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The CNR-ISAC Informatics Infrastructure for the Satellite Climatological and Oceanographic data: production, harmonization and dissemination in Interoperability Frameworks

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GOS presentation

The Satellite Oceanography Group (**GOS**) is one of the leading Units of the **Earth Observation** Division of **ISAC-CNR** since 1987 and focuses on operational Satellite Data processing and analysis.

CNR-ISAC GOS is responsible for the **Mediterranean** and **Black Seas satellite operational systems** (**Ocean Color (OC)** and **Sea Surface Temperature (SST)**) in the framework of several Partnerships (e.g. MyOcean, SeaDataNet, MONGOOS, RITMARE, etc) and carries out regular **oceanographic campaigns** to acquire (**insitu data**) meteorological, hydrographic and biological data, as well as in-water and above-water optical measurements for the validation of ocean color satellite data.

Interoperability

A property referring to the ability of diverse systems and organizations to work together (inter-operate).

Wikipedia

"*Being able to accomplish end-user applications using different types of computer systems, operating systems, and application software, interconnected by different types of local and wide area networks*"

James O'Brien, George Marakas: Introduction to Information Systems, McGraw-Hill/Irwin)

Interoperability

Services:

- Common file format
- Common protocols

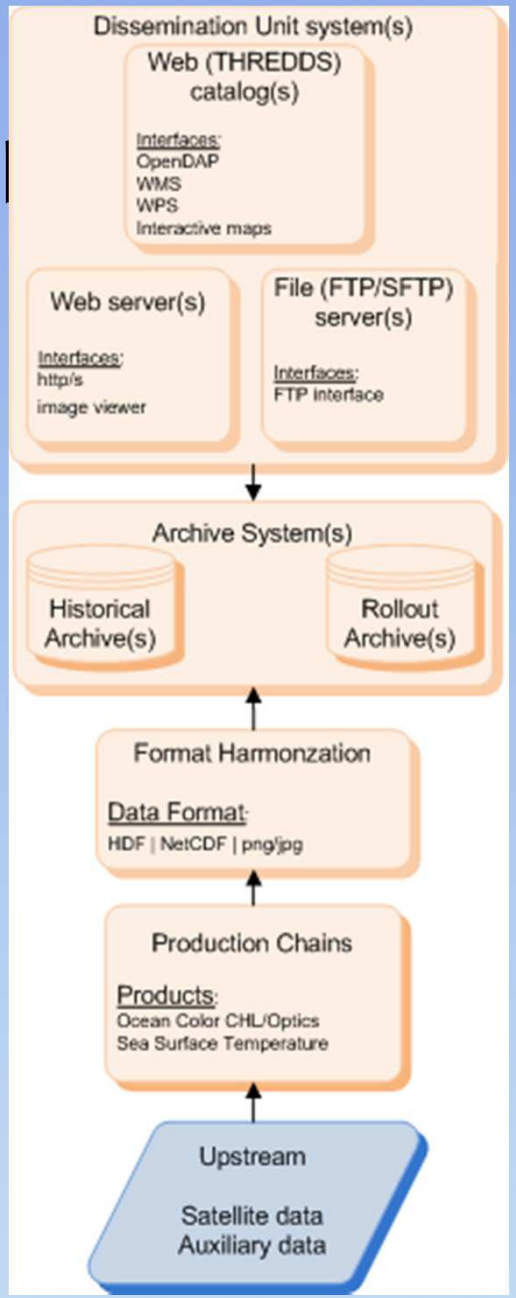
Data:

- Common data format
- Common metadata

Outline

- Satellite data processing
- Products harmonization
- Products dissemination

Satellite pr workflow



Data processing

Sensors	Upstream
MODIS (AQUA)	NASA (Oceancolor GSFC & Lance), ESA, NOAA
Multisensor SST	IFREMER, NOAA
SEAWIFS	CNR, NASA (Oceancolor GSFC)
MERIS	ESA
MODIS (TERRA)	NASA (Oceancolor GSFC & Lance)
VIIRS	NASA (Oceancolor GSFC)

	L3/L4 Products	Temporal resolution	Proc freq
Ocean Color	CHL Optical (RRSXXX, KD490, PAR, SENZ, TSM, …)	Daily Monthly, weekly and 5days average	NRT DT REP
Sea Surface Temperature	HR (1/16°) UHR (1/100°) Anomalies	Daily	NRT REP

Data processing

Grid User Interface

Sends and controls grid jobs

Total Processing Time: 40-60 minutes/day

Download source & auxiliary files

Grid Gatekeeper + Working Nodes

Historical Archive

Rolling Archives / Dissemination Units

Download Source & aux files

Process Source files to L2

Process L2 files to L3 products

Process L3 files to L4 products

Products harmonization

Upload Products

Product harmonization

Why “product harmonization”?

