

# GLASS, a Tool for Quality-Controlled GNSS Data and Products Dissemination

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## ABSTRACT

Europe is covered by various networks of GNSS stations maintained by different agencies with different technical and scientific objectives. The EPOS-IP (European Plate Observing System – Implementation Phase) project aims to harmonize and standardize data collection and processing and to design and establish dedicated products and services that benefit the existence of national and pan-European infra-structures (in particular EUREF), optimized for Solid Earth Research applications. We present here the efforts carried out by the members of this group to create a distributed software architecture called GLASS, a tool for quality-controlled dissemination within the EPOS, which during the operational phase, to start in 2019, shall provide GNSS data and derived products (coordinates, time series, velocities and strain rates) from thousands of stations in Europe region.

## EPOS-ERIC MISSION : GNSS Data and Products (Thematic Core Service)

Since the 30th of October 2018 the European Commission granted the legal status of European Research Infrastructure Consortium (ERIC) to EPOS. The ERIC legal framework is recognized throughout EU member states and participating countries and provides a legal and financial framework in which to coordinate Solid Earth Sciences in Europe. In particular the thematic core service of GNSS Data and Products aims to

- facilitate access, through EPOS, portals and web sites to relevant GNSS data, meta-data, and data products
- coordinate the archiving of relevant GNSS data, metadata and data products
- promote best practice for GNSS station operation, data quality control and data management
- maintain and distribute open source software for GNSS data and metadata discoverability
- maintain and develop GNSS data products

In partnership with EUREF, the International Association of Geodesy (IAG) sub-commission for the European Reference Frame.

## PRINCIPLES AND ARCHITECTURE

GNSS Data archival and dissemination within EPOS was based on a set of Use Cases Requirements for Solid Earth Scientists within EPOS, described in full in the Epos Deliverable Report on Use Cases, Requirements, Metadata and Interoperability of EPOS-GNSS WG. Examples of such Use cases are:

- Obtaining GNSS data for the estimation of Volcano deformation
- Co-seismic displacements associated with a Mw7 earthquake
- Compute Eurasian strain rates from EPOS stations velocities

A new software system was developed that focuses on: GNSS station uniqueness, Data redundancy, Data monitoring, Efficiency and where GNSS data remains fully controlled by the data suppliers and physically located at the underlying data nodes.

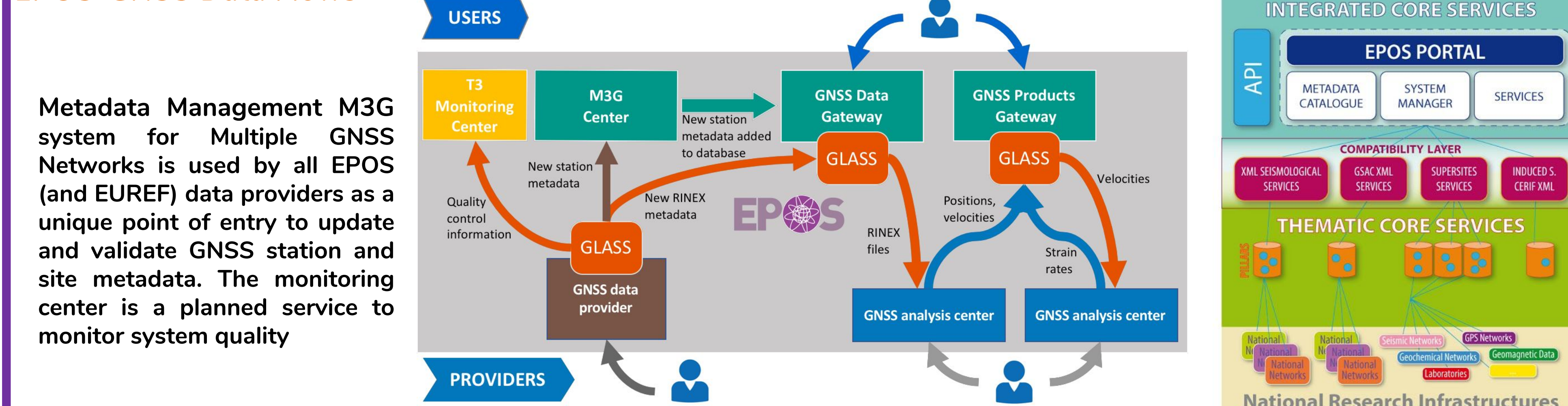
GLASS (Geodetic Linkage Advanced Software System) provides:

