



The GEOSS Platform

Manual n. 1

All you need to know to become a GEO Data Provider

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Introduction

Some History

The GEO Strategic Plan states that “GEO is a coalition of governments and participating Organizations having as its mission the implementation of the Global Earth Observation System of Systems (GEOSS) to meet the need for timely, quality long-term global information as a basis for sound decision-making”.

Earth observations from diverse sources, including satellite, airborne, in-situ platforms, and citizen observatories, when integrated together, provide powerful tools for understanding the past and present conditions of Earth systems, as well as the interplay between them”.

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.

Why the GEOSS Platform is a unique infrastructure

The Global Earth Observation System of Systems (GEOSS) is a social and software ecosystem sharing independent and open Earth observation (EO) information and processing services.

GEOSS 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 and the Disaster Risk Reduction.

The GEOSS Platform is the cornerstone around which the GEOSS software ecosystem is implemented. The GEOSS Platform is the “glueware” that enables the connection and coordination of the many autonomous and multi-organizational systems and services contributing to GEOSS.

The uniqueness of this platform relies on the fact that all data providers are connected to a single infrastructure, accessible via the GEOSS Portal (geoportal.org), with the specificity that data providers remains the only owner of the shared resources. The other uniqueness is that data providers do not have to change or adapt to the standards used by the GEOSS Platform, but leverage the GEO Discovery and Access Broker (GEO DAB) component that deal with the

majority of the standards (**table**) used and the appropriate standard to build interoperability can be selected and used to establish discoverability and accessibility of the Earth Observation resources.

The GEOSS Platform count as of end of 2017 established interoperability with more than 166 Data catalogs, for more than 5000 organizations providing data and more than 400 millions resources discoverable/accessible

What are the benefits of the GEOSS Platform for the Users and Data Providers?

Through the GEOSS Platform users can **discover and access the required Earth Observation**, leveraging the enhanced search and discovery capability of the [GEOSS Portal](#); Resources keep the format distributed by the provider which can be specifically a GIS usable format, or knowledge type such as documents, research analysis.

Beside discovering and accessing the required resources, users are also exposed to a large variety of EO resources from a multitude of Providers, this **can broaden up the knowledge of the users looking for specific sets of resources**, by discovering additional sources not taken into account before.

The GEOSS Platform has an important role to play as well towards Data providers, who at the moment of being brokered are going through an interoperability test. Thanks to this interoperability test, done by the GEO Discovery and Access Broker component, elements such completeness of the metadata as well accessibility, usability of the resources are checked. This enable the data provider to enhance the metadata description of the resources as well a check on the accessibility and usability of the resources, enhancing the quality of their Earth Observations shared.

Benefits of the GEOSS Platform as infrastructure - advancing interoperability, at the benefit of the EO community

The principles that the GEOSS Platform follows for establishing interoperability are:

1. Advocate the use of and support the implementation of international and community standards;
2. Do not impose any existing standard, leaving the multiple GEO Communities of Practice to select and implement the ones they consider most effectively
3. Support the many standards characterizing the multi-domains covered by GEOSS through the implementation of the mediation/brokering pattern
4. Maintain and evolve the mediation/brokering capabilities of the GEOSS platform in order to implement the ultimate interoperability standards (the IT landscape changes rapidly) but continuing to support the existing legacy standards

The GEOSS Platform as infrastructure provides a service to the entire Interoperability community, by enhancing the interoperability of the various standards. Every time a new standards, not yet supported by the GEO DAB is encountered, the GEO DAB team work towards including it into the brokering module. This enables more standards to become interoperable to each other.

