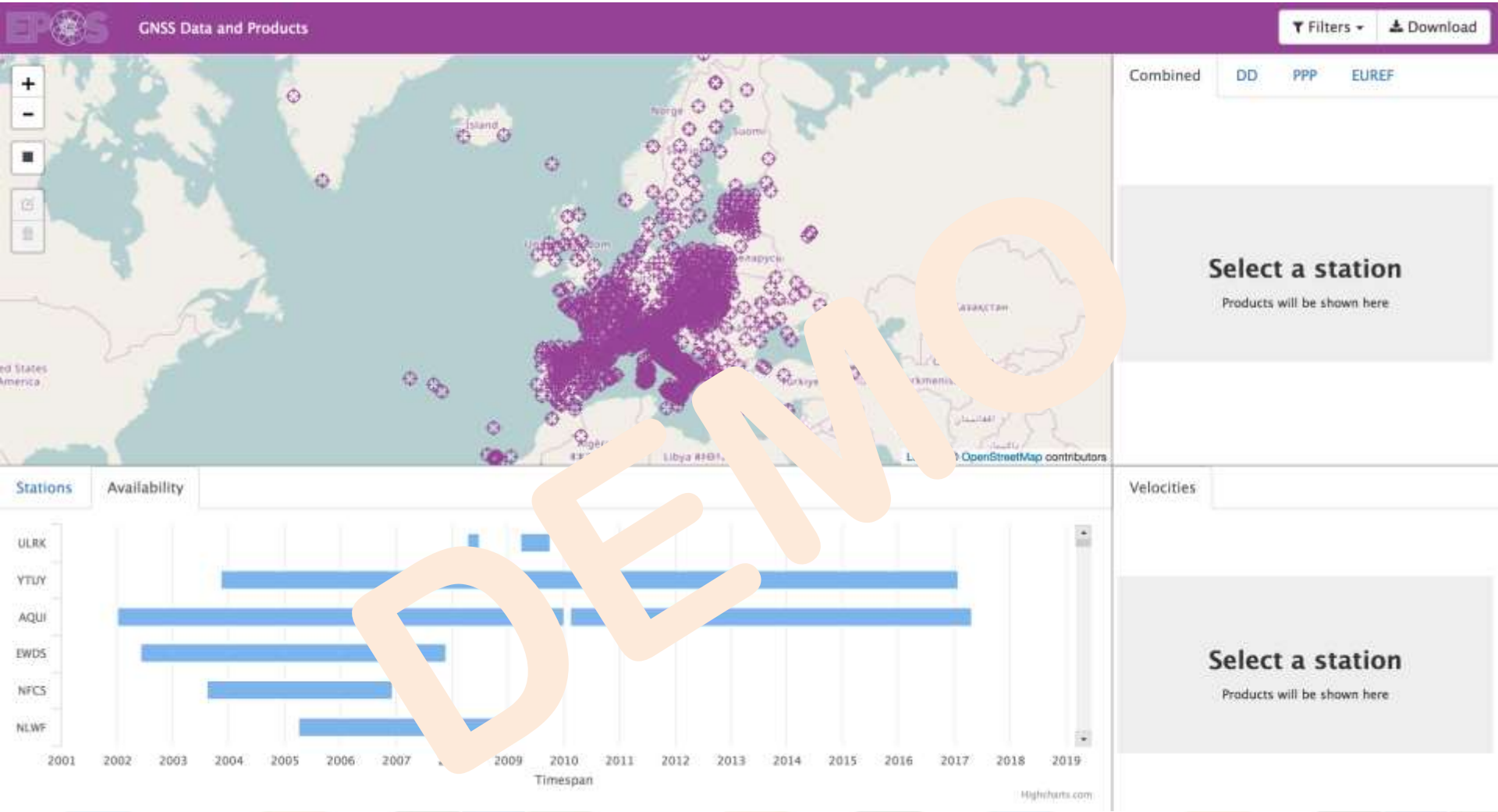
- Individual Solutions (INGV, UGA-CNRS)
- Combined Solution (BFKH)

