



GROUP ON
EARTH OBSERVATIONS

Energy Scenario
***“Generation of local atlases for decision-support in solar
energy policy planning and private investment”***
Engineering Report GEO Architecture Implementation
Pilot, Phase 5
GEOSS Architecture Implementation Pilot

Version Final

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GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

Table of Contents

1. Introduction	4
1.1 Scope of this document	4
1.2 GEOSS AIP	4
1.3 Summary of SBA development	4
1.4 Future work	4
2. Community SBA Objectives	4
3. Scenario: Generation of local atlases for decision-support in solar energy policy planning and private investment.	5
3.1 Actors	5
3.2 Context and pre-conditions	6
3.3 Scenario Events	8
3.4 Post-Conditions	9
3.5 Special Requirements	9
4. System Model of the Scenario	9
5. Use Cases	10
5.1 AIP Engineering Use Cases	10
5.2 Specialized Use Cases	13
6. Implementation	13
6.1 Deployed Components	13
6.2 Interoperability Arrangements	24
6.3 Use of the GCI	24
6.4 Demonstrations	25
6.5 Future plans for deployment	25
7. References	25
8. Annex 1	26

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

Energy Scenario

1. Introduction

1.1 Scope of this document

MINES ParisTech has contribute to the AIP-5 by developing local atlases for decision-support in solar energy policy planning and private investment. Targeted users such as policy planners or consulting companies don't know with enough accuracy what is the potential of solar energy in their area of interest. Having access to such potential is important but users also need additional information to support decision-making. This include geographical information e.g., physical and administrative, delivered within a WebGIS application for decision-making or for due diligences for banks. The information is recent, of known quality and uncertainty, spanning over several years and easily accessible. Providing such information support studies for sitting, sizing and estimates return-on-investment on solar plants local policies for energy planning and attraction of investors. The European Commission FP7 funded project ENDORSE (ENergy DOwnstReam Services - Providing energy components for GMES; 2011-2013); exploiting the GMES CoreService (MACC, Geoland2) supports this response by providing the necessary layers information for the generation of local atlases.

1.2 GEOSS AIP

The GEOSS Architecture Implementation Pilot (AIP) task develops process and infrastructure components for the GCI and the broader GEOSS architecture as a means of coordinating cross-disciplinary interoperability deployment. The AIP Task provides phased delivery of components to GEOSS operations, with each phase consisting of: architecture refinement based on user interactions; component deployment and interoperability testing; and SBA-focused demonstrations.

This Engineering Report (ER) is a key result of the fifth phase of AIP. AIP-5 was conducted from January 2012 to December 2012. A separate ER describes the overall process and results of AIP-5 and thereby provides a context for this Community SBA ER.¹

1.3 Summary of SBA development

Energy SBA, benefits from new components that have been provides in the AIP-5 framework. An extended set (around 90) of Web Services (OGC Web Map Service (WMS) into a GeoServer at: <http://geoserver.webservice-energy.org/geoserver/wms?service=wms&AcceptVersions=1.1.0&request=GetCapabilities&namespace=paca>) related to Energy and Environment has been made available. A new OGC Catalog Service for the Web (CS-W) available at: <http://geocatalog.webservice-energy.org> containing among other resources the Atlas WMS has been deployed and harvested via the GEOSS Discovery and Access Broker (DAB). A dedicated WebGIS client available at: <http://www.webservice-energy.org/viewer/heron/applications/atlas-paca/> has been developed in order to provide to GEOSS users an access to the Atlas layers through a user-friendly application. The GEOSS Community Portal Webservice-energy.org (<http://www.webservice-energy.org>) acts as an umbrella for the above-mentioned resources and components provided in the AIP-5 framework.

1.4 Future work

N/A

2. Community SBA Objectives

The "Information for Societal Benefit" section of the GEO 2012-2015 work plan has a dedicated section on Energy. This section on Energy untitled « Improving management of energy resources » has defined the following task: EN-01 Energy and Geo-Resources Management. The pillars of this task imply to:

- Support the development of Earth observation products and services for energy and geo-resources management.

¹ A listing of all AIP-5 Engineering Reports: <http://www.ogcnetwork.net/AIP5ERs>

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

- Promote collaboration between users and providers of Earth observation and information.
- Encourage the use of Earth observation and information for informed energy and geo-resources policy planning in developing and developed countries.

The proposed response is fully aligned with this task and will support it. Moreover the European Commission FP7 funded project ENDORSE has been listed in the GEO 2012-2015 work plan as one of the available resources for implementation.

3. Scenario: Generation of local atlases for decision-support in solar energy policy planning and private investment.

3.1 Actors

Actors that benefit from the AIP-5 Energy Scenario have been identified at the early stage of the proposal.

- **GEOSS Resource Provider:** for the energy scenario they include data providers in energy, geography (physical and administrative) and meteorology. They provide the raw or transformed Earth observation components (data, metadata, catalog, methodology, services, tools...) in a GEOSS interoperable compliant form for the realization of the scenario as follow:
 - **MINES ParisTech**
 - Solar energy datasets.
 - Temperature datasets
 - **French Ministry in charge of environment**
 - Land Cover from Corine Land Cover 06 (CLC06)
 - Wind speed classification (10 meters high mean speed)
 - **French Mapping Agency (IGN)**
 - Natural and protected areas, administrative limits
 - **Università degli Studi di Genova (UNIGE)**
 - Air temperature at 2-meter height. Point-wise uncertainty in air-temperature mapping
- **SBA Integrator:** The scenario provides access to a combination of irradiation map and other meteorological data (e.g. temperature) with additional geospatial data (e.g. elevation, land cover, administrative units...) at a scale suitable for analysis (1/250 000) which now benefit to local decision makers. Based on the use of the GCI and Community Resources, the SBA Integrator has developed and deployed the persistent applications required to achieve the scenario goals.
 - **MINES ParisTech** has developed:
 - A GeoServer platform for geo-based Web-Services deployment
 - A Geo catalog for resources, services and datasets dissemination
 - A dedicated WebGIS Client for geodata visualization and data retrieval
- **GEOSS User:** This scenario address two types of GEOSS users:
 - High end-users like **local policy planners** that need easy accessible information that is recent, of known quality including uncertainties in order to support local policies for energy planning and attract investors.
 - **Private investors and/or installers of renewable energy systems**, who conduct studies for siting, sizing and want to estimate return-on-investment on their solar plants.

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

3.2 Context and pre-conditions

The AIP-5 Energy pilot provides atlases at a scale suitable for local level analysis, namely 1/250 000. The selected region for the pilot study is the PACA (Provence Alpes Côte d'Azur) region in south east of France (Figure 1). The pilot among others exploits several services coming from the GMES (Global Monitoring for Environment and Security) Cores Services. This include:

- MACC: HelioClim3 irradiance database
- TerraSAR-X dataset (or SRTM) elevation
- Geoland 2 land cover

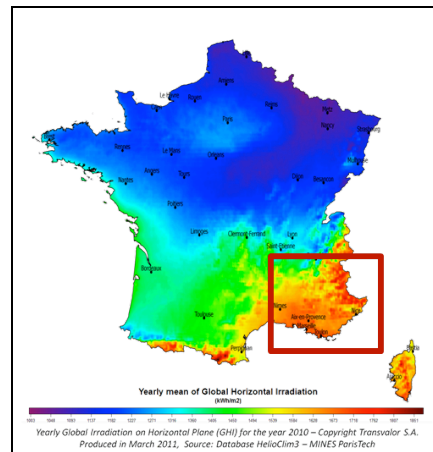


Figure 1: PACA Region

Ground measurements from 30 Météo-France stations spread in the area of interest have been used for calibration. Several initiatives providing atlases at a coarse scale (1/3 000 000) already exists but there is no such tool presently available at local level scale e.g. 1/250 000.

This pilot provides several innovations that benefit to local decision makers:

- Scale refinement methodology of the solar radiation maps which will be suitable for local decisions (Figure 2)
- Replicable and scientifically validated methods of creation of such atlases by the consortium of the ENDORSE project
- Combination of irradiance and other meteorological data (e.g. temperature) with additional geospatial data (e. g. elevation, land cover, in-situ measurements) to intervene in decision-making process (Figure 3)

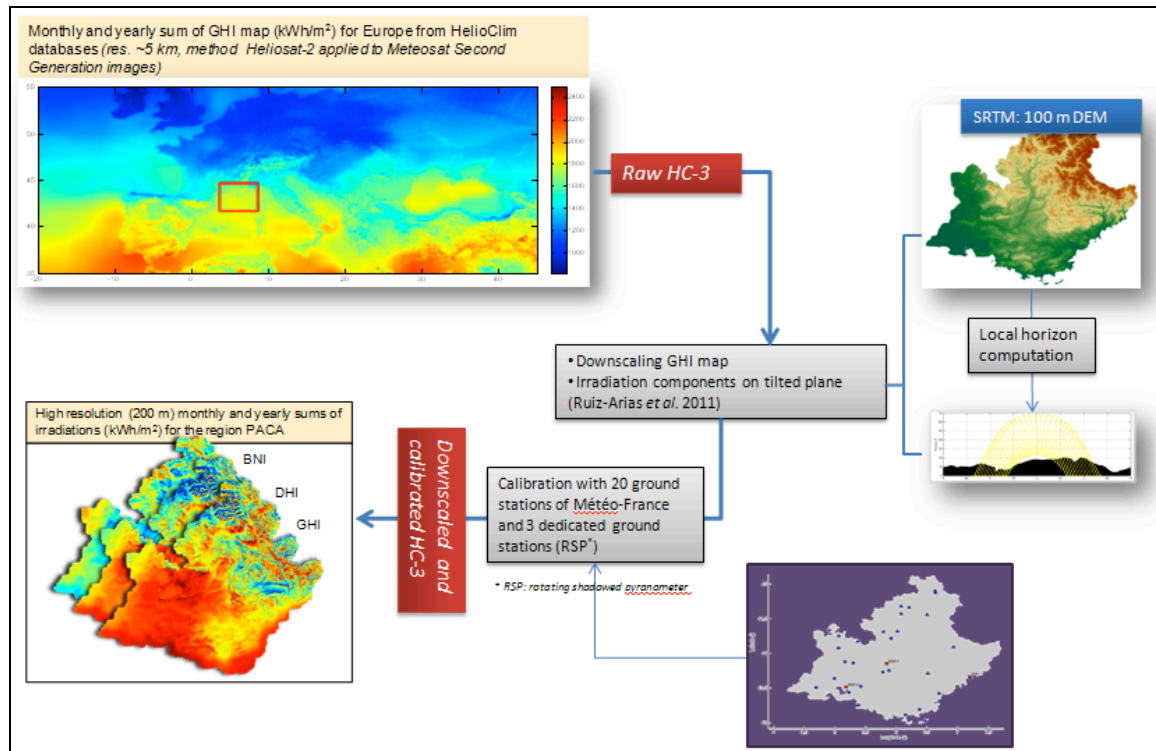


Figure 2: Overview of the solar processing (downscaling + calibration)