One of the main objective is to integrate existing products in a “**system of systems**” (e.g. “MyOcean”, “SeaDataNet”, etc) for disseminating products to the highest number of end users.

This requires to define **common interfaces** and **common data formats** in order to connect systems and provide users with unique and easy interfaces for product access.

Product harmonization

- File format
- Data variables names and units
- Filename format

Product harmonization

Use case: MyOcean – OCTAC (Ocean Color Thematic Assemble Center)

An hard and long work has been done in order to decide common data format specification as well as filename convention.

…is not easy to “convince” producers to change their own data…

Product harmonization

Use case: MyOcean – OCTAC (Ocean Color Thematic Assemble Center)

File format: NetCDF v3 (moving to NetCDF v4)

Format conventions (variables names and units):

- CF 1.4
- INSPIRE
- GDS (GHRSST Data Service)
- EN-ISO19115
- EN-ISO19119
- …

Product harmonization

Use case: MyOcean – OCTAC (Ocean Color Thematic Assemble Center)

NetCDF-CF variables:

Variable	Var Name nc file	Standard Name	Units
Chlorophyll	CHL	mass_concentration_of_chlorophyll_a_in_sea_water	milligram m-3
KD490	KD490	volume_attenuation_coefficient_of_downwelling_radiative_flux_in_sea_water	m-1
RRS??? **Where ???= band**	RRS???	surface_ratio_of_upwelling_radiance_emerging_from_sea_water_to_downwelling_radiative_flux_in_air	sr^-1
BBP	BBP	volume_backwards_scattering_coefficient_of_radiative_flux_in_sea_water_due_to_particles	m-1
ZSD	ZSD	secchi_depth_of_sea_water	m
…	…	…	…

Product harmonization

Use case: MyOcean – OCTAC (Ocean Color Thematic Assemble Center)

Filename format:

{valid date}[{_freq flag}{_end date}]-{producer}-{level/type}-{parameter}-{config}-{region}-[{bul date}_]{free field}-v{file version}.nc

"-" : mandatory fields ; "_" : optional fields

Examples:

20130914_d-OC_CNR-L3-CHL-MedOC3_A_1KM-MED-DT-v01.nc

20130916_d-ACRI-L4-CHL-OINTERPOL_A_4KM-GLO-NRT-v01.nc

20130914_d-OC_PML-L3-RRS412-nasa_A_1KM-ARC-NRT-V01.nc

20130401_m_20130430-OC_CNR-L4-KD490-MedOC3_A_1KM-BS-DT-v01.nc

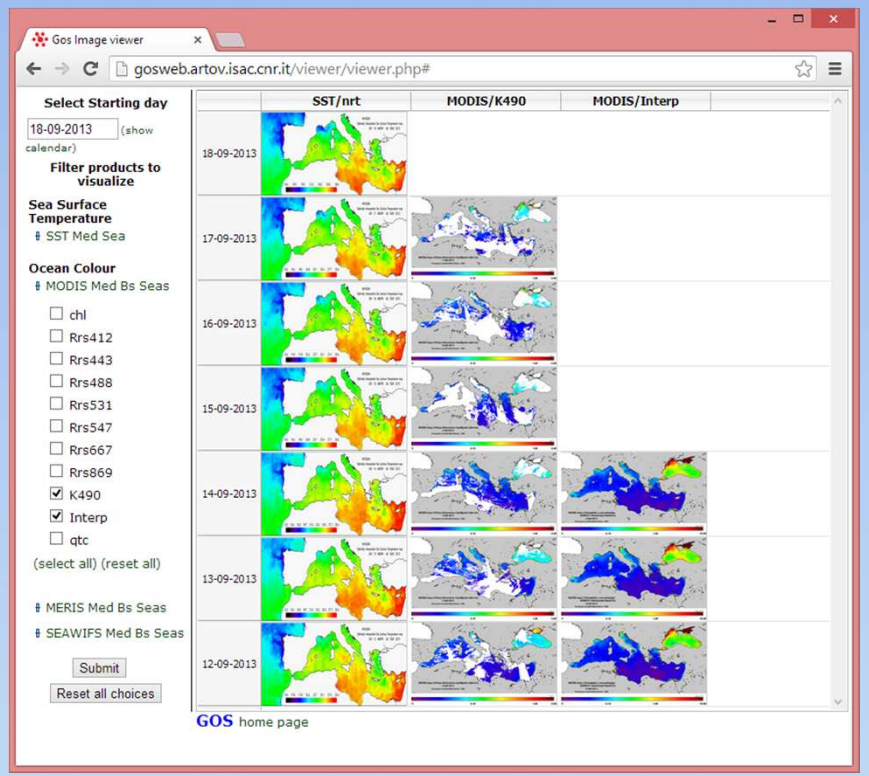
Product dissemination

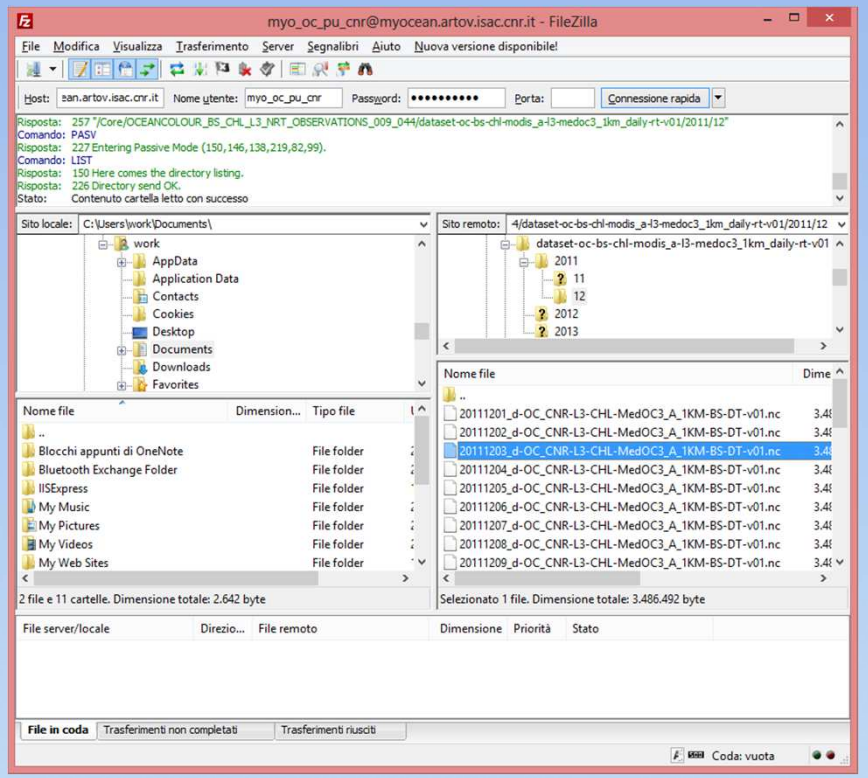
Once harmonized, products are ready for being published and disseminated.

Products are stored in **filesystems** and organized in **catalogs** which are logical directories of on-line data resources, encoded as **XML** documents, which provide a place for annotations and other metadata about the data resources to reside.

Product dissemination

http, ftp, sftp (Basic Interfaces)





