



European Direction in GCI Enhancements

D3.4

The Enhanced GEOSS Portal – v2.0

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Abstract:

This document describes the technical implementation of GEOSS Platform enhancements at the end of the EDGE project, in response to the requirements identified in WP2 as input to development activities of, in particular, GEOSS Portal and GEO DAB capabilities and provides an overview of the corresponding integration and verification activities. Some requirements may lead however as well to evolution of the wider GEOSS Infrastructure; for these cases proofs of concept have been identified that serve as input to the GEOSS Infrastructure Development Task Team with which EDGE liaises through WP1.



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Executive Summary

This document, (*D3.4, The Enhanced GEOSS Portal*), provides an architectural overview and describes the technical implementation of the enhancements identified for the GEOSS Platform, and in particular the GEOSS Portal and the GEO DAB, and recognised (and documented as requirements) in the context of WP2, *User requirements elicitation and functional analysis* at the end of the EDGE project.

The developed GEOSS Portal and GEO DAB capabilities are presented following various strategic lines of action to clearly highlight the overall user-centric approach adopted by the project, being:

- High-level Functionality-based Enhancements: Discovery, Access and Use
- Resource-based Enhancements: Data, Information and Knowledge
- Tools-based Enhancements: APIs, Views, Widgets, Mirror Sites and Generic GEOSS Portal
- Stakeholder-based Enhancements: Resource provider, End-User, Knowledge provider and Developer
- Community-based Enhancements: SBAs, Copernicus Services, Thematic Exploitation Platforms, Sustainable Development Goal (SDG), Climate Goals and Disaster Reduction
- GEO Priority-based Enhancements

This objective has been pursued in synergy and synchronization with the GEO Tasks, with which the project liaises and builds upon the documents delivered at M12.

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1 Introduction

1.1 Purpose and Scope

This document (D3.4 - *The Enhanced GEOSS Portal*) has been generated in the context of *WP3 - GEOSS Portal and GEO DAB Enhancements* within the *EDGE* (short for European Direction in GEOSS Common Infrastructure Enhancements) project, Grant Agreement no 776136 [RD-1].

The objective of this document is to describe the architectural overview and the implementation of the required enhancements, as identified and documented in the context of *WP2* in the documents *EDGE-WP2-DEL-D2.2* and *EDGE-WP2-DEL-D2.4, Functional and Non-functional Enhancements Specification*, that underpin the user needs elicited and analysed in the context of the document *EDGE-WP2-DEL-D2.1* and *EDGE-WP2-DEL-D2.3, Use Cases Description and User Requirements Document*, by developing the related *GEOSS Portal (GWP)* and *GEO DAB* capabilities.

This objective has been pursued in synergy and synchronization with the *GEO Tasks*, with which the project liaises (through *WP1 - Project Management*).

In line with the overall user-centric approach adopted by the project, the developed *GEOSS Portal* and *GEO DAB* capabilities are presented following various strategic lines of action to clearly highlight the overall user-centric approach adopted by the project, being:

- High-level Functionality-based Enhancements: Discovery, Access and Use
- Resource-based Enhancements: Data, Information and Knowledge
- Tools-based Enhancements: APIs, Views, Widgets, Mirror Sites and Generic *GEOSS Portal*
- Stakeholder-based Enhancements: Resource provider, End-User, Knowledge provider and Developer
- Community-based Enhancements: SBAs, Copernicus Services, Thematic Exploitation Platforms, Sustainable Development Goal (SDG), Climate Goals and Disaster Reduction
- *GEO Priority-based Enhancements*

1.2 Document Organisation

The document is organised as it follows:

- Section 1: Introduction: it describes the purpose and scope of the document and its organization.
- Section 2: Rationale and Context: it contextualizes the content of this document by providing background information and details on the operational landscape encompassing the *GEOSS Platform*.
- Section 3: Architecture: describes the architecture of the system.
- Section 4: Enhancements: it is the hearth of the document where all the enhancements are described divided by the Project strategic lines.
- Section 5: Requirements traceability: Traces the *WP2 User Requirements* to the *JIRA* tickets.
- Annex A. References: List the references used in the document.
- Annex B. Figures and Tables: Provides links to figures and tables in the document.
- Annex C: The *GEOSS Portal* release notes issued in the reporting period
- Annex D: The *GEO DAB Standards*
- Annex E: Terminology: explains the meaning of the acronyms and definitions used in the document.



2 Rationale and Context

2.1 Background and operational context

The GEOSS Platform, formerly called the GEOSS Common Infrastructure (GCI) has been created to provide the technological tool to implement the Global Earth Observation System of Systems (GEOSS).

The birth of the former GCI has been in 2008, as Clearinghouse catalogue, in 2012 the GCI evolved into a Brokering infrastructure with the inclusion of the GEO Discovery and Access Broker (GEO DAB). The first user interface, the GEOSS Portal was initially created in 2010 and in 2016 has seen great enhancements in terms of user experience and enhanced discovery, access and visualization functionalities. In 2017 the formerly called GCI has evolved into a GEOSS Platform.

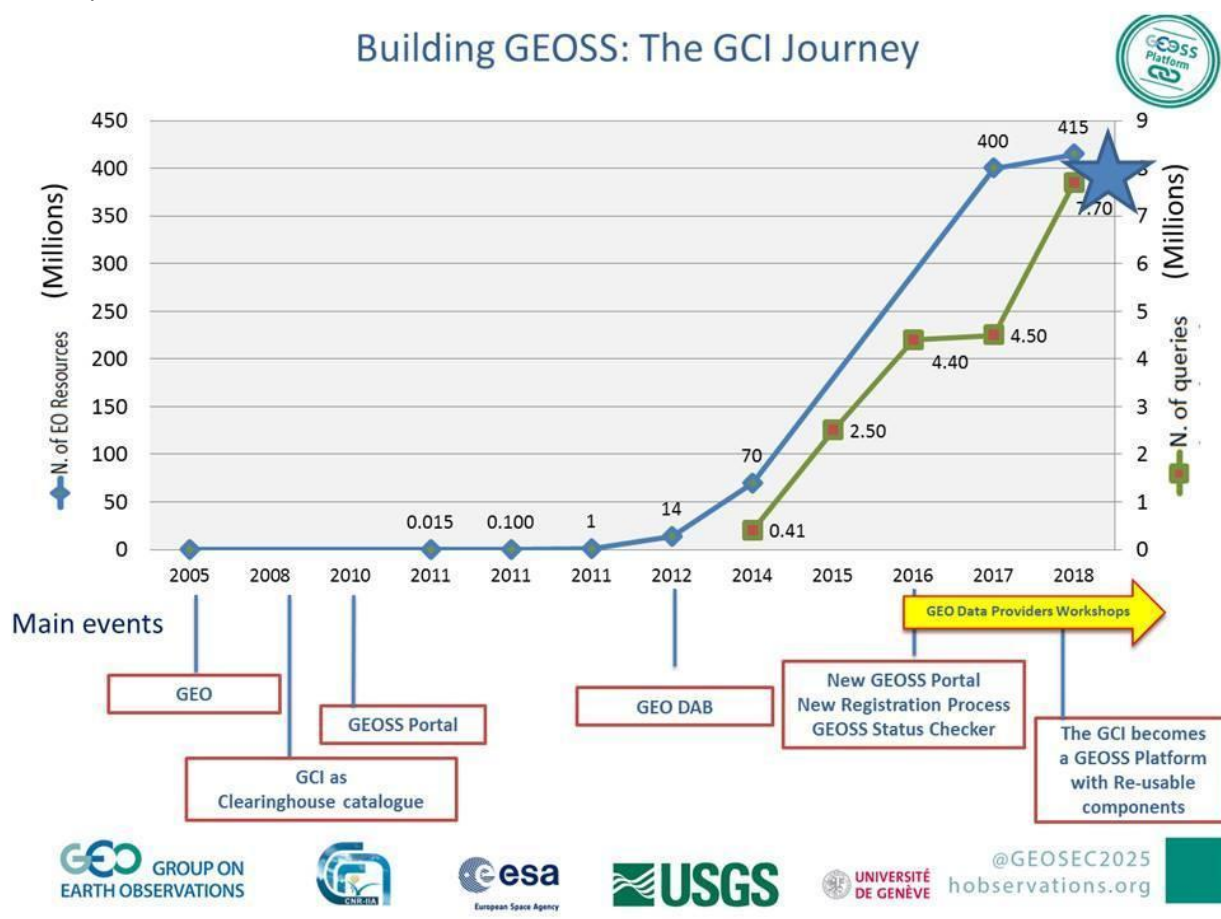


Figure 1 - The GCI Journey

GEOSS is a social and software ecosystem sharing independent and open Earth observation (EO) information and processing services. It connects and coordinates a large array of observing systems, data systems and processing services to strengthen monitoring of the state of the Earth. It facilitates the sharing of environmental data and information collected by countries and organizations within GEO. GEOSS facilitates data and information accessibility and interoperability to support the Sustainable Development Goals (SDG) agenda, the Paris agreement and the Disaster Risk Reduction framework.

Implementing **GEOSS** through the GCI

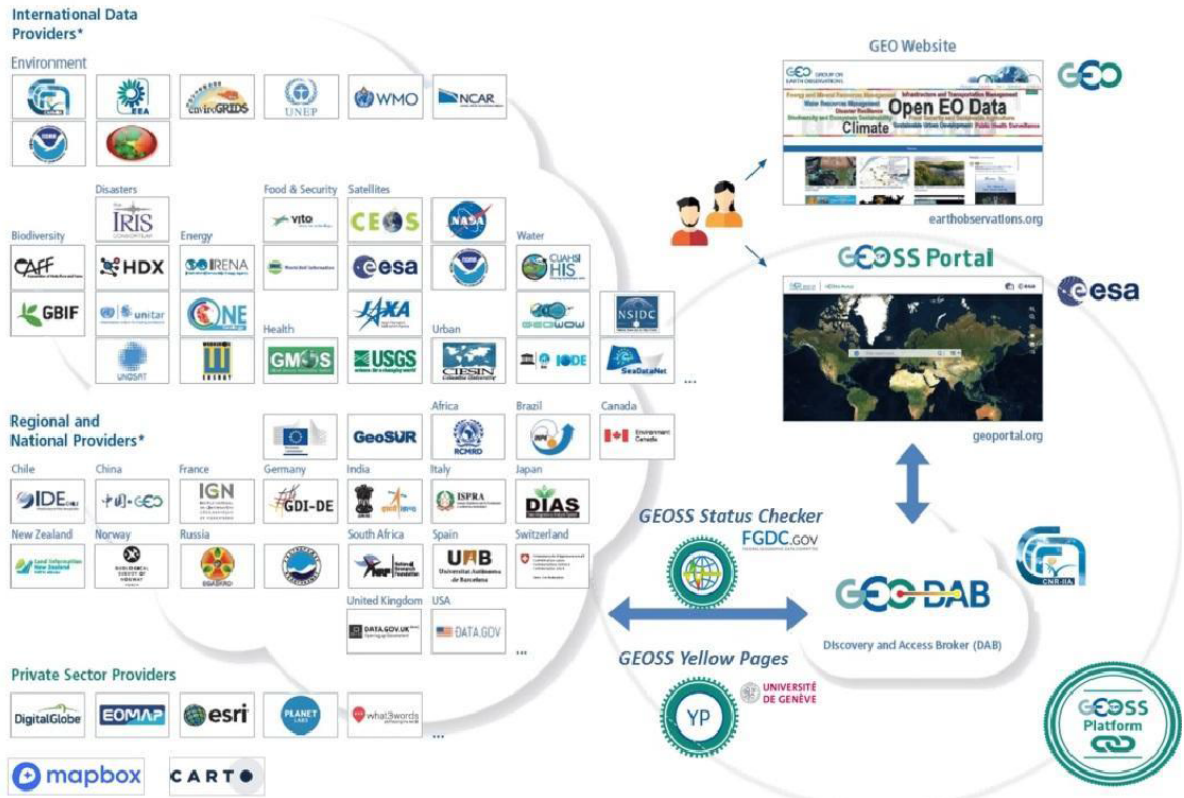


Figure 2 - The Global Earth Observation System of Systems

Any user can have interactive access to GEOSS resources via the GEOSS Portal. The Portal is one of the components of the GEOSS Platform and is an online web map-based user interface which allows users to discover and access Earth observation data and heterogeneous collections from satellites, airplanes, drones and in-situ sensors at global, regional and local scales, from different providers from all over the world. It connects users to existing databases and portals and provides reliable, up-to-date and user-friendly information – vital for the work of decision makers, planners and emergency managers.



Figure 3 - GEOSS Platform Components

The portal provides a single Internet discovery and access point to the ever-growing quantities of heterogeneous collections of Earth observations from satellites, airplanes, drones and in-situ sensors at global, regional and local scales.

The GEO Discovery and Access Broker (GEO DAB) is the primary mechanism by which all data and information is discovered and accessed. The GEO DAB implements the necessary mediation and harmonization services accessible through Application Program Interfaces (APIs). These APIs allow data providers to share resources without having to make major changes to their technology or standards.

The other two components of the GEOSS Platform are the GEOSS Service Status Checker, implemented and operated by USGS/FGDC, and the GEOSS Yellow Pages, implemented and operated by the University of Geneva.

The GEOSS Portal Development framework is based on Liferay 6.2, Open layer 5.

The application programming interface used to interface with the GEO DAB is based on OpenSearch; CSW is used for detailed metadata retrieval.

2.2 Links with other project activities

EDGE identifies five work packages as follows:

- WP1: Project management
- WP2: User requirements elicitation and functional analysis
- WP3: GEOSS Portal and GEO DAB Enhancements
- WP4: Deployment and user assessment
- WP5: Dissemination and exploitation



European Direction in GCI Enhancements

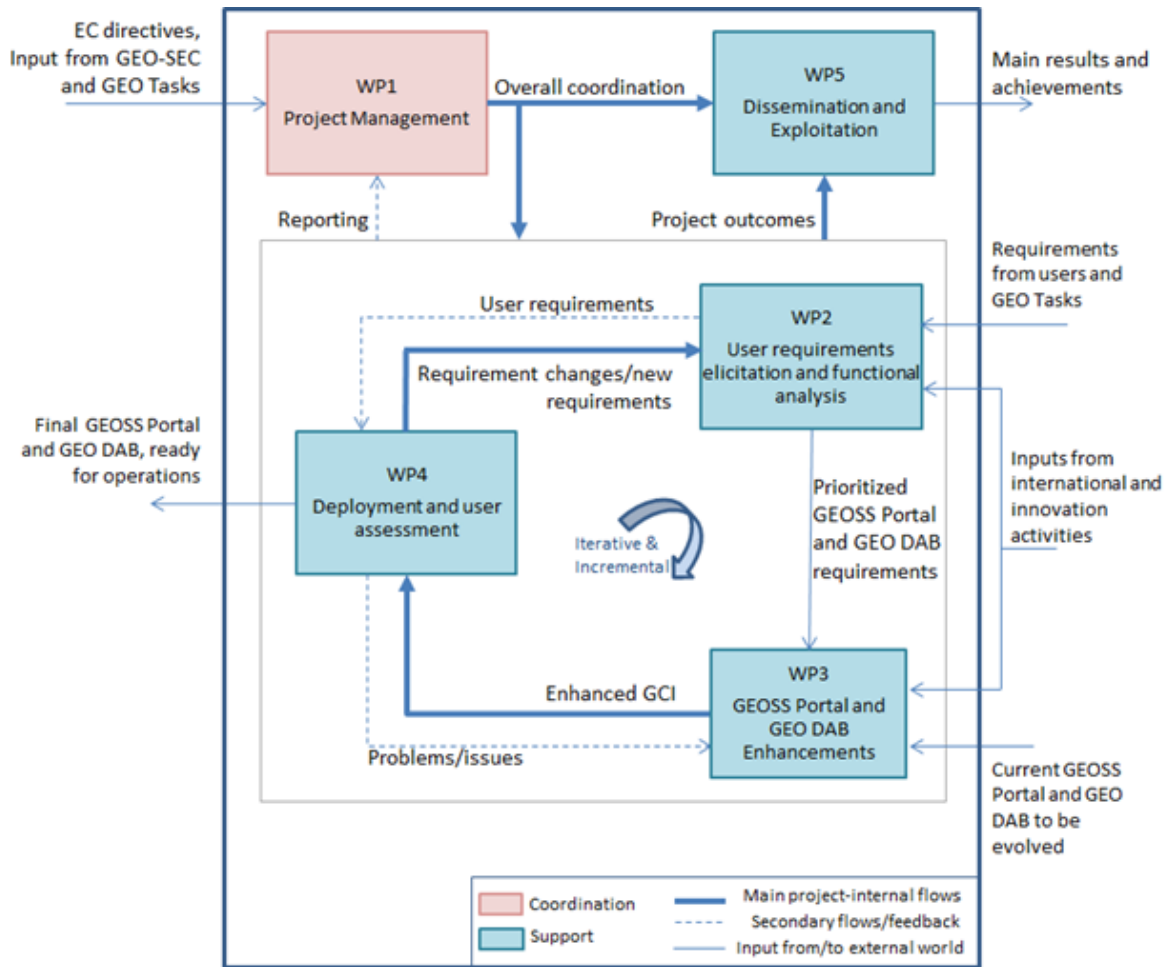


Figure 4 - EDGE Workpackages and their relationships

Workpackage 3 builds on prioritized GEOSS Platform (in particular GEOSS Portal and GEO DAB) requirements as input to the identification of enhancements, their implementation and definition of an integration and verification strategy. The output of WP3 is an enhanced GEOSS Platform (formerly referred to as GEOSS Common Infrastructure – GCI). On top of the requirements resulting from WP2, current workpackage considers requirements and other inputs as well resulting from other (external activities).