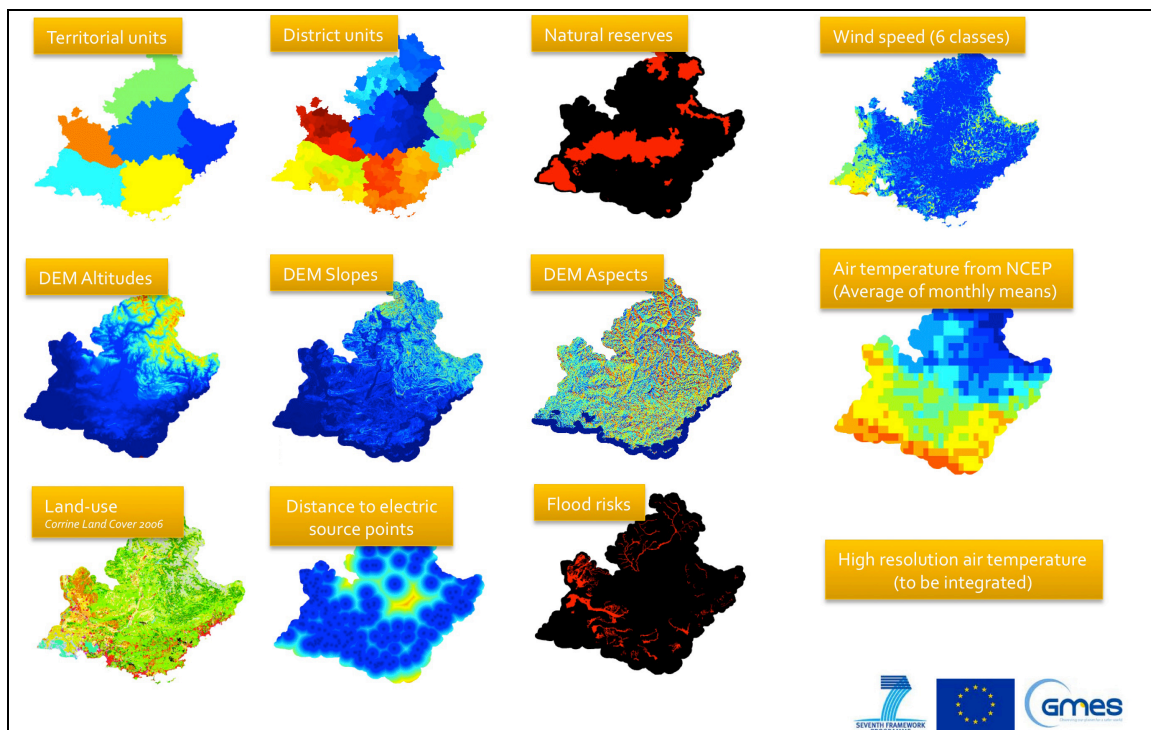


Figure 3: Additional GIS layers for solar energy usages

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

To support the creation of atlases a portfolio of resources layers including high-resolution irradiation maps of Global Horizontal Irradiation (GHI) Diffuse Horizontal Irradiation (DNI) Beam Horizontal Irradiation (BNI) and additional GIS layers for solar energy usages as been provided (see **Table 1: Contributed Resources**).

Provider	Resources	Components Format
MINES ParisTech	Irradiation maps (GHI, DNI, BHI) Temperature maps	OGC Web Map Services
MINES ParisTech	Elevation and Slopes from SRTM DEM	OGC Web Map Services
Ministère de l'Écologie, du Développement Durable, des Transports et du Logement	Land Cover from Corine Land Cover 06 (CLC06)	OGC Web Maps Services
Ministère de l'Écologie, du Développement Durable, des Transports et du Logement	Wind speed classification (10 meter high mean speed) from CARMEN DREAL PACA	OGC Web Map Services
Institut national de l'information géographique et forestière (IGN)	Natural and protected areas, administrative limits from GEOFLA® database	OGC Web Map Services
Università degli Studi di Genova (UNIGE)	Air temperature at 2-meter height. Pointwise uncertainty in air-temperature mapping.	OGC Web Map Services

Table 1: Contributed Resources

The overall infrastructure provide the necessary functionalities to allow users and stakeholders to search, find, discover, view, access and exchange the resulted maps and layers. Attention has been paid to ensure that GEOSS recommendations on interoperability have been taken into account along the maps and layers production life cycle.

As an OGC (Open Geospatial Consortium) member, MINES ParisTech has emphasized the use of GEOSS accepted standards enabling the “search, find, bind” paradigm. This includes OGC WMS (Web Map Service), OGC WFS (Web Feature Service), OGC CSW (Catalogue Service for the Web) and ISO Metadata.

A WebGIS client allowing end users to view and to browse map results has been developed.

3.3 Scenario Events

Legend: Services in blue Products in red Actors in orange

Steps	Description	Number (#) and Use Case Description
00	Local policy planners, private investors and/or installers of renewable energy systems (GEOSS User) are searching for resources regarding solar energy for decision making on a local area. These resources as a form of Web Services are discovered through the GEO Portal and/or the Webservice-Energy Catalog. The GEO Portal and/or the Webservice-energy Catalog provide minimum information about available services and how to	D1. Search for resources in Registry, Clearinghouse, Community Catalogs and Portals.

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

	access them. This includes GEOSS Data CORE and Helper Application information.	
01	Based on resources found at Step 00 and thanks to the Helper Application link, the GEOSS User accesses a WebGIS client on the Energy Community Portal displaying available energy related resources. Those resources are available on the Energy Community Portal Geoserver as OGC Web Services . The GEOSS User can triggers on demand OGC Web Services (WMS, WFS) to perform site siting and/or site sizing analysis in order to come-up with decision making. The GEOSS User can download the corresponding map layers allowing him to run legacy desktop client applications .	A1. Access web maps services and display a composite map to the user. A3. Access data from using a service that allows for user selection of data returned based on content. A6. Exploit - visually and analytically- in Client Applications.
02	The WebGIS client as well as all Solar Radiation and related geographical meteorological Web Services have been previously harvested by the GEOSS Discovery and Access Broker (DAB) by the GEOSS Resource Provider . In order to allow Search & Discovery mechanism the GEOSS Resource Providers have previously registered all OGC Web Services within the OGC/CSW Webservice-energy Catalog . The GEOSS Resource Provider has created the appropriate Metadata and ingested this into the Catalog to allow harvesting by the GEOSS Clearinghouse and/ the GEOSS Discovery and Access Broker (DAB) .	P1. Register resources in GEOSS Components and Services Registry (CSR) or Community Catalog. P2. Deploy services for use in GEOSS P3. Service Provider tests its deployed service using a proper Test tool discovered in the GEOSS CSR.
03	Reference to the GEOSS Resource Provider datasets as well as IPR (Intellectual Properties Rights) and data quality, will be provided if appropriate within the WebGIS Client .	P1. Register resources in GEOSS Components and Services Registry (CSR) or Community Catalog. A6. Exploit - visually and analytically- in Client Applications.

Legend: *Services in blue Products in red Actors in orange*

Table 1 – Steps in the Energy Scenario

3.4 Post-Conditions

NA

3.5 Special Requirements

NA

4. System Model of the Scenario

The GEOSS Unified Modeling team engineering report has provided the depiction and expresses the Reference Model of the Open Distributed Processing (RM-ODP) viewpoint using the Unified Modeling Language as the syntax. This has been done by expressing the Enterprise View Point (Figure 4) for the Energy scenario as described in ISO/IEC 10746:1996 Part 3 Reference Model ODP Architecture. A detailed description of this development can be found in the Unified Modeling ER:

(http://www.ogcnetwork.net/pub/ogcnetwork/GEOSS/AIP5/documents/AIP5Docs/Technical/SystemDesign/AIP-5_GEOSS_Unified_Modeling_Team_Engineering_report.doc).