- Management of GNSS data and metadata from distributed repositories:
  - collect data + generate metadata, quality control + validate metadata, disseminate data + metadata
- Provision of GNSS products and metadata: coordinates and time series, velocity fields, strain rate fields.

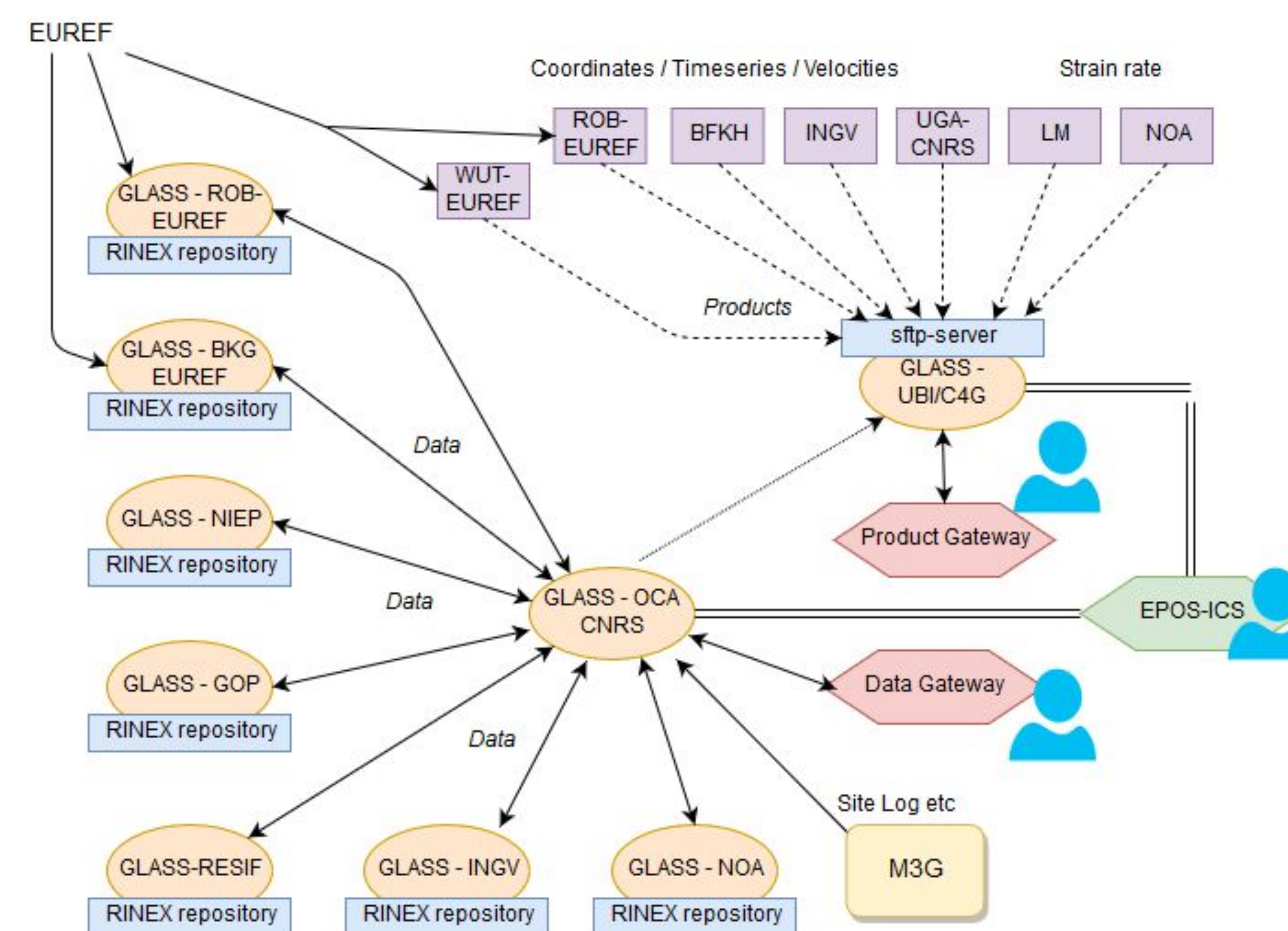
The GLASS system encompass the following key elements:

