

New way of GNSS data dissemination within the European Plate Observing System (EPOS)

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ABSTRACT

The European Plate Observing System (EPOS) has been established to facilitate, harmonize and standardize data collection and processing for Solid Earth Research applications. The EPOS is principally based on the existence of national and pan-European infra-structures while it is completed with Thematic Core Services (TCS) for individual scientific domains, and Integrated Core Services (ICS). Besides geophysical data and products, the contribution of geodesy to EPOS is currently represented mainly with GNSS data and products. As Europe is covered by various networks of GNSS stations maintained by variety of agencies with different technical and scientific objectives, the GNSS TCS has been established in order to integrate as many as GNSS data and products. For this purpose, the TCS developed a new distributed system disseminating and controlling data and metadata, and which enables an easy data search, selection or download for any specific application. Within the EPOS Implementation Phase (EPOS-IP) project, a major effort in GNSS TCS targeted these developments: a) new distributed system for GNSS data dissemination and quality control, b) pan-European products such as coordinate time-series, velocity fields and strain-rates and, finally, c) sustainable model for data, data products, software and services provision and maintenance in future operational phase which will start in 2019. The poster focuses on developments towards a new way of data dissemination including new GLASS software, data and metadata quality control. It presents the overall concept, implemented architecture, software and portal components, the technologies that are used and resulting API's and their descriptions in formal languages for integration into the central EPOS project software and the existing workflow system. The EPOS-IP project is funded by the ESFRI European Union.

EPOS-TCS LONG-TERM MISSION

EPOS-GNSS supports Solid Earth Sciences in Europe through the European Plate Observing System (EPOS). Its goals are:

- to facilitate access, through the European Plate Observing System (EPOS), to relevant GNSS data, meta-data, and data products
- to coordinate the archiving of relevant GNSS data, metadata and data products
- to promote best practice for GNSS station operation, data quality control and data management
- to maintain and distribute open source software for GNSS data and metadata discoverability
- to maintain and develop GNSS data products

The efforts are done in close partnership with EUREF, the International Association of Geodesy (IAG) sub-commission for the European Reference Frame.

PRINCIPLES AND ARCHITECTURE

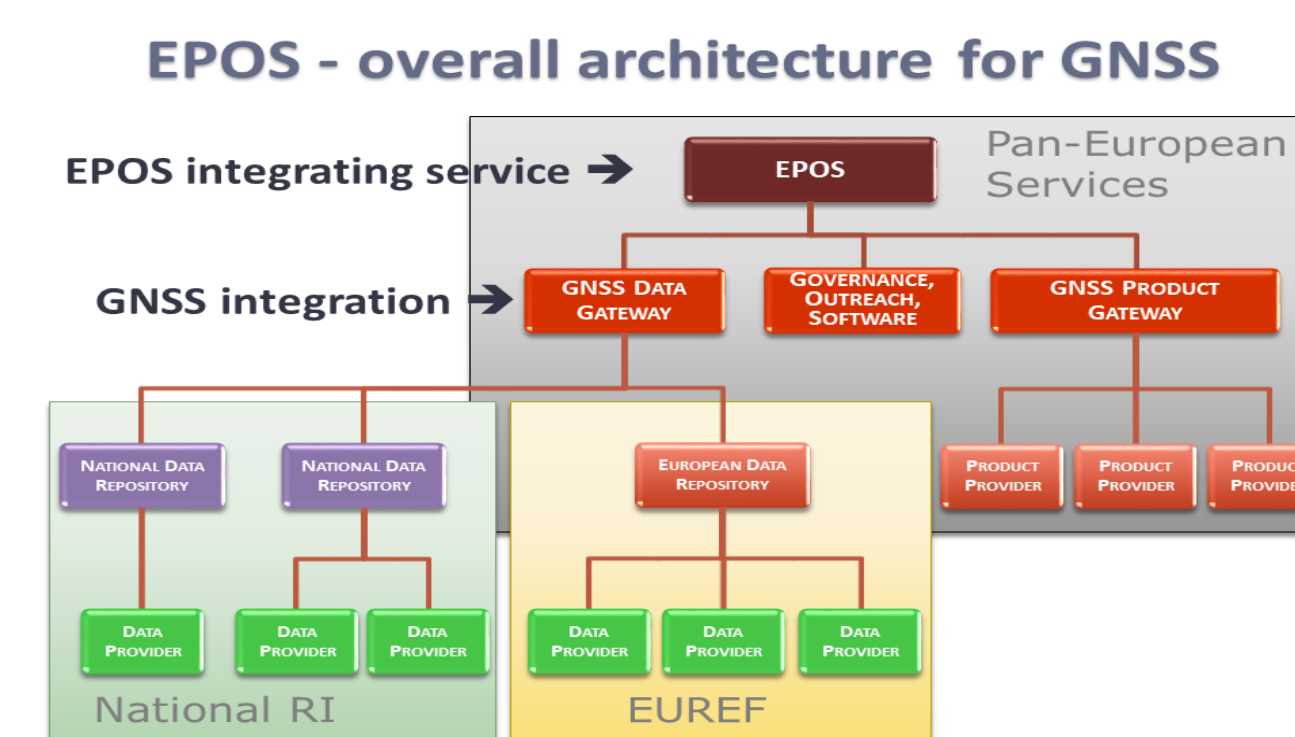
The new way of data dissemination within EPOS was inspired by ideas and functionalities of UNAVCO's GSAC (Geodesy Seamless Archive Centers). Several issues were identified in the GSAC (blind search, no site uniqueness, no file redundancy, no quality control, no product handling, hardwired web service etc.) which led to designing a new software system, called the GLASS Software Package.

