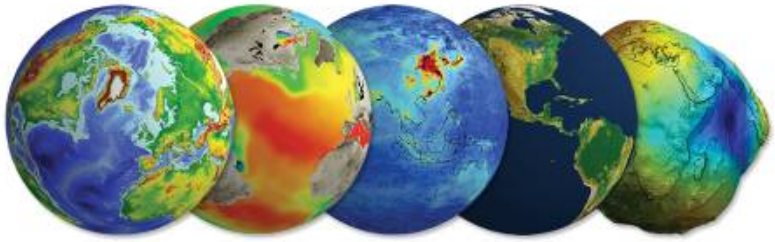
Federated Earth Observation (FedEO) Status



CEOS WGISS Meeting #37
14-18 April, 2014
Cocoa Beach, Florida, USA
Hosted by NASA

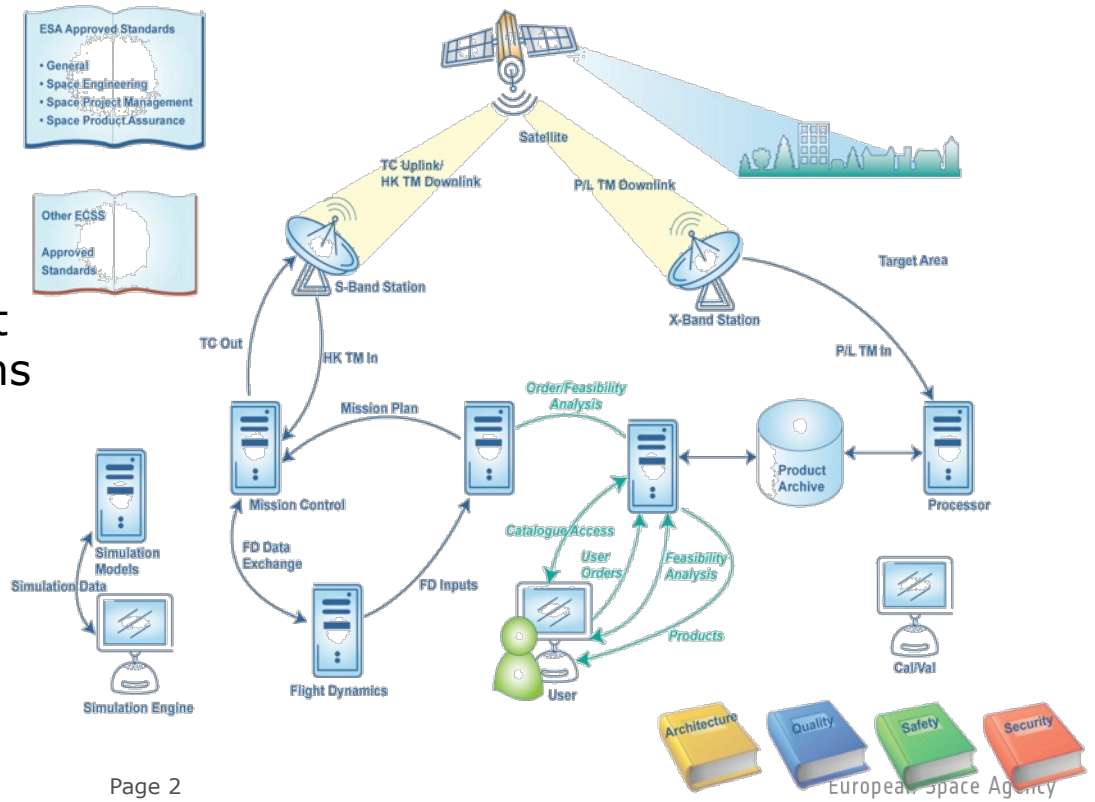
M.Albani, P.Mougnaud, A.Della Vecchia (ESA)

Yves Coene (Spacebel)

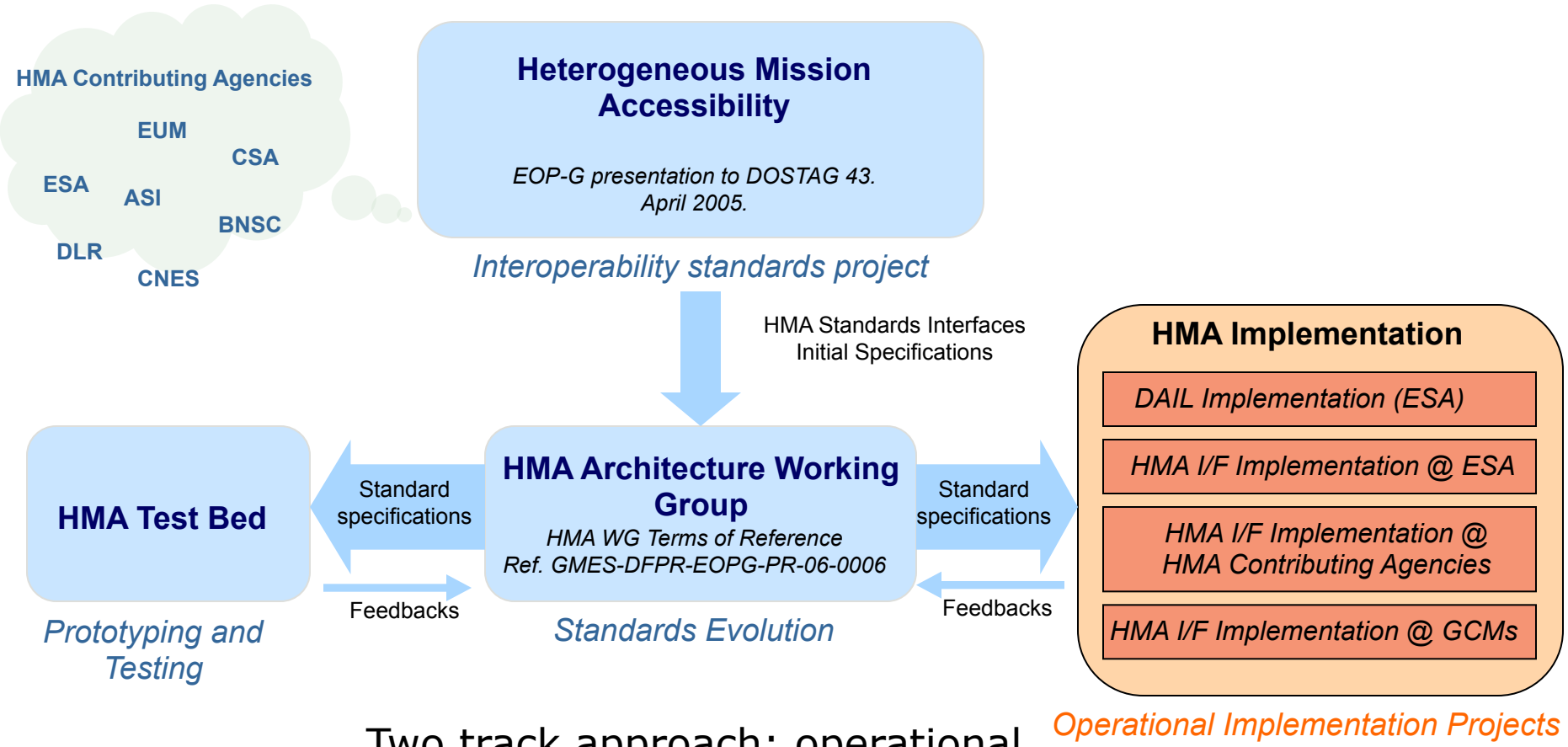
What is HMA

A collaborative project started in Europe and Canada by the Ground Segment Coordination Body (GSCB) in 2005 with the objective to:

- Guarantee a seamless and **harmonised access to heterogeneous EO datasets from multiple mission** ground segments, including national missions and ESA missions.
- **Standardise** the ground segment **interfaces** of the satellite missions for easier access to EO data.
- Provide **interoperability for coordinated data access** enabling the interactions with services or Value Adders and EO Contributing Missions.