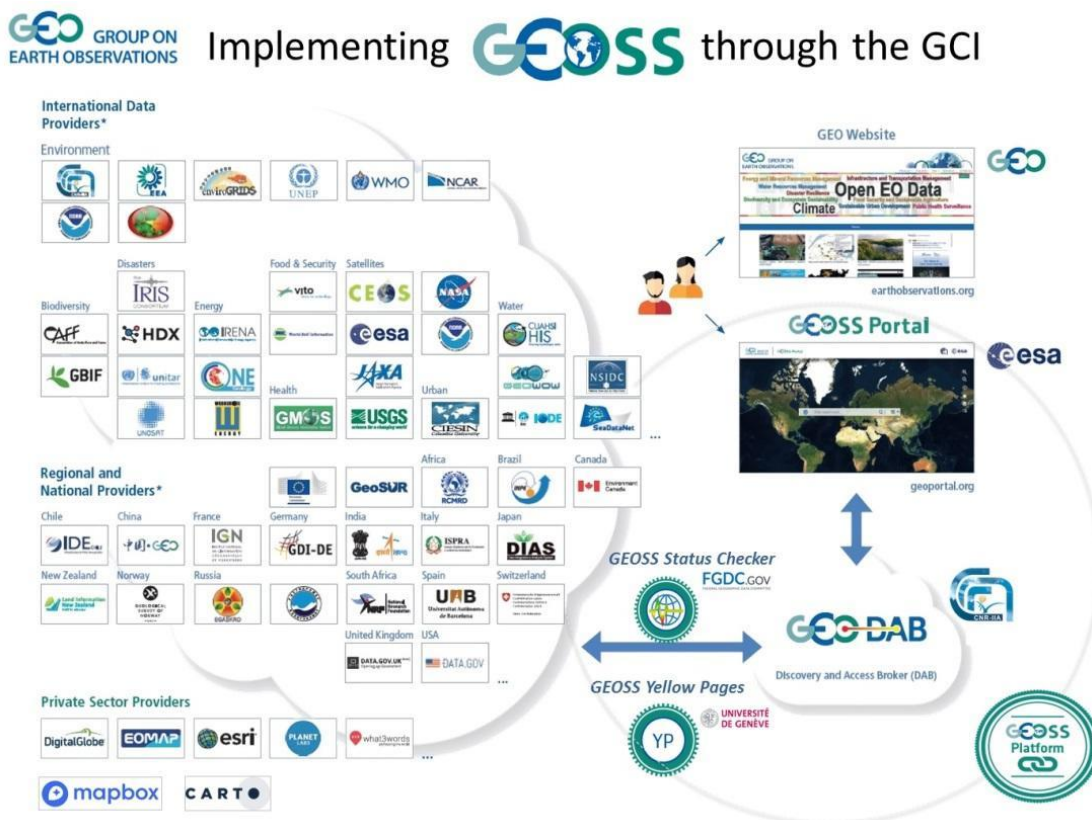
In the example of the Essential Climate Variables, tangible examples of the benefits that the GEOSS Platform brings to the community are:

- Interoperability is essential to build an efficient climate data value chain;
- Interoperability is necessary to deliver effective climate services;
- Standards support data storage, visualization, download, analysis and integration.

(Source: <http://www.sciencedirect.com/science/article/pii/S2405880716300772>)

Presently, the GEO DAB brokers more than 166 autonomous data catalogs and information systems, comprising over 400 million data and information resources. Data providers are constantly being added and brokered, according to user needs, according to the GEO strategic priorities, GEO Flagships, Initiatives and Community Activities thematic and geographic balance of the data and relevance of resources shared. Data providers maintain full ownership of the data linked to GEOSS, but commit to open data sharing principles.

Inside the GEOSS Platform



How is the data connected to the platform?

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 through Application Program Interfaces (APIs). These APIs allow data providers to share resources without having to make major changes to their technology or standards.

How do users access GEOSS resources?

The GEOSS Portal (www.geoportal.org) is an online map-based user interface which allows users to discover and access Earth observation data and resources 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.

The portal is implemented and operated by the European Space Agency and 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.

For users with limited or no access to the Internet, similar information is available via the 'GEONETCast' network of telecommunication satellites.

Finally, other platforms and cyber-infrastructures can access GEOSS resources programmatically by means of the GEO APIs.

GEOSS Yellow pages: Registration process

www.earthobservations.org/gci_yellowpages

The GEOSS Yellow pages service implements the simplified registration process for new Data providers.

In order to avoid any confusion in the process of becoming formal contributor to GEOSS as data and information providers, GEO Secretariat is the entry focal point for all engagement in GEO for new data providers.

GEO Secretariat will engage with all the new Data Providers to guide them on the steps to ensure a successful dialogue and technical interoperability.

Objectives for having implemented the simplified registration process are

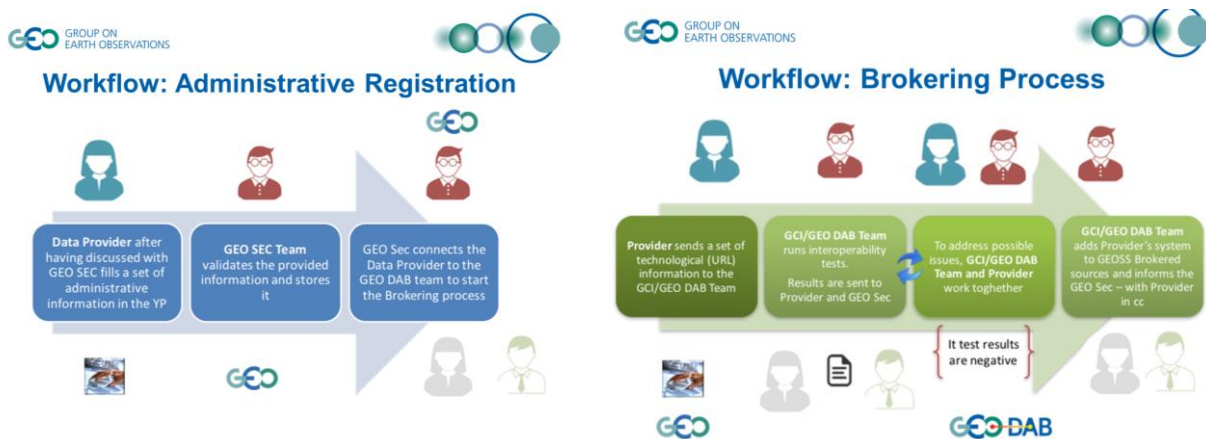
- ❖ Provide clarity, simplicity and visibility in the procedures contributing to GEOSS for data providers.
- ❖ Light and operational interface for non Technical people
- ❖ The GEOSS Registration process aims to add a new resource Provider to GEOSS
- ❖ This process relies on the following principles and requirements