Strain Rate maps + metadata

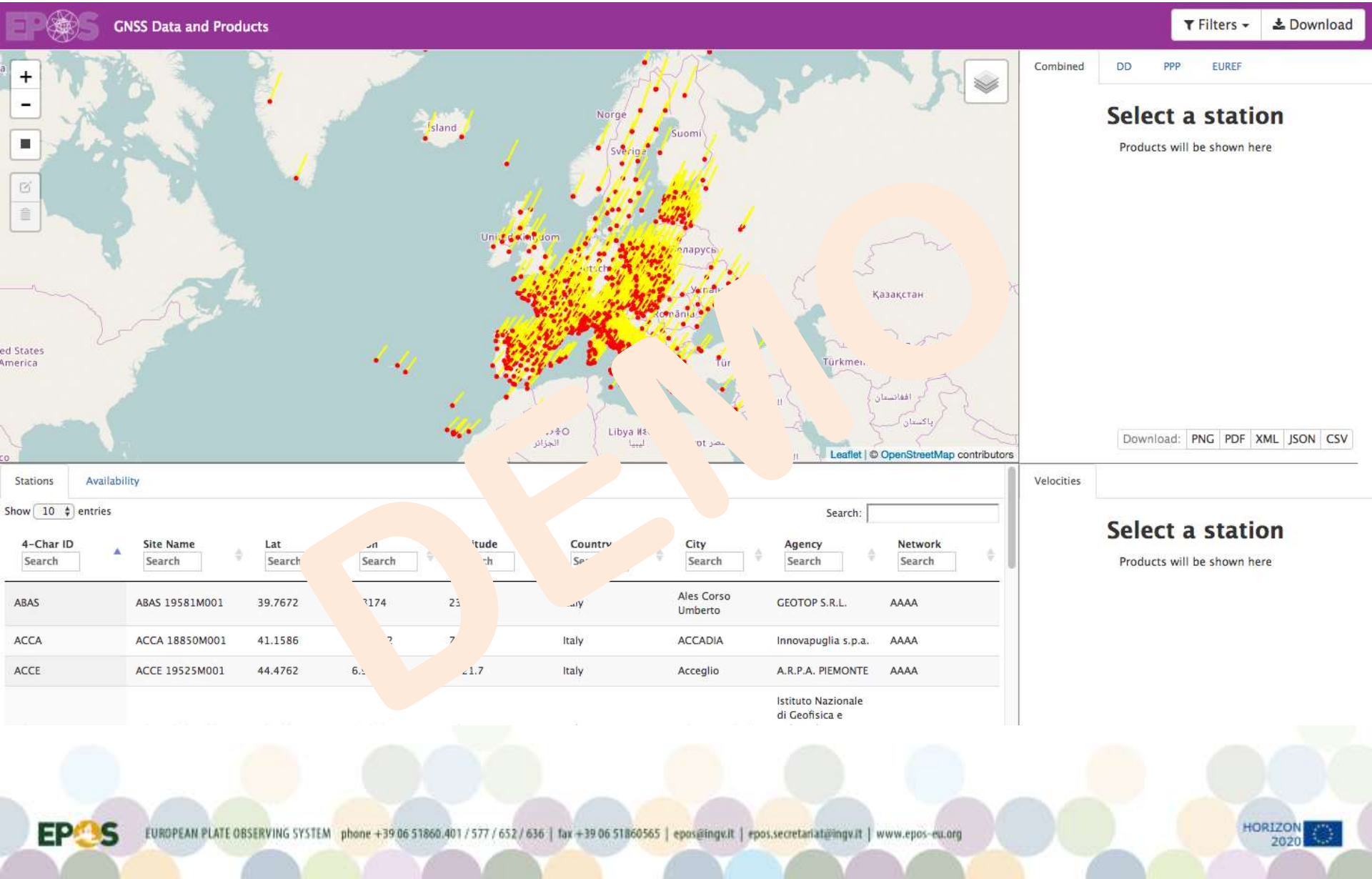
- Global + Regionals (LM)