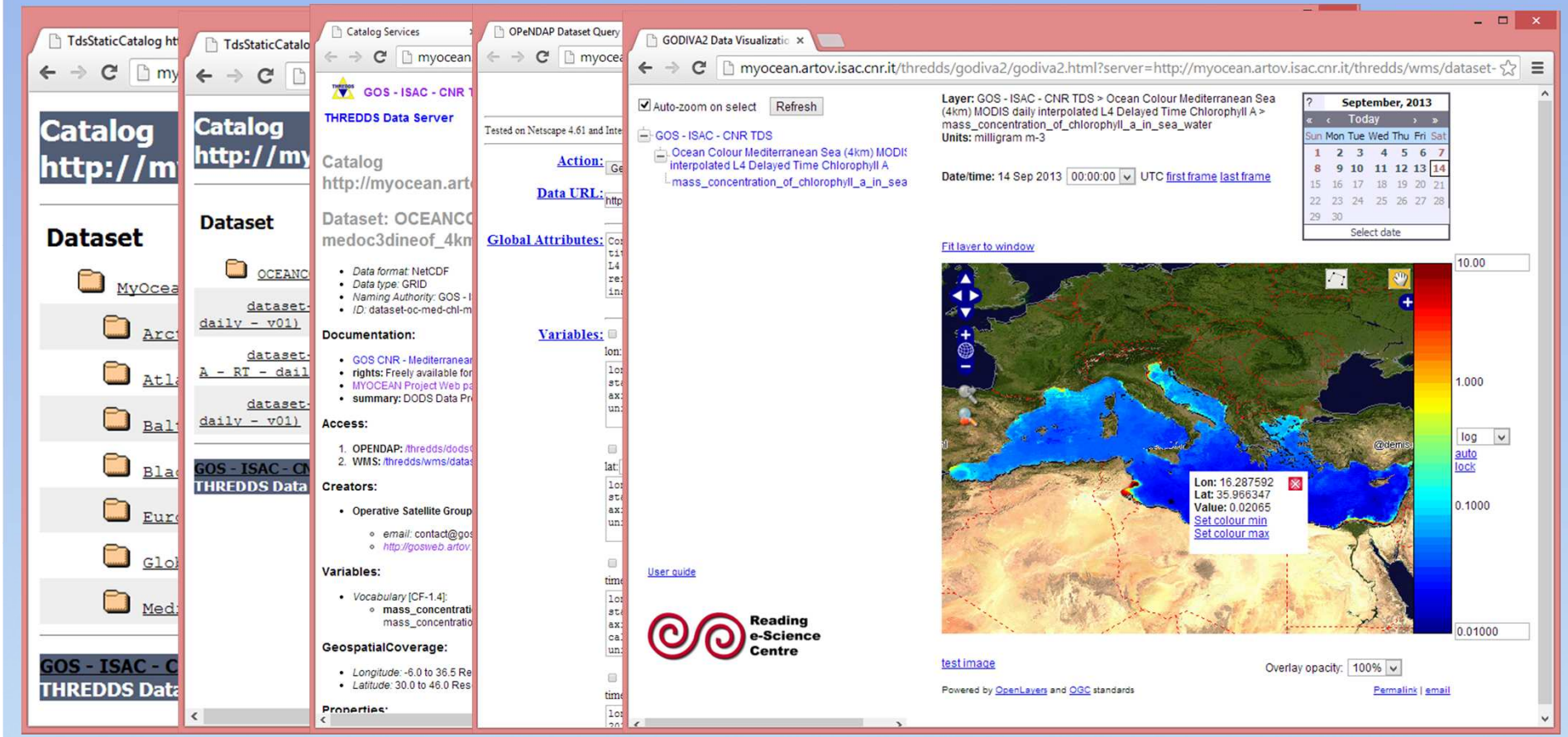
Product dissemination

TDS - THREDDS Data System (Advanced Interface)

- reads the XML metadata archive and netcdf metadata
- can aggregate products
- creates dynamically interfaces like:
  - OpenDaP,
  - WMS,
  - http (direct download)
  - and others

Product dissemination

TDS - THREDDS Data System (Advanced Interface)



Details - TDS XML 1/4

```
<?xml version="1.0" encoding="UTF-8"?>
<catalog name="MYOCEAN Project - Ocean Color datasets inventory" version="1.0.1"
     xmlns="http://www.unidata.ucar.edu/namespaces/thredds/InvCatalog/v1.0"
     xmlns:xlink="http://www.w3.org/1999/xlink" expires="2010-04-24T00:00:00">

    <service name="thisDODS" serviceType="Compound" base="" >
       <service name="OpenDAP" serviceType="OpenDAP" base="/thredds/dodsC/" />
       <service name="wms" serviceType="WMS" base="/thredds/wms/" />
    </service>


<dataset name="OCEANCOLOUR_MED_CHL_L3_REP_OBSERVATIONS_009_054"
ID="OCEANCOLOUR_MED_CHL_L3_REP_OBSERVATIONS_009_054">
<dataset name="dataset-oc-med-chl-seawifs_s-l3-medoc4_1km_daily-rep-v01 (Mediterranean (1KM)
CHL L3 SEAWIFS S - REP - daily - v01)" ID="dataset-oc-med-chl-seawifs_s-l3-medoc4_1km_daily-
rep-v01" urlPath="dataset-oc-med-chl-seawifs_s-l3-medoc4_1km_daily-rep-v01">
 <serviceName>thisDODS</serviceName>

 <metadata inherited="true">
 <property name="aggregation-level" value="view"/>
  <documentation xlink:href="http://catalogue.myocean.eu.org/external/en/OC-CNR-MED_BS-
DT_CHL_SEAWIFS_L3-OBS.html" xlink:title="GOS CNR - Mediterranean CHL L3 SEAWIFS S - RT -
daily">
  </documentation>
```