Thanks to the inclusion of the Yellow Pages

- ❖ Data Providers get higher visibility of their contribution to GEOSS Platform by being able to add their logo, description, visible via the GEOSS Portal.
<http://www.geoportal.org/community/guest/yellow-pages>
- ❖ Data Providers can associated their data to specific SBA /SDGs and thus easier to filter and discover by the GEOSS Portal
- ❖ Data Providers are requested to Assess their adherence to the Data Management Principles

The registration process is divided in two main steps

- Administrative registration**, filling up the Yellow pages form with the requested information.
 - ❖ During the Administrative registration process, it is suggested to fill all of the fields and if in any doubt it is suggested that Data providers contact GEO Secretariat for consultation.
 - Interoperability registration**, providing the necessary tests to be brokered by GEOSS. It includes:
 - ❖ An interoperability test (aka Brokering process), where the GEO DAB team tests the interoperability of the Data providers Data catalogue towards the standards already used by the data provider;
 - ❖ The test phase is followed by a test report highlighting elements to be fixed and fine tuned by both parties and upon clearance of the data provider the new catalogue is added to the Geoss Platform and thus become discoverable and /or accessible by the users.
- ❖ If the two registration phases are successfully accomplished, finally, GEO and the new Provider decide to move the new Provider on the operational (or production) GEOSS instance. A public press communication may be jointly released.



Data Openness and Quality Assurance

During the Yellow Pages registration process, the data providers have to assess how their data catalog is compliant to the GEOSS Data Sharing Principles and Data Management Principles to ensure quality of the resources and their openness, discoverability, accessibility and usability.

[GEOSS Data Sharing Principles](#) ensure the openness of data. Data providers are requested to assess if their data can be labelled as Data Collection of Open Resources for Everyone (Data-CORE).

The [White Paper: Legal Mechanisms to Share Data as Part of GEOSS Data-CORE](#) provides an overview of Data-CORE compatible open data licenses, waivers and other legal instruments.

GEOSS Data Management Principles are described at <http://www.geolabel.info/>

During the self-assessment process the data provider will be able to select those principles he is compliant to.

- Discoverable - <http://geolabel.info/Discoverable.htm>
- Accessible - <http://geolabel.info/DataAccess.htm>
- Standard encoding using - <http://www.geolabel.info/Encoding.htm>
- Well documented metadata- <http://geolabel.info/Metadata.htm>
- Traceable - <http://geolabel.info/Provenance.htm>
- Quality documented - <http://geolabel.info/Quality.htm>
- Preserved - <http://geolabel.info/Preservation.htm>
- Periodically verified - <http://geolabel.info/Verified.htm>
- Reviewed and refreshed - <http://geolabel.info/Processing.htm>
- Tagged with permanent ID - <http://geolabel.info/Identifier.htm>

In the new release of the Yellow pages, (planned for January 2018) Data providers will be asked if they want to receive a Peer Review of their Self assessment on DMPs and eventually if interested receive a formal data repository certification provided by a third party. The existing certification schemes include [CoreTrustSeal](#), [Nestor Seal](#) and [ISO 16363:2012](#).

GEOSS Portal

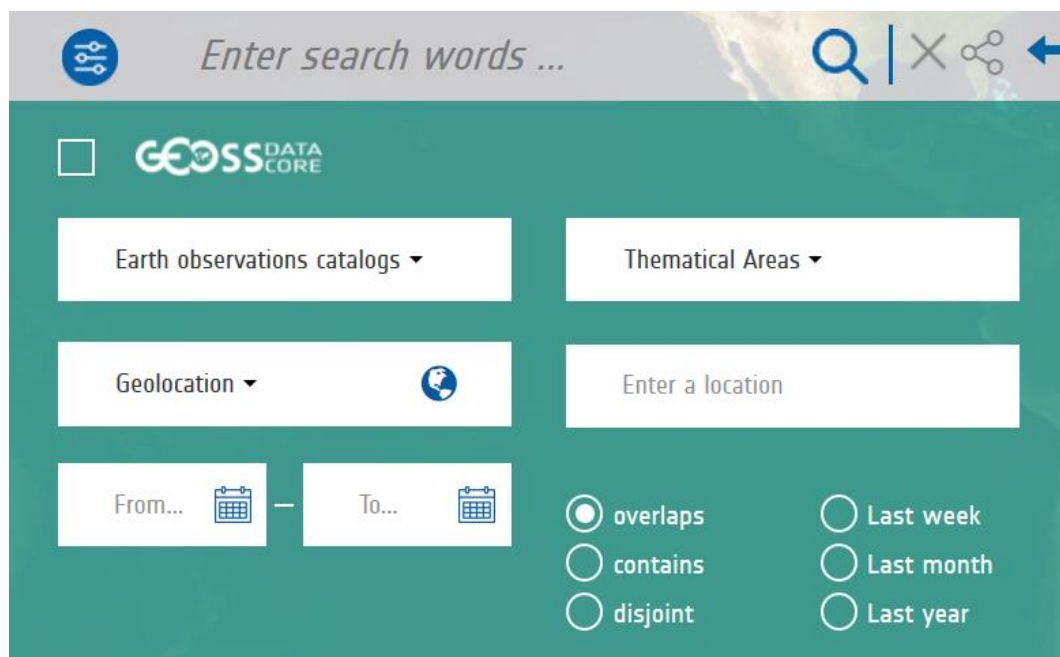
The GEOSS portal - available at www.geoportal.org - has completely refurbished during 2016 and early 2017 and is continuously updated following an Agile approach.