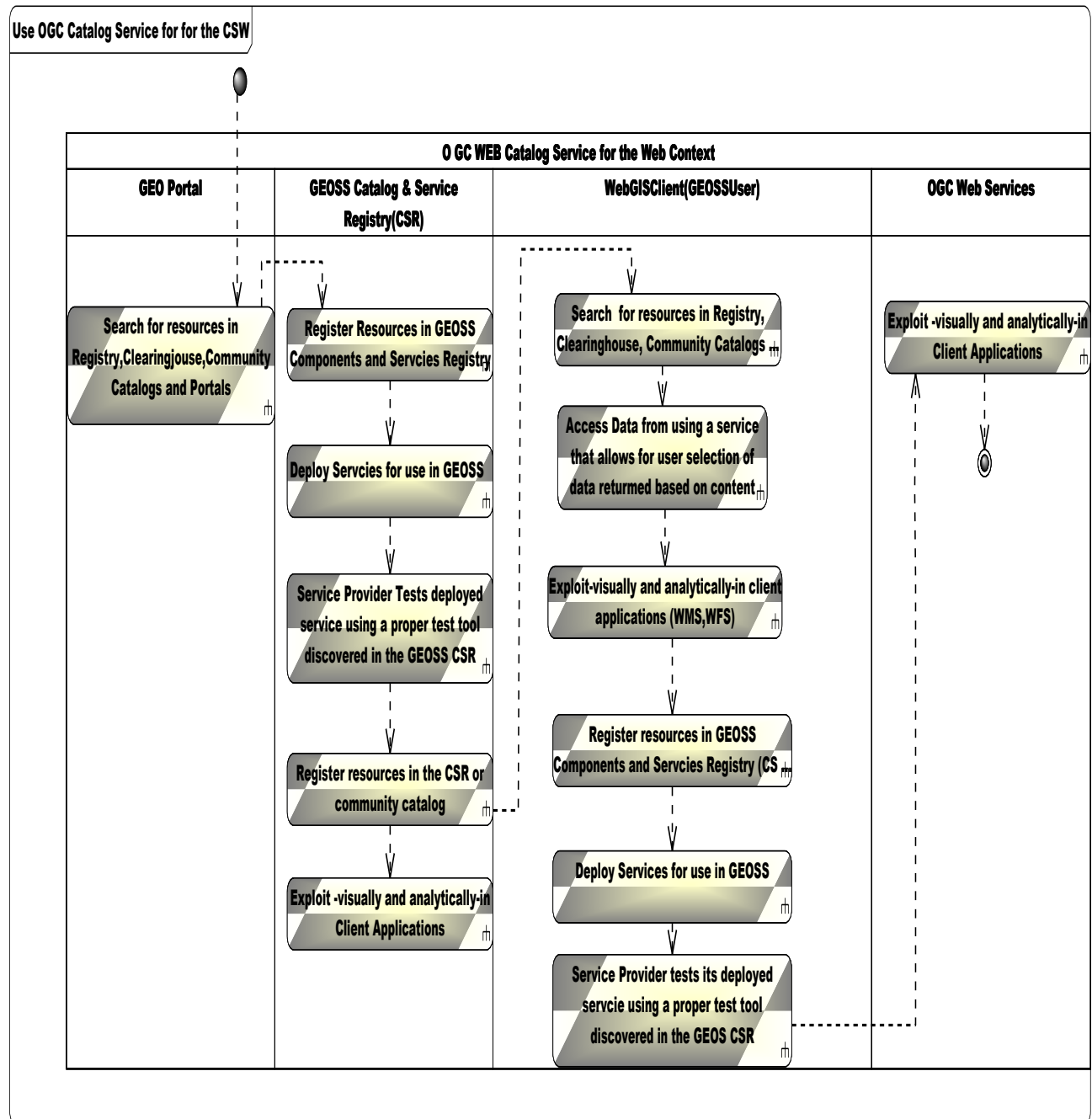


Figure 4: Enterprise View Point "Use OGC Catalog Service"

5. Use Cases

5.1 AIP Engineering Use Cases

The GEOSS AIP Architecture approach supports the several SBA communities with a reusable process of SBA

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

Scenarios and Engineering Use Cases.² Scenarios are implemented by use cases. Use cases describe reusable functionality of the GEOSS service oriented architecture implemented through Interoperability Arrangements.

A summary of GEOSS AIP Use Cases is shown in Figure 5 with details provided in the following tables. In addition to the actors shown in Figure 5 the GEOSS Actors involved in GEOSS use cases are listed in Table 2.

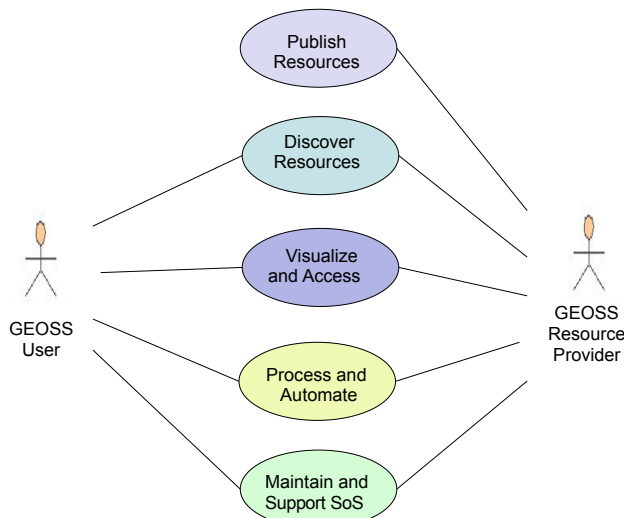


Figure 5 – GEOSS AIP Use Case Summary Diagram

Table 2 – GEOSS Actors

Actor	Description	Role Type
GEOSS User	Discovers, consumes, and exploits GEOSS resources	Principal
GEOSS Resource Provider	Deploys, operates, registers GEOSS resources	Principal
SBA Integrator	Builds network of organizations and components to achieve objectives on an SBA community	Secondary
GCI Operator	Operates GCI components and approves registrations	Administrative

Table 3 – Publish Resources Use Cases

Name	Description	Actors (may be optional)
P1. Register Resources (AIP-3 ER: 1)	Register resources in GEOSS Components and Services Registry (CSR) or Community Catalog	<ul style="list-style-type: none"> • GEOSS Resource Provider • SBA Integrator – optional • GCI Operator – optional
P2. Deploy a Service (AIP-3 ER: 2)	Deploy services for use in GEOSS.	<ul style="list-style-type: none"> • GEOSS Resource Provider • SBA Integrator – optional
P3. Test a Service (AIP-3 ER: 09)	Service Provider tests its deployed service using a proper Test tool discovered in the GEOSS CSR.	<ul style="list-style-type: none"> • GEOSS Resource Provider • SBA Integrator – optional
P4. Develop SBA network (AIP-3 ER: 14)	Identify resources in particular services relevant to an SBA. Promote concerted use on a larger-scale	<ul style="list-style-type: none"> • SBA Integrator • GEOSS Resource Provider

² For details, see “AIP Development Process,”

http://earthobservations.org/documents/cfp/201202_geoss_cfp_aip5_development_process.pdf

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

Table 4 – Discover Resources Use Cases

Name	Description	Actors (may be optional)
D1. Search for Resources (AIP-3 ER: 4)	Search for resources of interest. Variations: user initiated (e.g. GWP), process initiated, searching data sharing conditions.	<ul style="list-style-type: none"> • GEOSS User
D2. Aggregate Metadata ³ (AIP-3 ER: 3)	Harvesting and/or query metadata from community catalogs or services via GEOSS Clearinghouse	<ul style="list-style-type: none"> • GEOSS Resource Provider • SBA Integrator • GCI Operator
D3. Conduct semantic search (AIP-3 ER: 13)	Utilize mediated vocabularies to extend GEOSS search queries across disparate domains or communities.	<ul style="list-style-type: none"> • GEOSS User
D4. Semantic mapping (AIP-3 ER: 12)	Register, mediate, and map between disparate vocabularies used to describe GEOS resources.	<ul style="list-style-type: none"> • SBA Integrator • GEOSS Resource Provider • GCI Operator
D5. Launch Enabler App (AIP-4)	Associated with resources discovered in GCI are enabler applications, e.g., clients. User launches help application including context from previous search.	<ul style="list-style-type: none"> • GEOSS User

Table 5 –Visualize and Access Use Cases

Name	Description	Actors (may be optional)
A1. Web Mapping (new)	Access web maps services and display a composite map to the user. Allow user to modify map layers. Variation: include use of portrayal service	<ul style="list-style-type: none"> • GEOSS User
A2. Access files (new)	Retrieve a file from an access server using FTP. Variations include: user-initiated, process-initiated.	<ul style="list-style-type: none"> • GEOSS User if user initiated.
A3. Access data via services (AIP-3 ER: 5&6)	Access data from using a service that allows for user selection of data returned based on content. Variation: use of Access Broker	<ul style="list-style-type: none"> • GEOSS User if user initiated
A4. User Authentication (new)	User login with single sign-on (SSO). May used with Use Cases: A2, A3, W1. Variations: user-initiated, process-initiated.	<ul style="list-style-type: none"> • GEOSS User
A5. Access with Acknowledgement (new)	May used with Use Cases: A2, A3, W1. Variations: user-initiated, process-initiated.	<ul style="list-style-type: none"> • GEOSS User
A6. Exploit Data (AIP-3 ER: 7)	Exploit - visually and analytically- in Client Applications using information retrieved through access use cases.	<ul style="list-style-type: none"> • GEOSS User

³ See also the Catalog Use Case in "OGC Engineering Report: Water Information Services Concept Development Study," OGC Document 11-013r6, 2011-07-012.