Principles defined for EPOS data dissemination:

- GNSS station uniqueness (central submission point, see M3G frame),
- Data redundancy (robust system supporting secondary/mirror repositories),
- Data monitoring (quality control used for file status setting, see QC frame),
- Efficiency (knowledge of the system hierarchy is used in search and dissemination),
- Interdependency (standard tools, see GLASS frame, can be used autonomously),

Architecture of the data dissemination:

- GLASS software offers the standard means to make this data discoverable at the portals.
- GNSS data are not physically located at EPOS Data gateways, but remain on underlying data nodes or data centers.



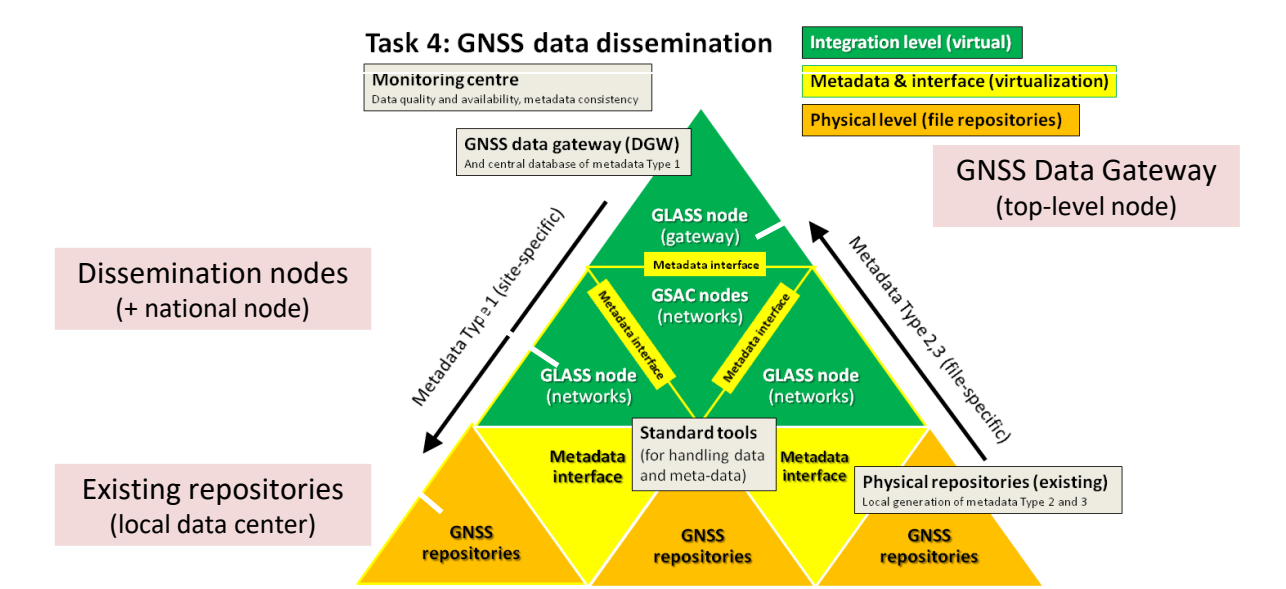
VIRTUALIZATION CONCEPT BASED ON METADATA

New way of data dissemination exploits principles of virtualization architecture thus