HMA Build-up



Two track approach: operational implementations and parallel "standardisation and support activities (e.g. SW development and conformance testing)"

HMA Standards

Defined through the work of 25 companies over 10 countries and with the contribution from HMA project partners (agencies and users)

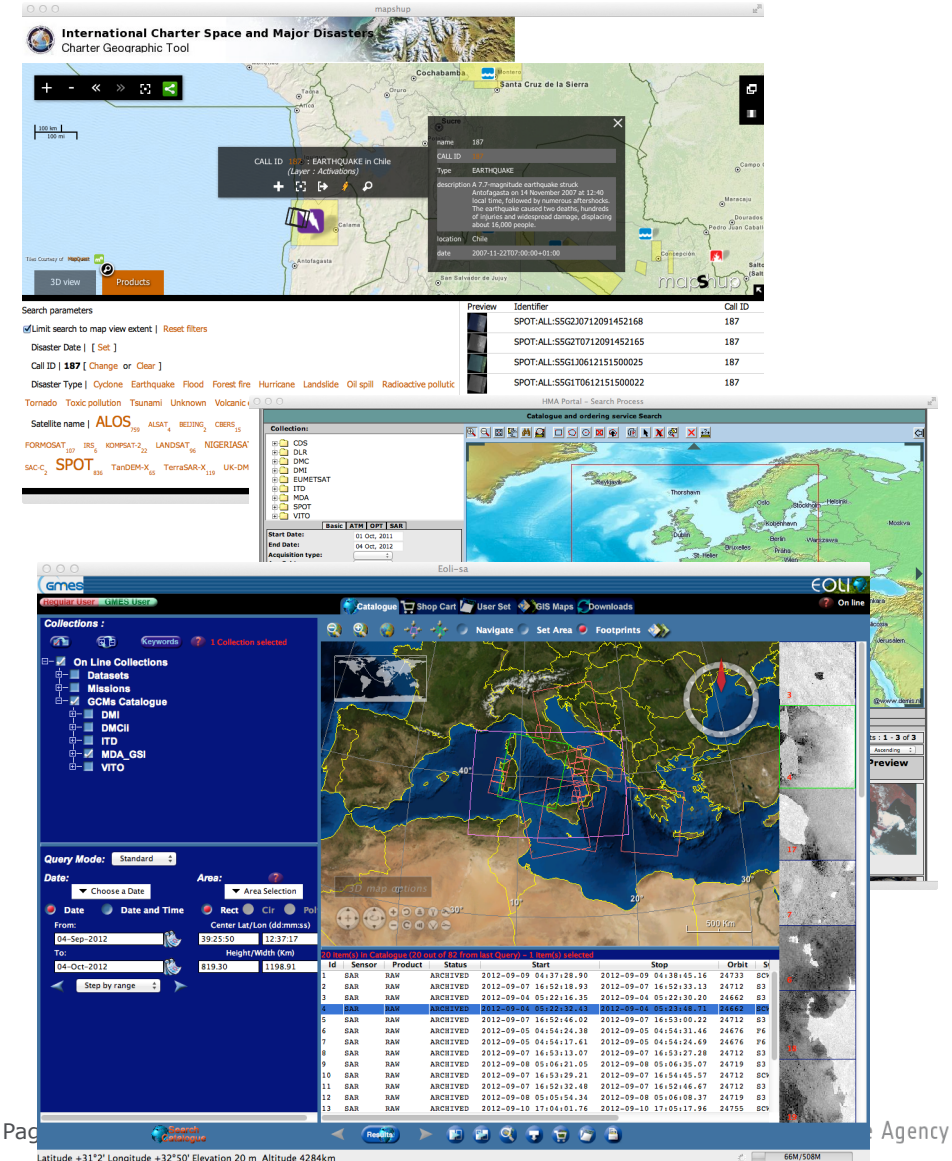
1. **Collection and service discovery (Advertisement):** OGC's Cataloguing of ISO Metadata using the ebRIM profile of CS-W (OGC 07-038, OGC 13-084)
2. **EO product metadata:** OGC's GML 3.1.1 Application Schema for EO Products (OGC-06-080) and EOP O&M (OGC 10-157). **EO collection metadata:** ISO 19115 Geographic Information – Metadata (OGC 11-035).
3. **Catalogue Service:** OGC's Catalogue Services Specification 2.0 Extension Package for ebRIM Application Profile: Earth Observation Products (OGC 06-131)
4. **Ordering from Catalogue:** OGC's Ordering Services for Earth Observation Products (OGC 06-141, OGC 13-042)
5. **Feasibility Analysis (Programming):** OGC's Sensor Planning Service Application Profile for EO Sensors (OGC 10-135, OGC 13-039, OGC 14-012)
6. **Web Map Service** OGC's WMS EO Extension (OGC 07-063)
7. **Online Data Access**
   - **Web Coverage Service** OGC WCS 2.0 extension for EO (OGC 10-140)
   - **Download Service**: Download Service for EO products (OGC 13-043)
8. **Identity (User) Management:** OGC's User Management Interfaces for Earth Observation Services (OGC 07-118)

Frozen set of standards under implementation (configuration control)

HMA Implementations

Agency Developments &
Copernicus Contributing Missions:

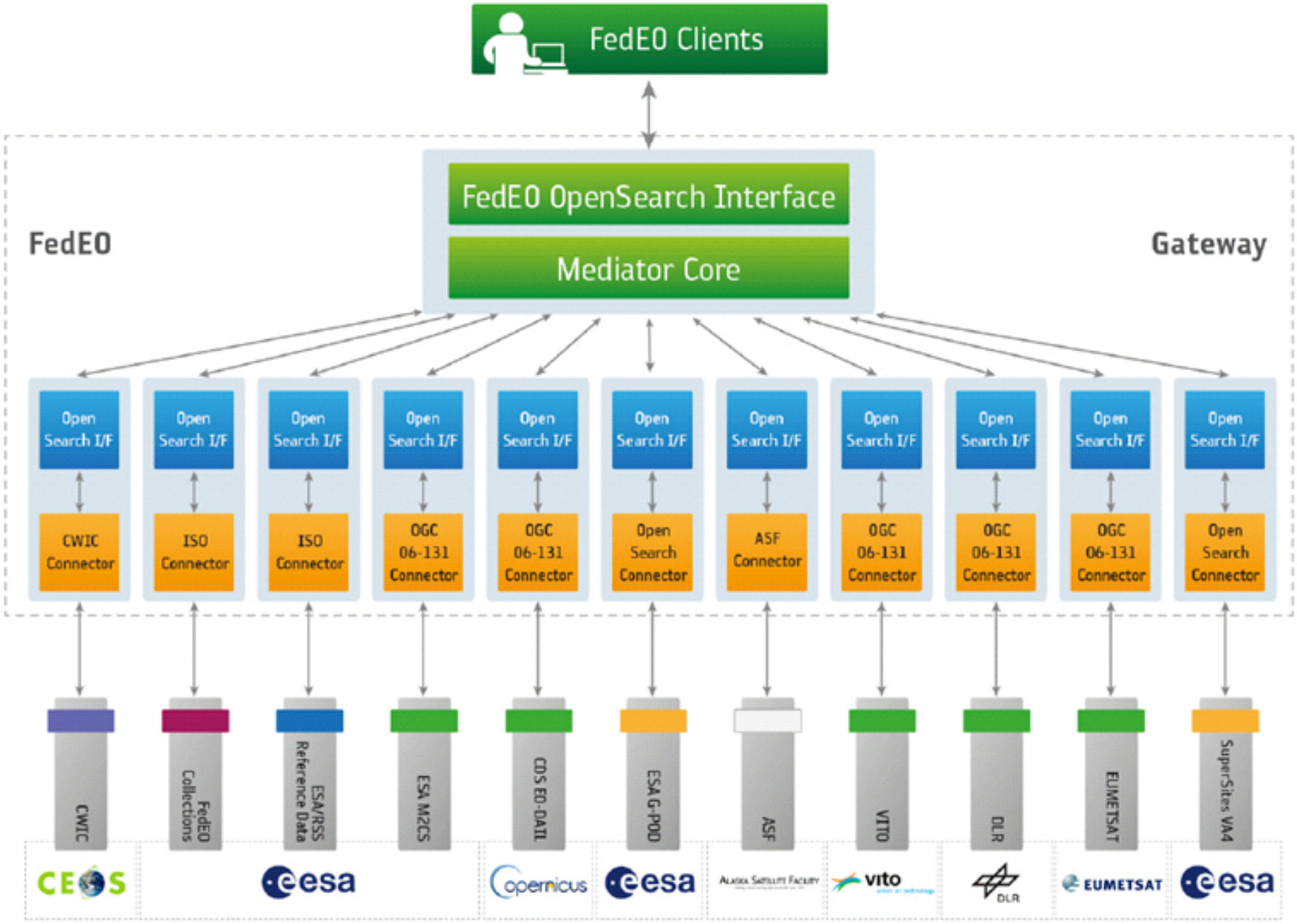
- ESA
- DLR
- EUMETSAT
- CNES – Disasters Charter
- VITO
- MDA (RSAT2)
- DMCii
- Astrium GbH (TSX)
- DEIMOS
- E-GEOS
- Astrium France (spot/pleiades)
- RapidEye
- Euromap
- EUSI
- Astrium France (spot 6/7)
- Proba-V
- others