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

Table 6 – Process and Automate Use Cases

Use Case	Description	Actors
W1. Execute Processing Service (AIP-3 ER: 11)	Invoke a processing service, to produce new derivative data resources. Variations: user-initiated, process-initiated	<ul style="list-style-type: none"> • GEOSS User
W2. Construct and Deploy Workflow (AIP-3 ER: 8)	Design, deploy and execute a workflow. Described in Business Execution Language (BPEL) or any other script language.	<ul style="list-style-type: none"> • SBA Integrator • GEOSS User
W3. Process with Waiver or License (new)	Use metadata containing information about the waiver or license to handle aggregation of data, derived data, re-use of data, and layered data.	<ul style="list-style-type: none"> • GEOSS User if user initiated

Table 7 – Maintain and Support Use Cases

Use Case	Title	Actors
M1. Register Interoperability Arrangements (AIP-3 ER: 10)	Register Interoperability Arrangements in the GEOSS SIR	<ul style="list-style-type: none"> • GEOSS Resource Provider • SBA Integrator • GCI Operator
M2. Share Best Practices (AIP-3 ER: 15)	Create a Best Practice relevant to GEOSS in the GEOSS BP Wiki	<ul style="list-style-type: none"> • GEOSS User • GEOSS Resource Provider • SBA Integrator • GCI Operator
M3. Monitor Services (AIP-3 ER: 10)	Services registered with GEOSS are routinely monitored for network connectivity and application response.	<ul style="list-style-type: none"> • GCI Operator
M4. User Registration (new)	User information is provided to a centralized authentication server to support single sign-on (SSO) with GEOSS providers.	<ul style="list-style-type: none"> • GEOSS User • GCI Operator
M5. Metrics Management (new)	GEOSS data provider, or GCI, gathers access and use metrics and stores information for reporting to the GCI. Variations: reports pushed, reports available for query	<ul style="list-style-type: none"> • GEOSS User • GEOSS Resource Provider • GCI Operator

5.2 Specialized Use Cases

NA

6. Implementation

6.1 Deployed Components

In order to provide the portfolio of maps to the GEOSS users all the granular layers and associated information have been deployed in order to make them discoverable and accessible. Consequently several interoperable components have been provided including:

- A Community Portal
- A GeoServer hosting OGC compliant Web Services

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

- A Catalog providing standard ISO Metadata for dissemination
- Geodata Visualization aka WebGIS client

The AIP-5 Energy Atlas Scenario Wiring Diagram (

Figure 6) below shows how components are linked together with a detailed description of each of those components with screenshots shown hereafter.

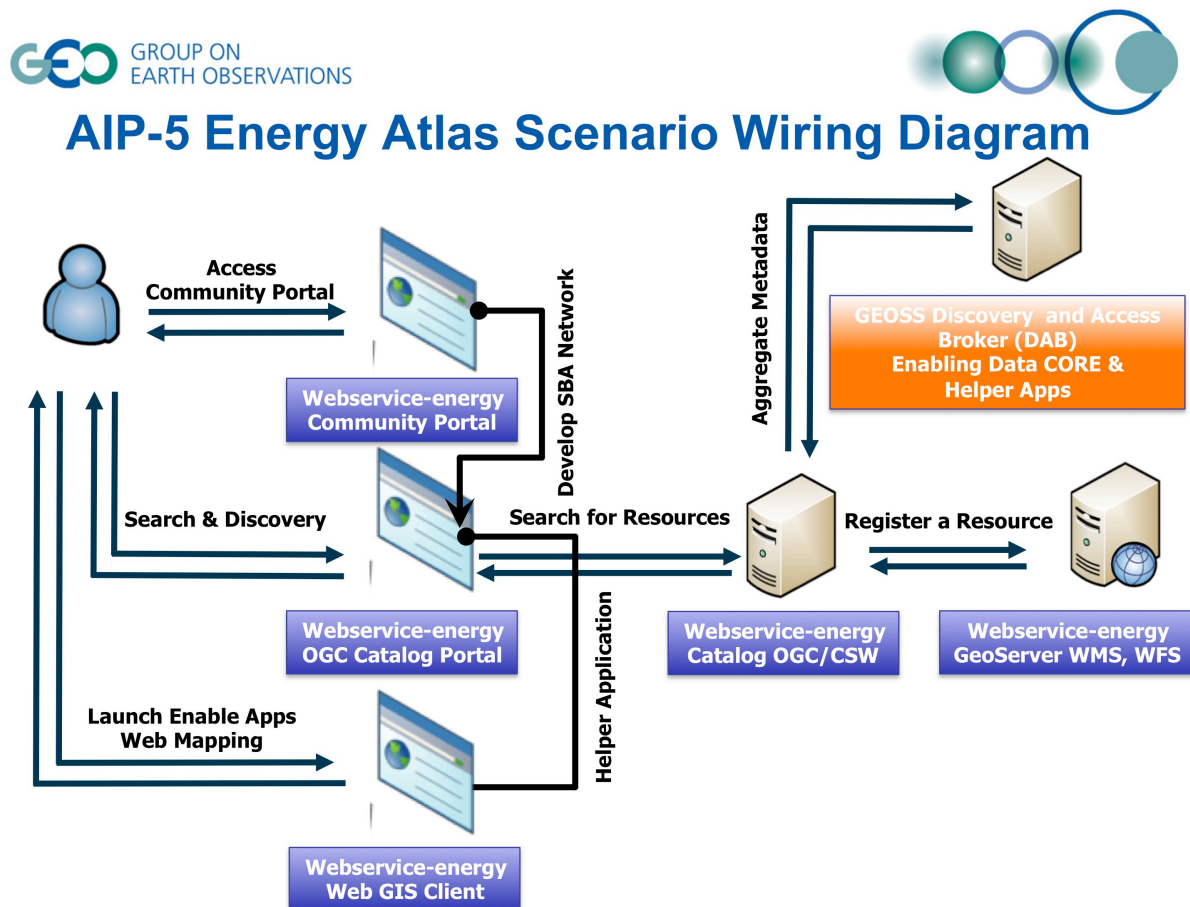


Figure 6: AIP-5 Energy Atlas Scenario Wiring Diagram

As a whole this architecture follows and enables the GEOSS “Search, Find, Bind” recommendations.

- **The GEOSS Energy Community Portal** – www.webservice-energy.org
 - Several OGC, Web Map Services (WMS) and Web Processing Services (WPS) giving access to Solar Energy, Wind Energy, Elevation, Shadow and Environmental Impact Assessment maps, datasets and Algorithms. This [Energy Community Portal](http://www.webservice-energy.org) is registered in the [GEOSS Registry](http://www.geo.gov.ge) since 2009.

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

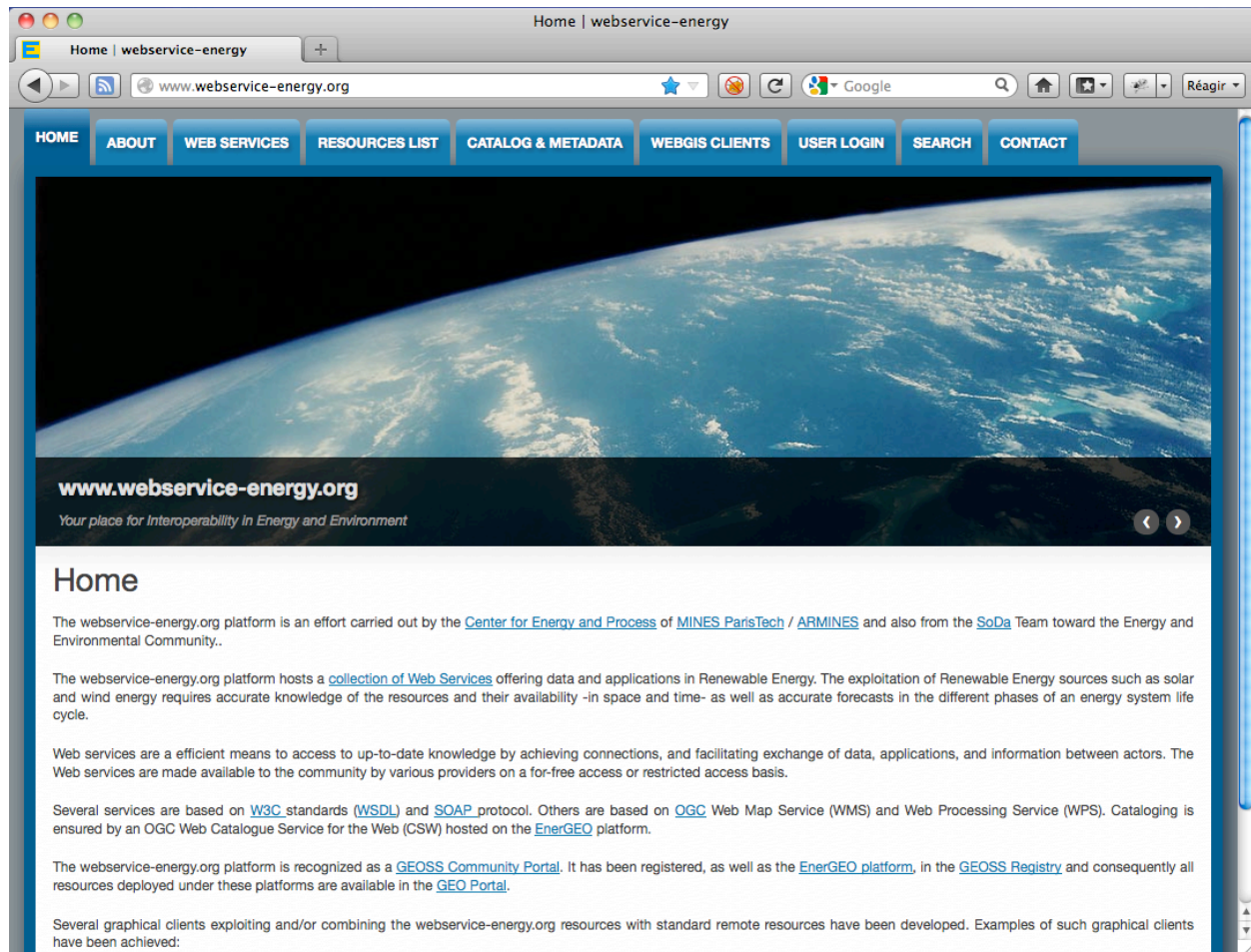


Figure 7: Webservice-energy.org GEOSS Community Portal

- **A Geographical Server**
 - Hosted under the Energy Community Portal domain, this GeoServer (Figure 8) provides several hundreds of resources as WMS and WFS. The subset Atlas layers are accessible via this GetCapabilities URI:
 - <http://geoserver.webservice-energy.org/geoserver/wms?service=wms&AcceptVersions=1.1.0&request=GetCapabilities&name=space=paca>