It was completely restyled with the objective to provide a more intuitive interface and align it with the new GEO brand.

At opening of the portal, you will see:

- a map of the world with in the middle a simple keyword based search panel;
- in the upper right corner, a series of icons for basic GIS (Geographical Information System) functionality, including:
 - zooming,
 - recentering,
 - layers handling,
 - area of interest and basemap selection;
- in the upper left corner, a button for accessing the menu with options to
 - sign-in,
 - obtain information regarding the portal and data providers,
 - contact the Help-Desk,
 - go to a personalised workspace and retrieve information regarding popular (most used) searches,
 - provide feedback and access information regarding terms and conditions.



Multi-Criteria Searches



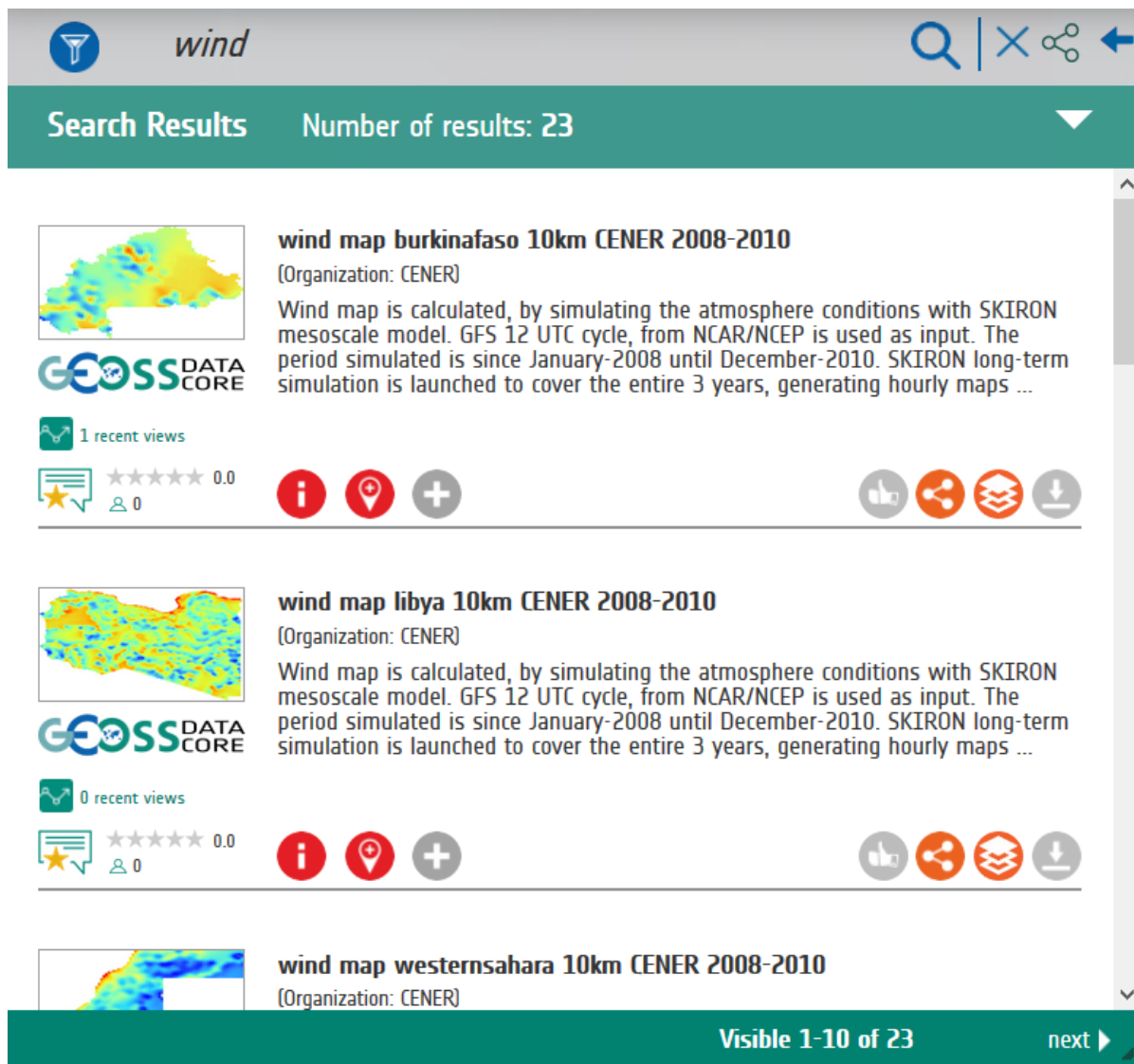
The multi-criteria search panel can be unfolded selecting the most-left icon in the simple keyword based search panel.