Details - TDS XML 2/4

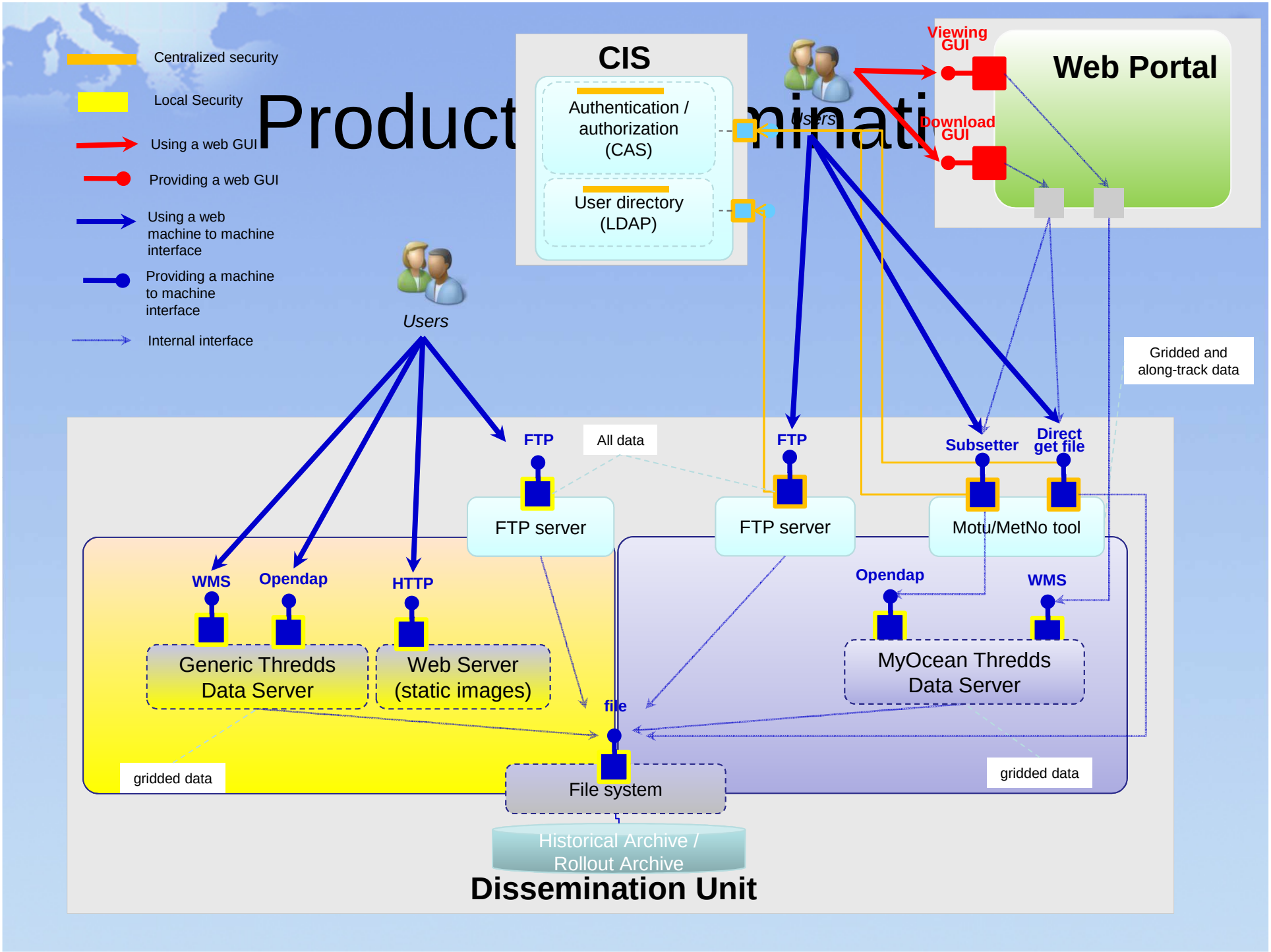
```
<authority>GOS - ISAC  - CNR</authority>
<dataType>Grid</dataType>
<dataFormat>NetCDF</dataFormat>

<documentation type="rights">Freely available for scientific use after subscription to
MyOcean</documentation>
<documentation xlink:href="http://www.myocean.eu.org" xlink:title="MYOCEAN Project Web page"/>
<documentation type="summary">DODS Data Prepared for the MYOCEAN EU Project.</documentation>

<creator>
<name vocabulary="GOS - ISAC - CNR">
Operative Satellite Group - Institute of Atmospheric Sciences and Climate of the Italian
National Research Council
</name>
<contact url="http://gosweb.artov.isac.cnr.it/" email="contact@gos.artov.isac.cnr.it"/>
</creator>

<variables vocabulary="CF-1.4">
<variable name="mass_concentration_of_chlorophyll_a_in_sea_water"
vocabulary_name="mass_concentration_of_chlorophyll_a_in_sea_water" units="milligram m-
3">Chlorophyll-a concentration,MedOC4 algorithm over Mediterranean sea</variable>
</variables>
```