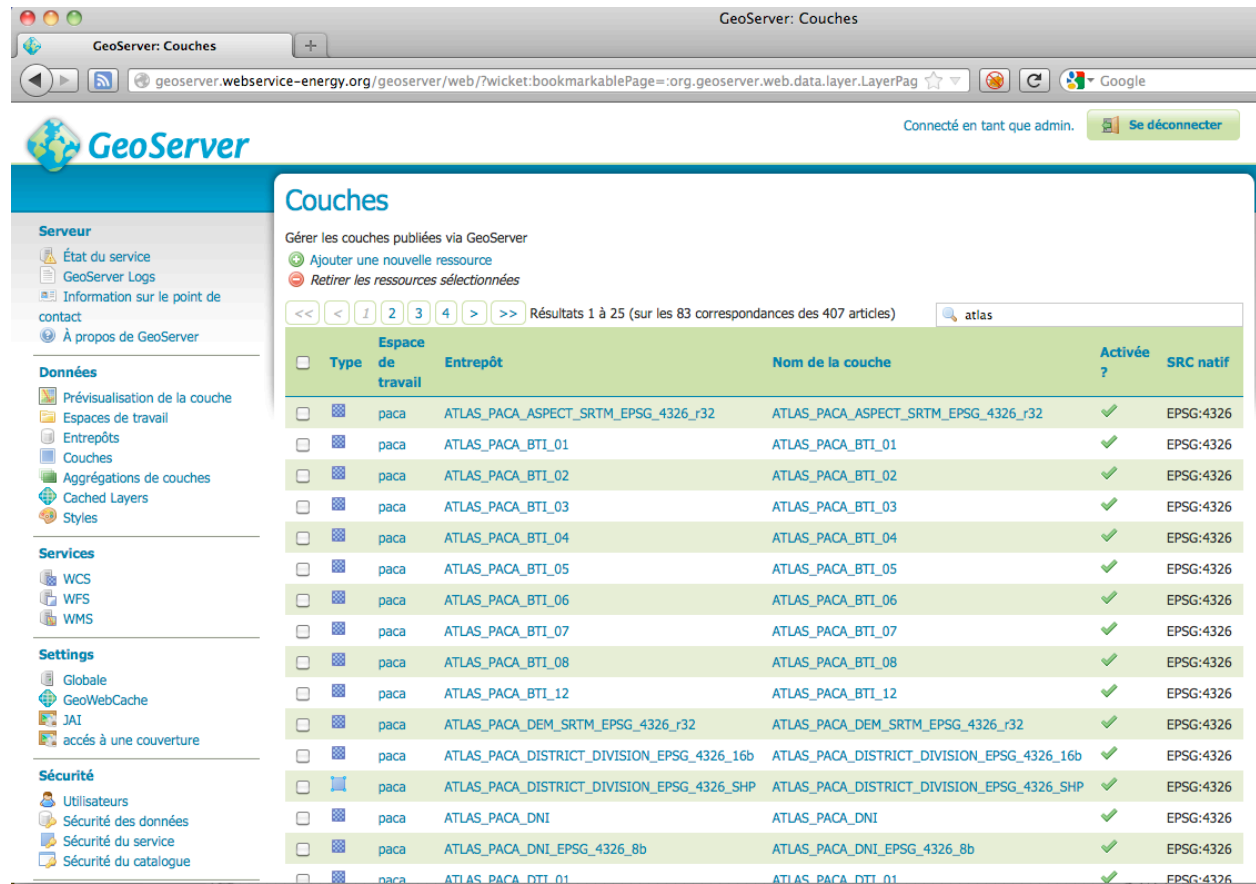


Figure 8: Webservice-energy.org GeoServer

Some of the WMS layers in AIP-5 Energy Atlas scenario are provided as floating point-based GeoTIFF. The floating-point based GeoTIFF format offers the possibility to directly store "real" physical data, without linear or look-up table encoding in 8 bits or 16 bits (signed or unsigned).

This possibility is interesting when handling such GeoTIFF data directly with GIS software or WebGIS client such as the one developed in this project because the correspondence with the quantity of interest is straightforward.

In the framework of Web Map Service, GeoServer offers the possibility to generate 8 bits RGB standard image for visualization purpose with a WMS, while value at a given location can be directly retrieved (without decoding) thanks to a specific request of the WMS named GetFeatureInfo. It is also interesting to note that floating-point based GeoTIFF easily handle "no value data" thanks to the Nan (Not A Number) value of the IEEEFP standard for float encoding. It is also to be noted that single precision floating-point encoding with 32 bits (single or float) generally provides enough precision for standard data storage.

The benefit of such encoding approach of WMS using floating point-based GeoTIFF is illustrated in Figure 18 where the WebGIS client displays physical measurement result form a GetFeatureInfo request on a WMS layer after a user click on a given layer.

In Annex 1 two tutorials regarding the generation of float32 GeoTIFF are provided:

1. How to write a float32 TIFF image with Matlab and in C with libtiff
2. How to create a GeoTIFF from a TIFF ?

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

- **An OGC Catalog Service for the Web (CSW)** (<http://geocatalog.webservice-energy.org>). During the AIP-5 framework MINES ParisTech has deployed an OGC CSW Catalog. This catalog offers a single Internet access point for GEOSS users seeking data, datasets, services, maps, imageries, algorithms,... related to energy and environment relevant to all parts of the globe (Figure 9).
- The Webservice-energy catalog is built on the GeoNetwork catalog application (<http://geonetwork-opensource.org/>).



Figure 9: Webservice-energy.org Community Catalog

This catalog enables GEOSS resources providers to register and publish, data and services, to a directory (such as a registry or catalog). It consequently allows publishing of service metadata describing the capabilities of the services and the network address.

Visualization of related information such as “GEOSS Data CORE” and “GEOSS Helper Application” are crucial for the GEOSS user.

- GEOSS Data Collection of Open Resources for Everyone (Data-CORE) is a distributed pool of documented datasets, contributed by the GEO community under the following principles, as set forth in the 2010 GEOSS Action Plan:
- The data are free of restrictions on re-use;
 - User registration or login to access or use the data is permitted;
 - Attribution of the data provider is permitted as a condition of use; and
 - Marginal cost recovery charges (i.e., not greater than the cost of reproduction and distribution) are permitted.

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

- GEOSS Helper Application provides additional capabilities upon a dataset, a service or a given resource discovery process. An additional capability could for example link a remote URL based WebGIS client to a metadata record in order to enable such resources to be bind with the most appropriate client as specified and advertise by the GEOSS resource provider upon metadata creation.

In AIP-5, new developments have been carried out in order to enhance the capability of this catalog to provide the GEOSS users with such information if made available by the GEOSS resource provider.

Resources provided in the catalog are recorded as ISO 19139 metadata. In this ISO profile a keywords field is available. This field has been use to provide (if decided by GEOSS resource provider) GEOSS Data-CORE information by adding to the record description the following keywords recommended by GEOSS: *GEOSS Data CORE*, *geossDataCore*, *geossNoMonetaryCharge*. By doing so the GEOSS resource provider provides the necessary information related to the use and constrains attached to its resources (Figure 10).

The screenshot displays the 'WELCOME TO THE WEBSERVICE-ENERGY CATALOG' interface. At the top, it shows 'Aggregate Results matching search criteria : 11-12/12 (page 2/2) , 0 selected'. Below this, there are controls for 'Select : all, none' and 'actions on selection', along with a 'Sort by Relevance' dropdown. The main content area features the 'ATLAS_PACA_BTI DATASET' entry. It includes a logo for MINES ParisTech, an abstract describing the 'Solar Atlas of Provence-Alpes-Cote d'Azur', keywords such as 'Insolation, Irradiance, Irradiation, Beam, Tilted, BTI, Helioclim, MINES ParisTech, GEOSS Data CORE, geossDataCore, geossNoMonetaryCharge, OGC, WMS, France, Provence Alpes Cote d'Azur, PACA', a schema of 'iso19139', and an extent of '3.91625 42.91667 8.01625 45.41667 2004-01-01T00:00:00 2010-12-31T23:45:00'. To the right of the text is a map thumbnail showing a geographical area with a color gradient from blue to red. At the bottom of the entry, there are three buttons: 'Metadata', 'Helper Application', and 'Interactive Map'.

Figure 10: GEOSS Data-CORE tags in ISO 19139 Metadata

To ease the access to GEOSS Data-CORE resource a dedicated category has been created in the Webservice-energy catalog category list. Any resource that is flagged with the GEOSS Data-CORE keywords can be promoted in this category (Figure 11).