3 Architecture

3.1 Architectural background and challenges for GEOSS

As shortly described above, starting from 2017 GEOSS underwent a major change moving from a Common Infrastructure to an open Platform exposing its data access and use functionalities with the publication of APIs and portal widgets. They allowed developers to build applications and community portals based on GEOSS capabilities. This opened GEOSS to a completely new user category – i.e. application developers – meanwhile widening the potential end user audience. Such a major change required the enhancement of functional and non-functional capabilities of the two core components of the former GCI: the GEOSS Portal and the GEO DAB. ESA and CNR-IIA implemented most of the transition as a European contribution to GEO, through EC and ESA financial support, in particular, in the last years through the H2020 EDGE project. This activity constitutes the operational pillar of the EDGE project.

In the meantime, important changes in the technological and societal scenarios imposes a reflection on how big infrastructures can effectively and efficiently support end-users. The identification of engagement priorities in the new strategic plan, the introduction of regional components in GEO (Regional GEO), the birth of multiple cloud platforms often with specialization on scientific data storage and processing, are examples of major changes impacting on the design and development of GEOSS.

Since 2017, the GEOSS EVOLVE Initiative, implemented with the GEO Work Plan 2017-2019, started discussing the potential evolution of GEOSS. GEOSS EVOLVE delivered a discussion paper describing a proposed architectural framework for a new GEOSS. ESA and CNR, as part of the EDGE project activities, contributed to the GEOSS EVOLVE discussions in particular from the European point-of-view. As a specific action, EDGE developed a set of prototypes aiming at a) evaluating the feasibility and advantages of the GEOSS EVOLVE proposed architecture; b) bringing relevant outcomes of European Research and Innovation projects to a pre-operational phase; c) integrating European capacities in the GEOSS Platform; d) showcasing applications on engagement priorities based on European capacities.

These activities constitute the innovation pillar of the EDGE project, whose efforts have been directed to two main targets:

- Supporting data-to-knowledge transition: there is an increasing demand to the scientific community about science-based answers to questions related to policy and societal needs. GEO reflects this with the identification of engagement priorities. To support decision-makers, it is necessary to generate scientific knowledge from observational data. The data-to-knowledge transition requires knowledge formalization and model execution. It has a deep impact on infrastructures moving from the traditional data download approach to a code-moving approach (e.g. cloud processing). Based on the GEOSS EVOLVE activities, and on specific actions they led in respective research projects, ESA and CNR-IIA recognized the importance of supporting the data-to-knowledge transition in GEO, proposing solutions that exploits relevant outcomes of European research and innovation.
- Supporting multi-cloud environment: in recent years multiple cloud platforms have been born, ranging from big commercial platforms to Earth Observation dedicated systems. Technological, financial and legal aspects suggest that in the near future the technological landscape, in particular in Europe, will be characterized by multiple cloud offers each with its strengths and weaknesses. Based on the GEOSS EVOLVE activities, and on specific actions they led in respective research projects, ESA and CNR-IIA recognized the importance of enabling GEOSS to exploit the capabilities of existing clouds leveraging their differences avoiding locking in a single



cloud provider. EDGE proposed solutions to run scientific models moving code to the cloud where datasets are available, among many different choices. In particular, in line with the EuroGEO vision, it aimed to support the major European initiatives in the field of Big Earth data clouds, including Copernicus DIAS and EOSC (European Open Science Cloud).

A possible evolution of GEOSS Ecosystem deriving from the GEOSS EVOLVE discussion paper is shown in the following Figure 5. In addition to data, different types of resources must be handled, including documents, software code, HPC infrastructures, etc. Next evolution should also consider the inclusion in such an ecosystem of new components (i.e. infrastructures and platforms) implementing innovative and important technological breakthrough, such as: Analysis-ready data infrastructures (e.g. Data Cubes infrastructures), Big Data Analytics platforms (e.g. by applying AI instruments like ML/DL), etc.

In keeping with System of Systems, each type of resource is provided by one or more providers according to the provider-specific technology. A mediation/harmonization layer provides the required functionalities to discover and access the different resource types in a homogeneous way. On top of this layer, orchestration and knowledge management components are in charge of implementing the business logic necessary to perform actions required by users through the Human/Computer interface layer.

Possible evolution of GEOSS Ecosystem

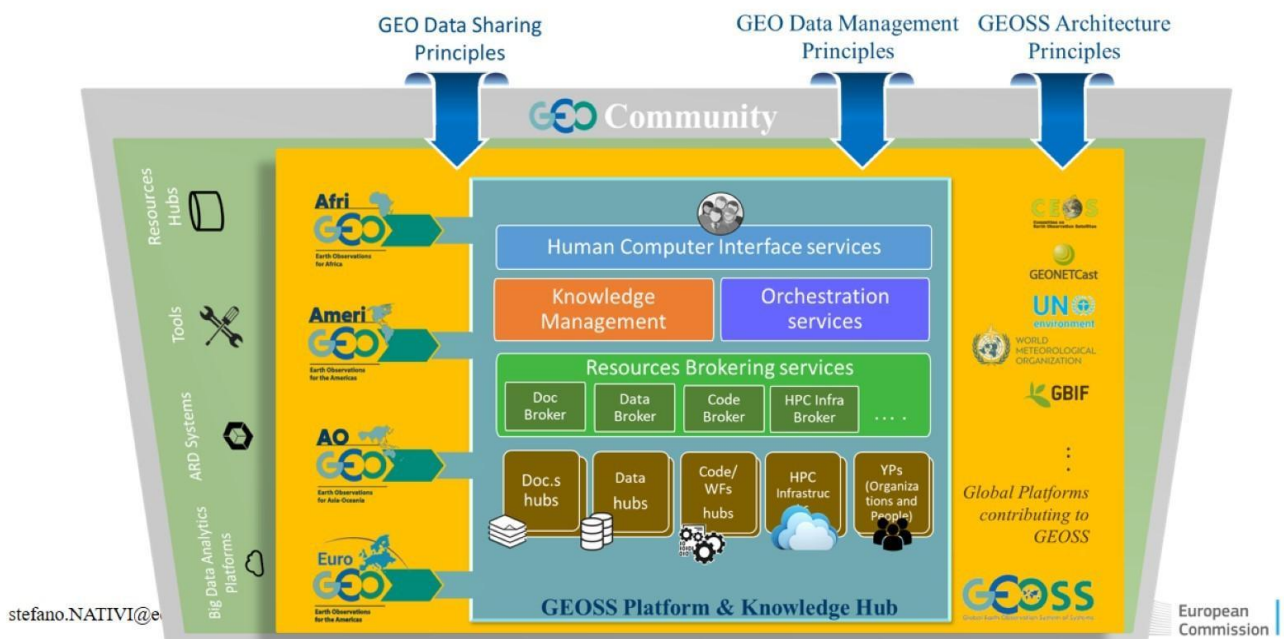


Figure 5 - Possible Evolution of GEOSS Ecosystem (Stefano Nativi, "Digital Society paradigms and Digital Ecosystems: enabling Digital Twins of the Earth", presentation at the UNEP Science Policy Business Forum, Canberra 2019.)

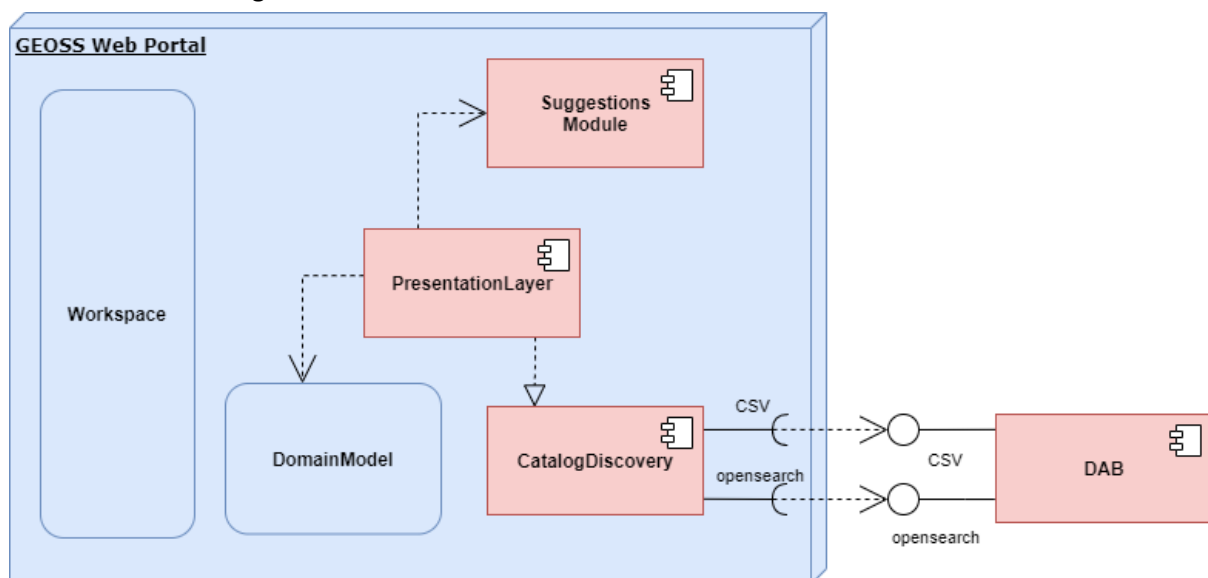
3.2 The GEOSS Portal and GEO DAB architecture

Looking at Figure 5, due to the multiple APIs and various knowledge perspectives, each component has to be based on a layered architecture. The GEOSS Portal internal architecture of the main component - which is a Single Page Application search part - has been furtherly decoupled to support interoperability even better. The main extracted components of the search are:

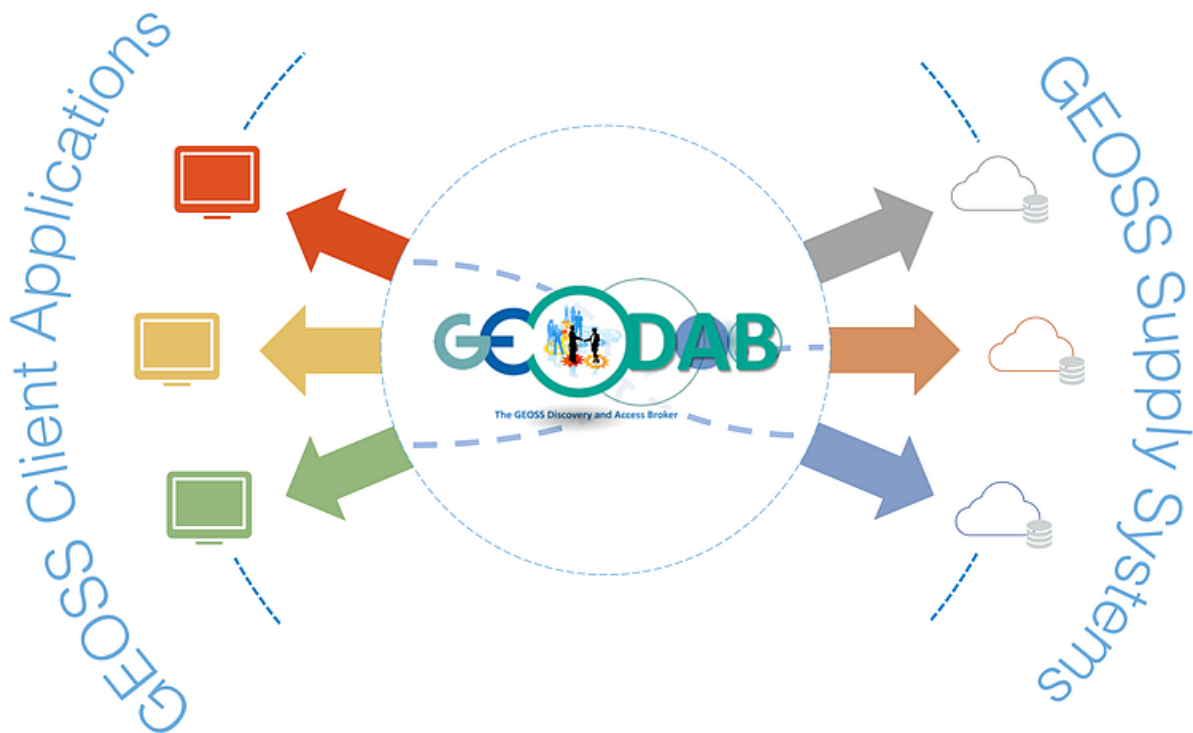


- Search Presentation layers – targeted search with various perspectives and various concept models:
 - GEOSS common search – opensearch based resource discovery/download/access;
 - SBA search – supported with internal domain model search in the thematically predefined subdomains;
 - Geo-spatial data visualisation with WMS integration. OGC WMSes are presented based on DAB or Data Providers services.
- Catalogue discovery:
 - DAB Opensearch client
 - DAB CSW metadata explorer
- Suggestions module:
 - Suggestions for search phrase - autocomplete functionality - Earth Observation Thesauri search, which is based on semantic relations between terms

The front-end side is supported with Liferay based content management with user workspace functionalities for registered users.



The GEO DAB transparently connects GEOSS Portal to the resources shared by the GEOSS Data provider. The main goal is to facilitate cross and multi-disciplinary discovery and access of disparate data and information interconnecting several hundreds of autonomous and heterogeneous Supply Systems. The GEO DAB applies the broker pattern, which separates users of services (GEOSS Client Applications) from providers of services (GEOSS Supply Systems). When a client needs a service, it queries a broker via a service interface. The broker then forwards the client's service request to a server, which processes the request. The GEO DAB presently provides broker components for discovery, access and semantics-enabled search.



The main components of the layered architecture are:

- **Data Harmonization:** this layer provides harmonized discovery and access to heterogeneous data systems. The heterogeneity of data sources is hidden, resources appear as a single data source.
- **Data Access:** this layer provides data discovery and access functionalities to heterogeneous data systems.
- **Data Processing:** this layer enriches discovery and access with processing and semantics services.

The GEO DAB internal architecture is extensively described in several research papers [RD-6] [RD-7]. A high-level overview is shown in Figure 8. The three main sub-components are: Profilers, Core, Accessors. Profilers component implements the different service protocols and APIs which client applications can use to communicate with GEO DAB. Incoming requests are transformed into messages for the Core component and results are transformed back into the specific service protocol/API format to be returned to client applications. The Core component implements the business logic for executing requests. This includes query distribution, DB interrogation, view management, etc. All the Core sub-components work utilizing the internal data model of the GEO DAB, which is based on ISO 19115, ISO 19115-2 specifications with a set of extensions covering possible missing concepts. Finally, the Accessors component interacts with GEOSS providers' services. Its sub-components implement all required functionalities to translate the query the incoming request, according to the external service protocol, distribute it and translate the results to GEO DAB internal data model.