FedEO: Federated Earth Observation

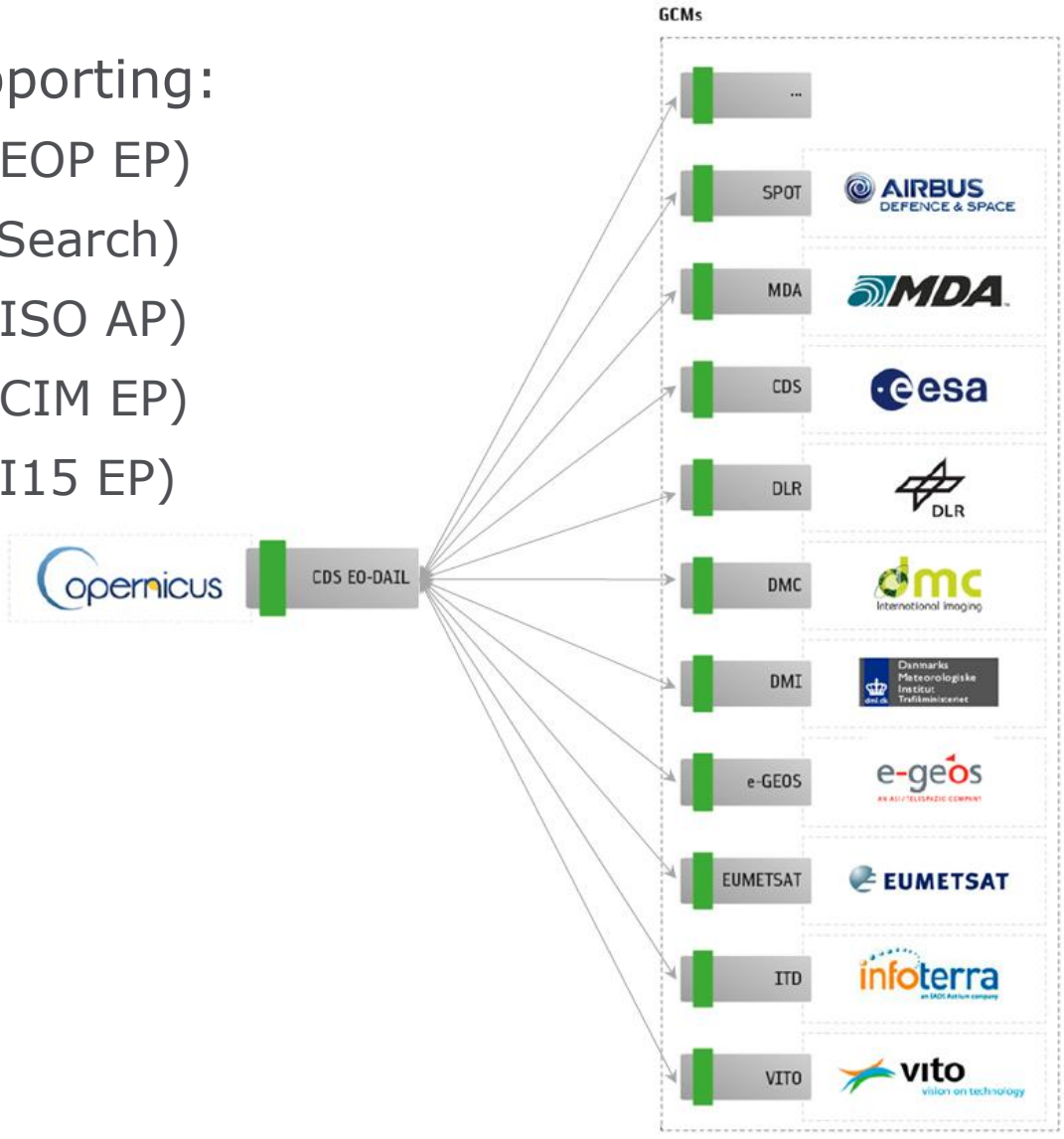
FedEO is a prototype system providing a brokered discovery (and access) capability to European (and Canadian) EO missions data based on HMA (and other) interfaces.

FedEO Brokered Architecture



FedEO Back-end Connections

- Backend Connectors supporting:
  - OGC 06-131 (CSW EOP EP)
  - OGC 10-032 (OpenSearch)
  - OGC 07-045 (CSW ISO AP)
  - OGC 07-038 (CSW CIM EP)
  - OGC 13-084 (CSW I15 EP)
  - CWIC
  - ASF



FedEO Current Status

- FedEO end-point/component and demo client portal being migrated to ESRIN.
- M2M External access tests with GEO Discovery and Access Broker (DAB) started.
- Opensearch gateway available at: http://geo.spacebel.be/opensearch/readme.html
- Further catalogues interfacing ongoing within the HMA-SE project

FedEO Statistics (end 2013)

of discoverable and accessible collections = 477

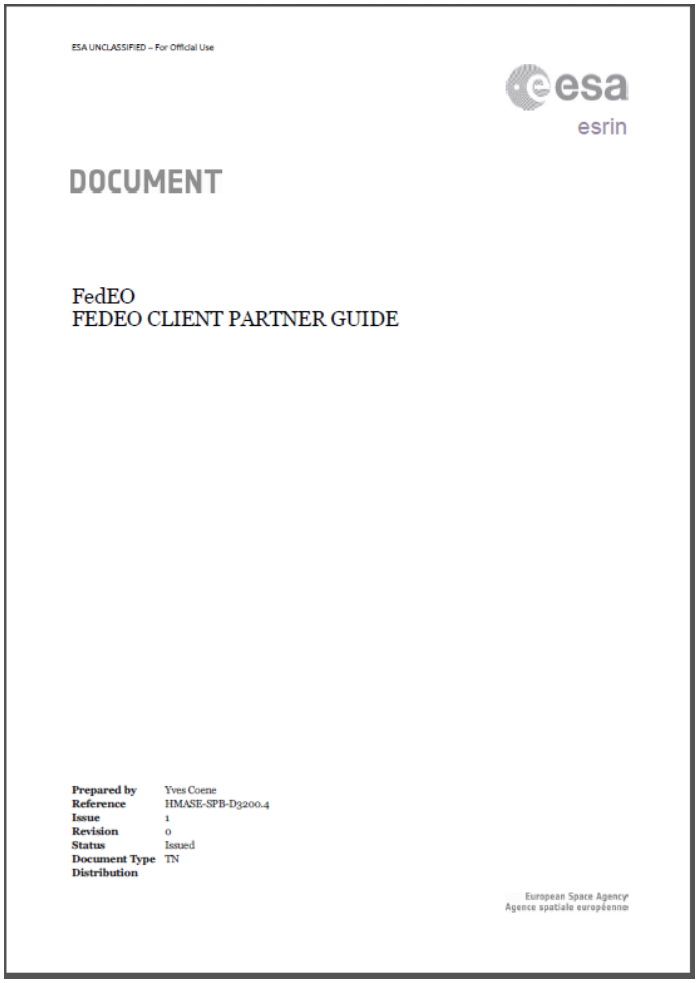
# of discoverable granules > 6 millions

Dataset Series	# Dataset Series
ESA EO-DAIL	61
ESA G-POD	331
ESA M2CS	20
ESA SuperSite Virtual Archive 4	16
DLR EO Web	16
EUMETSAT Catalogue	13
VITO Catalogue	1
Alaska Satellite Facility	19
GSCDA	> 242

In addition CWIC collections discoverable & accessible

FedEO Client Partner Guide

- General description of the FedEO environment and its relation to other systems
- Details about the FedEO query interface based on OpenSearch (e.g., principles, the search parameters, search response format, etc ...)
- Description of two cases: one starting from a dataset series catalogue, and a second one accessing immediately the dataset catalogue
- Details on the catalogue connectors and how their corresponding dataset series and dataset metadata can be discovered


ESA UNCLASSIFIED – For Official Use

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DOCUMENT

FedEO
FEDEO CLIENT PARTNER GUIDE

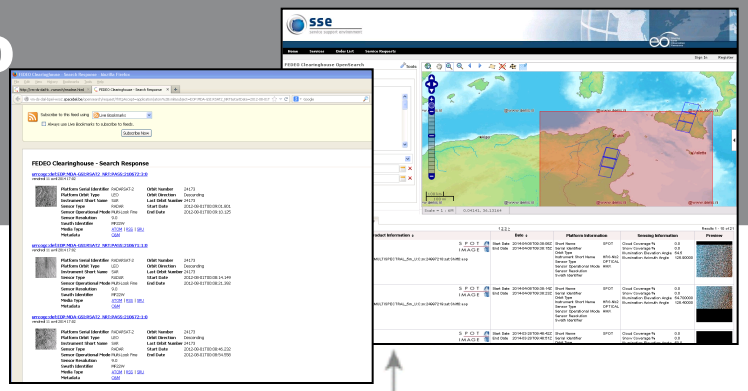
Prepared by	Yves Coene
Reference	HMASE-SPB-D3200.4
Issue	1
Revision	0
Status	Issued
Document Type	TN
Distribution	