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

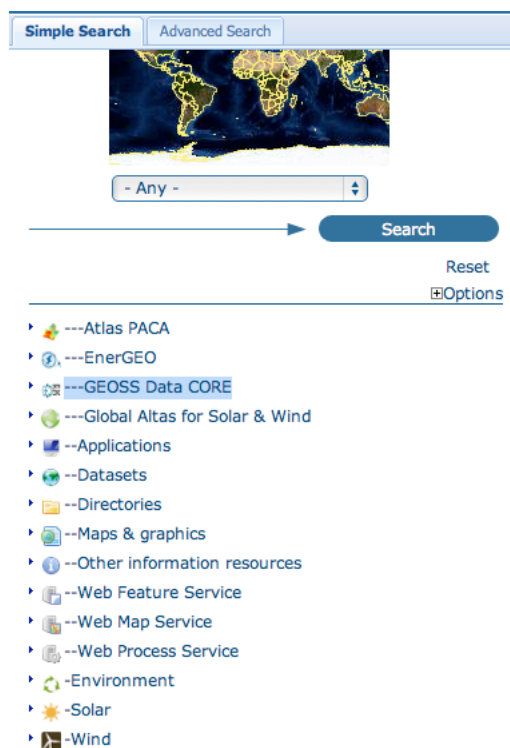


Figure 11: GEOSS Data CORE category

Figure 12 shows the GEOSS Data CORE resources in context after a click on GEOSS Data CORE category link. As expected all “Keywords” section of available records contains the *GEOSS Data CORE*, *geossDataCore*, *geossNoMonetaryCharge* keywords.

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

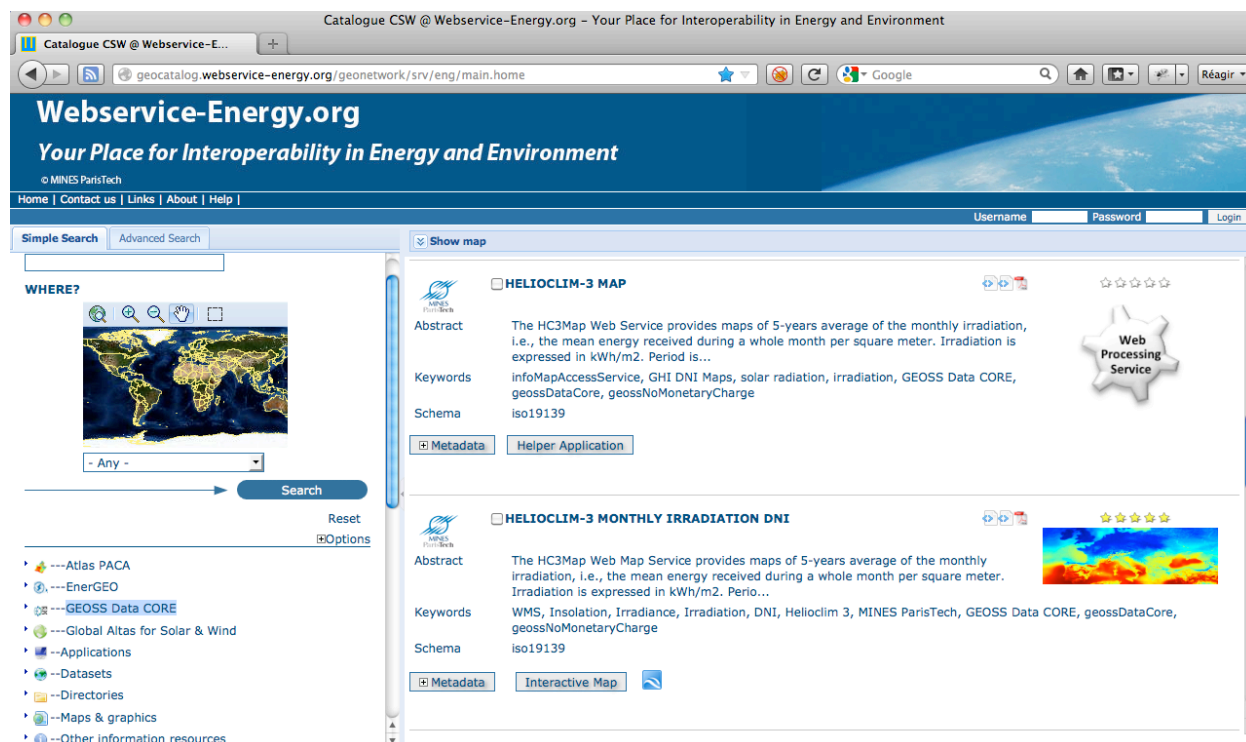


Figure 12: Resources display of the GEOSS Data CORE category

On Figure 13 one can see that a “Helper Application” button is available as an action button from the result summary view. This feature has been developed on the Webservice-energy catalog to enable a GEOSS resource provider to decide upon metadata creation what is, according to his knowledge and wishes, the best application to consume his resources. When this feature is enable it provides GEOSS user with a button named “Helper Application” that link the given resources to a URL based application in order to consume as best as possible the discovered resource.

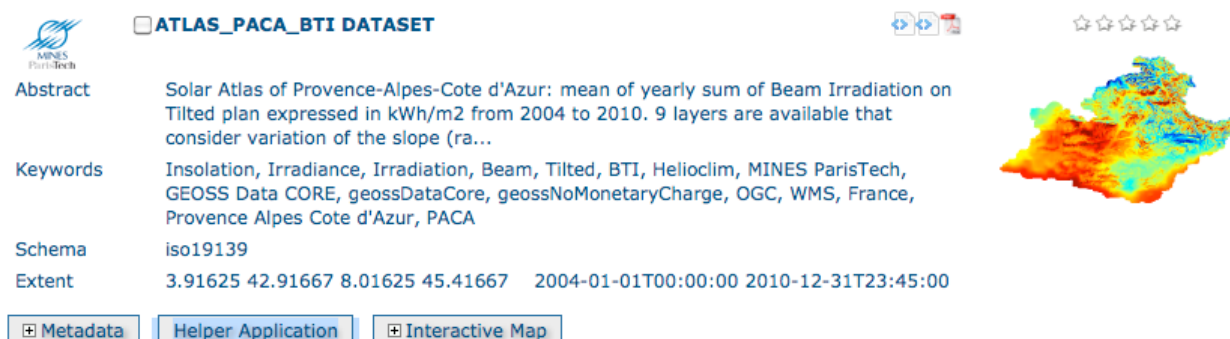


Figure 13: "Helper Application" action button

This new feature takes benefit from existing ISO 19119 metadata fields namely the “Partner web address (URL)” in the “Distribution Information” section. Figure 14 shows an excerpt of the metadata record in edit mode in the catalog where the GEOSS resource provider could simply add the link to the Helper Application he wish to attached to his resource.

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

Figure 14: "Helper Application" Metadata field in edit mode

Figure 15 shows the same section of the metadata resource in XML.

```

</gmd:CI_OnlineResource>
</gmd:onLine>
<gmd:onLine>
  <gmd:CI_OnlineResource>
    <gmd:linkage>
      <gmd:URL>
        http://www.webservice-energy.org/viewer/heron/applications/atlas-paca/
      </gmd:URL>
    </gmd:linkage>
    <gmd:protocol>
      <gco:CharacterString>WWW:LINK-1.0-http--partners</gco:CharacterString>
    </gmd:protocol>
    <gmd:name>
      <gco:CharacterString>Helper Application</gco:CharacterString>
    </gmd:name>
    <gmd:description>
      <gco:CharacterString>GEOSS Helper Application</gco:CharacterString>
    </gmd:description>
  </gmd:CI_OnlineResource>
</gmd:onLine>
</gmd:MD_DigitalTransferOptions>
</gmd:transferOptions>

```

Figure 15: Helper Application ISO 19139 Metadata in XML view

In order to provide this custom “Helper Application” action button to appear when a GEOSS data provider fills the “Partner web URL” field some enhancements of the search-results-xhtml.xml file have been performed. The “Helper Application” label has been hard coded and consequently does not take into accounts I18n options. Excerpt of the search-results-xhtml.xml file containing the creation of the “helper Application” custom button is provided below.

```

<xsl:if test="$metadata/geonet:info/download='true'">

  <xsl:choose>
    <xsl:when test="count($metadata/link[@type='url'])>1">
      <xsl:choose>
        <xsl:when test="$remote=true()">
          <button class="content"
            onclick="load('{/root/gui/locService}/remote.show?id={ $metadata/geonet:info[server]/i\
d}&currTab=distribution')" title="Related URL">
            Related URL
          </button>
        </xsl:when>
        <xsl:otherwise>
          <button class="content"
            onclick="load('{/root/gui/locService}/metadata.show?id={ $metadata/geonet:info/id}&currTab=distribution')" title="Related URL">
            Related URL
          </button>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:when>
  </xsl:choose>

```

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

```

;currTab=distribution')" title="Related URL">
    Related URL
  </button>
</xsl:otherwise>
</xsl:choose>
</xsl:when>
<xsl:when test="count($metadata/link[@type='url'])=1 and
$metadata/link[@type='url'] != "">
    <button class="content"
onclick="load('{ $metadata/link[@type='url']}')" title="Related URL">
        Related URL
    </button>
</xsl:when>
</xsl:choose>
</xsl:if>

```

As a result, the GEOSS user by clicking on this link will be redirected to the WebGIS client that has been developed for consuming this resource.

- **A Geodata Visualisation Client (WebGIS Client)**

MINES ParisTech has developed a customized geographic WebGIS client (Figure 16, Figure 17, Figure 18) (<http://www.webservice-energy.org/viewer/heron/applications/atlas-paca/>) to allow GEOSS users to select and display geographic layers for a particular area of interest. This WebGIS client is based on the Heron Mapping Client (MC) available under the GNU GPL v3 license (<http://heron-mc.org/index.html>) that facilitates the creation of browser-based web mapping applications with the GeoExt JavaScript toolkit.