While preserving the general approach and the main components described above, during EDGE project the GEO DAB was re-engineered to improve scalability and performances.

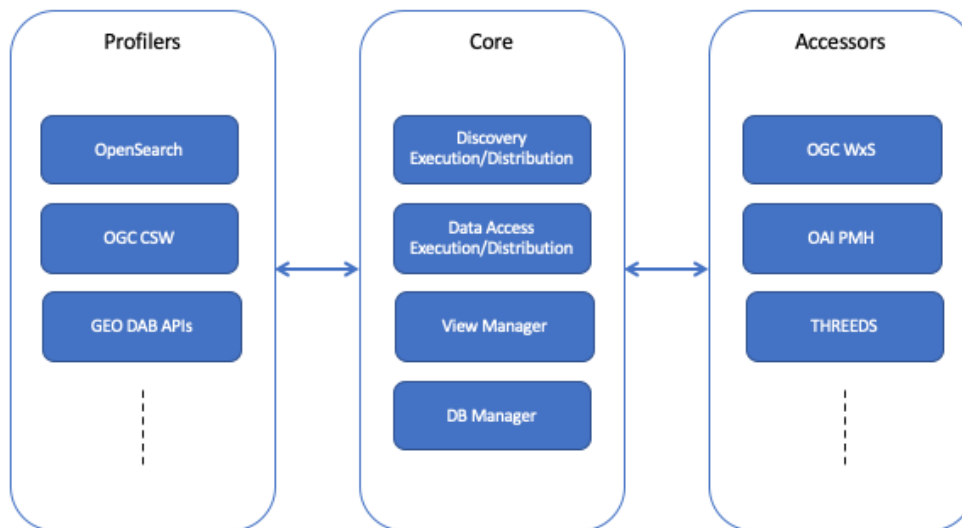


Figure 6 - High-level overview of GEO DAB internal architecture

3.2.1 Proof of concept

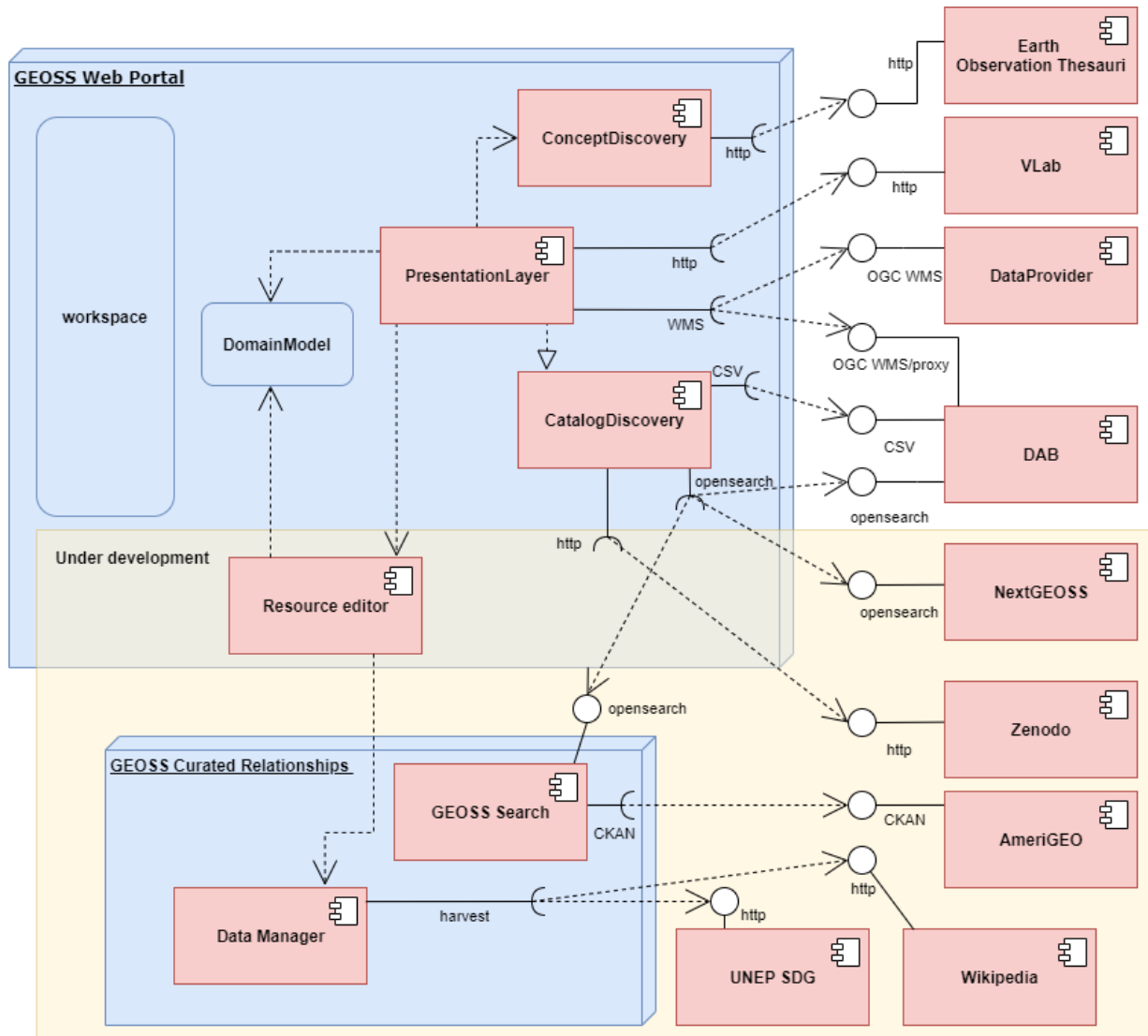
Experimentation of new functionalities was based on the possible evolution of GEOSS Ecosystem depicted in Figure 5. Due to the lack of some of the components represented in Figure 5, EDGE project has either developed some internal prototypes or re-used relevant outcomes of European Research and Innovation projects.

The following sections describe the developed prototypes addressing two high-level use cases: (i) Knowledge management and (ii) Knowledge generation in multi-cloud environment.

3.2.1.1 Knowledge Management

The GEOSS Portal was extended to implement some of the Knowledge management functionalities. In order to provide the access to even more resources, GEOSS Portal has been integrated with other, additional data sources like: NextGEOSS, AmeriGEO, Zenodo and Wikipedia. In order to present all resources in a unified, friendly format GEOSS Portal translates the knowledge concepts on the resources level to the internal domain model.

As integrating with additional data sources improves overall search quality, user is still not given any tools to contribute to the GEOSS Ecosystem Knowledge, at least not on the resources level. For that purpose, a new domain called GEOSS Curated Relationships has been created. It provides new, additional Knowledge management functionalities for GEOSS Web Portal, without breaking any existing functionalities. Its purpose is to facilitate resources access and related management features to GEOSS community. It consists of multiple components, where each addresses a separate concern. Such decoupling allows for easier extension of the portal's features in the future and greatly improves overall scalability of the system.



Beside GEOSS Web Portal and GEO DAB integration, GEOSS Curated Relationships components provide access to additional resources like UNEP SDG or Wikipedia in order to support various domain specific perspectives. One of the main goals of GEOSS Curated Relationships concept was to widen resources access. It can be accomplished by encouraging GEOSS Portal users to contribute to collected knowledge base. The components of GEOSS Curated Relationships were designed to provide users efficient and convenient tools, which allow to create new resources and even extend existing ones. It is done by improving their definition or by adding relations between resources from different data sources. A component called Resource editor, which is available within GEOSS Web portal itself handles general resources management within GEOSS Curated Relationships domain and provides necessary tools for users to contribute to the GEOSS Ecosystem knowledge base.

The GEOSS Curated Relationships concept unifies data from external data sources and user contributions. One of the challenges in such complex domain model is the necessity to balance between high performance of data access and possibility to update and extend existing data. The solution to this problem was splitting domain model into read and write data models. The read model is used only to performs access data operations like search operations. It can be optimized to provide high

performance. The write model on the other hand deals with only data modification. It means that safety and security is crucial, which leads to conclusion that high normalization of a domain model is strongly preferable.

3.2.1.2 Knowledge Generation

Science-informed decision-making requires the generation of knowledge from collected data and scientific models, also outlining the existence of possible different options. Although, current cloud technologies provide valuable solutions for addressing several of the Big Earth Data challenges. building a workflow that implements a scientific process to generate knowledge on a multi-cloud environment is a complex task requiring multiple expertise on policy needs, different scientific domains, data and model interoperability, cloud services management. Therefore, it is necessary to automate, as much as possible, the technical tasks, in order to lower the existing barriers and allow the different stakeholders to focus on their specific fields of expertise.

In the possible evolution of GEOSS Ecosystem, depicted in Figure 5, the Orchestration service is in charge of implementing, in an automatic way, the configuration, coordination, and management of online accessible systems and technologies required for knowledge generation.

The Virtual Earth Laboratory (VLab) is a technology that implements such an orchestrator, enabling the implementation of the co-design and co-development digital framework. VLab aims to minimize the interoperability requirements for sharing and re-using existing scientific models and data that are going to contribute to the implementation of the knowledge generation process.



Figure 7 - Conceptual Framework of VLab Experimentation

The VLab solution was developed in the context of different H2020 projects: ECOPotential, ERA-PLANET, and ESOC-hub. This component implements orchestration functionalities needed for executing a scientific model, i.e. retrieving the model source code, transferring it to a computing platform, ingesting the required input data, triggering the model execution and finally collecting the generated output data. Another functionality of VLab is to be able to execute the model on different computing infrastructure, this served as a basic prototype of the HPC broker depicted in Figure 5. Code Brokering functionalities were prototyped utilizing Docker technology as part of the VLab implementation.



The design of VLab architecture allows the execution of models on different cloud environments. This allowed to experiment the execution of scientific models on different cloud platforms, including: Copernicus DIAS platforms (Creodias, ONDA, Sobloo), the European Open Science Cloud and the commercial Amazon Web Services (AWS) cloud.

Exploiting this possibility, the user (or the client application) can choose which platform to use for a specific model run, e.g. depending on the required data which might be available on a specific platform only (move code to data).

4 The Enhancements

The development activities that have taken place during the whole project life span, are described in this section. The paragraph decomposition follows the various strategic lines of action identified in the project.

In enhancing the GEOSS Platform, the project is always trying to better serve the EO community at large and to understand the needs, provide advance solutions and ultimately better respond to the user needs delivering knowledge.

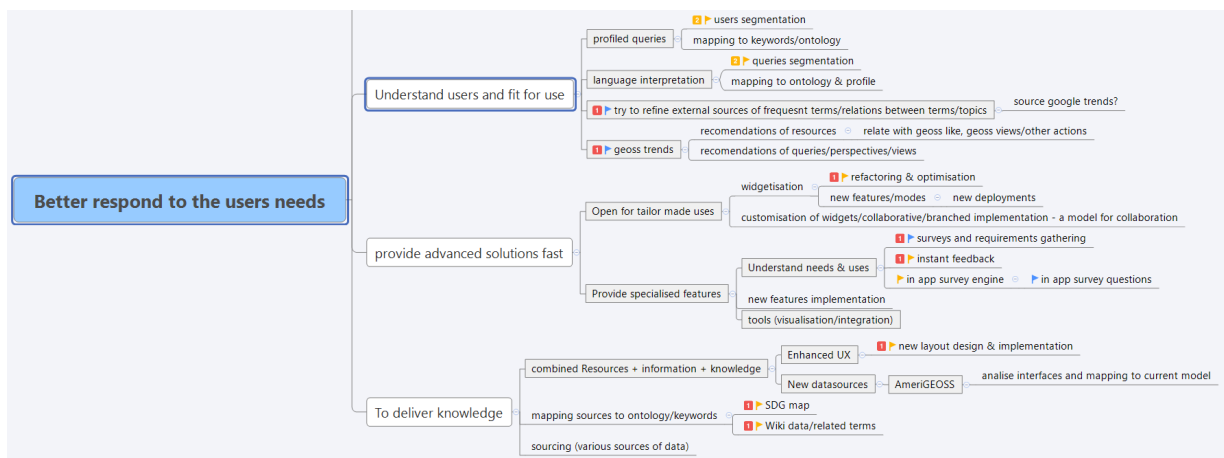


Figure 8 - Mind Map showing the main elements of the data-to-knowledge transformation

As already highlighted in section 3.1, the GEOSS Platform is moving from a *data* to a *knowledge* platform providing users not only with the possibility to *discover, inspect, access* data (see section 4.1) but also with functionalities to *use data* to derive *information and knowledge*. Activities are on-going as well to *discover, inspect, access* and *use information and knowledge* via the Platform (see section 4.2). Such developments have been implemented via Platform tools (see section 4.3). In addition to this, a number of enhancements have been documented in the last two subsections (4.4 and 4.5) showing the direct link respectively with the main stakeholders of the project and the GEO *Priority Areas*. Every section mentioned above are split to document both the operational and proof of Concept environments.

Each GEOSS Platform Enhancements (GPE) is identified by an ID in the form:

- GPE-<Counter>

where <Counter> is a unique identifier automatically created by JIRA Software (<https://www.atlassian.com/software/jira>). JIRA is the COTS tool been selected by the GEOSS Portal development contractor allowing agile project management.

4.1 High-level Functionality-based Enhancements: Discovery, Access and Use

4.1.1 Operational Environment

Below you can find listed changes, that are accessible on our Operational Environment.



4.1.1.1 [GPE-159]: Responsive Web Design

Responsive Web Design has been further developed to improve the user experience; it supports smooth navigation between result list and map with particular quick-view data. All the user interactions are logged with device specification to acquire usage statistics.

- On small screens, margins are reduced, so that more content will fit the screen;
- The Navigation changes on the result list, so that the user would be able to see most of the map and only one result at the time, with hidden search bar and filters;
- The presentation of the field 'Earth Observations catalogues' has been improved;
- The mechanism of logging all the user actions has been enhanced to fully reflect the variety of devices and specific layouts.

4.1.1.2 [GPE-108]: Improved handling errors from other SW

When the Portal receives an error from any other party, it informs the user about the anomaly, gives the possibility to the end user to have more detailed information on the error and logs the event (time, platform, browser, O/S, user (if logged in), error name, details of the error, SW in error).

4.1.1.3 [GPE-180]: GEO-Like feedback data model

GWP allows the user to rank resources on a 1-5 scale and comment them. Ranks and comments are currently stored in GWP but will ultimately flow to the GEO DAB. DAB will expose this additional information of ranks given, aggregate ranking and comments

While discovering the resources, the additional rankings sorting method (apart from current relevance) will be made available. The selection of a method will be part of the advanced criteria parameters.

GWP also provides a mechanism for sharing/recommending resources with any other user.

4.1.1.4 [GPE-118]: Drag-and-drop interactions with the map

The Portal provides the ability to drag-and-drop interactions with the map, e.g. the user will be able to load GPX, GeoJSON, IGC, KML, or TopoJSON files on to the map. Added layers will be available on the same list as WMS/TMS layers. The user will be able to create own views with layers placed on the map.

4.1.1.5 [GPE-169]: Access transformation

In order to exploit discovered geospatial data, it is necessary not only to simply “download” the data. In fact, in the most of cases a user will need to pre-process such data in order to comply with her/his needs. Main pre-processing functionalities are:

- Sub-setting (i.e. trimming, slicing)
- Format conversion
- CRS transformation
- Data Interpolation

Data sources providing data typically support only a subset of the above functionalities. Alternatively, they support all the above functionalities but not all their possible parameters (e.g. a WCS might support CRS transformation, but only a small number CRSs).



The GEO DAB supplies missing data provider functionalities without supplanting the existing ones. In this way, users can select a set of data from different data sources. After this selection, they can define a so-called common grid, that is spatial extent, temporal extent, and spatial resolution, coordinate reference system, and file format. The GEO DAB downloads all selected data according to the defined common grid.

To invoke this process the GWP must submit a request containing the mandatory fields for any WPS execute request as described in Table 39 of (OGC, 2007), namely: service, request, version, identifier.

4.1.1.6 [GPE-186]: Multiple Earth Observation Catalogues selection

It is now possible to select multiple catalogues as advanced parameters. Organization can be defined in the search criteria.