Details - TDS XML 3/4

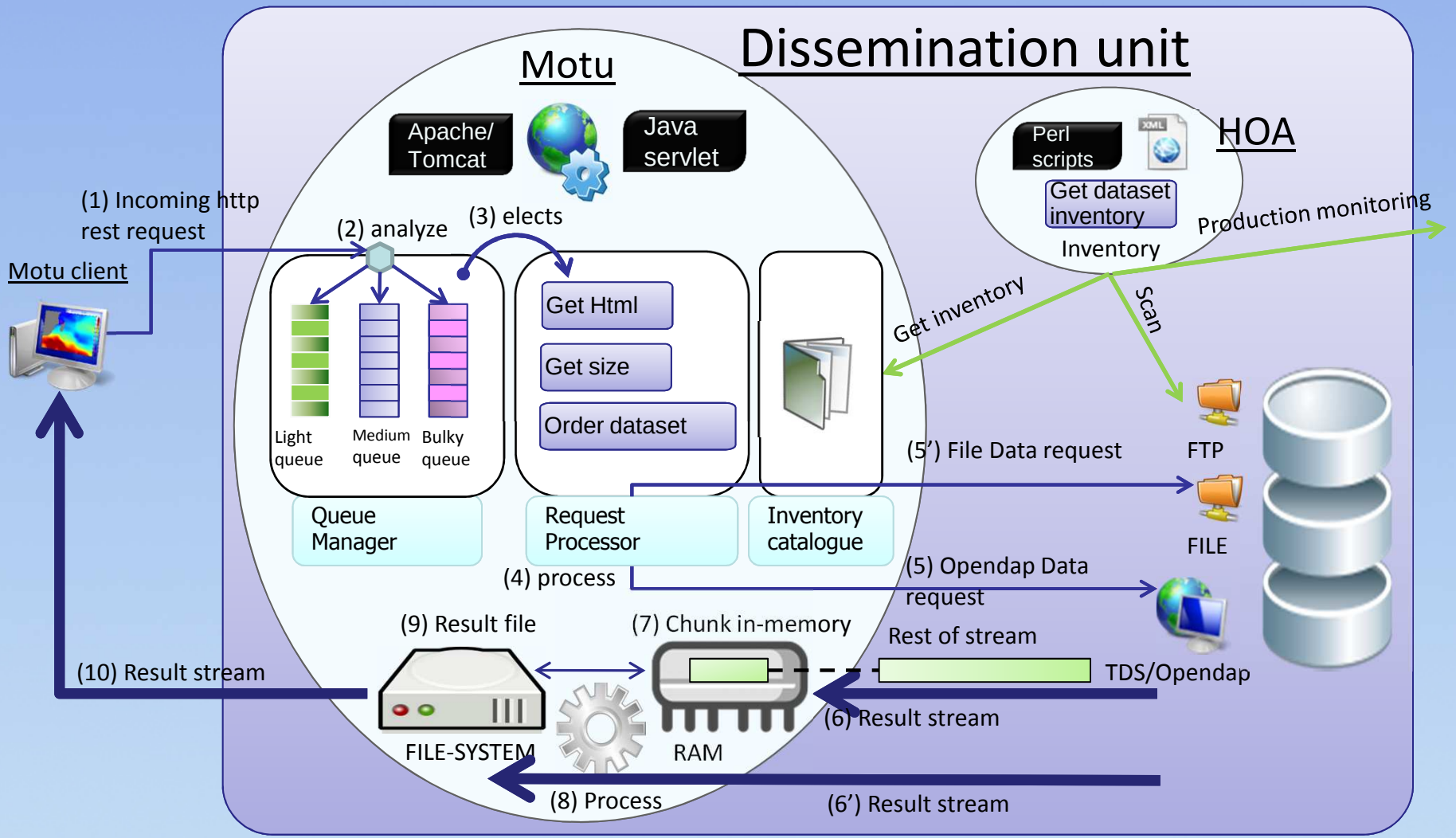
```
<geospatialCoverage zpositive="down">

<northsouth>
<start>30.0</start>
<size>16.0</size>
<resolution>0.012</resolution>
<units>degrees_north</units>
</northsouth>

<eastwest>
<start>-6.0</start>
<size>42.5</size>
<resolution>0.012</resolution>
<units>degrees_east</units>
</eastwest>

</geospatialCoverage>

</metadata>
```

Details - TDS XML 4/4

```
<netcdf xmlns="http://www.unidata.ucar.edu/namespaces/netcdf/ncml-2.2">
<aggregation dimName="time" type="joinExisting" >

<scan
location="/data/products/MyOcean/Core/OCEANCOLOUR_MED_CHL_L3_REP_OBSERVATIONS_009_054/dataset-
oc-med-chl-seawifs_s-l3-medoc4_1km_daily-rep-v01/" suffix=".nc" subdirs="true" />

</aggregation>
</netcdf>

</dataset>

</dataset>

</catalog>
```


Centralized security
Local Security
Using a web GUI
Providing a web GUI
Using a web machine to machine interface
Providing a machine to machine interface
Internal interface
Product
minati
CIS
Authentication / authorization (CAS)
User directory (LDAP)
Users
Users
Viewing GUI
Download GUI
Web Portal
Gridded and along-track data
FTP
All data
FTP
Subsetter
Direct get file
FTP server
FTP server
Motu/MetNo tool
WMS
Opendap
HTTP
Opendap
WMS
Generic Thredds Data Server
Web Server (static images)
MyOcean Thredds Data Server
file
gridded data
gridded data
File system
Historical Archive / Rollout Archive
Dissemination Unit