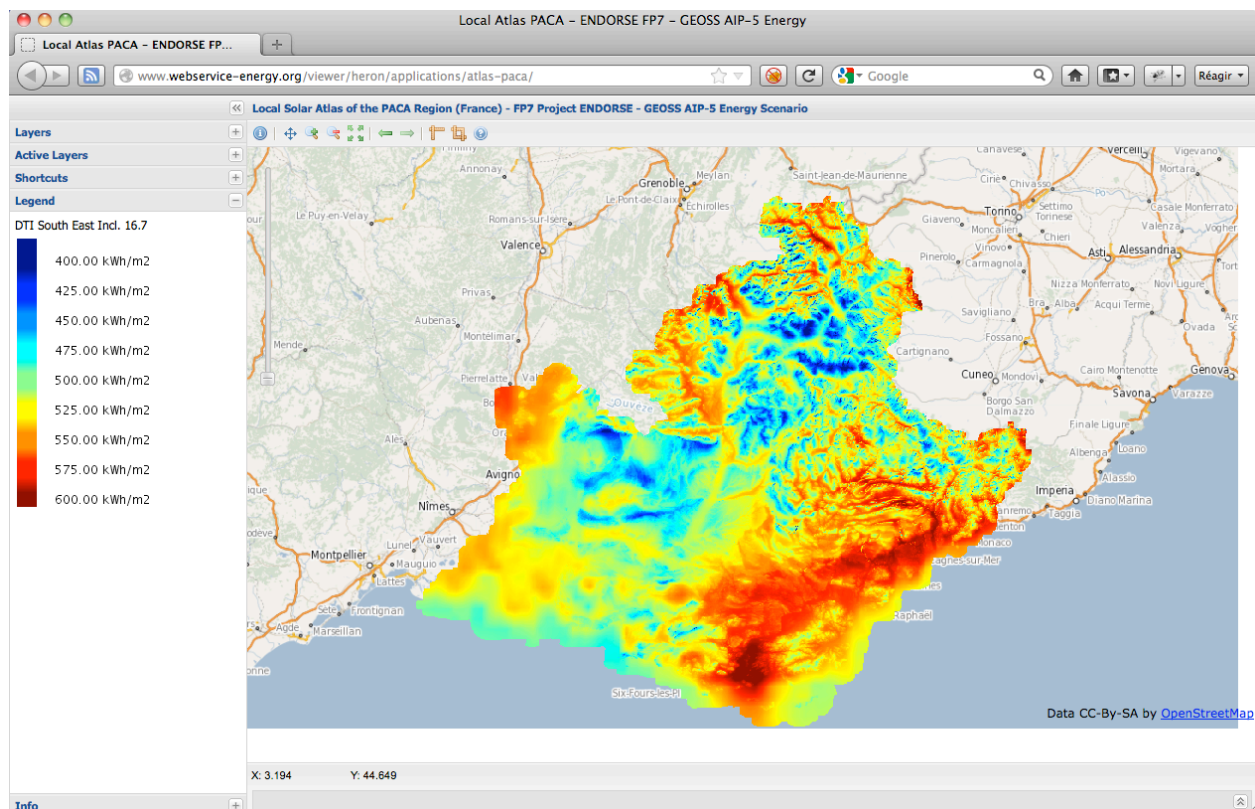


Figure 16: WebGIS client showing a WMS layers and its associated legend

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

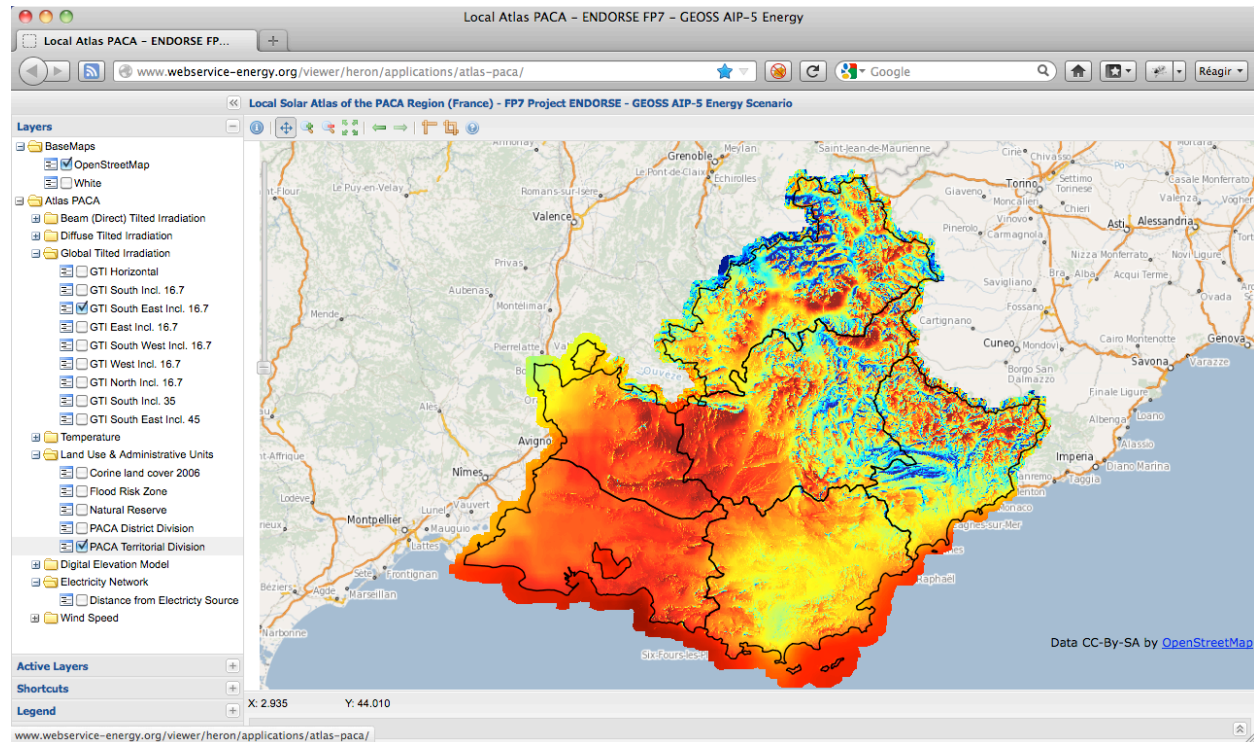


Figure 17: WebGIS client showing tree layer structure and PNG /Shape-file overlay

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

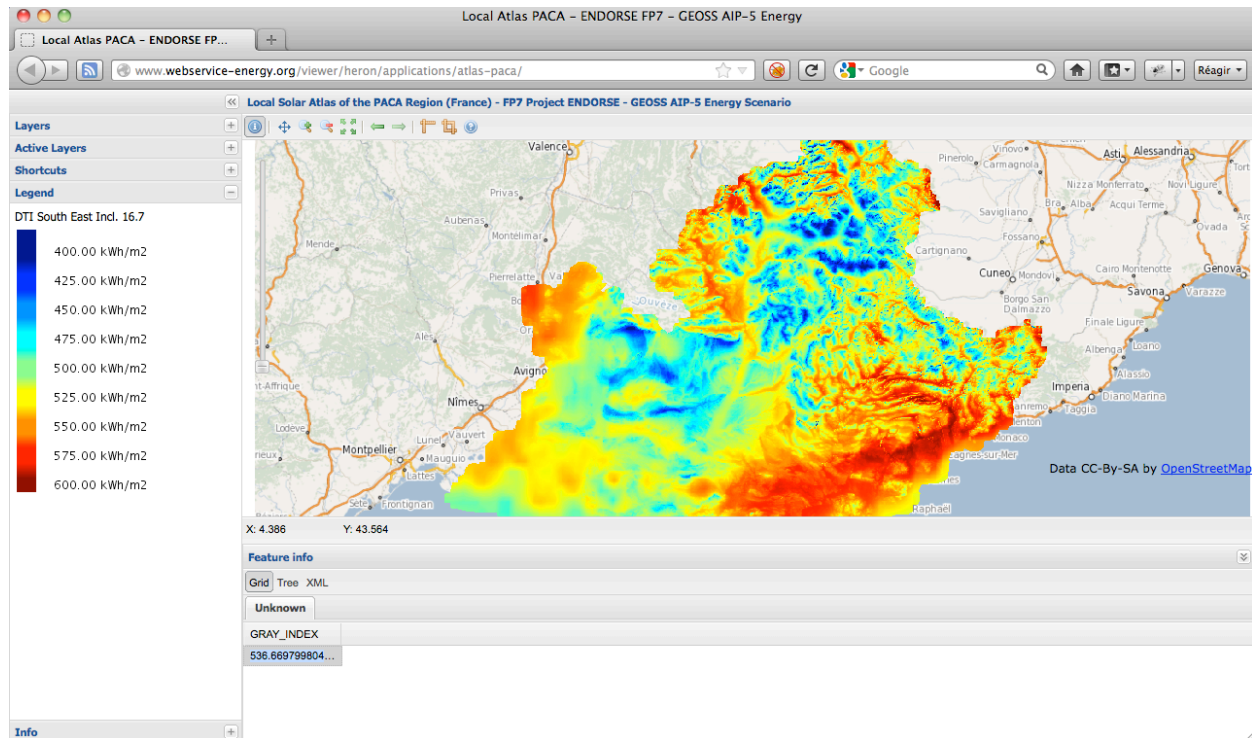


Figure 18: WebGIS client displaying physical measurement result form a GetFeatureInfo request on a WMS layer

6.2 Interoperability Arrangements

N/A

6.3 Use of the GCI

In collaboration with the GCI Research WG, the MINES Paris Tech Web Service Energy catalog was integrated as a new available resource in the GEOSS Common Infrastructure (GCI) through the GEO Discovery and Access Broker (GEO DAB). The catalog is accessed through a CSW/ISO interface. A set of test was performed to assess the correctness of the integration. As far as the metadata discovered via the GEO DAB, no bug was identified in the Broker middleware component (GEO DAB). After this assessment, the catalog was integrated in the operational GCI. Presently the catalog provides more than 200 records with 11 GEOSS Data Core entries (01/02/2013).