Expert users are more familiar with catalogues. Users at large are familiar with the source organisation of the data provider. Thus, the organisation has been added as additional advanced parameter in the interface with the DAB and simultaneously, it has been added as a searchable parameter in the main search term. According to the users' usage, the optimal solution will be chosen for the best user experience.

4.1.1.7 [GPE-528]: WMS legend support

Due to the fact that not all the providers of OGC services registered in the GEOSS supports the Legend, a special handling has been added to the map. The interface supports OGC WMS based on the getCapabilities and getLegend services.

4.1.1.8 [GPE- 543] The legend shall be detachable and/or movable subwindow

GWP provides the possibility to detach and move the legend as a sub-window, so that every part of the map is always visible.

4.1.1.9 [GPE-503]: Sentinel-3 filters support

Based on the newly published support for the Sentinel 3 mission API on the Copernicus Data Hub specialised faceted criteria filters have been added:

- Product Level: L1, L2;
- Product Type: SR_1_SRA, SR_1_SRA_A, SR_1_SRA_BS, SR_2_LAN;
- Instrument: SRAL.

4.1.1.10 [GPE-634]: New filters enrichment

The GWP provides the possibility to filter resources gathered from DAB by the type of data and specific format. Other types of resources will be defined as WEB Sites, Satellite Data, In-situ data, Services and Tools. The data format will be specified as layers, NetCDF, table/Text and image.

4.1.1.11 GEOSS Portal Version 4 - Interface changes

GWP provides a new portal interface – more intuitive interface aligned with the new GEO brand. It will mean that all page elements like header, footer, bars, lists and buttons will be restyled and reshuffled. The search presentation layer has various perspectives and sources of data provided to the user.

This reshuffled interface introduces the targeted search to promote knowledge from different perspectives and guide the user in discovering EO concepts. Later on this concept was discarded even though user interface elements have been reused in the proof of concept.



4.1.1.12 [GPE-240] Multi-lingual support

The GEOSS Portal supports interaction in multiple languages, so that the content, navigation, menu items and error/information is available in multiple languages.

4.1.1.13 [GPE-1044] - Create account

This task introduces the possibility of creating an account within GEOSS Platform, which further give access i.e.: to my workspace. Except the standard data, that normally appears in such forms there is also option to add login and password data for Sentinel Data Access. If users fill this data in future when trying to download Sentinel Data they will not have to type in password and login if they are already logged into GEOSS Platform.

4.1.1.14 [GPE-585]: Maps limits enhancements

To ensure the possibility of continuous work on maps, GWP will provide mechanism to switch between base maps if an error occurs on the current map, which the user is working on. It means that the portal will switch to another map if quota level is reached, the user will be informed about map unavailability and a base map change.

4.1.2 Proof of Concept

Below you can find listed changes, that are accessible on our Development Environment.

4.1.2.1 [GPE-1113] - Migration to https

This task was addressing the migration of the GEOSS Platform on devel environment to https protocol.

4.1.2.2 [GPE-1716] - GWP/DAB text searches

GWP search option after this change is doing the search according to what user type without connecting words with conjunction such as 'or' and 'and'. Instead of this on the search page result within See Also module user can click on such phrase with such conjunction to make a search according to those conjunctions. Furthermore, this change also affected what kind of content is search scanning so far it was only tittle and keywords of the resources. After the change it is also the description.

4.2 Resource-based Enhancements: Data, Information and Knowledge

4.2.1 Operational Environment

Below you can find listed changes, which are accessible on our Operational Environment.

4.2.1.1 [GPE-178]: Resource and catalogues availability information

GWP informs the user about external resources availability in the discovery. This requirement has been developed in two areas: search and resources.

a) Search

GWP will get from DAB, the additional information about the search status based on the 3-step scale:

- Success – no issues occurred,
- Failure – critical issue caused the system failure,
- Problems – system met one or more problems that can influence the search response.

The problem and failure status will contain the additional information about issues met during search processing e.g. the particular external catalogue unavailability. The basic status will



be presented graphically; detailed information will be available on the user request as additional popup dialog on hover/click.

b) Resources

GWP will get from DAB, the additional information about data resources linked from the results based on the 3-step scale:

- available – resource reliable,
- not available – resource not available usually,
- problems – resource with issues occurring temporarily.

The status will be based on DAB and the 3rd party internal link discovery processes. Information will be provided by GWP in a way that is not overloading (i.e. different colours/icons) with additional information while hovering on resources or on request for advanced users.

Additionally, GWP will register all resources that the user wanted to gather but where the link was not accessible.

4.2.2 Proof of Concept

Below you can find listed changes, that are accessible on our Development Environment.

4.2.2.1 [GPE-593]: Knowledge/Information Navigation

The Knowledge/Information navigation target search has been added to support various thesaurus and ontologies provided by different domain experts. It will help any user to navigate all the way through concepts in order to retrieve resources, both data and knowledge, in relation with the focused concept.

4.2.2.2 [GPE-590]: Wikipedia Navigation

The GEOSS Portal added Wikipedia navigation approach to support the user in continuously expanding the knowledge. Based on this the user have the possibility to discover knowledge from multiple sources and completely different perspectives. Later on in the project, the Wikipedia is a source of information “selectable” from a information source selector



4.2.2.3 [GPE-1178] - Zenodo extended data

The changes introduced an upgraded view on website for resources retrieved from Zenodo. Based on extra parameters end users gained access to references, information about keywords and licensing.

4.2.2.4 [GPE-1678] - Extended Search View, See Also

This task introduce new options to the search for end users.

a) Extended Search View



Within all resources, that are searchable for end users we have added option to expand their view. Each resource has a dedicated icon, that leads (via link) to dedicated extended view for this resource. If the user decides to click on it the page reloads and shows extended info about the resource, info about the same resource found in Wikipedia and information about related topics within GEOSS Platform in categories data, service and information.

b) See Also

Based on typed in phrase by the end user system on the search page result applies new module called See Also. Within See Also module user can see combination of his phrase with conjunctions 'and' and 'or', as well as, related words from thesauri. By clicking any of them user starts a new search according to their choice.

1.1.1.1 [GPE-1263] - Change presentation of related resource

This task changed the view and presentation of related sources. Instead of leading to related resources by an arrow within the system was created a dedicated icon, which can be accessible in the bottom left part of resource box. What is more, within this task was also added dedicated icon for services function (in the same spot).

6 Ensure availability and sustainable management of water and sanitation for all

 42  0.0 

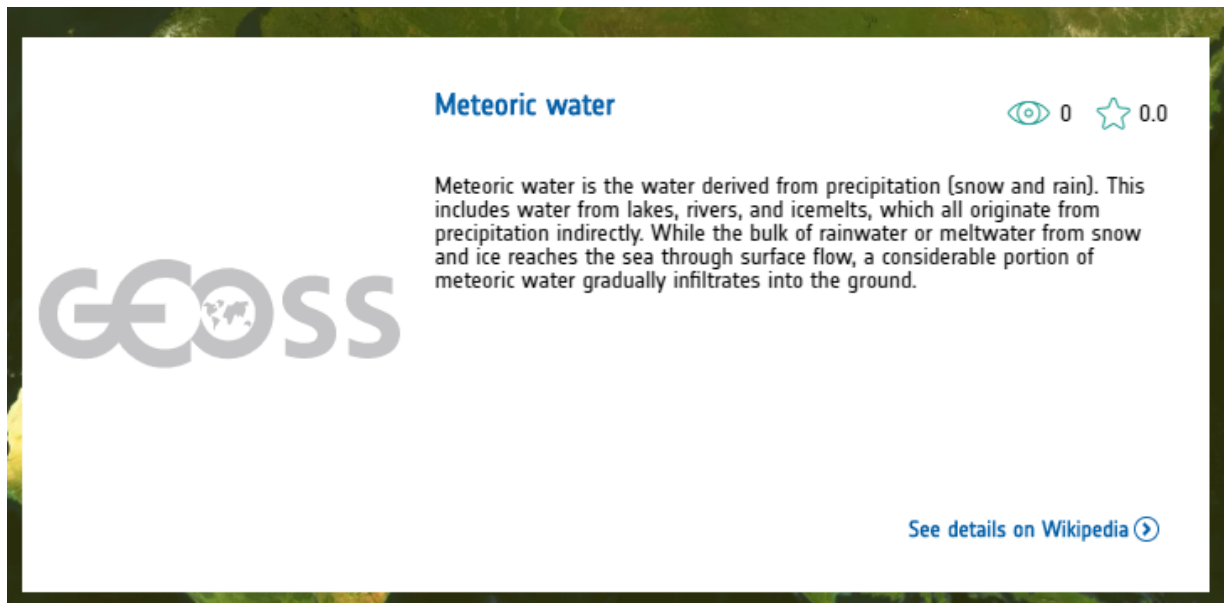
Goal 6 goes beyond drinking water, sanitation and hygiene to also address the quality and sustainability of water resources. Achieving this Goal, which is critical to the survival of people and the planet, means expanding international cooperation and garnering the support of local communities in improving water and sanitation management.

[See more](#) 



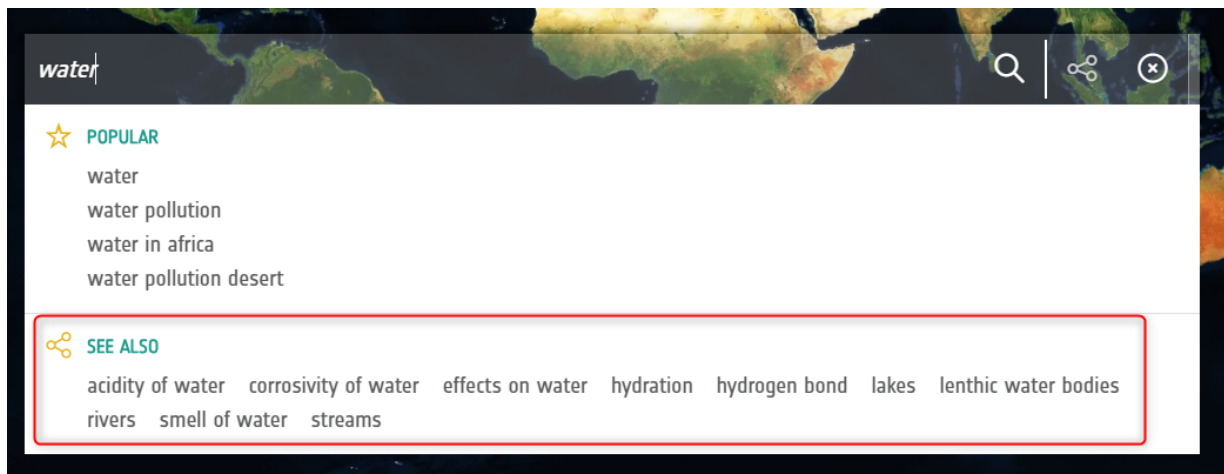
4.2.2.5 [GPE-1361] - Wikipedia as another source of knowledge

Wikipedia was added as another source of knowledge from which users can gain, data from. Data from Wikipedia was narrowed to only check results for Earth Observation not all of the content that Wikipedia has.



4.2.2.6 [GPE-1360] – Thesaurus

Integration with Thesaurus (<https://fedeo.spacebel.be/thesaurus/en/index>) allowed us to add See also option, which relates to what user typed phrase wise into the search bar and shows what other phrases user can search for. This option was introduced into the autocomplete part of the search bar. This view is temporary it disappears as soon as user starts the search.



4.2.2.7 [GPE-1433] – NextGEOSS direct connection

Thanks to integration with NextGEOSS catalogue we were able to extend list of resources that GWP can search in to find data needed for Users. The integration is done based on openSearch specification. NextGEOSS is a hub, which contains data regarding European Earth Observation.



4.3 Tools-based Enhancements: APIs, Views, Widgets/ Mirror Sites and Generic GEOSS Portal

4.3.1 Operational Environment

Below you can find listed changes that are accessible on our Operational Environment.

4.3.1.1 GEOSS Re-Use Components

Communities often use their own Data and Portals and have their own specificities. GEOSS shall respond to that and be built around the Communities.

To this end, a new concept in supporting User Communities has been developed to help Communities to reuse selected GEOSS Portal components. A detailed description of this is highlighted in what follows.

4.3.1.2 GEOSS View

Site for Reference: <http://www.geodab.net/test-apis>

The GEOSS View can provide to the community access only to a subset of specifically defined resources using temporal, thematic and spatial criteria, to be included in their community Portal.

A GEOSS View is defined by the following criteria:

Subset of the whole GEOSS resources defined by applying a set of clauses

- *Discovery clauses* (e.g. spatial envelope, keywords, sources, etc.)
- *Access clauses* (e.g. data format, access protocol, CRS, etc.)
- Defined “View” exposed to the GEOSS Portal

Consumer-defined View – i.e. Client-side These views are available only for the client application which defined the view.

Provider-defined View –i.e. Server-side These views are available for all client applications.

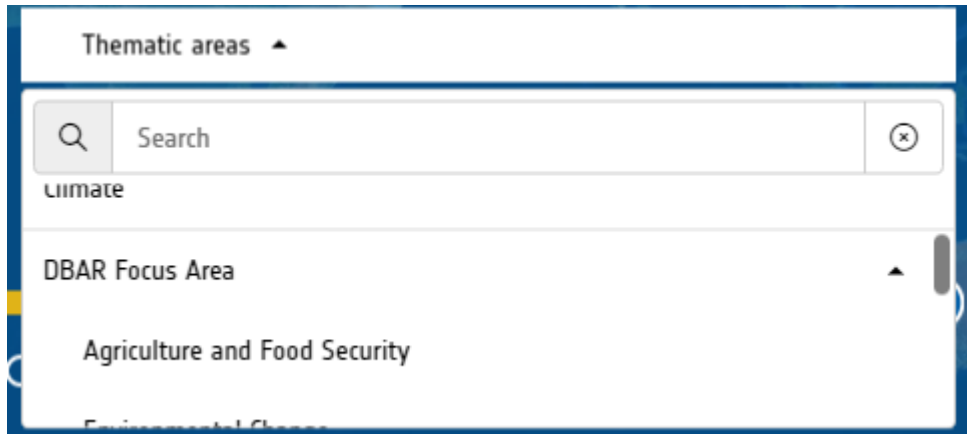
4.3.1.3 GEOSS NESTED Views

The GEOSS View functionality was extended to support hierarchy in views definition. That is, allowing defining a view as a sub-view of an existing one. All the clauses from the parent view are inherited by the sub-view, which combines them with its own clauses in an “and” relation.

Multiple sub-views can be defined from the same parent view.

4.3.1.4 [GPE-1714] - GEOSS NESTED Views - User interface behaviour and interaction with the DAB

The main goal for this task was to prepare the filter interface for two level structures within thematic area filter. When using this filter user can check all subcategories that exist within a category or can choose one option from subcategories.



4.3.1.5 GEOSS API

Site for Reference: <http://www.geodab.net/apis>

The **GEO Discovery and Access Broker (DAB)** is a middleware component which is in charge of interconnecting the heterogeneous and distributed capacities contributing to **GEOSS**; The DAB provides three main functionalities:

1. **Data/Metadata Harmonization:** provides harmonized discovery and access to heterogeneous data systems. The heterogeneity of data sources is hidden, resources appear as a single data source.
2. **Data Access:** provides data discovery and access functionalities to heterogeneous data systems.
3. **Data Transformation:** enriches access functionalities by allowing users to customize their downloads (e.g. change format and/or CRS).