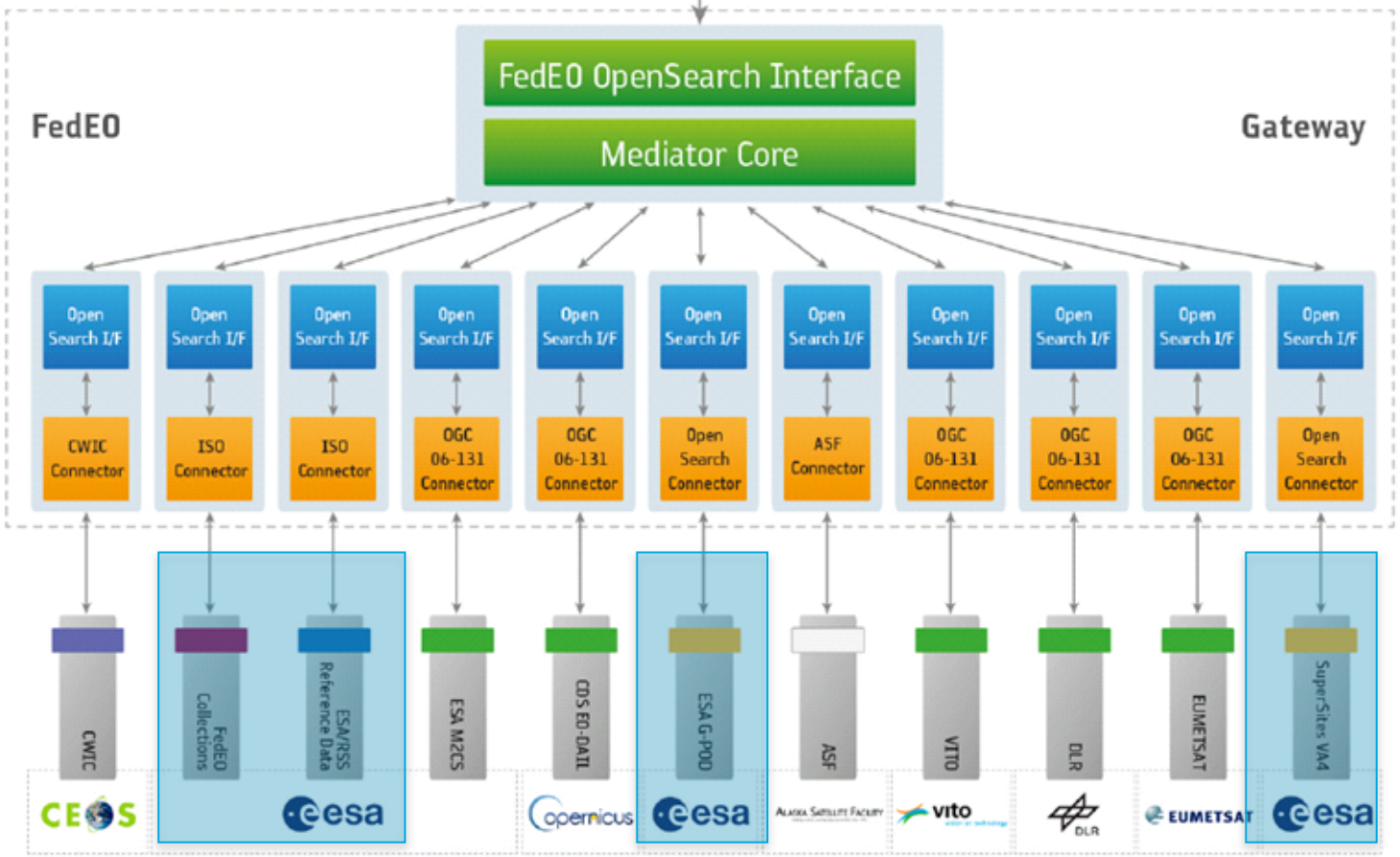
European Space Agency
Agence spatiale européenne

FedEO OpenSearch Implementation

- Currently OpenSearch access to:
  - HMA Catalogs supporting OGC 06-131: Atom with EOP O&M (OGC 10-157) metadata as foreign markup or atom:link.
  - CWIC catalogs: Atom with DC or ISO metadata as foreign markup or atom:link
  - Virtual Archive 4 and G-POD: Atom or RDF or …
- Interface aligned with OASIS searchRetrieve 1.0 conventions
- Implemented:
  - OGC 10-032 Geotemporal Extension
  - OGC 13-026 Extension for Earth Observation

FedEO Demo

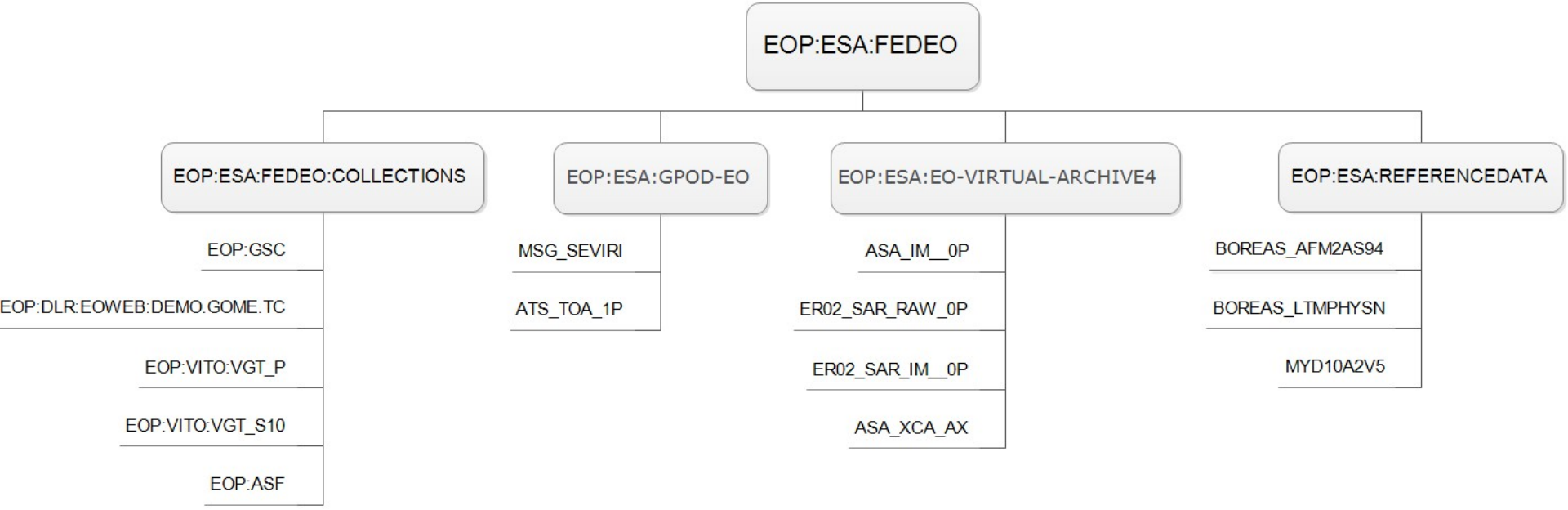




(*) (*) (*) include series metadata

FedEO Demo

- Two step search approach:
  - Step 1: search dataset series (parallel search in 4 catalogs - see below)
  - Step 2: search datasets inside the selected dataset series..



Demo - Scenario

- Go to Home page / developers page (Firefox)
  - Explain content:
    - OSDD: 3 Atom URL templates
    - Explain: mainly for list of dataset series
    - 2 tabs / 2 columns (foreign markup)
  - Click on 1st dataset series example,
    - show link to ISO metadata content by doing "view source"
    - Add query=meris to URL
  - Click on dataset example (MDA collection):
    - show EOP O&M content by doing "view source "
  - Click on example dataset (MDA Roma) (gazetteer)
    - Copy URL to Google Maps to visualise results

Demo - Scenario

- Search Dataset Series Catalog (OpenSearch Step 1)
  - Find series with "vegetation" in abstract
    - Explain this involves 4 searches
  - Find series published by "vito"
  - Find series with "MERIS" in abstract. Explain they result from multiple datset series catalogs …. Explain

 button.
  - Find services (dc:type) with "FEDEO" in abstract

Demo - Scenario

- Search Dataset Catalog (OpenSearch Step 2)
  - Explain search form is created on-the-fly from dataset series specific OSDD document (and Param extension info).
    - Use ASF and SPOT (1st)
  - (1) Find optical imagery (Spot ALL) over Sicily 1/1/2014-11/4/2014
    - Show metadata
  - Reduce number of values by filtering on eo:cloudCover 50]
  - (2) Find radar images (MDA) over same area
    - Show detailed metadata
  - (3) Ikonos 1/2/2007 to today
    - Name = Antwerp
    - Name = Amsterdam, radius = 10000
    - Name = Paris

FedEO Demo

sse
service support environment

Home | Services | Order List | Service Requests

Sign In | Register

Use and Support
- About Us
- Terms of Use
- Contact Us
- How to Access

Community
- RSS Join & Share

Document Library
- SSE
- FedEO

External Links
- Copernicus
- GEO
- CEOS
- OGC

OpenSearch I/F details

Browse FEDEO Dataset Series and Datasets (OGC 10-032, OGC 13-026)
This distributed FEDEO dataset series and dataset catalogue, set up as part of the HMA for Science Evolution Project, serves dataset metadata in the metadata format supported by the FEDEO backend catalogs including ISO19139 (as per **OGC 11-035r1, EO Collection and Service Discovery using the ebRIM Application Profile of CSW 2.0.**), **OGC 10-157r3, Earth Observation Metadata profile of Observations & Measurements** , OGC 10-157r4 and Dublin Core. The OpenSearch catalogue is also accessible from external applications complying with the specification OGC 10-032 and OGC 13-026. The FEDEO Client Partner Guide (to be published) provides detailed guidelines for access by third-party clients.