As part of a multi-criteria search, a user can:

- restrict search results to the freely and openly accessible ones only, so-called GEOSS Data CORE resources;
- restrict the search to a limited set of Earth observation catalogues of interest to the user;

- define the area of interest, by specifying:
 - the bounding box as lat/lon coordinates;
 - a continent or country from a drop-down menu;
 -  coordinates;
 - or a [point of interest](#) via  API;
- define a timeframe of interest;
- direct the search towards a specific Thematic Area applying predefined views on the data - interested users are invited to contact the Geo Secretariat.

Results Inspection



The screenshot shows a search results panel for the query "wind". At the top, there is a search bar with the text "wind" and navigation icons. Below the search bar, a green header indicates "Search Results" and "Number of results: 23". The results are displayed as a list of items, each with a thumbnail map, a title, organization, description, and interaction icons.

wind map burkinafaso 10km CENER 2008-2010
 (Organization: CENER)
 Wind map is calculated, by simulating the atmosphere conditions with SKIRON mesoscale model. GFS 12 UTC cycle, from NCAR/NCEP is used as input. The period simulated is since January-2008 until December-2010. SKIRON long-term simulation is launched to cover the entire 3 years, generating hourly maps ...

wind map libya 10km CENER 2008-2010
 (Organization: CENER)
 Wind map is calculated, by simulating the atmosphere conditions with SKIRON mesoscale model. GFS 12 UTC cycle, from NCAR/NCEP is used as input. The period simulated is since January-2008 until December-2010. SKIRON long-term simulation is launched to cover the entire 3 years, generating hourly maps ...

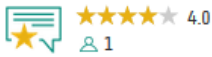









wind map westernsahara 10km CENER 2008-2010
 (Organization: CENER)

At the bottom of the results panel, a green bar shows "Visible 1-10 of 23" and a "next" button.

Results of a query are displayed in a results panel

A default number of ten results is displayed; users can easily access the next (or previous) ten results by clicking the next (or prev) arrow at the bottom of the panel. Each result item shows a title, a brief description, a browse image (if available), the GEOSS Data CORE flag (which means that the data is freely and openly accessible, according to the GEOSS Data CORE principles), and a series of icons corresponding to applicable functions.

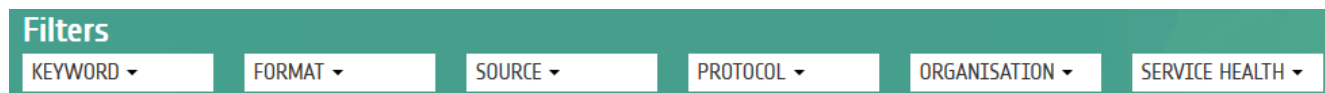
More precisely, the following functions may be available:

Icon	Description
	<i>GEOSS Like</i> (assign stars) and comment the result
	Information (complementing the brief summary) in an information window that can be opened.
	Localization of the data on the map either as bounding box or as a placeholder.
	Bookmark the result and save it in the MyWorkspace section, available if the user has signed in.
	Open the collection, if the result is a collection, the collection start date is also displayed.
	Collapse the collection, if the result is an opened collection.
	Collaboration and sharing of resources.
	Follow the links in case links are identified by the Data Provider.
	Add a layer to the map in case layers are available from the Data Provider.
	Download the data in formats made available by the Data Provider.

Filtering

The GEOSS portal provides the possibility to narrow down the search results to a smaller set by applying filters. The type of filters depends on the actual search and results.