- Physical components – repositories/data centers
- Web Based Applications – Web Portals and Application Programming Interfaces (API's)
- Monitoring tools, data and products mining solutions

## EPOS-GNSS Data Flows



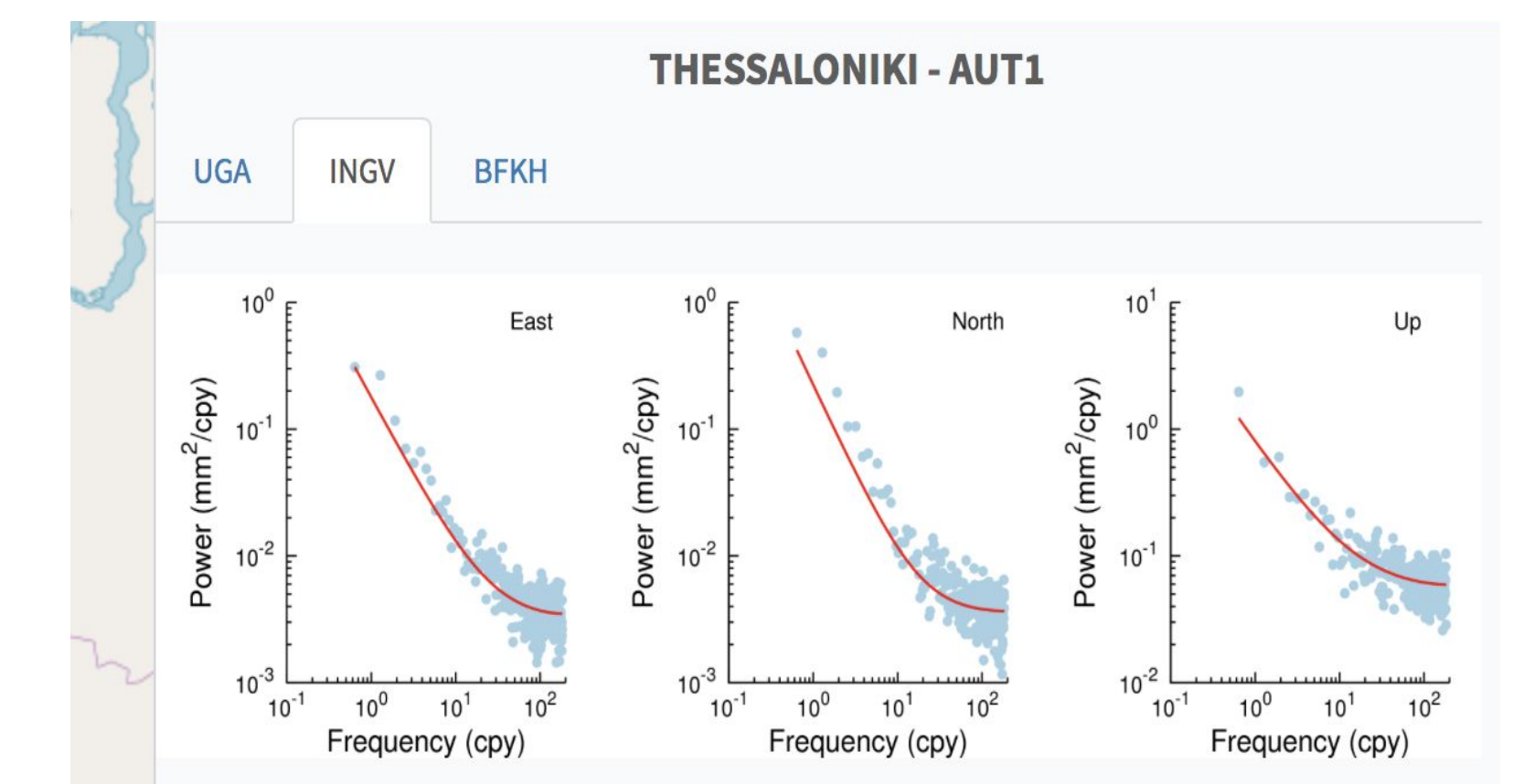
The left panel shows the flow of GNSS data inside the GNSS Thematic core service which makes use of GLASS (GNSS Linkage Advanced Software System). Data & Products can be obtained by users at the WP10 portals, via the graphical user interface or GLASS REST API. Products and Data are also available at the EPOS ICS portal (see right panel) where cross TCS searches are available for accessing GNSS, Seismic, Volcanology, Multi Scale Labs. etc. data, products and services.