Product dissemination



Product dissemination

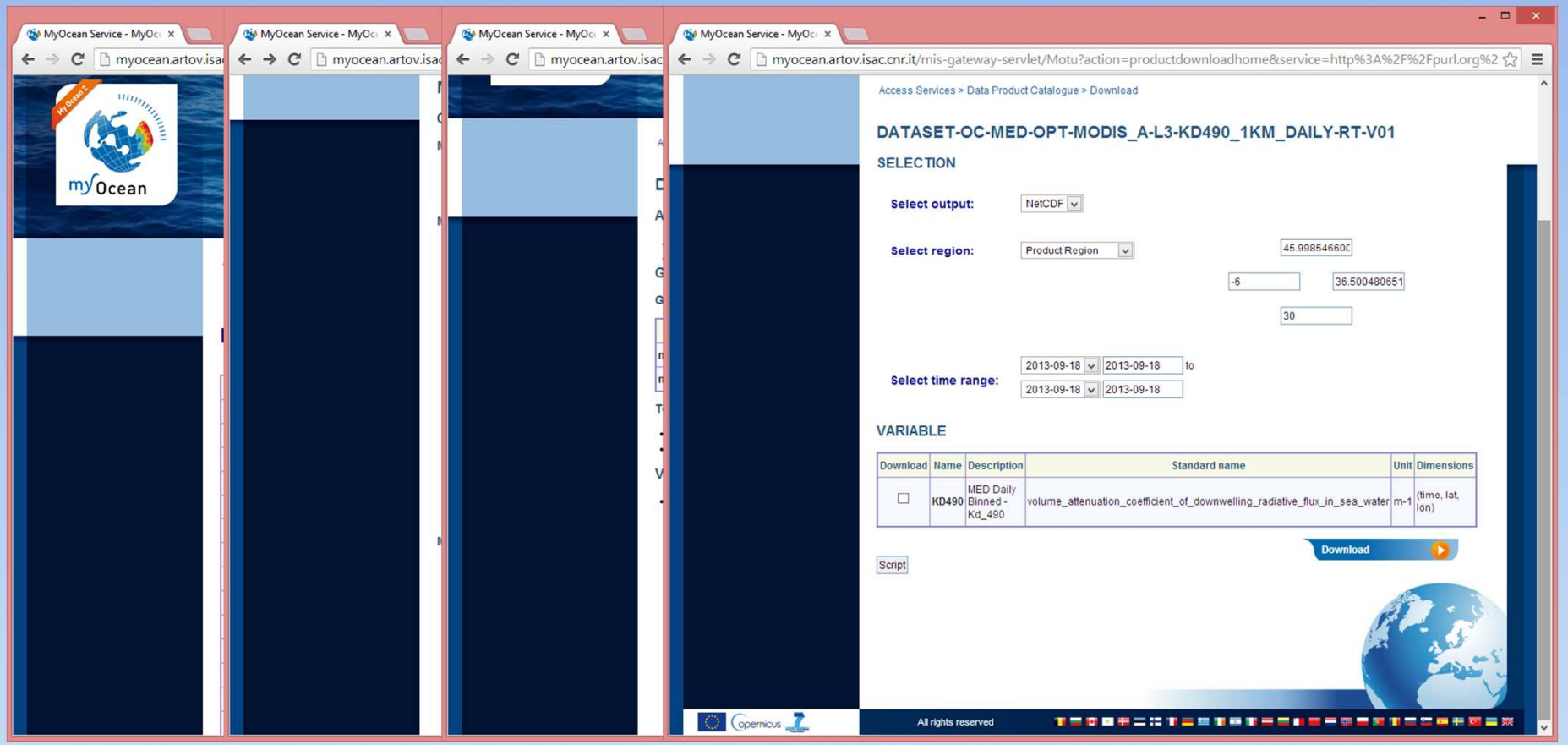
MOTU (Advanced Interface)

Motu is a high efficient and robust Web Server which fills the gap between heterogeneous Data Providers to end users.