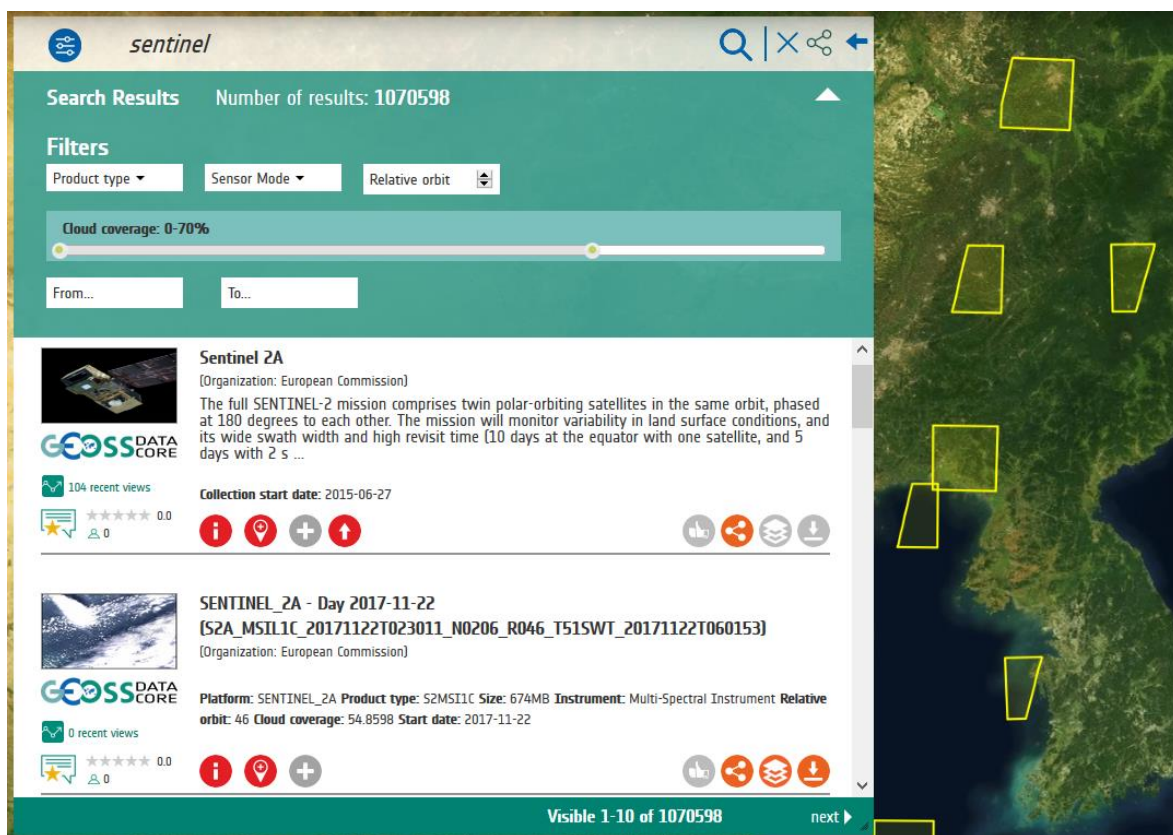
Default Filtering



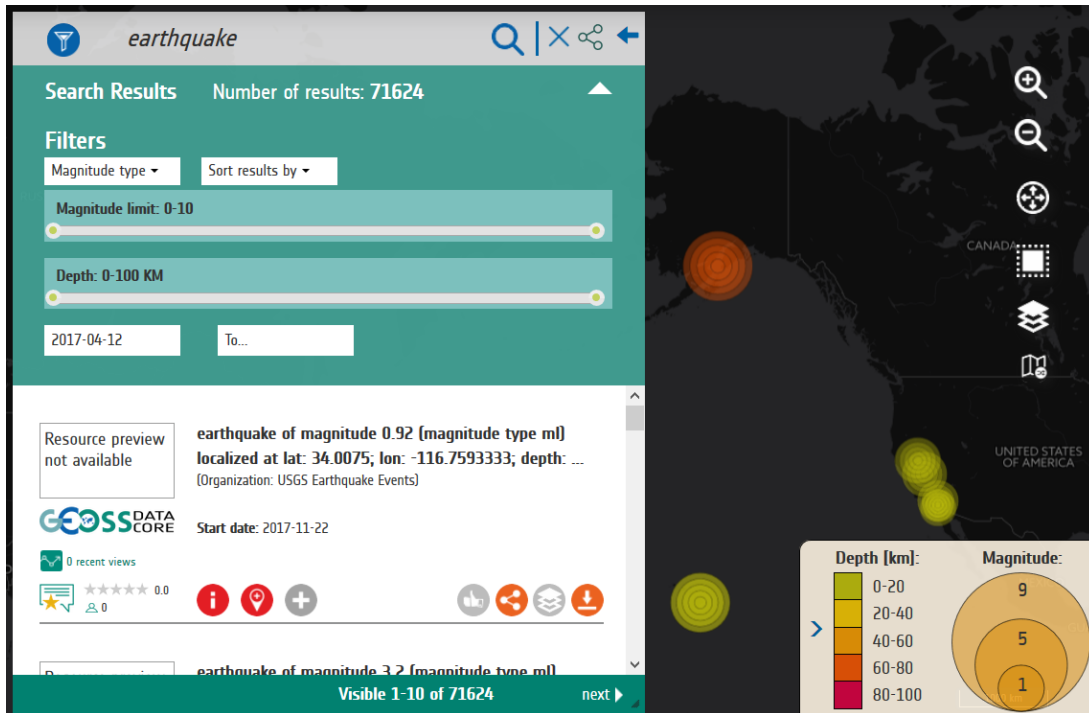
Default filters are available for most search results and include filtering on keywords, format, source, protocol and organisation. Filtering is progressive, implementing an 'AND' operation and not an 'OR'. For each filter only one value can be selected.

Smart Filters

Smart filters and visualisation specificities are implemented for some of the result types. For example, a smart filter considering a combination of cloud coverage, product type, sensor mode and relative orbit has been implemented for data from the [Sentinel 2](#) and the Landsat imagery, and a smart filter considering product type, sensor polarisation, sensor mode, sensor swath and relative orbit has been implemented for Sentinel 1 data.