Order HMA-SE Datasets (OGC 06-131, OGC 06-141)
This distributed dataset catalogue, set up as part of the HMA for Science Evolution Project, serves dataset metadata in **OGC 06-080** "Application schema for Earth Observation products" format from EUMETSAT, DLR, VITO via the OGC 06-131 protocol. The service provides access to the corresponding datasets via ordering to selected users. Datasets from the dataset series can be ordered using the OGC 06-141 protocol from external applications complying with the HMA specifications **OGC 06-131**, OGC 07-118 and OGC 06-141.

Browse FEDEO Dataset Series (OGC 13-084)
This catalogue, set up as part of the HMA for Science Eolution Project, provides access to FEDEO dataset series and services metadata via the OGC 13-084r1 "OGC I15 (ISO19115 Metadata) Extension Package of CS-W ebRIM Profile" protocol. Registered services will include in the future dataset catalogues, Web map services and feasibility analysis services. The catalogue is also accessible from external applications complying with the HMA specification OGC 13-084r1.

Search

Copyright © 2010-2013. Best viewed with Mozilla Firefox.

How to access: OpenSearch I/F

Welcome to the FEDEO Clearinghouse. This entry point is setup by the HMA-S Evolution Project and provides access to the FEDEO Clearinghouse Product and Collections Catalogs via different interfaces.

- OpenSearch Description Document
- Explain Document

The implementation of the above interfaces is based on:

- OGC 10-157r3, Earth Observation Metadata profile of Observations & Measurements, Version
- OGC 10-032r8, OpenSearch GeoSpatial and Temporal Extensions
- OGC 13-026r3, OpenSearch Extension for Earth Observation
- Relevant OASIS searchRetrieve specifications.

The current interfaces are work in progress and subject to change.

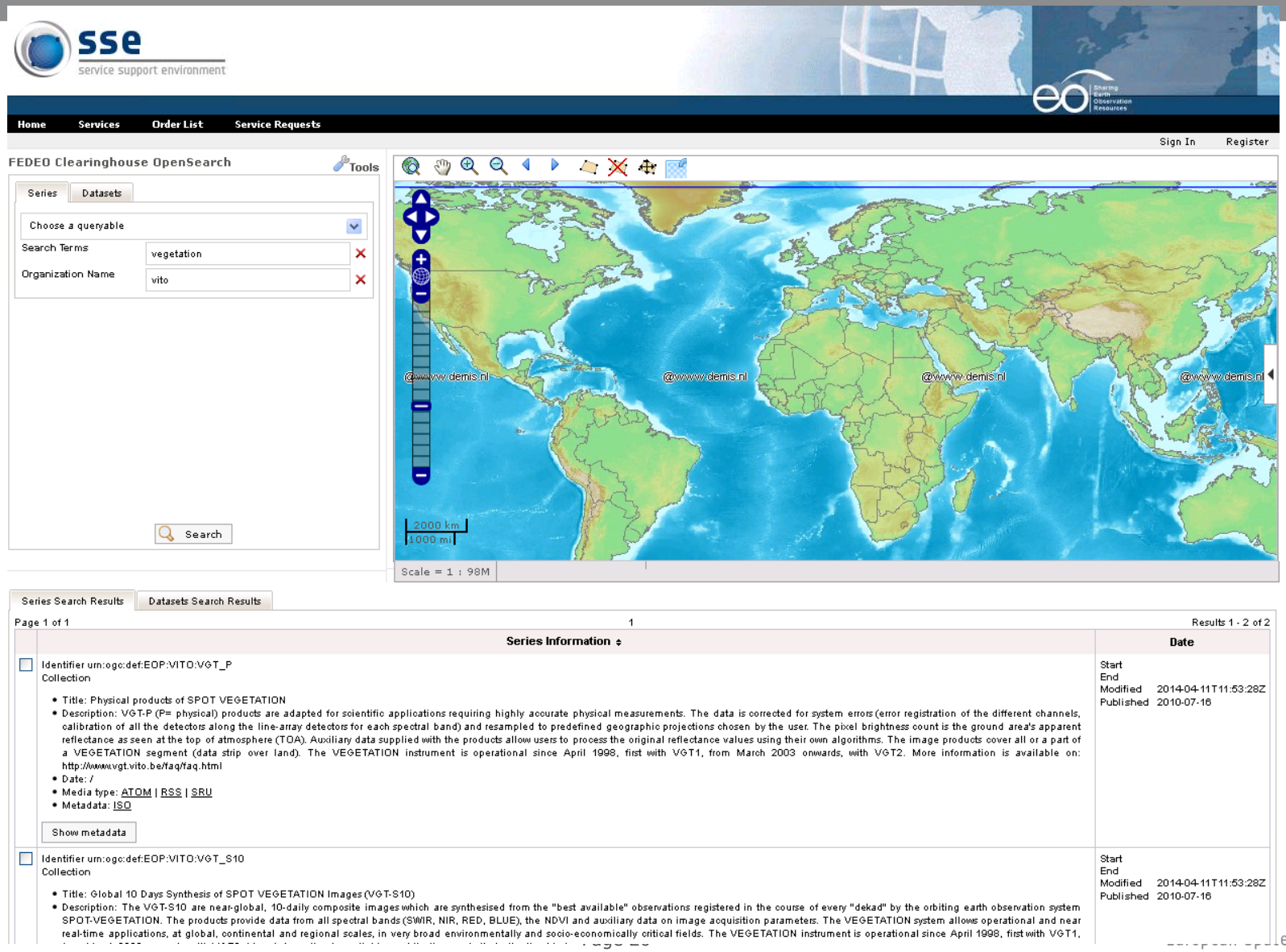
The following is a list of example OpenSearch requests returning A... ...S and RDF results:

Dataset Series | **Datasets**

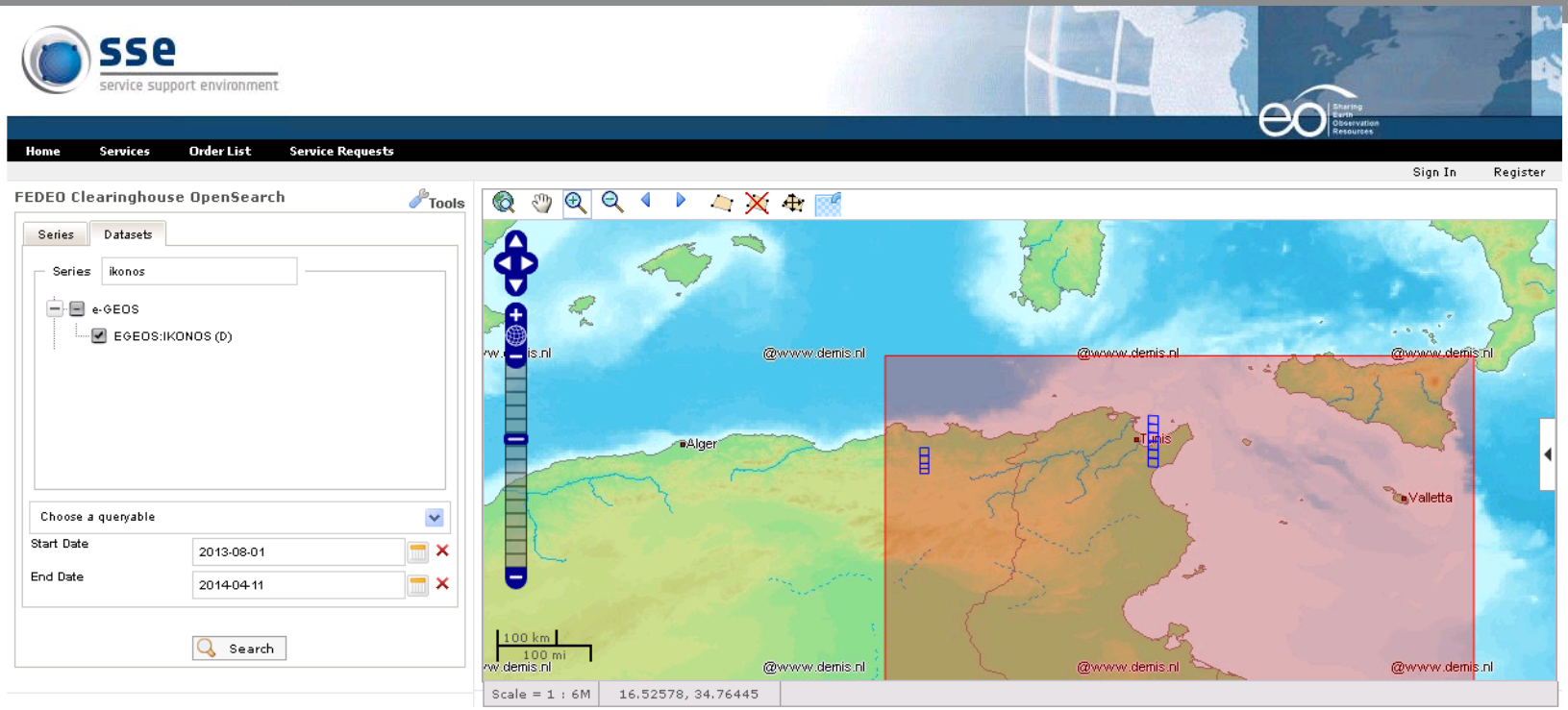
With metadata as foreign markup	With link to metadata
HMA with use of dc:subject parameter	HMA with use of dc:subject parameter
HMA with use of time:start and time:end parameters	HMA with use of time:start and time:end parameters
HMA with use of time:start,time:end and geo:box parameters	HMA with use of time:start,time:end and geo:box parameters
HMA with use of eop:platformShortName parameter	HMA with use of eop:platformShortName parameter
HMA with use of eop:instrumentShortName parameter	HMA with use of eop:instrumentShortName parameter
HMA with use of eop:instrumentShortName parameter	HMA with use of eop:instrumentShortName parameter
HMA with use of eop:sensorType parameter	HMA with use of eop:sensorType parameter
HMA with use of geo:uid parameter	HMA with use of geo:uid parameter
HMA MDA collection search	HMA MDA collection search
HMA MDA collection search with use of geo:name (ROMA) and geo:radius (100km)	HMA MDA collection search with use of geo:name(ROMA) and geo:radius (100
HMA MDA collection search with use of geo:lat, geo:long(ROMA) and geo:radius (100km)	HMA MDA collection search with use of geo:lat, geo:long(ROMA) and geo:radiu
HMA SPOT Optical search	HMA SPOT Optical search
HMA VITO search	HMA VITO search
M2CS ENVISAT_ASA_APC_0S search with use of time:start,time:end	M2CS ENVISAT_ASA_APC_0S search with use of time:start,time:end
M2CS LANDSAT_TM_ETM_P search with use of time:start,time:end	M2CS LANDSAT_TM_ETM_P with search use of time:start,time:end

Examples of two-step approach: dataset series and dataset search

FedEO OpenSearch (Series)



FedEO OpenSearch (Datasets Ikonos)

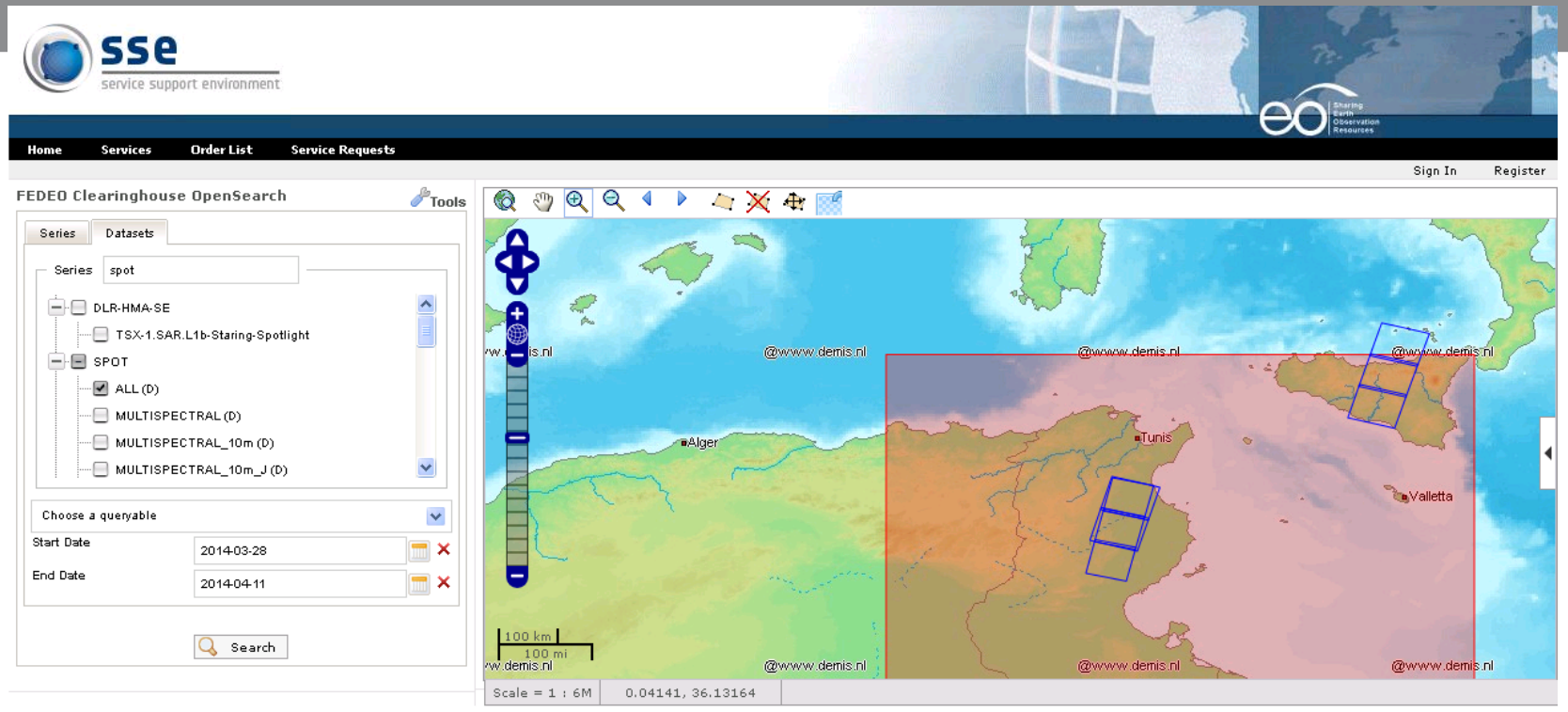


Series Search Results | Datasets Search Results

Page 1 of 3 — 1 2 3 > — Results 1 - 10 of 25

Product Information	Date	Platform Information	Sensing Information	Preview
Collection Identifier EGEOS:EGEOS#IKONOS Product Id urn:ogc:def:EOP:EGEOS:EGEOS#IKONOS:2000114439200THC:EOP Orbit Number Orbit Direction Last Orbit Number Show metadata	Start Date 2013-08-21T10:18:41.00Z End Date 2013-08-21T10:18:45.00Z	Short Name IKONOS Serial Identifier Orbit Type Instrument Short Name Sensor Type OPTICAL Sensor Operational Mode PAN/MSI Sensor Resolution 0.89 Swath Identifier	Cloud Coverage % 51.0 Illumination Elevation Angle 59.94395 Illumination Azimuth Angle 139.34042	
Collection Identifier EGEOS:EGEOS#IKONOS Product Id urn:ogc:def:EOP:EGEOS:EGEOS#IKONOS:2000114439201THC:EOP Orbit Number Orbit Direction Last Orbit Number Show metadata	Start Date 2013-08-21T10:18:41.00Z End Date 2013-08-21T10:18:45.00Z	Short Name IKONOS Serial Identifier Orbit Type Instrument Short Name Sensor Type OPTICAL Sensor Operational Mode PAN/MSI Sensor Resolution 0.89 Swath Identifier	Cloud Coverage % 41.0 Illumination Elevation Angle 59.94395 Illumination Azimuth Angle 139.34042	
Collection Identifier EGEOS:EGEOS#IKONOS Product Id urn:ogc:def:EOP:EGEOS:EGEOS#IKONOS:2000114439202THC:EOP Orbit Number Orbit Direction Last Orbit Number	Start Date 2013-08-21T10:18:41.00Z End Date 2013-08-21T10:18:45.00Z	Short Name IKONOS Serial Identifier Orbit Type Instrument Short Name Sensor Type OPTICAL	Cloud Coverage % 33.0 Illumination Elevation Angle 59.94395 Illumination Azimuth Angle 139.34042	

FedEO OpenSearch (Datasets SPOT)