Since it is a middleware component, DAB users are typically software agents, such as web-based or desktop client applications. These can exploit the DAB functionalities implementing the client-side of one (or more) of the protocols published by the DAB for the above functionalities. The available protocols include:

- OGC Catalog Service for the Web (CSW)
- OpenSearch with geo, time and semantic extensions
- Open Archive Initiative (OAI) PMH
- OGC Web Processing Service
- etc

In order to simplify the development of applications and clients making use of the DAB, the following APIs have been developed:

GEOSS APIs	Geospatial Expert	Web Dev. Expert
Standard Web Services (OGC Web Services, OAI-PMH, CKAN,	X	



etc.)		
OpenSearch (Extended)	X	
GEO DAB API JS		X
GEO DAB API REST		X

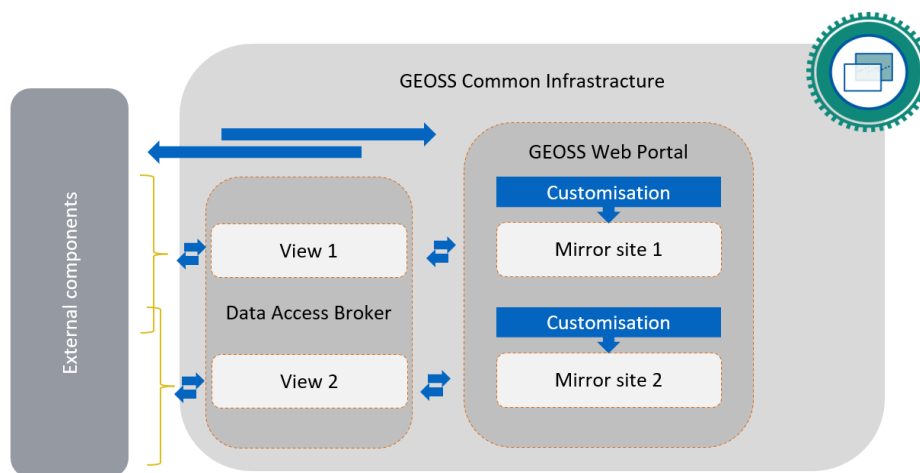
4.3.1.6 GEOSS Mirror

The GEOSS Mirror is a GEOSS Portal site customisation for SBAs, Flagships, Initiatives, Communities.

It is available at www.geoportal.org/community/<NameOfTheGEOInitiative>

The customisation better serves the specific community interests by filtering:

- Catalogues and search results by a specific theme or **GEO DAB view** (e.g., cold regions, mountains, etc.)
- Location of interests
- Services/Processing/Tools (in the future ...)



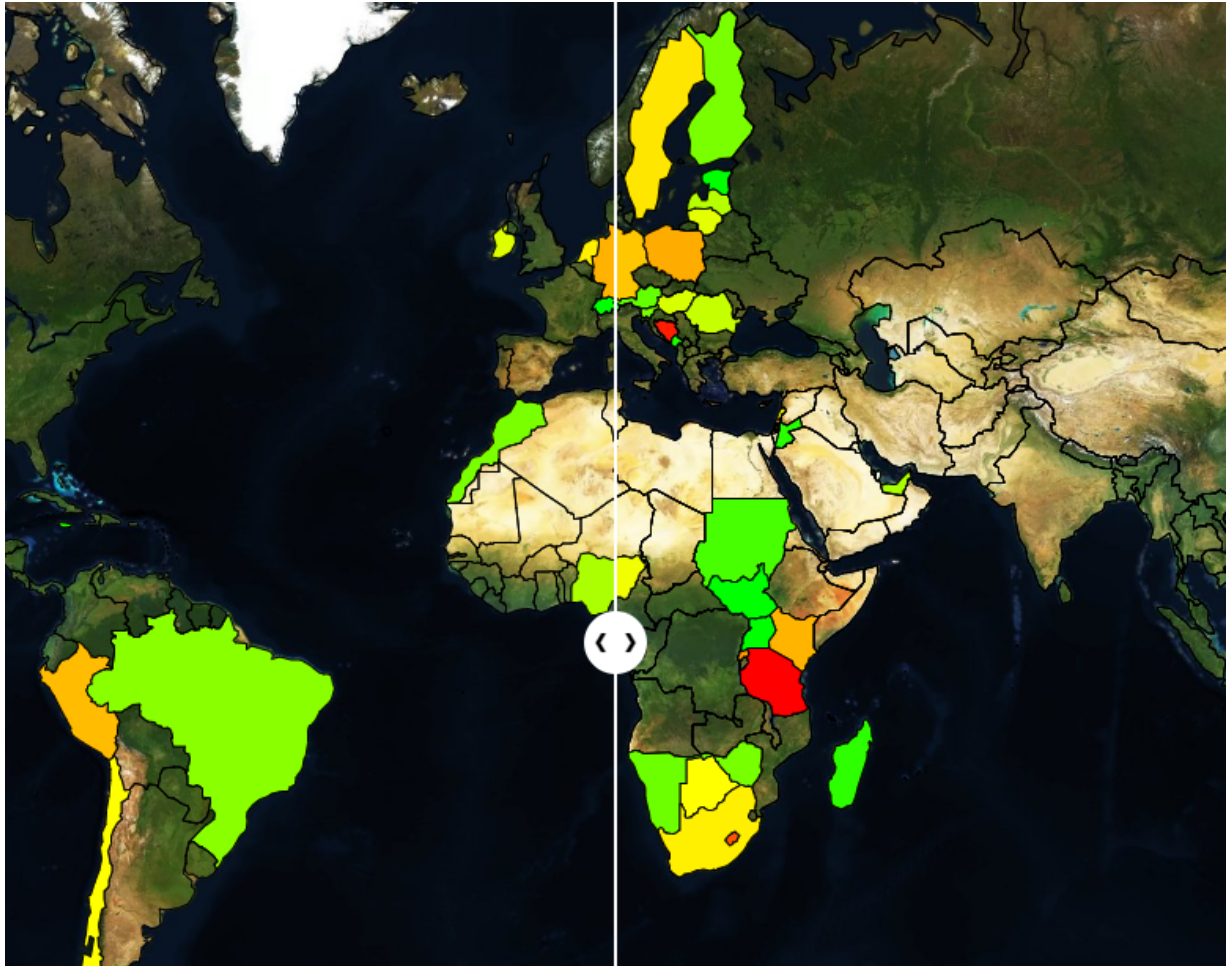
Navigation enhancements have been added to allow users for fluent backward navigation (GPE-512).. Currently mirror sites are to support the community portals defined using GWP widgets with back-end resource logic.

4.3.2 Proof of concept

Below you can find listed changes that are accessible on our Development Environment.

4.3.2.1 [GPE-1560] - Compare layers function common to layers

Within this task we have created a tool for end users that allow them to compare 2 separate layers on our map. Comparison shows difference between 2 of the layers using a dedicated line with arrow. Difference are marked based on layers, that user is comparing.



4.3.2.2 [GPE-1343] - GEOSS-cr facet filters

This change added new option for facet filters for GEOSS Curated resources. Attributes such as Organization, Keyword, and Protocol were added. Thanks to this addition users can narrow down their search even more.

4.3.2.3 [GPE-1417] - Workflow VLAB integration

Integration with VLAB new API allowed to upgrade the look and feel of service tool, as well as, gave new option for doing runs. Users using setup wizard can see how the workflow looks like and can choose which resources should be used in chosen service for the run.



Workflow & Runs ✕

WIMMED

See this Workflow RUNS

```
graph LR; In(( )) --> WiMMed[WiMMed]; WiMMed --> Out(( )); InputData[Input data] -.-> WiMMed; WiMMed -.-> OutputData[Output data];
```

Required fields Options fields Expert options Outputs



Workflow & Runs ✕

WORKFLOW INPUT

Input name	Chosen resources	Actions
Input data*	<i>This field is required</i>	<input type="button" value="SELECT RESOURCES"/>

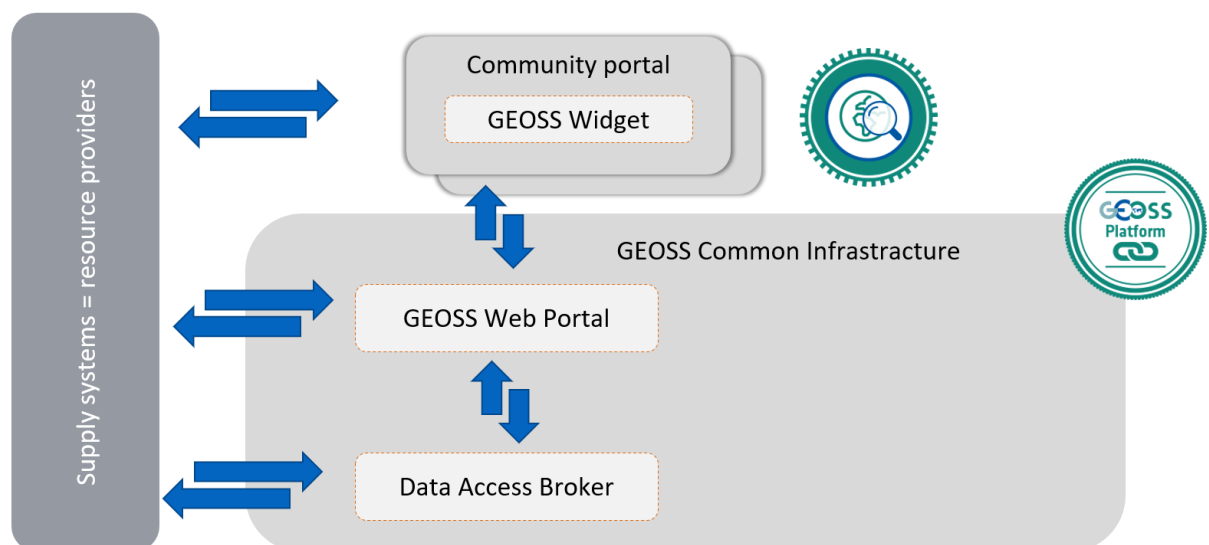
* required fields

CLOUD PLATFORM SELECTION

<input checked="" type="radio"/> AWS	<input type="radio"/> CREODIAS	<input type="radio"/> ONDA	<input type="radio"/> SOBLOO
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RUN NAME

4.3.2.4 [GPE-1362] - GEO IDE – widget



GEOSS Search Widget can be treated as external component that connects to:



GWP - it provides access keys for widget users and then it controls the traffic via Apache, so that only registered pages with valid keys can pass requests further to Data Access Broker,

Resource providers - they grant access to variety of data to download e.g. images, documents or maps.

The widget is configurable by the use of call back functions that trigger user's piece of code. Its design can be customized as well by the means of overridden CSS classes.

Widget is particularly recommended for people who:

- own a website with a OpenLayers map in it;
- wish to present GEOSS resources;
- do not want to implement user interface from the scratch.

4.3.2.5 [GPE-1713] - Bulk-download from multiple sources

Bulk-download on GEOSS Platform allows users to gather data they want and then download it in one go. This functionality is only accessible to those who have created an account on GEOSS Platform and are logged in. Users can choose which items they want to add to the download list. Bulk download has dedicated icon on the right of the portal where User can click to view the actual list of files to be downloaded.

After the data to download has been selected, the GEOSS Portal sends a proper request to the GEO DAB. The request is executed by accessing all requested data by GEO DAB, which finally packages all data in a zip file to be returned to users. Details of GEO DAB interface for this operation are described in D3.6.

4.3.2.6 [GPE-1347] - Information Editor – prototype

Knowledge Editor (now known as Information Editor) is a tool, which allows users to create content for the website, enrichment it and make correlation between it. Within this task we have created the base for this structure where we implemented first workflows for all the content created data. Setup the roles and permissions and decided on the structure of the metadata.

4.3.2.7 [GPE-1348] - GEOSS Like and GEOSS Curated resources

This change introduced option of “GEO liking” a resource by end user. GEO Like is nothing else, than saying, that this article user liked. If you are a logged user all the likes you leave are added to your workspace to tab GEO Likes. When you click on it a list with all likes will appear. Within the same task we also added option for logged only users to improve the data they are reading. They can do so by clicking on the button user contribution which can be found in top right of the resource box. Updated data is sent to moderator for verification with Knowledge Information.

4.3.2.8 Data cubes

Data cubes are multi-dimensional arrays of values that can be organised with reference to geo-spatial coordinates, time extent, data type and parameters, like resolution. Based on this organisation and provided APIs pixel-level data exploitation should be possible. In the geo-spatial data there is no standard approach, but experience is growing and growing. A proof of concept research has been implemented by an ESA intern based on the GWP integration environment. The study was focused on the datacube exposing standard 2.0 OGC WCS interface which contains the following functions:

- GetCapabilities - For finding a list of all the internal datasets (parameters) comes as xml



- **DescribeCoverage** - For finding the bounding box of a specific dataset as well as the coordinate type (lat, long, North, East)
- **GetCoverage** - For getting the actual image. It takes bounding box parameters and return an image ready to be shown

The study showed the possibilities for operational integrations and presented value that can be delivered with data cubes support. The project code is to be reused in standard evolution workflow of defined functional requirements especially for visual analytical toolset like data series analysis, temporal layers comparisons, front-end transformations.

4.4 Stakeholder-based Enhancements: Resource provider, End-User, Knowledge provider and Developer

4.4.1 Operational Environment

Below you can find listed changes that are accessible on our Operational Environment

4.4.1.1 [GPE-179]: Statistics page or web service for common users and data providers

The GEOSS Platform exposes the statistics information on the resource's usage. Data providers have access to resources discovery statistics.

Currently, both GWP and DAB collect statistics on their part. GWP provides a sub-page with resources discovery statistics and other information that meet the stakeholders needs.

- GWP gathers statistics that DAB possesses and present combined with internal statistics;
- GWP loads online data that it collects to DAB where further all aggregates will be counted;
- GWP presents statistics from DAB aggregates.

The specific selections will be made by ESA, CNR-IIA and EVERSIS according to discussions held at subsequent workshops on existing DAB and GWP data.

GWP will continue collecting the portal usage statistics for the UX analysis.

4.4.1.2 [GPE-606] Export statistics as pdf/xls

To improve exposition of the statistics information on the user behaviour the GEOSS Portal provides the possibility to export the Kibana statistics to pdf or csv file.

4.4.1.3 [GPE-182]: Data providers' accessibility

Data providers can be easily recognized on the GWP. Most current searchable list of stakeholders are presented as Yellow Pages with name, description, logo and other specified information.

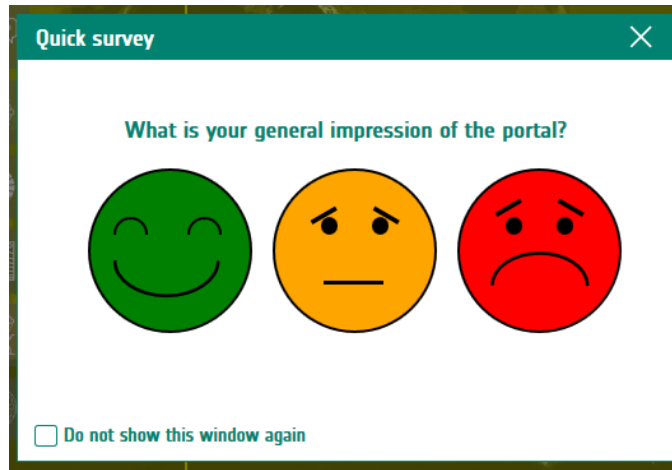
Preserving the current GCI architecture and taking into account maintainability of the current data provider list, GWP will utilise a new interface of DAB. The DAB server exposes the existing list, a Yellow Pages section with searchable data providers will be added to GWP. As logos are not going to be part of the DAB interface these will be maintained on GWP by the administrator with predefined naming convention to match GCI resource providers' IDs.

4.4.1.4 [GPE-534] GEOSS Instant Feedback

To ensure the possibility to gather the feedback from the users GWP will provide a survey that will gather user assessment of the GEOSS Portal user interface.



For the instant feedback as well as more articulated surveys, the user feedback mechanics have been integrated into the portal. After the user inactivity or actions that can suggest portal exit very short instant feedback buttons appear on the screen:



Responses are stored with session data in the ELK (elasti.co) stack document database the same way as the other user actions like search and discovery. Continuous context allows analysing the feedback and correlating with actions taken.

Additionally, further survey is proposed for users that have given instant feedback response. Survey is based on the configurable question set with 1-choice, multiple choices and open questions. Configuration is based on txt file upload on the server.

4.4.1.5 [GPE-447] - More hints layers or toast messages to show to beginners

More hints and “Take a tour” icon has been implemented to show users how to save searches, bookmark results, sign-in and retrieve settings, save searches, results bookmarked from My Workspace and show the My Workspace functionalities.

4.4.2 Proof of Concept

Below you can find listed changes that are accessible on our Development Environment.

4.4.2.1 [GPE-447/448] - Knowledge Producer

ECOPotential is a community project in the area of geo-spatial data processing. As the virtual computational environment, it naturally fits in the GEOSS ecosystem as service provider. Additionally, ECOPotential project provides own ontology model. It has been integrated as the external domain model (look Architecture) with GWP hosted visual navigation and processing tracking concept on the Users workspace. Logged-in user can search for the workflow, which is recognised as analytical algorithm with possible multiple steps and data sources. The user is able to select resources from GEOSS that fit into the algorithm input standard and run the algorithm. Algorithm execution can take significant amount of time (like several hours). GWP User portal stores the execution Id (RunID) that enable user to review the execution results after some time.