Other smart filters and specific visualisations are available for [earthquake events](#).



Some numbers and technicalities

The GEOSS Portal is the front-end component of the GEOSS Platform providing access to hundreds of millions of data records from more than 150 GEO Resource Providers through the GEO DAB. Numbers are growing every day.

The Portal Development framework is based on LifeRay 6.2, Openlayer 3.

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

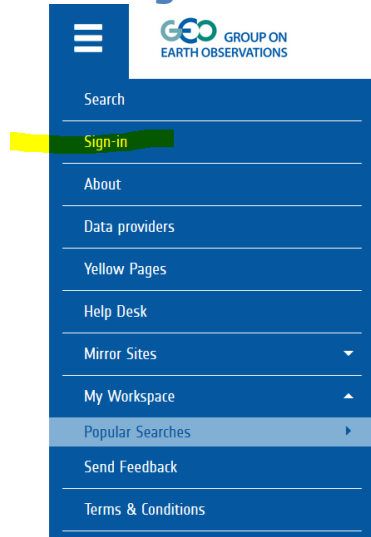
Evolutions

The GEOSS Portal is continuously subject to evolutions in response to the evolving user requirements.

Upcoming evolutions consider layer handling, processing services, new smart filters, feedback data model, views.

One of the evolutions currently under implementation regards the reuse GEOSS Portal Look & Feel and functionalities. Mirrored and customisable GEOSS Portal sites are available for SBAs, Flagships, Initiatives, and GEO Communities at large, to better serve the specific community interests. In addition to this, a freely available instantiation of selected GEOSS Portal *widgets* is made available for possible customization. This will be accomplished by publishing portal code parts (widgets) wrapped up in API.

Obtaining credentials to log-in



Open the Hamburger menu on the top-left corner of the GEOSS Portal website and click on the item Sign-in.

Movies

All the GEOSS Portal tutorials and stories are available at the [GEOSS Portal YouTube channel](#).

GEO DAB

The GEO Discovery and Access Broker, built and maintained by the Italian National Research Council (CNR _ IIIA) represent the middleware component that can build interoperability with the various Data providers thanks to the variety of Standards handled.

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

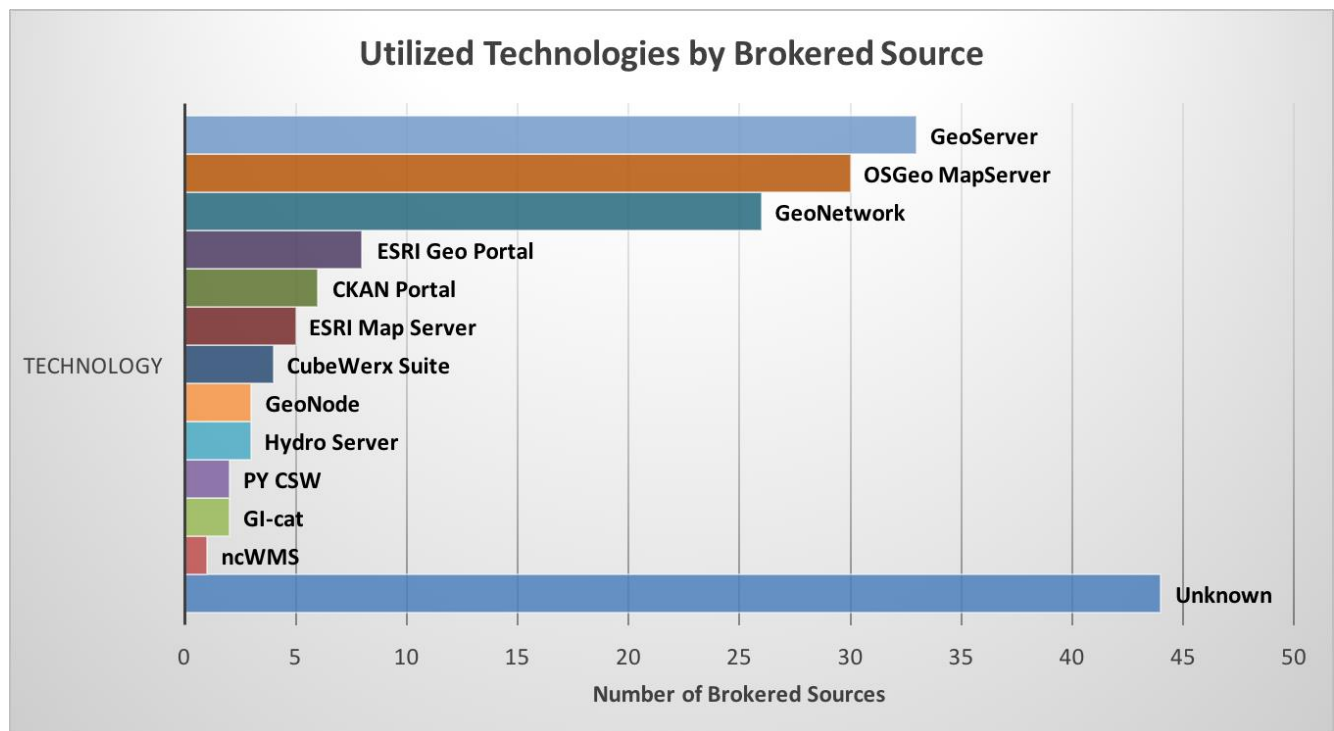
OGC CSW 2.0.2 AP ISO 1.0	INPE
OGC CSW 2.0.2 ebRIM EO	CKAN
OGC CSW 2.0.2 ebRIM CIM	DCAT
ESRI GEOPORTAL 10	GI-cat
OAI-PMH 2.0	ESRI GEOPORTAL 10
OpenSearch 1.1	NCML-OD
OpenSearch 1.1 ESIP	BCODMO
OpenSearch GENESI DR	NCML-CF
CKAN	NetCDF-CF 1.4
CUAHSI HIS-Central	FTP populated with supported metadata types
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
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 Healthsites API Json
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3 Table of all the standards handled by the GEO DAB

