OBSERVATORIO OCEANOGRÁFICO

INTECMAR INSTITUTO TECNOLOXICO PARA O CONTROL DO MEDIO MARIÑO DE GALICIA

RAIA OBSERVATORY: VISUALIZATION OF OCEANOGRAPHIC DATA UNDER INSPIRE DIRECTIVE

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The INSPIRE Directive establishes an infrastructure for spatial information in Europe to support Community environmental policies and activities which may have an impact on the environment. One of the main goals of RAIA Project (supported by POCTEP through the European Regional Development funds) is to incorporate the requirements defined by this directive in order to ensure that the spatial data infrastructures collected by the oceanographic observatory for the northwest Iberian Peninsula are compatible and usable at all levels.

1. INSPIRE DIRECTIVE

INSPIRE (Infrastructure for Spatial Information in the European Community) is an initiative launched by the European Commission described by Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007.

This directive contemplates the existing problems regarding the availability, quality, organization, accessibility and sharing of spatial information.

INSPIRE involves the following points:

- The establishment of metadata services.
- The interoperability of spatial data sets and services.
- The provision of network services that enable data discovery, view and download services, transformation services, services that involve spatial data services.
- Enabling data sharing.
- SDI coordination.

2. JOINING TWO WORLDS

The ability to build a successful marine software architecture requires bridging the gap between different communities, primarily the Earth and Ocean Sciences (EOS) community that uses a collection of scientific data formats and standards and the GIS community that employs a set of tools, formats and standards with a traditional focus on static geographic information.

GIS COMMUNITY

The GIS community typically works with a different set of data standards, driven by the commercial GIS vendors (ESRI and others) and the open-source community encapsulated mostly by the OGC (Open Geospatial Consortium). The OGC aims for the definition of international standards for geospatial interoperability, which will make complex spatial information and services accessible and useful with all kind of applications.

EOS COMMUNITY

The EOS community typically uses a set of binary data formats, often in grids, and which are typically HDF (satellite data), GRIB (meteorology data), and NetCDF (gridded oceanographic data). For in-situ observations, buoys and drifters, there has historically been less consistent.

Standard	Advantages / Uses	Weaknesses
OGC WMS Web Mapping Service	• Many technologies support WMS • Wide client side support • Good for server-side rendering of large datasets • ncWMS allows WMS implementation for gridded data managed with THREDDS	• Returns a "picture", no actual data • GetFeatureinfo spec does allow access to data but not widely implemented • Symbology and legends are complicated • Inconsistent projection implementation • Time specification is included in WMS but is still not widely supported by servers and clients
OGC WCS Web Coverage Service	•Useful for uniform rectangular grids	• Not widely supported on servers and/or clients • No support for unstructured and non-uniform grids
OGC WFS Web Feature Service	• Very flexible • Provides all relevant information for data (ASA point of view) • Allows for custom client-side rendering and analysis • Extensible	• Not practical for large amounts of data • Poor client support, not widely supported • Requires a sophisticated client application
KML Keyhole Markup Language	• Very flexible and practical • Provides all relevant information for data • Widely used, supported by Google Earth and Google Maps so easy to deploy	• For very large amounts of data, it is not practical (e.g. 3 or 4D datasets such current fields) • Creating KML for complex symbols (e.g. rotating vectors) not simple • Google Maps (thin client) support for KML is very weak so need to use Google Earth for full KML support • Not well supported by other GIS clients
OGC SOS Sensor Observation Service	• Growing adoption as part of Sensor Web Enablement (SWE) • Provides consistent methodology to share sensor data • Ideally suited for sharing data between sensor and data assembly center	• No widespread client support • Verbose so not practical for large amounts of data
OGC GML Geography Markup Language	• Consistent method to encode geographic information in an XML schema • Good client support, especially in opensource mapping community	•Verbose so not practical for large amounts of data
Gridded data NetCDF, GRIB, HDF	• Served by OpeNDAP/Thredds so allows for subsetting and distribution • Very efficient for large data volumes • Expanding use for non-gridded data such as drifters • Wide client support in science community • Growing support in GIS community • ncWMS allows WMS support for the data	• Java library is very mature – C library is lagging behind • No support from mass market viewers (Google Earth etc.) • Support in ESRI tools is limited • No support for unstructured grids yet

Figure 1. List of main protocols

3. ORGANIZATION

One of the challenges of RAIA Project is the development of an interoperability platform to disseminate the data collected by several real-time sources (mooring buoys, models, HF radar maps, satellite images,...)

The system is divided into several layers:

Layer of data sources: Each provider saves and maintains its own data.

Layer of servers: Interfaces can serve data in standard protocols, mainly focused on serving georeferenced information.

Layer of clients: Software and solutions that are able to understand standard protocols and gather together georeferenced oceanographic information.

The **advantages** are: 1) Each layer has its own responsibilities; 2) Very heterogeneous sources of data can be used at the same time; 3) Visualization and analysis software is very easy to develop.

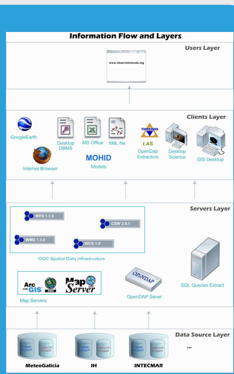

Figure 2. Information flow and layers in RAIA Project

4. RAIA PROJECT ACHIEVEMENTS

RAIA Project is already offering Web Services based on INSPIRE Directive and OGC standards, such as WMS (Web Map Service).

In the short term, RAIA will also provide spatial information that complies with the specification of other OGC standards, such as WFS (Web Feature Service) or WCS (Web Coverage Service). Gridded data are served by several OpeNDAP and Thredds servers.

A catalogue service (CS-W) will be available in order to help the publication and search collections of descriptive information (metadata) for data, services and related information objects.

All of these services are available in RAIA project website:

http://www.observatorioraia.org

To develop client software is a very straightforward task since the data protocols are standard. One RAIA objective is to develop a general web application (Figure 3) that lets the end user discover, visualize and download the different sources of data provided by partners, but also develop specific tools. Regarding this last task, a tool (Figure 4) was developed in order to provide specific oceanographic and weather forecast for barnacle fishers.

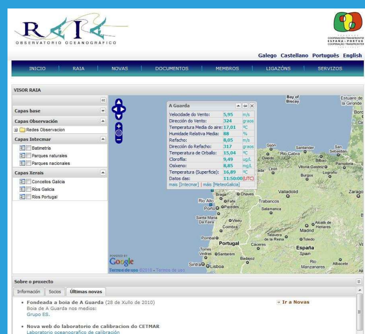

Figure 3. RAIA Observatory Website
www.observatorioraia.org

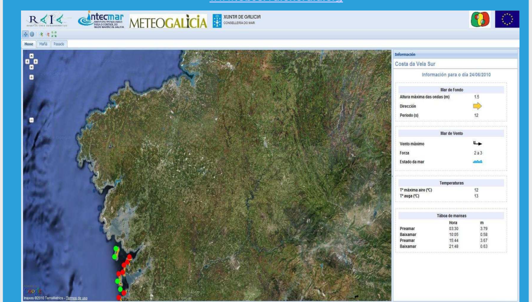

Figure 4. Website for barnacle fishers

(1) Tragsatec.
(2) RAIA Project Partners: Meteogalicia, INTECMAR, IEO, CISC-IIM, CETMAR, GOFUVI-Uvigo, CIIMAR, INESCP, INEGI, FEUP, IH, Univ. Aveiro, FCUP.

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