4.4.2.2 [GPE-1444] - Add EuroGEO view id to thematic areas

This change introduced new thematic areas into the thematic area filter accessible under the search bar within advance search option. EuroGEO is Europe part of the group, which works on Earth Observation. Thanks to their large knowledge gained in previous programs as well as data we can use it as resource for GWP.

4.4.2.3 [GPE-622] - AmeriGEO CKAN as new data source

This task was created to integrate with AmeriGEO CKAN solution, to add this as another source of data accessible on GEOSS Platform. AmeriGEO is an organization, which main aim is to collaborate and coordinate GEO members in America continent. Thanks to this all the data can be found in one place.

4.4.2.4 [GPE-1024] - Implement ECOPotential case in new design

ECOPotential is a community project in the area of geo-spatial data processing. As the virtual computational environment, it naturally fits the GEOSS ecosystem as service provider. Additionally, ECOPotential project provides own ontology model. Within this task the ECOPotential case gained new and refreshed design.

4.4.2.5 [GPE-1063] - ECOpotential knowledge crawl and load into db

Within this task we have crawled Ecopotential knowledge and added it to our database for GEOSS Platform for our relationship model.

4.4.2.6 [GPE-1076] - ECOpotential products as data resources

This change in system made possible for runs, that are made in labs to appear in GEOSS Platform as separate resources, if the run was completed successfully.

4.5 Community-based Enhancements: SBAs, Copernicus Services, Thematic Exploitation Platforms, Sustainable Development Goal (SDG), Climate Goals and Disaster Reduction

- User communities from the GEOSS Societal Benefit Areas: Disaster Resilience, Water Resource Management, Biodiversity and Ecosystems Sustainability, Public Health Surveillance and the former SBA Climate;
- The GEO Regional Hubs;
- User communities not linked to a particular theme, in this document defined as “cross-thematic”.

4.5.1 Operational Environment

Below you can find listed changes that are accessible on our Operational Environment

4.5.1.1 [GPE-191]: Restructure Societal Benefit Areas

Current SBA implementation will be replaced by a new one based on DAB views. To make this work, the DAB view for REST interface has to be analysed and integrated into GWP. The Views configuration will be prepared by DAB with GEO cooperation and will automatically limit searched resources according to GWP selection.



4.5.1.2 [GPE-532]: AtlantOS: Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems

The GEOSS Platform has provided a portal that mirrors the capabilities of the GEOSS Portal and is specifically customized for the AtlantOS community as defined in their user requirements.

4.5.1.3 [GPE-454]: AmeriGEO

The AmeriGEO users shall be enabled to access a dedicated Portal, the AmeriGEO Portal, providing search capabilities that mirror the ones offered by the GEOSS Portal, in particular as regards the search criteria, the filtering criteria, the results browse, selection and visualization capabilities.

4.5.1.4 [GPE-393]: GEO-GNOME: GEO Global Network for Observation and Information in Mountain Environments

The GEOSS Platform has provided a portal that mirrors the capabilities of the GEOSS Portal and is specifically customized for the GEO-GNOME community as defined in their user requirements.

4.5.1.5 [GPE-25]: GEOSS for the Satellite-based Wetland Observation Service

The GEO Wetlands community has expressed the need to import in their own portal (SWOS Service Portal) the search and browsing capabilities of the GEOSS Platform to have access to defined collections of GEOSS data.

4.5.1.6 [GPE-439]: GOS4M: Global Observation System for Mercury

The GOS4M user is enabled to access a dedicated Portal, the GOS4M Portal, providing search capabilities that mirror the ones offered by the GEOSS Portal, in particular as regards the search criteria, the filtering criteria, the results browse, selection and visualization capabilities.

4.5.1.7 [GPE-494]: DBAR: Digital Belt And Road

The DBAR users is enabled to access a dedicated Portal, the DBAR Portal, offering ad-hoc functionalities for discovering, accessing and visualizing data and information concerning the DBAR.

4.5.1.8 [GPE-424]: ENERIG-OD: European NETwork for Redistributing Geospatial Information to user Communities - Open Data

The ENERIG-OD user is enabled to access a dedicated Portal, the ENERIG-OD Portal, providing search capabilities that mirror the ones offered by the GEOSS Portal, in particular as regards the search criteria, the filtering criteria, the results browse, selection and visualization capabilities. This dedicated portal is pointing to a specific GEO DAB instance, tailored to the needs of this specific Community.

4.5.1.9 [GPE-499]: EnviDat: The Environmental Data Portal of the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL)

The EnviDat user is enabled to access a dedicated Portal, the EnviDat Portal, providing search capabilities that mirror the ones offered by the GEOSS Portal, in particular as regards the search criteria, the filtering criteria, the results browse, selection and visualization capabilities.

4.5.2 Proof of Concept

4.5.2.1 [GPE-1119] - Present data from UNSD

First prototyped approach on presenting the data from UNSD within GEOSS Platform to show it is possible to present data from UNSD in a homogeneous way.



4.5.2.2 [GPE-592]: New SBA Navigation

This task was focusing on a new concept of SBA navigation. But it was later discarded in the project.

4.5.2.3 [GPE-613]: GEO Programme Navigation

GEO program is considered as another knowledge structuring concept. From the GWP point of view it is another domain model with DAB views reference and GUI organisation that is clear for domain users. For such, targeted search mock-ups have been implemented. Later in the project this prototype interface was discarded.



4.5.2.4 [GPE-1717] - GEOSS View "Essential Climate Variables (ECV)" and nested views

The GEOSS Platform end user is able to use GEOSS View "Essential Climate Variables (ECV)", which was created and configured within this task. This was possible due to other changes made so that the thematic areas filter will allow two-level structures to exist within one filter. ECV are linked variables, which contribute to how climate acts on earth.

4.5.2.5 [GPE-1715] - GEOSS View "DBAR Focus Area" and nested views

GEOSS Platform end user is able to use GEOSS View "DBAR Focus Area" that was created and configured within this task. This was possible due to other changes made so that the thematic areas filter will allow two-level structures to exist within one filter. DBAR is a shortcut for Digital Belt and Road. This is a "framework" which is created by China and its main vision is to draw upon historical Silk Road. This new road shall spread from China to Europe and Africa as a platform, which can be developed by all. It will contain data regarding climate, use of land, marine, etc.

4.5.2.6 [GPE-1672] - Generating SDG indicator 15.3.1 and comparing with values from other sources

This concept was about creating a function within the system, which will compare to separate data chosen by the end user of the portal. It allowed to compare two separate picture files and as end result



created a picture that showed the differences. In future (based on the examples we will receive) same should be done for numbers comparison and their presentation on the map. SDG 15 focuses on life on land, mainly the investments on both economic and environmental side.

4.6 GEO Priority-based Enhancements

The GEO work plan recognizes the following Global priorities:

- The **UN 2030 Agenda for Sustainable Development:** *Earth observations* play a major role in achieving the SDGs. GEO is instrumental in integrating Earth observation data into the methodology of measuring and achieving SDG indicators.
- **The Paris Agreement on Climate Change:** GEO makes available *Earth observations* in support of effective policy responses for climate change adaptation and mitigation, working with partners to enhance global observation systems in order to strengthen resilience and adaptive capacity to climate-related hazards.
- **The Sendai Framework for Disaster Risk Reduction:** *Earth observations* contribute to disaster preparedness and better mitigation and response. GEO supports disaster resilience by increasing coordination of Earth observations to forecast and prepare for disasters, to reduce damage and to better manage and recover from disasters.

These global priorities drive the specification and the prioritization of the enhancements of the GEOSS Platform deriving from the use cases and requirements described in this section.

4.6.1 Operational Environment

Below you can find listed changes that are accessible on our Operational Environment

4.6.2 Proof of Concept

Below you can find listed changes that are accessible on our Development Environment.

4.6.2.1 [GPE-591] - SDG Navigation

Sustainable Development Goals model is defined based on the UNEP documents in the GWP internal data model. They are organised in the tree structure and any Goal, Target and Indicator can be now mapped to the DAB View. DAB View defines GEOSS resource subset based on catalogues, aerial and temporal extent, keywords. That way the search result set is narrowed down to the topic related resources for better usability.

4.6.2.2 [GPE-1184] - Replace SDG data from our ontology with data from UNSD

This change has replaced data from our ontology with data from UNSD. The data for which the source was changed is as follow:

- SDG Goals are loaded from UN
- SDG Targets are loaded from UN
- SDG Indicators, which have some Series connected are loaded from UN
- SDG Indicators, which do not have Series connected are loaded from our internal GEOSS ontology
- SDG Series are loaded from UN



4.6.2.3 [GPE-591/476] - GEO Essential Project

User communities linked to the SDGs – in this version in particular the communities around the GEO Essential Project.

The main objective of GEOEssential is to demonstrate through workflows how to generate knowledge & indicators based on EVs to monitor SDGs.

Data and browse concept is the same as in the SDG functionality utilising the domain model generic interface.

Analysis of GEOEssential data to knowledge is still under way.



5 Requirements traceability

This is the traceability matrix between the system required capabilities and the User requirements found in document [RD-5] and the Jira Issue #, together with the information if the capability has been implemented on the operational platform or the proof of concept.

Req. Code	Req. Title	Linked User Requirements	JIRA #	Title	Environment	Note
SR-FUN-001	Data Discovery (with relationships to associated concepts)	UR-CLI-011 Retrieving climate information from different knowledge sources	GPE-1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-BES-003 Graph-based navigation of the ECOPOTENTIAL Ontology concepts	GPE-1063	Ecopotential knowledge crawl and load into db	Proof of concept	
		UR-BES-004 Input data for ECOPOTENTIAL workflows in GEOSS	GPE-1491	Possibility to multi-select resources to be passed as input to services	Proof of concept	
		UR-DRM-007 Discovery and access of data and information produced by the Geohazards TEP				Planned



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		UR-CLI-015 Discovery and access of data and information produced by the Coastal TEP				The Coastal TEP is under construction
		UR-CLI-018 Discovery and access of data and information produced by the Polar TEP				Planned
		UR-WRM-017 Discovery and access of data and information produced by the Hydrology TEP				Planned
		UR-BES-008 Discovery and access of data and information produced by the Forestry TEP				Planned
		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-AFS-004 Discovery and access of data and information produced by the Food Security TEP				Planned



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		UR-SUD-002 Discovery and access of data and information produced by the Urban TEP				Planned
		UR-DRM-001 Earthquake search	GPE-267	Filters and visualization for Earthquake events	Operational	
SR-FUN-002	Service Discovery (with relationships to associated concepts)	UR-DRM-006 Discovery of ESA GEOHazards TEP				Planned
		UR-CLI-014 Discovery of ESA Coastal TEP				Planned
		UR-CLI-017 Discovery of ESA Polar TEP				Planned
		UR-WRM-016 Discovery of ESA Hydrology TEP				Planned
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-BES-007 Discovery of ESA Forestry TEP				Planned
		UR-AFS-003 Discovery of ESA Food Security TEP				Planned
		UR-SUD-001 Discovery of ESA Urban TEP				Planned



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		UR-SDG-008 SDG indicator 15.3.1 computation service discovery	GPE- 591	Analysis of GEOessential data to knowledge	Proof of concept	
		UR-SDG-012 SDG indicator 14.1.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-SDG-016 SDG indicator 11.3.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-CRT-008 Discovering and accessing DIAS Platform services	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
SR- FUN- 003	Information Discovery (with relationships to associated concepts)	UR-CLI-010 Accessing climate information on coastal changes	GPE- 1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-CLI-011 Retrieving climate information from different knowledge sources	GPE- 1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE- 1444	Add EuroGEO view id to thematic areas	Operational	



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		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-GRH-011 Accessing data, information and knowledge from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	The Knowledge part is through SDG 15.3.1
		UR-GRH-012 Accessing data, information and knowledge from AmeriGEO	GPE-1350	AmeriGEO direct connection	Proof of concept	
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
SR-FUN-004	Inspection of search results	UR-DRM-002 Earthquake search results	GPE-267	Filters and visualization for Earthquake events	Operational	
		UR-DRM-003 Sorting earthquake search results	GPE-267	Filters and visualization for Earthquake events	Operational	
		UR-DRM-004 Selecting the earthquake magnitude type	GPE-267	Filters and visualization for Earthquake events	Operational	
		UR-CLI-010 Accessing climate information on coastal changes	GPE-1139	Show Zenodo results in knowledge tab	Proof of concept	



		UR-CLI-011 Retrieving climate information from different knowledge sources	GPE-1178	Zenodo extend data	Proof of concept	
		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-GRH-011 Accessing data, information and knowledge from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-GRH-012 Accessing data, information and knowledge from AmeriGEO	GPE-1350	AmeriGEO direct connection	Proof of concept	
		UR-DRM-006 Discovery of ESA GEOHazards TEP	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-CLI-014 Discovery of ESA Coastal TEP				The Coastal TEP is under construction
		UR-CLI-017 Discovery of ESA Polar TEP	GPE-1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor



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		UR-WRM-016 Discovery of ESA Hydrology TEP	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-BES-007 Discovery of ESA Forestry TEP	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-AFS-003 Discovery of ESA Food Security TEP	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-SUD-001 Discovery of ESA Urban TEP	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-SDG-008 SDG indicator 15.3.1 computation service discovery	GPE- 591	Analysis of GEOEssential data to knowledge	Proof of concept	
		UR-SDG-012 SDG indicator 14.1.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor



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		UR-SDG-016 SDG indicator 11.3.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-CRT-008 Discovering and accessing DIAS Platform services	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-CLI-011 Retrieving climate information from different knowledge sources	GPE- 1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE- 1331	Knowledge editor prototype	Proof of concept	Information content pushed through the Information Editor
		UR-BES-003 Graph-based navigation of the ECOPOTENTIAL Ontology concepts	GPE- 1063	Ecopotential knowledge crawl and load into db	Proof of concept	
		UR-BES-004 Input data for ECOPOTENTIAL workflows in GEOSS	GPE- 1491	Possibility to multi-select resources to be passed as input to services	Proof of concept	
		UR-DRM-007 Discovery and access of data and information produced by the Geohazards TEP				Planned



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		UR-CLI-015 Discovery and access of data and information produced by the Coastal TEP				The Coastal TEP is under construction
		UR-CLI-018 Discovery and access of data and information produced by the Polar TEP				Planned
		UR-WRM-017 Discovery and access of data and information produced by the Hydrology TEP				Planned
		UR-BES-008 Discovery and access of data and information produced by the Forestry TEP				Planned
		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-AFS-004 Discovery and access of data and information produced by the Food Security TEP				Planned



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		UR-SUD-002 Discovery and access of data and information produced by the Urban TEP				Planned
		UR-DRM-001 Earthquake search	GPE-267	Filters and visualization for Earthquake events	Operational	
SR-FUN-005	Selection of search results	UR-DRM-002 Earthquake search results	GPE-267	Filters and visualization for Earthquake events	Operational	
		UR-DRM-003 Sorting earthquake search results	GPE-267	Filters and visualization for Earthquake events	Operational	
		UR-DRM-004 Selecting the earthquake magnitude type	GPE-267	Filters and visualization for Earthquake events	Operational	
		UR-CLI-010 Accessing climate information on coastal changes	GPE-1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-CLI-011 Retrieving climate information from different knowledge sources	GPE-1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	



		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-GRH-011 Accessing data, information and knowledge from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-GRH-012 Accessing data, information and knowledge from AmeriGEO	GPE-1350	AmeriGEO direct connection	Proof of concept	
		UR-DRM-006 Discovery of ESA GEOHazards TEP	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-CLI-014 Discovery of ESA Coastal TEP				The Coastal TEP is under construction
		UR-CLI-017 Discovery of ESA Polar TEP	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-WRM-016 Discovery of ESA Hydrology TEP	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-BES-007 Discovery of ESA Forestry TEP	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-AFS-003 Discovery of ESA Food Security TEP	GPE-1331	Knowledge editor prototype	Proof of concept	