The table below list the most utilized technologies by brokered data catalog; this list can provide initial guidance to potential data providers who are willing to implement a data catalog and leverage one of the solutions listed below.



4 Table of solutions implemented by brokered Data providers to set up the Spatial data catalog

GEOSS Service Status Checker

The GEOSS Service Status Checker is the component, developed by USGS/FGDC and integrated into the GEO DAB, that aims at improving user experience by providing information on Reliability of Services. The Status Checker is an automatic mechanism to monitor, diagnose and alert data providers and users on the Health status of the web services provided by the GEOSS Platform.

GEOSS Service Status Checker

Monitor, Diagnose and Alert Providers and Users



The GEOSS Status Checker monitor Metadata Data services such as

Metadata Services

Catalog Services for the Web (CSW)
Web Accessible Folder (WAF)
Application Profile for
Geospatial Metadata (Z39.50)

Data Services

Web Map Service (WMS)
Web Feature Service (WFS)
Web Coverage Service (WCS)
Sensor Observation Service (SOS)
Open-source Project for a Network Data Access Protocol (OPeNDAP)
ArcGIS Map Server
ArcGIS Image Server
ArcGIS Feature Server
ArcIMS Image Service

The GEOSS Status Checker has been implemented and integrated into the GEO DAB and into the GEOSS Portal. The final user can search for Earth Observations data and filter available services using as well the Health Status filter provided by the GEOSS Status Checker

The screenshot shows the GEOSS Portal interface. At the top, there are logos for the Group on Earth Observations and the GEOSS Portal. Below the search bar, the search results for 'water' are displayed, showing 34,1028 results. A filter menu is open, showing the 'SERVICE HEALTH' section with the following options:

- Very reliable (44)
- Mostly available (40)
- Sometimes unavailable (93)
- Frequently unavailable (38)
- Very unreliable (127)

Below the filter menu, several search results are visible, including 'GPWv4: Water Area' and 'Water Well'. The 'Water Well' result includes a resource preview that is not available. The interface also shows a map of the world with a red location pin and a yellow bounding box over Africa. At the bottom, it indicates 'Visible 1-10 of 341028'.

GEOSS ReUse 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.

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.

GEOSS APIs



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. Discovery of resources from brokered sources
2. Semantics-enriched discovery
3. Access of resources

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

GEOSS Mirror

GEOSS Mirror



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 ...)

(click [here](#) for short clip demoing the concept)

GEOSS Widget

GEOSS Widget







GEOSS Widget is a freely-available instantiation of selected GEOSS Portal widgets made available for possible customization in various areas of application (e.g. a specific SBA, Initiatives, etc.).

This is accomplished by publishing portal code parts (widgets) wrapped up in API.

The Kernel stays at server side (continue maintenance, enhancements, etc., like a library).

Contributors

GEOSS Platform Component	Organization	Staff	e mail
GEOSS Portal GEOSS Mirrors GEOSS Widgets	European Space Agency (ESA)  <small>European Space Agency</small>	Joost Van Bemmelen Guido Colangeli	Joost.van.Bemmelen@esa.int guido.colangeli@esa.int
GEO DAB GEO APIs GEOSS VIEW	CNR - IIA National Research Council of Italy Institute of Atmospheric Pollution Research  <small>CNR-IIA</small>	Stefano Nativi Mattia Santoro Roberto Roncella	stefano.nativi@cnr.it mattia.santoro@cnr.it r.roncella@iia.cnr.it
GEOSS Yellow Pages	University of Geneva  UNIVERSITÉ DE GENÈVE	Gregory Giuliani	gregory.giuliani@unige.ch
GEOSS Status Checker	USGS/FGDC  <small>FEDERAL GEOGRAPHIC DATA COMMITTEE</small>	Elrich Frazier Michelle Antony	efrazier@usgs.gov michelle.anthony.ctr@usgs.gov
GEOSS Platform Operations coordination & GEOSS Data Management Principles	GEO Secretariat 	Paola De Salvo Wenbo Chu	pdesalvo@geosec.org wchu@geosec.org