The current operational situation showing the operational Analysis Centers, Glass Nodes and Repositories and Portals.

## Quality Control

- M3G - Metadata Management system for Multiple GNSS Networks is used by EPOS (and EUREF) data providers to update site logs, information about local networks, DOI, nominal data submissions, data license, and embargo times on the data. <http://gnss-metadata.eu>.
- GNSS data quality checking is performed using the G-Nut/Anubis software and standard report developed specifically for EPOS GNSS TCS.



- One aspect of the products Quality Control - Computing the power spectrum of residuals to detect abnormal noise behavior.

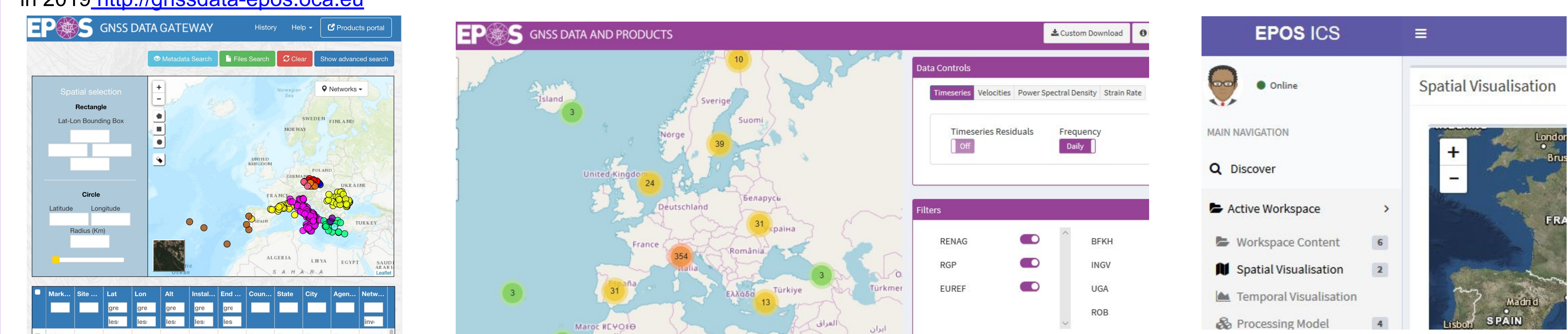
## DATA, PRODUCT & SOFTWARE DISSEMINATION

<http://glass.unicegnssdata-epos.oca.eu.fr:8080/>

in 2019 <http://gnssdata-epos.oca.eu>

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

<http://nodedev.bgs.ac.uk/epos/epos-gui/tra-master/search>



## SOFTWARE Availability



Software Distribution:

- Source Code  
GitLab GNSS Europe Group <https://gitlab.com/gpseurope>
- Virtual Machine Images [http://glass.c4g-pt.eu/epos\\_vm](http://glass.c4g-pt.eu/epos_vm)  
Formats: Vagrant BOX, OVA.

## API's and Interoperability

- Site log – geodesy XML
- Glass REST API – json, xml, geojson
- Glass REST API – Swagger Documentation.
- EPOS Web Service Description – RDF - Turtle Triples
- MetaData Catalogue – EPOS uses CERIF(Common European Research Information Format)