- connects to TDS OpenDaP interface
- handles, extracts and transforms oceanographic data
- has the capacity to process huge volumes of data without service overloading or performance collapse
- can set different downloading queues (priorities)
- is able to connect to a central authentication and provides advanced transaction accounting logs
- can federate several data servers

Product dissemination

MOTU (Advanced Interface)

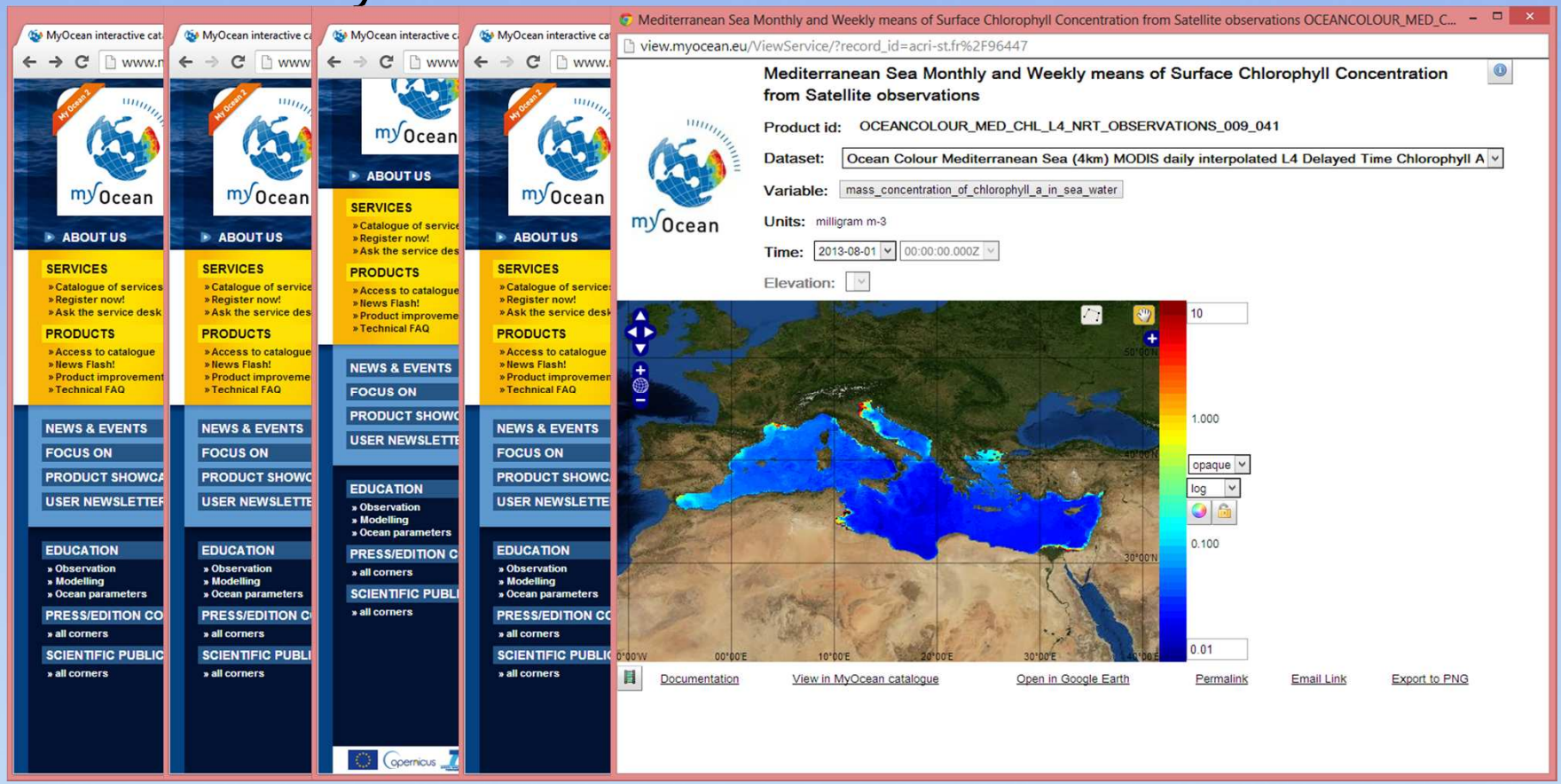


Details – MOTU XML

```
…snip…
 <configService defaultLanguage="UK"
description="OCEANCOLOUR_MED_CHL_L3_REP_OBSERVATIONS_009_054" group="OC-CNR-ROMA-IT"
httpBaseRef="http://resources.myocean.eu" name="http://purl.org/myocean/on
tology/service/database#OCEANCOLOUR_MED_CHL_L3_REP_OBSERVATIONS_009_054-TDS"
veloTemplatePrefix="myocean">
    <catalog name="OCEANCOLOUR_MED_CHL_L3_REP_OBSERVATIONS_009_054.xml" type="tds"
urlSite="http://myocean.artov.isac.cnr.it:8080/thredds/gos_myocean_oc_conf_aggr/MED"/>
  </configService>
…snip…
```

Product dissemination

Use case: MyOcean - Centralized Web Portal



Conclusions

Using standard formats and interfaces permits to “easily” confederate many systems which create higher level of services towards end users:

- Single access point for different data repositories (confederations of systems),
- Queryable data (through metadata)
- New functionalities (i.e. Subsetting, Online data viewing, etc)

…more & better services…more users!!!

THANKS

for being still awake

Questions???