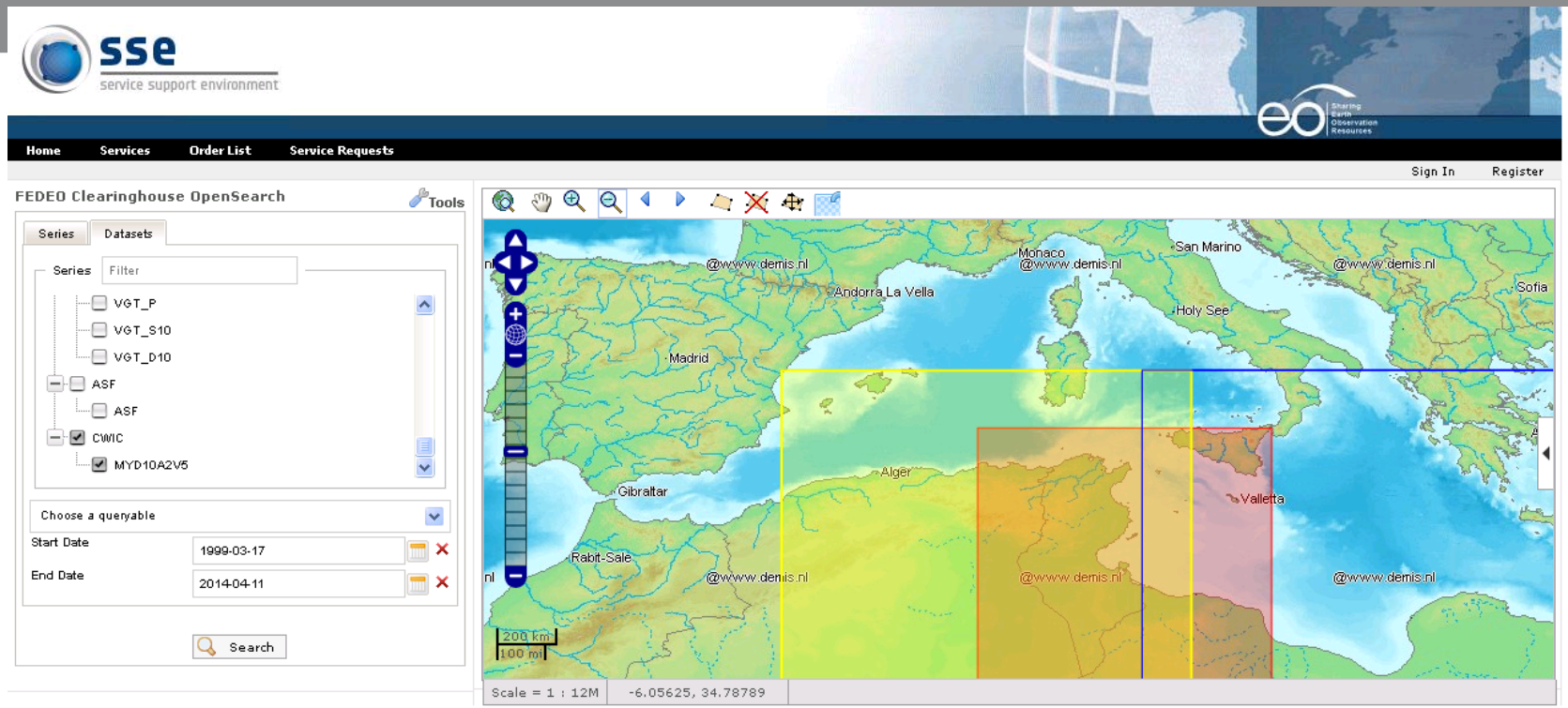


Series Search Results | Datasets Search Results

Page 1 of 3 — 1 2 3 > — Results 1 - 10 of 21

Product Information	Date	Platform Information	Sensing Information	Preview
SPOT IMAGE Collection Identifier SPOT:ALL Product Id urn:ogc:def:EOP:SPOT:MULTISPECTRAL_5m_U:C:sn:24997218:sat:Shift0:eop Orbit Number 14 Orbit Direction DESCENDING Last Orbit Number 14 Show metadata	Start Date 2014-04-08T09:38:06Z End Date 2014-04-08T09:38:15Z	Short Name SPOT Serial Identifier Orbit Type Instrument Short Name HRG-Nb2 Sensor Type OPTICAL Sensor Operational Mode HMX Sensor Resolution Swath Identifier	Cloud Coverage % 0.0 Snow Coverage % 0.0 Illumination Elevation Angle 54.5 Illumination Azimuth Angle 125.90000	
SPOT IMAGE Collection Identifier SPOT:ALL Product Id urn:ogc:def:EOP:SPOT:MULTISPECTRAL_5m_U:C:sn:24997219:sat:Shift0:eop Orbit Number 14 Orbit Direction DESCENDING Last Orbit Number 14 Show metadata	Start Date 2014-04-08T09:38:14Z End Date 2014-04-08T09:38:23Z	Short Name SPOT Serial Identifier Orbit Type Instrument Short Name HRG-Nb2 Sensor Type OPTICAL Sensor Operational Mode HMX Sensor Resolution Swath Identifier	Cloud Coverage % 0.0 Snow Coverage % 0.0 Illumination Elevation Angle 54.700000 Illumination Azimuth Angle 125.40000	
SPOT IMAGE	Start Date 2014-03-28T09:48:42Z End Date 2014-03-28T09:48:51Z	Short Name SPOT Serial Identifier Orbit Type	Cloud Coverage % 0.0 Snow Coverage % 0.0	

OpenSearch (Datasets CWIC)