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		UR-SUD-001 Discovery of ESA Urban TEP	GPE- 1331	Knowledge editor prototype	Proof of concept	
		UR-SDG-008 SDG indicator 15.3.1 computation service discovery	GPE- 591	Analysis of GEOEssential data to knowledge	Proof of concept	
		UR-SDG-012 SDG indicator 14.1.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	
		UR-SDG-016 SDG indicator 11.3.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	
		UR-CRT-008 Discovering and accessing DIAS Platform services	GPE- 1331	Knowledge editor prototype	Proof of concept	
		UR-CLI-011 Retrieving climate information from different knowledge sources	GPE- 1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE- 1331	Knowledge editor prototype	Proof of concept	



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		UR-BES-003 Graph-based navigation of the ECOPOTENTIAL Ontology concepts	GPE-1063	Ecopotential knowledge crawl and load into db	Proof of concept	
		UR-BES-004 Input data for ECOPOTENTIAL workflows in GEOSS	GPE-1491	Possibility to multi-select resources to be passed as input to services	Proof of concept	
		UR-DRM-007 Discovery and access of data and information produced by the Geohazards TEP				Planned
		UR-CLI-015 Discovery and access of data and information produced by the Coastal TEP				The Coastal TEP is under construction
		UR-CLI-018 Discovery and access of data and information produced by the Polar TEP				Planned
		UR-WRM-017 Discovery and access of data and information produced by the Hydrology TEP				Planned
		UR-BES-008 Discovery and access of data and information produced by the Forestry TEP				Planned



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		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-AFS-004 Discovery and access of data and information produced by the Food Security TEP				Planned
		UR-SUD-002 Discovery and access of data and information produced by the Urban TEP				Planned
		UR-DRM-001 Earthquake search	GPE-267	Filters and visualization for Earthquake events	Operational	
SR-FUN-006	Access to selected resource	UR-CLI-010 Accessing climate information on coastal changes	GPE-1139	Show Zenodo results in knowledge tab	Proof of concept	
		UR-CLI-011 Retrieving climate information from different knowledge sources	GPE-1139	Show Zenodo results in knowledge tab	Proof of concept	



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		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-GRH-011 Accessing data, information and knowledge from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-GRH-012 Accessing data, information and knowledge from AmeriGEO	GPE-1350	AmeriGEO direct connection	Proof of concept	
		UR-DRM-006 Discovery of ESA GEOHazards TEP				Planned
		UR-CLI-014 Discovery of ESA Coastal TEP				Planned
		UR-CLI-017 Discovery of ESA Polar TEP				Planned
		UR-WRM-016 Discovery of ESA Hydrology TEP				Planned
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE-447	Knowledge producer	Proof of concept	



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		UR-BES-007 Discovery of ESA Forestry TEP				Planned
		UR-AFS-003 Discovery of ESA Food Security TEP				Planned
		UR-SUD-001 Discovery of ESA Urban TEP				Planned
		UR-SDG-008 SDG indicator 15.3.1 computation service discovery	GPE- 591	Analysis of GEOEssential data to knowledge	Proof of concept	
		UR-SDG-012 SDG indicator 14.1.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	
		UR-SDG-016 SDG indicator 11.3.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	
		UR-CRT-008 Discovering and accessing DIAS Platform services	GPE- 1331	Knowledge editor prototype	Proof of concept	
		UR-CLI-011 Retrieving climate information from different knowledge sources	GPE- 1139	Show Zenodo results in knowledge tab	Proof of concept	



		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE-448	Graph presentation and navigation through nodes	Proof of concept	
		UR-BES-003 Graph-based navigation of the ECOPOTENTIAL Ontology concepts	GPE-448	Graph presentation and navigation through nodes	Proof of concept	
		UR-BES-004 Input data for ECOPOTENTIAL workflows in GEOSS	GPE-447	Knowledge producer	Proof of concept	
		UR-DRM-007 Discovery and access of data and information produced by the Geohazards TEP				Planned
		UR-CLI-015 Discovery and access of data and information produced by the Coastal TEP				The Coastal TEP is under construction
		UR-CLI-018 Discovery and access of data and information produced by the Polar TEP				Planned
		UR-WRM-017 Discovery and access of data and information produced by the Hydrology TEP				Planned



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		UR-BES-008 Discovery and access of data and information produced by the Forestry TEP				Planned
		UR-AFS-001 Discovering and accessing land degradation showcases from EuroGEO	GPE-1444	Add EuroGEO view id to thematic areas	Operational	
		UR-AFS-002 Retrieving knowledge on the creation of a crop mask	GPE-1331	Knowledge editor prototype	Proof of concept	
		UR-AFS-004 Discovery and access of data and information produced by the Food Security TEP				Planned
		UR-SUD-002 Discovery and access of data and information produced by the Urban TEP				Planned
		UR-DRM-001 Earthquake search	GPE-267	Filters and visualization for Earthquake events	Operational	
SR-FUN-007	Service Execution	UR-BES-002 – Running ECOPOTENTIAL workflows	GPE-1582	EODESM and Trends.Earth workflow IDs	Proof of concept	
		UR-BES-003 – Graph-based navigation of the ECOPOTENTIAL Ontology concepts	GPE-1063	Ecopotential knowledge crawl and load into db	Proof of concept	



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		UR-BES-004 – Input data for ECOPOENTIAL workflows in GEOSS	GPE- 1491	Possibility to multi-select resources to be passed as input to services	Proof of concept	
		UR-DRM-008 – Geohazards TEP service execution and products generation				Planned
		UR-CLI-016 – Coastal TEP service execution and products generation				Planned
		UR-CLI-019 – Polar TEP service execution and products generation				Planned
		UR-WRM-018 - Hydrology TEP service execution and products generation				Planned
		UR-BES-009 - Forestry TEP service execution and products generation				Planned
		UR-AFS-005 - Food Security TEP services execution and products generation				Planned



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		UR-SUD-003 - Urban TEP service execution and products generation				Planned
		UR-SDG-008 - SDG indicator 15.3.1 computation service discovery	GPE-591	Analysis of GEOEssential data to knowledge	Proof of concept	
		UR-SDG-009 - SDG indicator 15.3.1 computation service execution	GPE-591	Analysis of GEOEssential data to knowledge	Proof of concept	
		UR-SDG-012 - SDG indicator 14.1.1 computation service discovery				Planned
		UR-SDG-013 - SDG indicator 14.1.1 computation service execution				Planned
		UR-SDG-016 - SDG indicator 11.3.1 computation service discovery				Planned
		UR-SDG-017 - SDG indicator 11.3.1 computation service execution				Planned



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SR-FUN-008	Data Provision (Registration)	UR-DRM-007 Discovery and access of data and information produced by the Geohazards TEP				Planned
		UR-CLI-015 Discovery and access of data and information produced by the Coastal TEP				Planned
		UR-CLI-018 Discovery and access of data and information produced by the Polar TEP				Planned
		UR-WRM-017 Discovery and access of data and information produced by the Hydrology TEP				Planned
		UR-BES-008 Discovery and access of data and information produced by the Forestry TEP				Planned
		UR-AFS-004 Discovery and access of data and information produced by the Food Security TEP				Planned
		UR-SUD-002 Discovery and access of data and information produced by the Urban TEP				Planned



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SR-FUN-009	Service Provision (Registration)	UR-DRM-006 Discovery of ESA GEOHazards TEP				Planned
		UR-CLI-014 Discovery of ESA Coastal TEP				Planned
		UR-CLI-017 Discovery of ESA Polar TEP				Planned
		UR-WRM-016 Discovery of ESA Hydrology TEP				Planned
		UR-BES-001 Search for Ecosystems, Protected Areas, Storylines and Workflows	GPE-1138	Add keywords to eodesm service	Proof of concept	
		UR-BES-007 Discovery of ESA Forestry TEP				Planned
		UR-AFS-003 Discovery of ESA Food Security TEP				Planned
		UR-SUD-001 Discovery of ESA Urban TEP				Planned
		UR-SDG-008 SDG indicator 15.3.1 computation service discovery	GPE-591	Analysis of GEOEssential data to knowledge	Proof of concept	
UR-SDG-012 SDG indicator 14.1.1 computation service discovery	GPE-1331	Knowledge editor prototype	Proof of concept	Planned		



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		UR-SDG-016 SDG indicator 11.3.1 computation service discovery	GPE- 1331	Knowledge editor prototype	Proof of concept	Planned
		UR-CRT-008 Discovering and accessing DIAS Platform services	GPE- 1331	Knowledge editor prototype	Proof of concept	Planned
SR- FUN- 010	Information Provision (Registration)	UR-CLI-012 Registering own knowledge sources regarding coastline changes to GEOSS	GPE- 1331	Knowledge editor prototype	Proof of concept	
SR- FUN- 011	User Feedback	UR-CLI-012 Registering own knowledge sources regarding coastline changes to GEOSS	GPE- 1331	Knowledge editor prototype	Proof of concept	
SR- FUN- 012	Time series access	UR-PHS-002 Accessing data and information from the Copernicus Atmosphere Monitoring Service			Operational	The Copernicus Services have been registered in GEOSS
SR- FUN- 013	Analytical comparison	UR-SUD-005 Comparison of SDG indicator 11.6.2 from multiple sources	GPE- 1560	Compare layers function common to layers	Proof of concept	
		UR-SDG-011 Comparison of SDG indicator 15.3.1 from multiple sources	GPE- 1674	Comparison of SDG indicator 15.3.1 from multiple sources	Proof of concept	



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		UR-SDG-015 Comparison of SDG indicator 14.1.1 from multiple sources	GPE- 1560	Compare layers function common to layers	Proof of concept	
SR- NFC- 001	Exportability of discovery, inspection, selection and access capabilities	UR-BES-005 – Searching for GEOSS data via the SWOS Portal	GPE- 314	Prototype the initial GEOSS Portal Search Widget	Operational	
		UR-BES-006 – Browsing through GEOSS data via the SWOS Portal	GPE- 314	Prototype the initial GEOSS Portal Search Widget	Operational	
		UR-WRM-014 – Searching for GEOSS data via the Space4Water Portal	GPE- 1362	GEO IDE - widget	Proof of concept	
		UR-WRM-015 – Browsing through GEOSS data via the Space4Water Portal	GPE- 1362	GEO IDE - widget	Proof of concept	
SR- NFC- 002	Configurability of search domain	UR-CLI-001 – Climate search domain	GPE- 1717	GEOSS View "Essential Climate Variables (ECV)" and nested views	Operational	
		UR-CLI-002 – Search by GCOS ECV	GPE- 1717	GEOSS View "Essential Climate Variables (ECV)" and nested views	Operational	
		UR-CLI-003 – Search by GCOS Measurement Domain	GPE- 1717	GEOSS View "Essential Climate Variables (ECV)" and nested views	Operational	



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		UR-CLI-004 – Search by GCOS focus “area”	GPE-1717	GEOSS View "Essential Climate Variables (ECV)" and nested views	Operational	
		UR-CLI-005 - Search by GCOS ECV products	GPE-1717	GEOSS View "Essential Climate Variables (ECV)" and nested views	Operational	
		UR-SDG-002 – Search by EBV	GPE-1717	GEOSS View "Essential Climate Variables (ECV)" and nested views	Operational	
		UR-SDG-003 – Search by EWW	GPE-1717	GEOSS View "Essential Climate Variables (ECV)" and nested views	Operational	
		UR-WRM-002 – the AtlantOs search keywords	GPE-538	GEOSS View creation: AtlantOS Community	Operational	
		UR-WRM-003 – The AtlantOs Region Of Interest	GPE-705	AtlantOS mirror site: AOI Atlantic Ocean by default	Operational	
		UR-WRM-004 – the AtlantOs search domain	GPE-538	GEOSS View creation: AtlantOS Community	Operational	
		UR-WRM-006 – The GEO-GNOME search keywords	GPE-393	GEO-GNOME Community Data Profile	Proof of concept	
		UR-WRM-007 – The GEO-GNOME Region Of Interest	GPE-393	GEO-GNOME Community Data Profile	Proof of concept	



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		UR-WRM-008 – The GEO-GNOME search domain	GPE-393	GEO-GNOME Community Data Profile	Proof of concept	
		UR-WRM-010 – The GTN-H search keywords	GPE-505	GEOSS View creation: GTN-H Community	Operational	
		UR-WRM-011 – The GTN-H search domain	GPE-505	GEOSS View creation: GTN-H Community	Operational	
		UR-CRT-004 – The EnviDat search keywords	GPE-501	GEOSS View creation: EnviDAT Community	Operational	
		UR-CRT-005 – The Envidat Region Of Interest	GPE-501	GEOSS View creation: EnviDAT Community	Operational	
		UR-CRT-006 – The EnviDat search domain	GPE-501	GEOSS View creation: EnviDAT Community	Operational	
		UR-GRH-008 – Search by DBAR focus “area”	GPE-1715	GEOSS View "DBAR Focus Area" and nested views	Operational	
		UR-GRH-009 – The DBAR search domain	GPE-500	GEOSS View creation: DBAR Community	Operational	
		UR-GRH-002 – The AmeriGEOSS search keywords	GPE-454	AmeriGEOSS Community Data Profile	Operational	
		UR-GRH-003 – The AmeriGEOSS Region Of Interest	GPE-454	AmeriGEOSS Community Data Profile	Operational	



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		UR-GRH-004 – The AmeriGEOSS search domain	GPE-454	AmeriGEOSS Community Data Profile	Operational	
SR-NFC-003	Portal customizability	UR-SDG-001 – The Essential Variables Portal				Planned
		UR-WRM-001 – the AtlantOs Portal	GPE-532	AtlantOS mirror site	Operational	
		UR-WRM-005 – The GEO-GNOME Portal	GPE-393	Dedicated portal for the GEO-GNOME community	Proof of concept	
		UR-WRM-009 – The GTN-H Portal	GPE-504	GTN-H Community Data Profile	Operational	
		UR-PHS-001 – The GOS4M Portal	GPE-439	Dedicated portal for the GOS4M community	Operational	
		UR-CRT-001 – The ENERJIC-OD Portal	GPE-424	Dedicated portal for the ENERJIC-OD community	Operational	
		UR-CRT-003 – The EnviDat Portal	GPE-499	Dedicated portal for the EnviDat community	Operational	
		UR-GRH-007 – The DBAR Portal	GPE-494	Dedicated portal for the DBAR community	Operational	
		UR-GRH-010 – Chinese language support	GPE-1400	Add Spanish, Chinese and French to the multi-lingual support	Operational	
		UR-GRH-001 – The AmeriGEOSS Portal	GPE-454	Dedicated portal for the AmeriGEOSS community	Operational	



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		UR-GRH-005 – The AmeriGEOSS filtering capabilities	GPE-454	Dedicated portal for the AmeriGEOSS community	Operational	
SR-NFC-004	Accessibility through API	UR-WRM-014 Searching for GEOSS data via the Space4Water Portal	GPE-1362	GEO IDE - widget	Proof of concept	
		UR-WRM-015 Browsing through GEOSS data via the Space4Water Portal	GPE-1362	GEO IDE - widget	Proof of concept	
		UR-BES-005 Searching for GEOSS data via the SWOS Portal	GPE-314	Prototype the initial GEOSS Portal Search Widget	Operational	
		UR-BES-006 Browsing through GEOSS data via the SWOS Portal	GPE-709	SWOS Community Portal to be inserted in the Community Portal list	Operational	
SR-NFC-005	Increasing user traffic	N.A.	GPE-1371	GEOSS SEO optimizations	Operational	

Table 1 - Functional Requirements and Jira issues traceability matrix





Annex A. References

- [RD-1] EDGE: European Direction in GEOSS Common Infrastructure Enhancements – Grant Agreement Number 776136
- [RD-2] EDGE-WP2-DEL-D2.1, Version 1: Use Cases Description and User Requirements Document
- [RD-3] EDGE-WP2-DEL-D2.2, Version 1: Functional and Non-functional Enhancements Specification
- [RD-4] EDGE-WP2-DEL-D2.3, Version 2: Use Cases Description and User Requirements Document
- [RD-5] EDGE-WP2-DEL-D2.4, Version 2: Functional and Non-functional Enhancements Specification
- [RD-6] L. Vaccari, M. Craglia, C. Fugazza, S. Nativi e M. Santoro, «Integrative Research: The EuroGEOSS Experience,» *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 5, n. 6, pp. 1603 - 1611, 2012.
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Fix [GPE-1200] - Sharing doesn't work in My Workspace
Fix [GPE-1229] - Publishing saved search not working
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Fix [GPE-1486] - Sentinel 2A footprints not present
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Fix [GPE-1535] - Showing JSON as an error message when no results are found
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Fix [GPE-1734] - SIT - All custom downloads fail
Fix [GPE-1735] - SIT - Some Resources do not have any data in detail view
Fix [GPE-1736] - SIT - Error when opening shared links to resources
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Fix [GPE-1738] - SIT - No results are shown when selecting "Show inside folder" option from bookmarked results
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different datasources
[GPE-1395] - Add loaders for other sources while sending additional requests