- A. Virtual layer: represented by GLASS nodes and its hierarchy operating on metadata and data
- B. Physical layer: represented by data centers/repositories storing actual GNSS data.

and it is solely based on collecting, validating and distributing metadata:

- T0 metadata on GLASS virtualization architecture which describes the topology between nodes
- T1 metadata on GNSS sites and data centers which are centralized and downward synchronized to all nodes
- T2 metadata on GNSS files which are decentralized, upward synchronized to upper nodes and includes file status code based on the validation
- T3 metadata on GNSS data quality which are decentralized, not synchronized but used at local node for the file validation and status setting

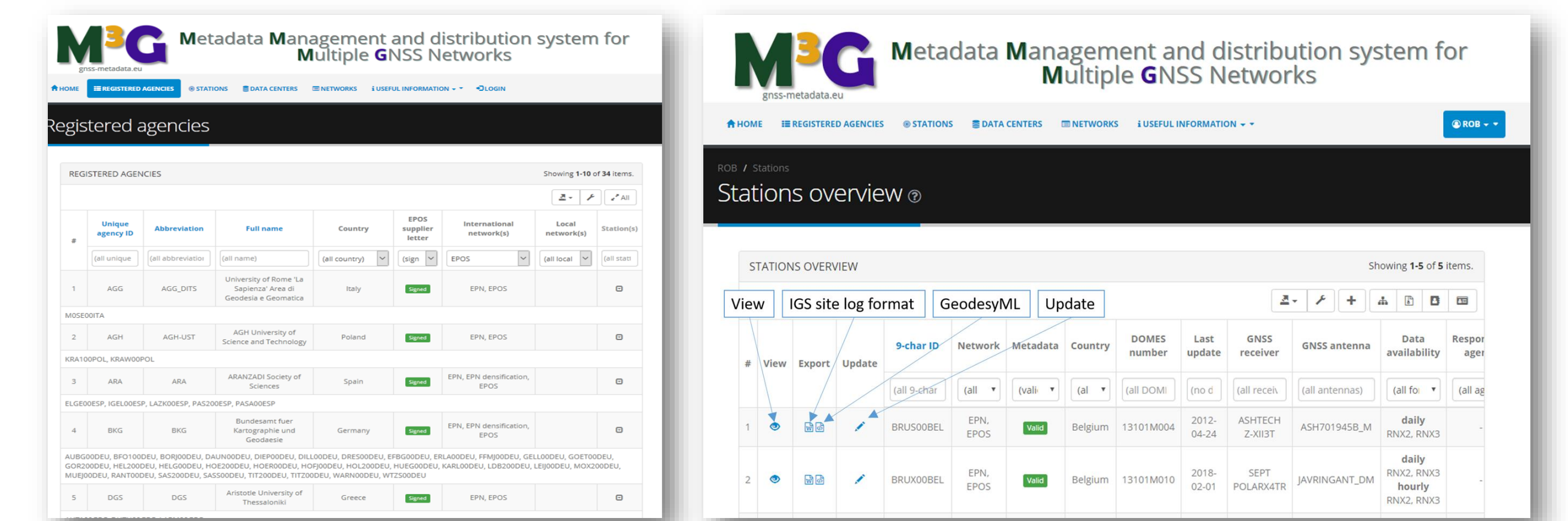


METADATA PORTAL (M3G)

M3G - Metadata Management system for Multiple GNSS Networks is used by all EPOS (and EUREF) data providers as a unique point of entry to update and validate T1 metadata. M3G manages site logs, information about local networks, DOI, nominal data submissions, data license, and embargo times on the data. It is compatible with GeodesyML and the EU GDPR regulation.

M3G is managed by and located at ROB, Belgium and it is available from <http://gnss-metadata.eu>.

Once updated in M3G, the T1 metadata are sent to the EPOS data gateway using the GeodesyML format.