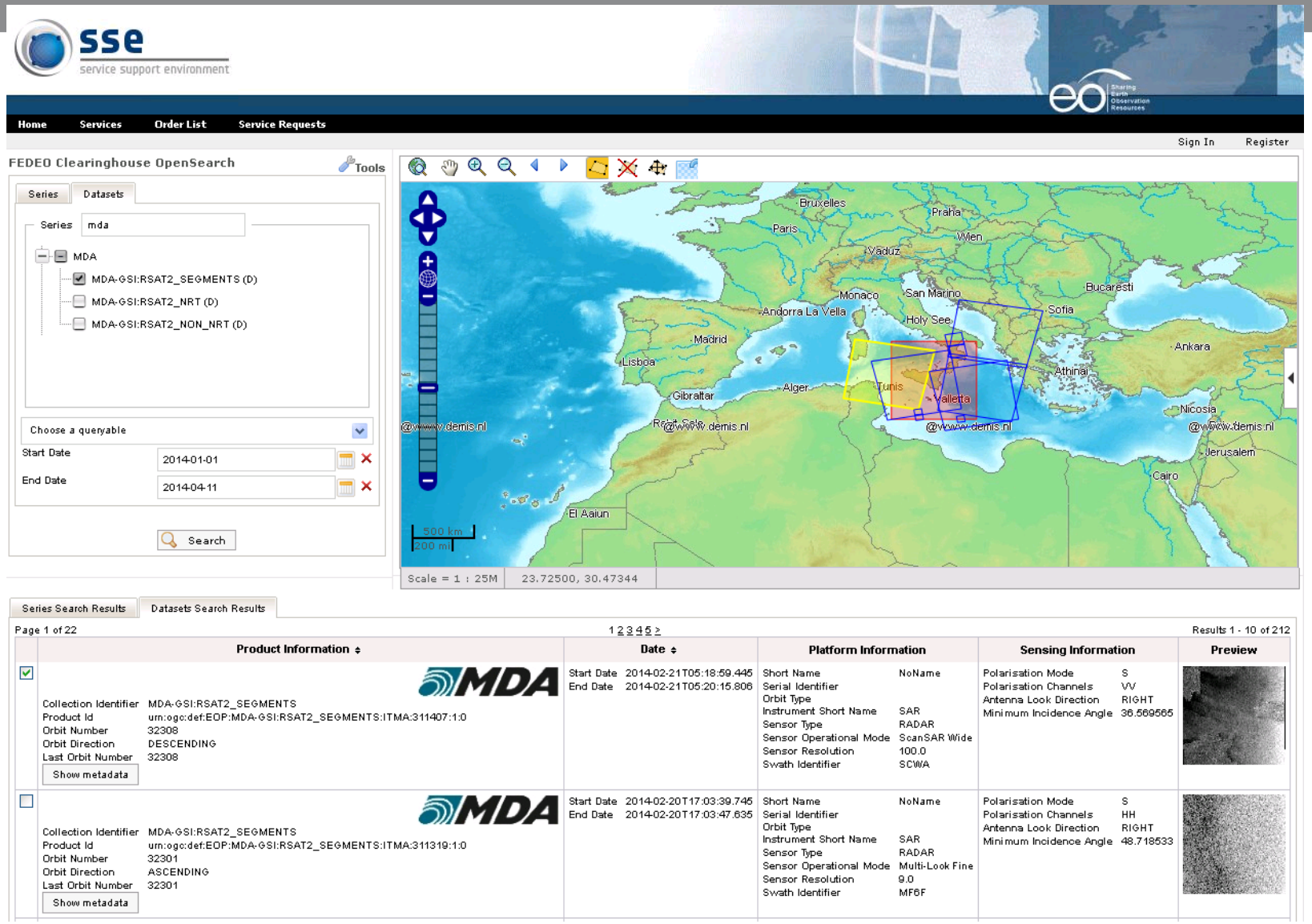


Series Search Results | Datasets Search Results

Page 1 of 217 — 1 2 3 4 5 > — Results 1 - 10 of 216

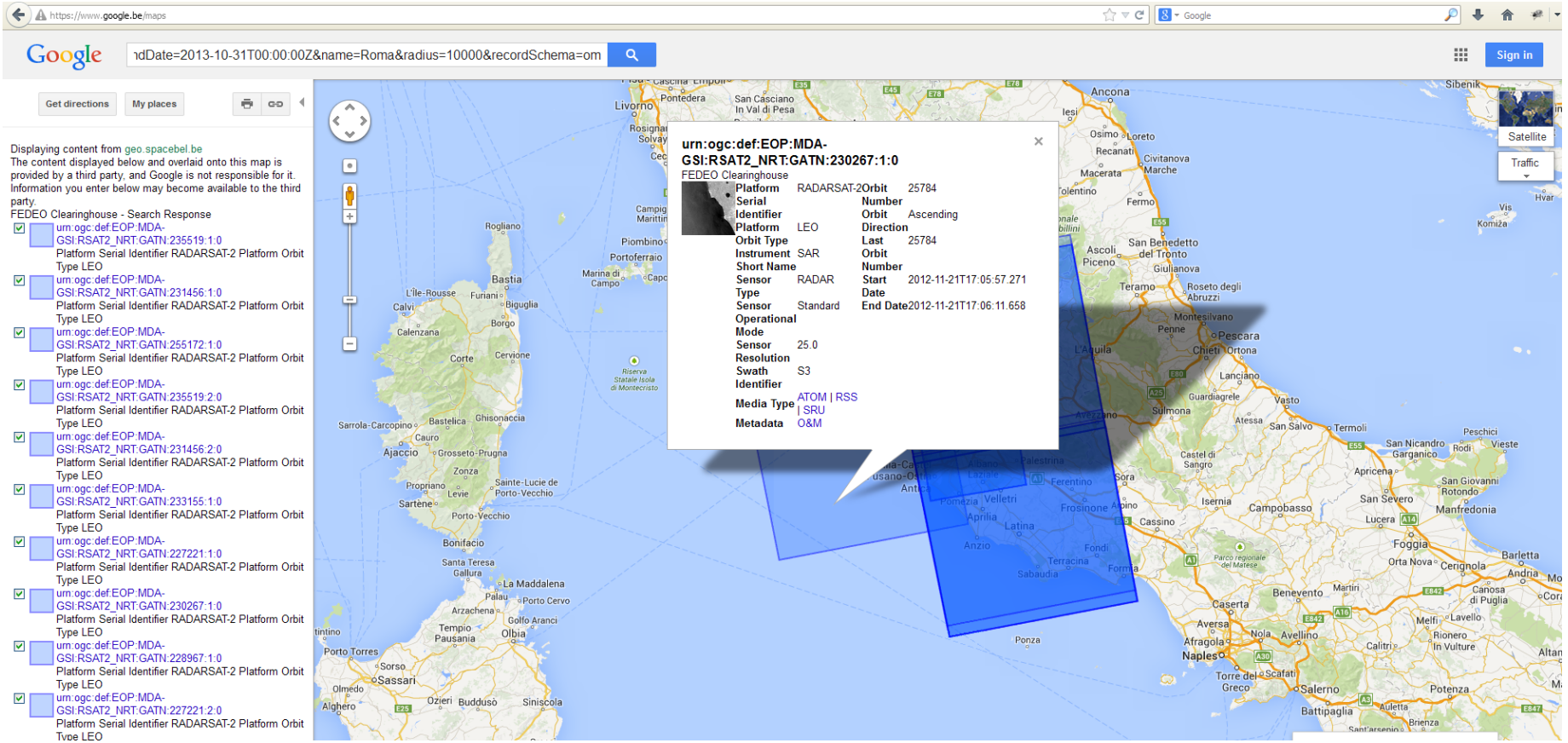
	Product Information	Date	Platform Information	Distribution Information
☐	Product Id: MYD10A2V5:G182641840-NSIDC_ECS Title: SC:MYD10A2.005:28308063 Abstract: Data granule returned from NASA's Earth Observing System Clearinghouse (ECHO) Show metadata	Start Date: 2002-07-20T00:00:00Z End Date: 2002-07-27T23:59:59Z	Short Name: Aqua Instrument Short Name: MODIS	Format: application/x-hdfeos Size: 0.0722895 Resource: G182641840-NSIDC_ECS G182641840-NSIDC_ECS G182641840-NSIDC_ECS
☐	Product Id: MYD10A2V5:G182641843-NSIDC_ECS Title: SC:MYD10A2.005:28308071 Abstract: Data granule returned from NASA's Earth Observing System Clearinghouse (ECHO) Show metadata	Start Date: 2002-07-20T00:00:00Z End Date: 2002-07-27T23:59:59Z	Short Name: Aqua Instrument Short Name: MODIS	Format: application/x-hdfeos Size: 0.0918093 Resource: G182641843-NSIDC_ECS G182641843-NSIDC_ECS G182641843-NSIDC_ECS
☐	Product Id: MYD10A2V5:G136602439-NSIDC_ECS Title: SC:MYD10A2.005:15899369 Abstract: Data granule returned from NASA's Earth Observing System Clearinghouse (ECHO) Show metadata	Start Date: 2002-07-12T00:00:00Z End Date: 2002-07-19T23:59:59Z	Short Name: Aqua Instrument Short Name: MODIS	Format: application/x-hdfeos Size: 0.071603 Resource: G136602439-NSIDC_ECS G136602439-NSIDC_ECS G136602439-NSIDC_ECS
☐	Product Id: MYD10A2V5:G136602444-NSIDC_ECS Title: SC:MYD10A2.005:15899368 Abstract: Data granule returned from NASA's Earth Observing System Clearinghouse (ECHO) Show metadata	Start Date: 2002-07-12T00:00:00Z End Date: 2002-07-19T23:59:59Z	Short Name: Aqua Instrument Short Name: MODIS	Format: application/x-hdfeos Size: 0.071589 Resource: G136602444-NSIDC_ECS G136602444-NSIDC_ECS G136602444-NSIDC_ECS

OpenSearch (Datasets Radarsat2)



OpenSearch (Example Gazetteer)

- http://geo.spacebel.be/opensearch/request/?httpAccept=application/atom%2Bxml&subject=EOP:MDA-GSI:RSAT2_NRT&startDate=2012-10-31T00:00:00Z&endDate=2013-10-31T00:00:00Z&name=Roma&radius=100000&recordSchema=om



Future work - 1

- Complete FedEO platform installation at ESA/ESRIN
- Populate dataset series catalogue with dataset series metadata for all available series. Currently, not all dataset series have ISO19139 metadata
- Integrate additional back-ends
- Add RESTful interface in addition to SRU-style interface
- Support content negotiation (via HTTP header)
  - Alternative to httpAccept parameter
- Support metadata translation
  - E.g. OGC 10-157r3 to r4 or vice-versa
- Support W3C RDF responses
  - Using W3C DCAT and W3C LDP 1.0
- Support sru:recordSchema for ISO metadata as well

Future work - 2

- Align with CEOS Best Practice
  - Add “icon” link for thumbnails
  - Simple GEORSS instead of georss:where
  - Support more queryables (e.g. startPage)

Conclusions

- Seamless and harmonised access to heterogeneous EO datasets from multiple mission ground segments is an operational reality in Europe and Canada
  - HMA is the European model and contribution to interoperability in the Earth Observation domain

- FedEO Prototype System:
  - Allows to provide brokered discovery (and access) capability for (European and Canadian) EO data through HMA standard interfaces
  - Implements the OpenSearch OGC interfaces for an increased number of discoverable and accessible EO data collections, and for interfacing with CEOS Community Catalogues and Clients

Information

HMA standards and related activities/projects, test suites and SW developments: http://wiki.services.eoportal.org/tiki-index.php?page=HMA%20Wiki

Standards configuration management table and download
http://wiki.services.eoportal.org/tiki-index.php?page=HMA+Configuration+Management+Table

FedEO: http://geo.spacebel.be/opensearch/readme.html

Thank you !
Any question ?

Contacts:

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- Philippe.Mougnaud@esa.int, Yves.coene@spacebel.be
  - FedEO Implementation
- Mirko.albani@esa.int
  - Coordination, GSCB, CEOS and GEO