Products Portal
to be maintained by UBI/C4G – Portugal



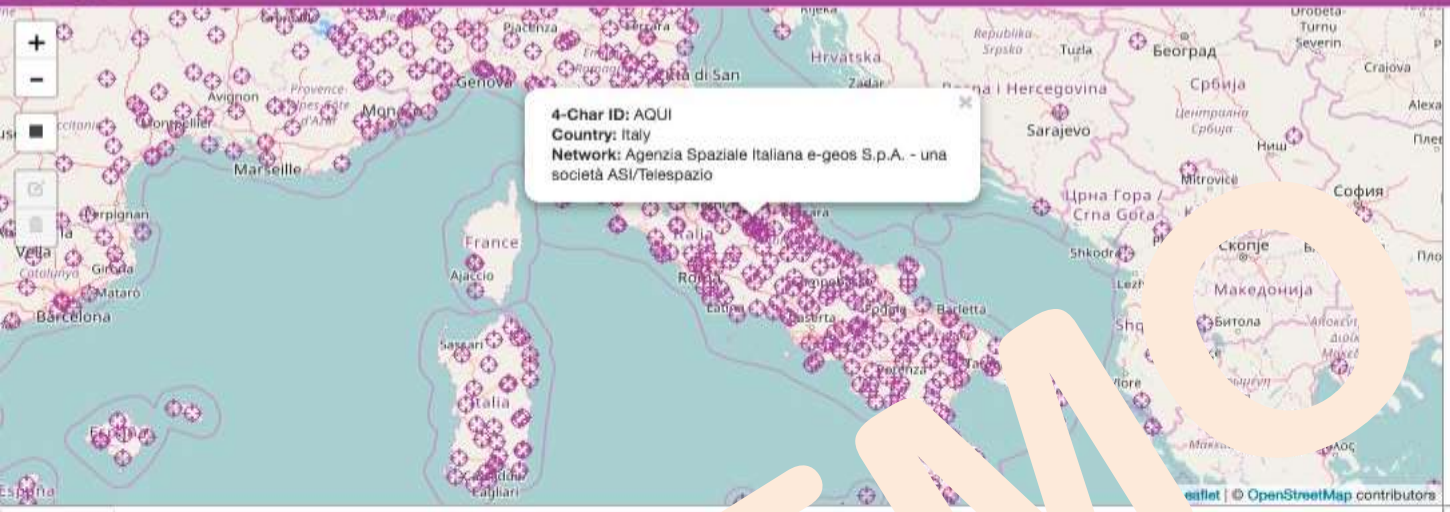
Products Portal



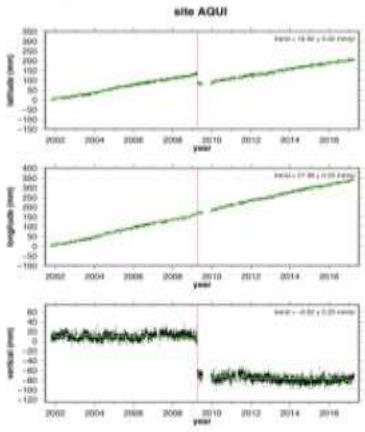
Products Portal

GNSS Data and Products

Filters | Download



Combined | DD | PPP | EUREF



Stations | Availability

Show 10 entries

Search: AQUI

4-Char ID	Site Name	Lat	Lon		Country		Agency	Network
AQRA	AQRA 12757M002	42.3659	13.37	N/A	Ita		Regione Abruzzo	AAAA
AQUI	L'Aquila	42.3682	13.3502		Ital	L'Aquila	Agenzia Spaziale Italiana e-geos S.p.A. - una società ASI/Telespazio	AAAA
AQUM	AQUM	42.3276	13.4672	N/A	aly	L'Aquila	LEICA GEOSYSTEMS S.P.A.	AAAA

Showing 1 to 5 of 5 entries (filtered from 1,476 total entries)

Previous 1 Next

Velocities

AQUI

Trend	N: 16.5 +/- 0.2 mm/year	
	E: 21.4 +/- 0.2 mm/year	
	U: -0.6 +/- 0.2 mm/year	
Offset 2009-04-09	N: -49.7 +/- 0.9 mm	
	E: 9.3 +/- 0.8 mm	
	U: -80.5 +/- 1.8 mm	

Added value of EPOS for GNSS community

- **Sustainability within EPOS:**
  - **Countries that join EPOS-ERIC commit to maintain their GNSS infrastructure integrated in EPOS (stations, operation).**
  - **Data and Product Gateways chosen based on the commitment of France and Portugal 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**

There are clearly synergies between EPOS-GNSS and FIG goals concerning the maintenance of the reference frames by continuously inspecting their materialization (CORS network) and evaluating internal deformations.

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Thank you for attention

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