GLASS SOFTWARE PACKAGE

GLASS (Geodetic Linkage Advanced Software System) is an integrated software package to be deployed in GNSS infrastructure (from a single to a multitude of distributed nodes) dedicated to:

1. Management of GNSS data and metadata from distributed repositories:

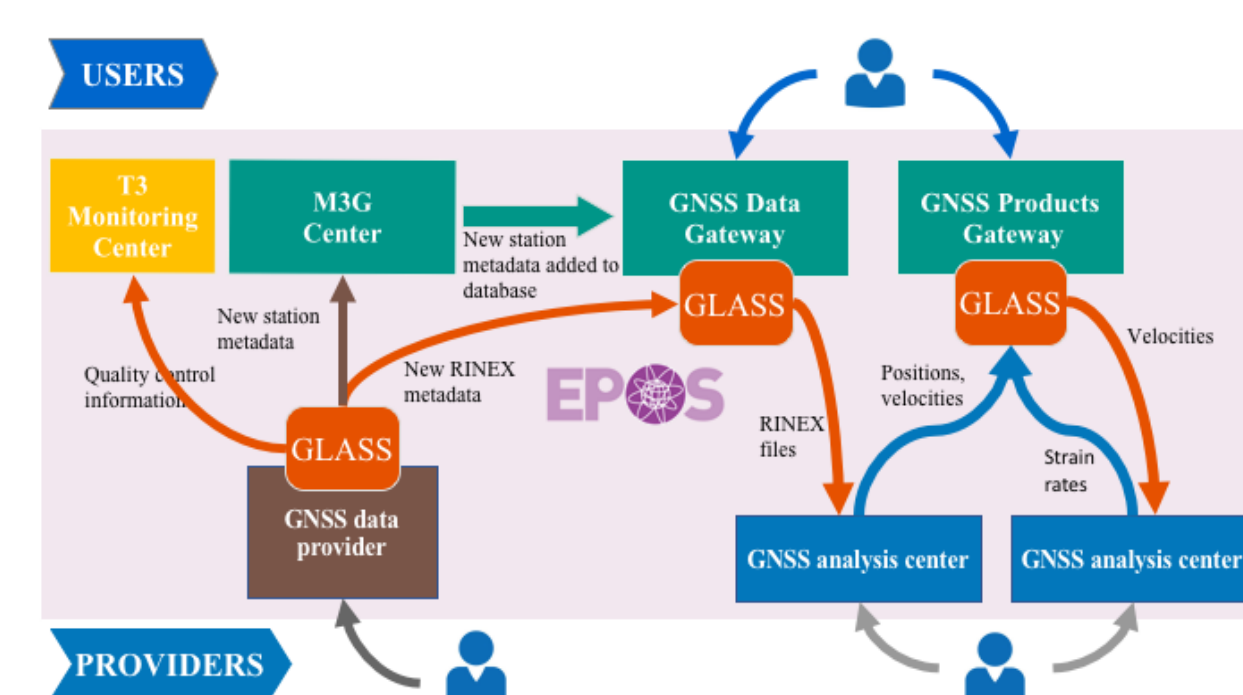
- collect data + generate metadata,
- quality control data + validate metadata,
- disseminate data + metadata.

2. Provision of GNSS products:

- coordinates and time series + metadata,
- velocity fields + metadata,
- strain rate fields and metadata.

GLASS encompasses 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.



FILE VALIDATION AND STATUS FLAG

Files entry into the system via generation of T2 and T3 metadata. The former is used to enable data dissemination, the latter is used for the data quality checking (QC), file header validation and the long-term monitoring. The QC is performed using the G-Nut/Anubis software and output via standardized reporting format developed specifically for the EPOS GNSS TCS.

Based on QC/validation, status flags are set to each file and used to control its dissemination:

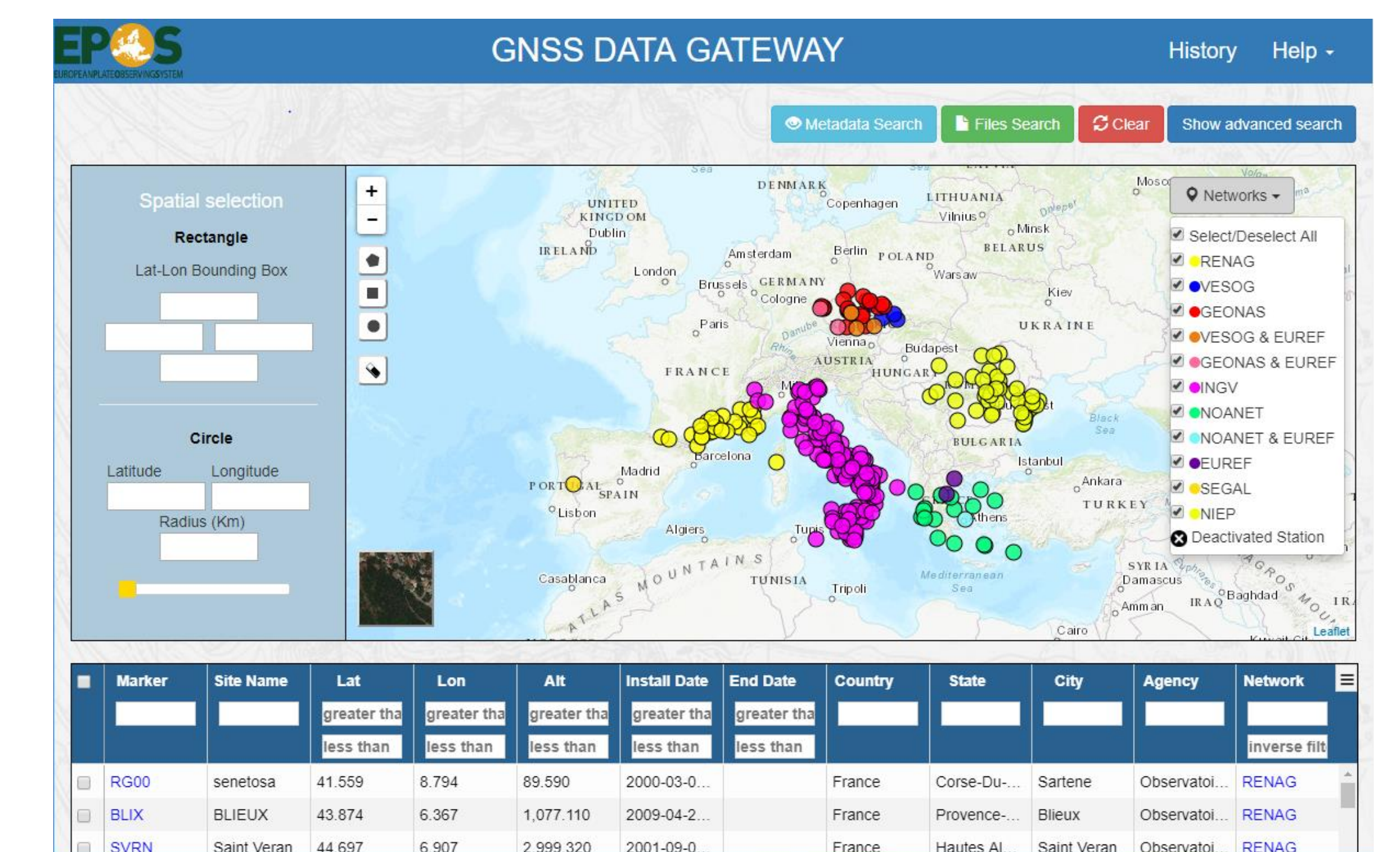
- STATUS -3: file header not compliant (critical)
- STATUS -2: QC not successful
- STATUS -1: QC running
- STATUS 0: file not checked
- STATUS 1: file checked and fully compliant
- STATUS 2: file header inconsistency
- STATUS 3: file header data QC warning

DATA PORTAL – BROWSE, SEARCH AND DOWNLOAD

The European EPOS GNSS data gateway is the gateway for searching and accessing data and metadata of all stations (expected 2000) from different existing local data centers or repositories. Data queries could be performed either interactively using a graphical web service or non-interactively using a command-line tool.

The GNSS data gateway is located at Geoazur/OCA, France, and maintained by CNRS. It currently hosts the metadata of 313 stations federating six prototype nodes, currently available at <http://glass.unice.fr>.

This uppermost node of the EPOS GNSS data flow architecture is running the GLASS software package without any related local data repository, unlike the lower nodes that are usually associated to data repositories. The GNSS data gateway hosts also the centralized T1 metadata data base which is introduced from the M3G metadata validation center. The current request estimate on this central data gateway envisions about 500 queries per day.



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