	<p>[GPE-1479] - Recreate UAT database from production</p> <p>[GPE-1512] - Create button in KnowledgeEditor for db sync</p> <p>[GPE-1277] - Make keywords clickable</p> <p>[GPE-1306] - Take a tour runs a video - Video URL in the configuration</p> <p>[GPE-1388] - GEOSS CR shouldn't be switch off after change in advanced search</p> <p>[GPE-1396] - On the AmeriGEOSS mirror site: AmeriGEOSS catalogue default first queried catalogue</p> <p>[GPE-1397] - Implement cache for Yellow Pages on backend side</p> <p>[GPE-1409] - Rewrite Saved Bookmarks page into Vue.js</p> <p>[GPE-1410] - Clean up front-end files in repository</p> <p>[GPE-1448] - Liquibase setup</p> <p>[GPE-1055] - Please hide the dropdown on the initial screen</p> <p>[GPE-1090] - Popup error "on our side"</p> <p>[GPE-1278] - Change "See also" label to "Source"</p> <p>[GPE-1426] - "Statistic" label on layer icon (CR) is misunderstanding</p> <p>[GPE-1455] - Change any reference/label from AmeriGEOSS to AmeriGEO</p>
3.7.1	<p>[GPE-259] - Semantic search implementation</p> <p>[GPE-1281] - Add source name support in Excel datasource</p> <p>[GPE-1345] - CNR VLAB alignment</p> <p>[GPE-1433] - NextGEOSS direct connection</p> <p>[GPE-1440] - Curated Relationship - referring DAB resources</p> <p>[GPE-1491] - Possibility to multi-select resources to be passed as input to services</p> <p>[GPE-1510] - Enable sync of geoss-cr entries between SQL db and Elasticsearch from Liferay Control Panel</p> <p>[GPE-1518] - Display error popup when request to UNSD fails</p> <p>[GPE-1519] - Trends Earth mockup workflows URL</p> <p>[GPE-1546] - Add isCustom column to entryRelation table</p> <p>[GPE-1547] - Provide support for RUN name</p> <p>[GPE-1548] - Default values for Trends Earth model</p> <p>[GPE-1556] - Trends Earth view parameters</p> <p>[GPE-1557] - Order of Saved runs</p> <p>[GPE-1576] - GEOSS Like and GEOSS Curated resources - extension in metadata</p> <p>[GPE-1581] - Add entry type information to entyrelation table</p> <p>[GPE-1599] - Create mechanism for backup of Elasticsearch index</p> <p>[GPE-1339] - Make searchable all the SDG time series names</p> <p>[GPE-1400] - Add Spanish, Chinese and French to the multi-lingual support</p> <p>[GPE-1476] - Add Zenodo support for BOOKMARKED_FEED</p> <p>[GPE-1508] - Rewrite Statistics page into VueJS</p> <p>[GPE-1562] - Change opensearch field: geoss_cr to type</p> <p>[GPE-1626] - Knowledge Producer - new naming scheme</p> <p>[GPE-1384] - Results missing when switching tabs on back by browser arrow</p>



[GPE-1411] - Load wikipedia entries to database
[GPE-1412] - Add wikipedia as datasource in opensearch
[GPE-1442] - Style knowledge editor
[GPE-1447] - Map drawing tool for "Set bounding box"
[GPE-1451] - TransferOptions - add multiple options support
[GPE-1494] - DAB external sources rebuilds
[GPE-1500] - Extend model definition to allow entry modifications
[GPE-1501] - Elasticsearch index for storing entry modifications
[GPE-1502] - Logstash configuration for loading entry modifications
[GPE-1503] - Java API for entry modifications
[GPE-1507] - Create Liferay workflow for extending entries by users
[GPE-1512] - Create button in KnowledgeEditor for db sync
[GPE-1516] - Window layout modifications
[GPE-1521] - Autocomplete for select inputs
[GPE-1522] - Add validation to Entities adding
[GPE-1524] - Update existing Elasticsearch index with new fields
[GPE-1525] - Update existing Logstash configuration for loading some entry modifications
[GPE-1528] - mail notification → would this be possible to add link redirecting to the entry
[GPE-1529] - add entry relation → filter by title/summary the list possibility
[GPE-1531] - Copy external resource after definition improvement
[GPE-1533] - Add entry relation to external resource FE
[GPE-1539] - Provide backend endpoint to validate url's
[GPE-1542] - Keep already filled transfer options between form refreshes
[GPE-1549] - Show current sync status in Knowledge editor in Control Panel
[GPE-1550] - GEO-IDE enable registration
[GPE-1551] - GEO IDE - apache configuration and script
[GPE-1552] - GEO IDE - recreate the manual page
[GPE-1553] - GEO-IDE update frontend to geo ide widget
[GPE-1610] - Send entry's type when extending entry's definition
[GPE-1620] - Distinction between dataSourceId and displayDataSourceId in entry table
Fix [GPE-1326] - SDG indicator download links (.csv) doubled
Fix [GPE-1459] - Customize your download - add some margin under drill down list
Fix [GPE-1469] - MyWorkspace/Saved Runs and "Workflow and Runs"/Run dialog shall share the same functionalities
Fix [GPE-1477] - Show Log of a run from myworkspace - dialog out of edge and impossible to close
Fix [GPE-1554] - Redundant TransferOptions in geoss-cr database
Fix [GPE-1555] - Knowledge Editor - entry relations pagination number format
Fix [GPE-1565] - Saved Runs page doesn't have blue header with page title



	<p>Fix [GPE-1574] - Knowledge editor - button label goes over the button</p> <p>Fix [GPE-1575] - NextGEOSS - backend error after switch to last page</p> <p>Fix [GPE-1577] - Run Name - not translated for other languages</p>
3.7.2	<p>[GPE-1087] - Add support for the parent to the opensearch</p> <p>[GPE-1348] - GEOSS Like and GEOSS Curated resources - extension adding</p> <p>[GPE-1433] - NextGEOSS direct connection</p> <p>[GPE-1443] - Entry relations should be connected using naturalId instead of database_id</p> <p>[GPE-1497] - Refactor the code handling data sources</p> <p>[GPE-1558] - Verify Trends Earth legend (png)</p> <p>[GPE-1576] - GEOSS Like and GEOSS Curated resources - extension in metadata</p> <p>[GPE-1582] - EODESM and Trends.Earth workflow IDs</p> <p>[GPE-1612] - Change isCustom reference to dictionary table</p> <p>[GPE-1338] - Share search and single resource not working for GEOSS Curated sources</p> <p>[GPE-1492] - Default AOI for services called from within a knowledge story</p> <p>GPE-1534] - Add entry relation to external resource be</p> <p>Fix [GPE-1436] - The download button seems to be not clickable</p> <p>Fix [GPE-1570] - GEOSS Curated Relationships - issues for changed language</p> <p>Fix [GPE-1575] - NextGEOSS - backend error after switch to last page</p> <p>Fix [GPE-1589] - Knowledge Editor - wrong workflow tasks count</p> <p>Fix [GPE-1593] - Knowledge Editor Extensions - can't restore workflow task</p> <p>Fix [GPE-1595] - GEOSS Extensions - manage all entities tab - page managing not working</p>
3.7.3	<p>[GPE-1544] - Extend user's Workflow Notification</p> <p>[GPE-1586] - GEOSS Curated Extensions - show entry's base data in add_entity.jsp</p> <p>[GPE-1616] - Add Knowledge Editor link to MyWorkspace</p> <p>[GPE-1122] - Fill in source of data/services/knowledge in to the google spreadsheet</p> <p>[GPE-1226] - Open saved run layer by URL parameters</p> <p>[GPE-1227] - Fix URLs on saved runs page</p> <p>[GPE-1368] - WCS support</p> <p>[GPE-1453] - GEOSS-CR workers should be able to update data in database</p> <p>[GPE-1605] - Change validation (remove Title) in extensions add_entity.jsp</p> <p>[GPE-1498] - Dictionary table should contain naturalId column</p> <p>Fix [GPE-1404] - Result form copied link on Knowledge take too much time</p> <p>Fix [GPE-1602] - Knowledge Editor - pass empty String values as nulls</p> <p>Fix [GPE-1603] - Knowledge Editor - users can't access workflow endpoints</p> <p>Fix [GPE-1606] - Knowledge Editor - wrong url in mail notification</p> <p>Fix [GPE-1607] - Knowledge Editor - error after opening already approved workflow task through link in notification</p>
3.7.4	<p>[GPE-1413] - Add wikipedia as another source on FE</p>



<p>[GPE-883] - Check if GA allows to explore statistics for specific mirror site</p> <p>[GPE-1362] - GEO IDE - widget</p> <p>[GPE-1445] - Zenodo bookmarks fix</p> <p>[GPE-1600] - NextGEOSS - adjust code to new OpenSearch format</p> <p>[GPE-1697] - Change flow for new entity relationships</p> <p>[GPE-1702] - Expanded View</p> <p>[GPE-1754] - Create job for soft-deleting invalid Bookmarked results</p> <p>Fix [GPE-1592] - Action buttons on GEOSS CR Relationships Extension - text over the buttons</p> <p>Fix [GPE-1594] - Fields are not covered in Improve definitions form and in GCR Extension form</p> <p>Fix [GPE-1608] - Cannot move to trash (GEOSS Curated Relationships Extension)</p> <p>Fix [GPE-1614] - Knowledge Editor - Invalid view after second click in link from email</p> <p>Fix [GPE-1615] - Knowledge Editor Extension - link is changed</p> <p>Fix [GPE-1617] - GEO-IDE geo ide widget bugs</p> <p>Fix [GPE-1618] - User without review role can Deny/Approve when have reviewer link</p> <p>Fix [GPE-1627] - Your saved searches - "old fashioned" share icons</p> <p>Fix [GPE-1631] - Register widget - page not translated to any language</p> <p>Fix [GPE-1633] - Your saved searches - message not translated (all languages)</p> <p>Fix [GPE-1640] - Widget in PL menu - different style</p> <p>Fix [GPE-1650] - Custom downloads stopped working</p> <p>Fix [GPE-1652] - Next GEOSS - show invalid amount of pages (0)</p> <p>Fix [GPE-1654] - GEO-IDE geo ide widget bugs (v2)</p> <p>Fix [GPE-1655] - GCR Extension is temporarily unavailable</p> <p>Fix [GPE-1657] - GCR Extension failed error</p> <p>Fix [GPE-1666] - RU - missing translation on Register Widget</p> <p>Fix [GPE-1691] - Translation - missing on Statistic PDF (all languages)</p> <p>Fix [GPE-1696] - Knowledge editor - problem with custom fields when in the review mode</p> <p>Fix [GPE-1752] - Custom Downloads fail immediately</p>
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Table 2 - The GEOSS Portal release notes



Annex D. GEO DAB Standards

The table below provides an overview of all the standards handled by the GEO DAB

OGC CSW 2.0.2 AP ISO 1.0	INPE
OGC CSW 2.0.2 ebRIM EO	CKAN/DKAN
OGC CSW 2.0.2 ebRIM CIM	DCAT
ESRI GEOPORTAL 10	GI-cat
OAI-PMH 2.0	ESRI GEOPORTAL 10
OpenSearch 1.1	NCML-OD
OpenSearch 1.1 ESIP	BCODMO
OpenSearch GENESI DR	NCML-CF
CKAN	NetCDF-CF 1.4
CUAHSI HIS-Central	FTP populated with supported metadata types
ESRI REST API 10.3	WAF Web Accessible Folders
OGC WCS	GeoNetwork (2.2.0 or greater)
OGC WMS	Ecological Markup Language 2.1.1
OGC WFS 1.0.0, 1.1.0, 2.0.0	NERRS (National Estuarine Research Reserve System)
OGC WMTS	HMA CSW 2.0.2 ebRIM/CIM
OGC SOS 1.0.0, 2.0.0, 2.0.0 Hydro Profile	HDF



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OGC WPS 1.0.0	IADC DB (MySQL)
OGC CSW 2.0.0 Core	GrADS-DS
OGC CSW 2.0.2 AP ISO 1.0	FedEO
OGC CSW 2.0.2 ebRIM/EO AP	ARPA DB (based on Microsoft SQL)
OGC CSW 2.0.2 ebRIM/CIM AP	ESRI Map Server
IRIS Station	SHAPE files (FTP)
IRIS Event	KISTERS Web - Environment of Canada
HYRAX THREDDS SERVER 1.9	Environment Canada Hydrometric data (FTP)
OAI-PMH 2.0 - Harvesting	OpenSearch 1.1
GBIF	Earth Engine
DIF	RASAQM
HYDRO	EGASKRO
UNAVCO	SITAD (Sistema Informativo Territoriale Ambientale Diffuso)
CDI 1.04, 1.3, 1.4	File System
ISO19115-2	GDACS
THREDDS 1.0.1, 1.0.2	GeoRSS 2.0
THREDDS-NCISO 1.0.1, 1.0.2	Degree catalog service 2.2
THREDDS-NCISO-PLUS 1.0.1, 1.0.2	OpenSearch GENESI DR



European Direction in GCI Enhancements

Healthsites API Json	
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Table 3 - Standards handled by the GEO DAB



Annex E. Terminology

E.1 Acronyms and Abbreviations

EDGE	European Direction in GEOSS Common Infrastructure Enhancements
BON	Biodiversity Observation Network
CA	Consortium Agreement
CAMS	Copernicus Atmosphere Monitoring Service
C3S	Copernicus Climate Change Service
CEOS	Committee on Earth Observation Satellites
CLMS	Copernicus Land Monitoring Service
CMEMS	Copernicus Marine Environment Monitoring Service
CNR-IIA	Consiglio Nazionale delle Ricerche – Istituto per l’Inquinamento Atmosferico
CO	Confidential
DESCA	Development of a Simplified Consortium Agreement
DEL	Deliverable
DG	Directorate-General
DN	Direct Negotiation
DOW	Description of Work
EAB	External Advisory Board
EC	European Commission
EGU	European Geosciences Union
EMS	Emergency Management Service
EO	Earth Observation
EOP	Earth Observation Programme
ESA	European Space Agency
ESAW	European Ground System Architecture Workshop
ESRIN	European Space Research Institute
EU	European Union
FP7	Seventh Framework Programme
GA	Grant Agreement
GCI	GEOSS Common Infrastructure
GEO	Group on Earth Observation
GEO DAB	GEO Discovery and Access Broker
GEOSS	Global Earth Observation System of Systems
GFOI	Global Forest Observation Initiative
GLAM	Global Agriculture Monitoring



European Direction in GCI Enhancements

GPE	GEOSS Portal Enhancements
GSNL	Geohazard Supersites and Natural Laboratories
GWOS	Global Wetlands Observing System
H2020	Horizon 2020
INT	Internal Note
IPR	Intellectual Property Right
JIRA	COTS tool selected by the GEOSS Portal development contractor allowing agile project management (https://www.atlassian.com/software/jira)
JRC	Joint Research Centre
MOM	Minutes of Meeting
OTH	Other
PD	Project Director
PP	Programme Participants
PQMP	Project Quality Management Plan
PRE	Presentation
PSB	Project Strategic Board
PU	Public Usage
QA	Quality Assurance
QAS	Quality Assurance Support
RE	Restricted
SDG	Sustainable Development Goal
SUS	System Usability Scale
TBD	To Be Defined
TEP	Thematic Exploitation Platform
UNICEF	United Nations International Children's Emergency Fund
USGS	United States Geological Survey
UTB	User and Technical Board
WBS	Work Breakdown Structure
WGISS	Working Group on Information Systems and Services
WP	Work Package
WPL	Work Package Leader