Besides the above, the GCI Research and Energy WGs experimented the use of *Helper Applications*. In a nutshell, when the user finds a dataset of interest for her/his research, it is often the case that she/he is not provided with any tool which is able to access and exploit that dataset. A *Helper Application* is a client application that is able to access and/or visualize a dataset provided through:

- One or more web service protocols;
- One or more encoding formats.

To provide users with a set of *Helper Applications*, it is needed to enrich providers' metadata record with the needed information to access the data with one or more *Helper Applications*. Moreover, when the discovered metadata record already provides a *Helper Application*, this should be marked as the provider's *recommended* *Helper Application*.

In the context of AIP-5, the GCI Research WG enhanced the GEO DAB to support such functionalities. A detailed description of this development can be found in the GCI Research ER (<http://www.ogcnetwork.net/pub/ogcnetwork/GEOSS/AIP5/documents/AIP5Docs/Technical/GCIResearch/GEOSS-AIP-5-GCIResearch-ER.pdf>).

The experimentation with Energy WG focused on the recognition of provider recommended *Helper Application*. In

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

fact, as described above, the catalog provides this information for datasets that can be exploited on the WebGIS client. The test was done using the GEO DAB test client. Figure 19 depicts a set of results from the MINES ParisTech Web Service Energy catalog and the associated Helper Application highlighted as a Provider Recommended Helper Application (i.e. in green). Instead, when a generic Helper Application is linked to a discovered dataset, this is shown as in Figure 20.

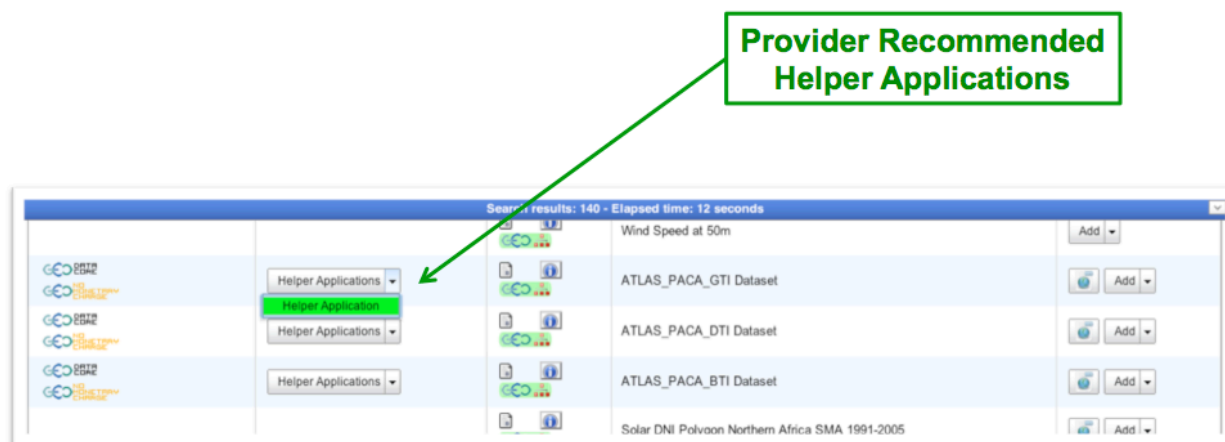


Figure 19: WebGIS client as a Provider Recommended Helper Application in the GEO DAB

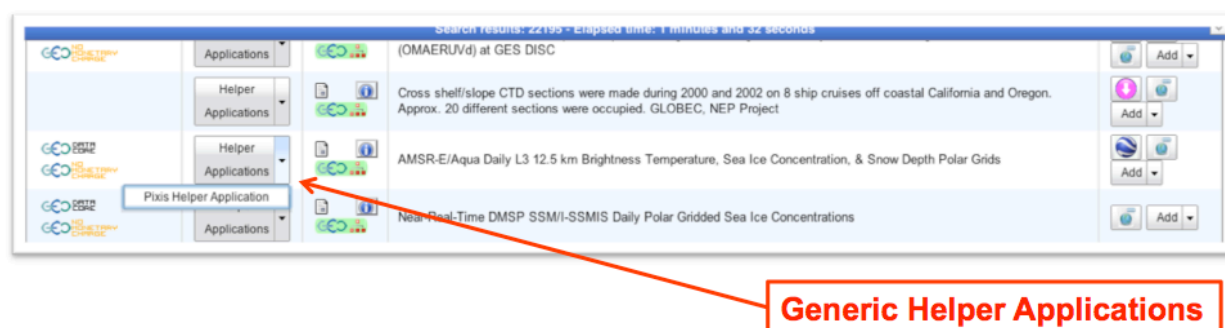


Figure 20: Generic Helper Application in the GEO DAB

6.4 Demonstrations

A narrative video summarizing the AIP-5 Energy High-resolution Solar Atlas Scenario is available here:

<http://www.webservice-energy.org/resources-list/geoss-aip-5>

6.5 Future plans for deployment

The components deployed under this scenario are in a full operation mode.

7. References

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

8. Annex 1

Tutorial 1 : How to write a float32 TIFF image with Matlab and in C with libtiff

MATLAB

```
% M is 2d matrix of nl rows and nc columns
% name_of_fic_tiff is variable of type string (e.g. name_of_fic_tiff =
'image_float32.tif')
% note : nan values are properly handled

t = Tiff(name_of_fic_tiff,'w');
% Number of rows
tagstruct.ImageLength = nl;
% Number of columns
tagstruct.ImageWidth = nc;
% No compression
tagstruct.Compression = Tiff.Compression.None;
tagstruct.SampleFormat = Tiff.SampleFormat.IEEEFP;
% IEEE Floating Point
tagstruct.Photometric = Tiff.Photometric.MinIsBlack;
% Define the number of bits for the IEEE Floating Point (single or
float)
tagstruct.BitsPerSample = 32;
% Only one channel
tagstruct.SamplesPerPixel = 1;
tagstruct.PlanarConfiguration = Tiff.PlanarConfiguration.Chunky;
t.setTag(tagstruct);
t.write(single(M));
t.close();
```

C and libtiff-3.8.2

* Example with the libtiff-3.8.2 (<http://www.libtiff.org/libtiff.html>)

```
TIFF *tif;

tif = TIFFOpen(name_of_fic_tiff, "w");

TIFFSetField(tif, TIFFTAG_IMAGELENGTH, nl);
TIFFSetField(tif, TIFFTAG_IMAGEWIDTH, nc);
TIFFSetField(tif, TIFFTAG_SAMPLESPELPIXEL, 1);
TIFFSetField(tif, TIFFTAG_BITSPERSAMPLE, 32);
TIFFSetField(tif, TIFFTAG_SAMPLEFORMAT, SAMPLEFORMAT_IEEEFP);
TIFFSetField(tif, TIFFTAG_COMPRESSION, COMPRESSION_NONE);
TIFFSetField(tif, TIFFTAG_PLANARCONFIG, PLANARCONFIG_CONTIG);

/*
```

GEO Architecture Implementation Pilot, Phase 5	Version: Final
Energy [Solar Atlas] Scenario Engineering Report	Date: 04/02/2013

```

    TIFFWrite...
*/

```

```
TIFFClose(tif);
```

Tutorial 2 : How to create a GeoTIFF from a TIFF ?

Use the command-line `geotifcp` (<http://trac.osgeo.org/geotiff/>)

Step 1: create a `.proj` file corresponding to the geographic projection

Example : EPSG:4326 (WGS84 lon/lat) with

```
    dlon = 9 arcsec, dlat = 6 arcsec
```

```
    min_lon = 3.916250000000 (bounding box)
```

```
    min_lat = 45.416666666667 (bounding box)
```

Upperleft pixel (*: center of pixel (min_lon+dlon/2, max_lat-dlat/2))

```

          <-dlon->
      ^   x-----
      |   |       |
dlat |   |   *   |
      |   |       |
      ù   -----

```

Corresponding `tiff.proj` :

Geotiff_Information:

```
    Version: 1
```

```
    Key_Revision: 1.0
```

```
    Tagged_Information:
```

```
        ModelTiepointTag (2,3):
```

```
            0 0 0
```

```
            3.916250000000 45.416666666667 0
```

```
        ModelPixelScaleTag (1,3):
```

```
            0.002500000000 0.001666666667 0
```

```
    End_Of_Tags.
```

```
    Keyed_Information:
```

```
        GTModelTypeGeoKey (Short,1): ModelTypeGeographic
```

```
        GTRasterTypeGeoKey (Short,1): RasterPixelIsArea
```

```
        GeographicTypeGeoKey (Short,1): GCS_WGS_84
```

```
        GeogCitationGeoKey (Ascii,7): "WGS 84"
```

```
        GeogAngularUnitsGeoKey (Short,1): Angular_Degree
```

```
    End_Of_Keys.
```

```
    End_Of_Geotiff.
```

Commande line : `geotifcp -g tiff.proj -c none image.tif image_geo.tif`