

# Visualising and comparing distributed coastal Oceanography model and in-situ data using standards-based web services

Alastair Gemmill<sup>1</sup>, Martin Price<sup>2</sup>, Jon Blower<sup>1</sup>, Keith Haines<sup>1</sup>, Keiran Millard<sup>3</sup>, Quillon Harpham<sup>3</sup>

1) Environmental Systems Science Centre, and Reading e-Science Centre, University of Reading, 2) UK Met Office, 3) HR Wallingford, UK



## Introduction

The work described here was carried out as part of the EU FP6 project "ECOOP (European COastal-shelf sea OPERational Observing and forecasting system Integrated Project)"

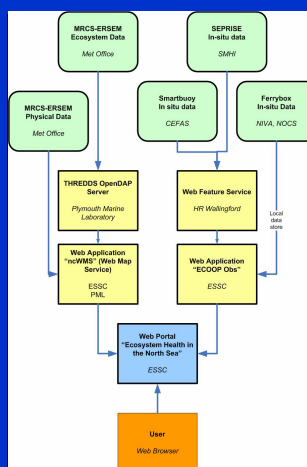
The Decision Support System (DeSS) described here is a prototype intended to provide information for evidence based decision making to help reduce uncertainty in the status assessments of ecosystem health in the North Sea, including assessment of the status of the OSPAR indicators including dissolved oxygen concentration. Other application areas include coastal aquaculture and model based assessment of algal bloom risk. It is based on ecosystem information from Met Office Medium Resolution Continental Shelf - European Regional Seas Ecosystem Model (MRCS-ERSEM), plus near real time ecosystem observations (principally Smartbuoys, Ferrybox, and observations collected through the EU SEPRISE project). The combination of information sources provides a five day forecast and hindcast information from the model and observations, and adds value to the model by providing quality assessment by comparison with the observations.

## Methods

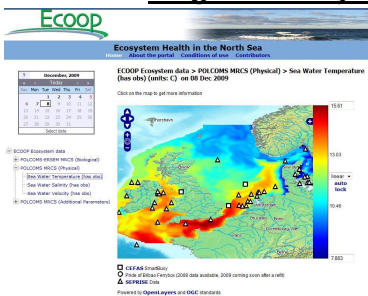
The user connects to the main web portal via a standard web browser.

The portal uses two web applications, the ncWMS Web Map Server and ECOOP Obs (built for the project by Uni Reading). ncWMS uses a local data store for the physical model data, and an OpenDAP to the ecosystem model data held remotely. Many remote and local data stores could be combined in this way and presented through a common interface. ECOOP Obs provides the in situ data, using a local data store for harvested data and an OGC Web Feature Service interface for remote data stores.

The Web Feature Service was hosted by HR Wallingford, and its data services demonstrate the flexibility to combine on demand many data sources hosted in many locations.



## Original Ecosystem Portal

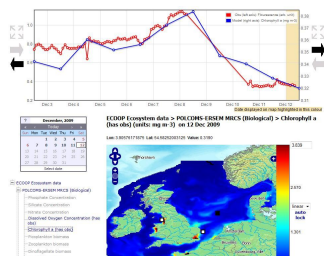


User arrives at front page. Selects model and variable to view. Can then change date via calendar widget.

Colour-contoured map of model data is then shown with colour scale.

Observing platforms which have transmitted data for this variable in previous 10 days are then shown.

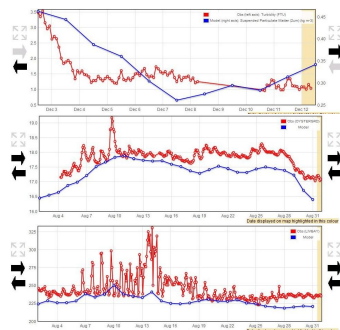
Screenshot to the left shows sea surface temperature for the POLCOMS MRCS model.



The user may click an observing platform to obtain a timeseries plot of the variable from both the platform and the model.

To the right we see a map and timeseries for chlorophyll from POLCOMS-ERSEM model and a North Sea SmartBuoy. Blue line shows model output, red is obs.

The timeseries may be expanded or contracted, and zoomed in and out. Hovering over a point reveals the value.



To the left we see timeseries plots for:

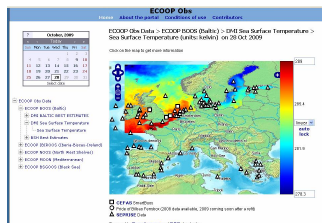
Top: suspended particulate matter from POLCOMS-ERSEM compared with SmartBuoy turbidity

Middle: Sea surface temperature from POLCOMS and SmartBuoy

Bottom: Dissolved Oxygen from POLCOMS-ERSEM and SmartBuoy.

Note: the SmartBuoys and model do not always measure/calculate like quantities, but we can usually compare similar quantities as in the top plot here by using dual axes to spot common trends.

## Extended Portal – more datasets



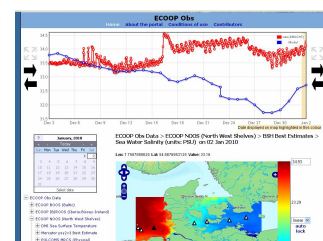
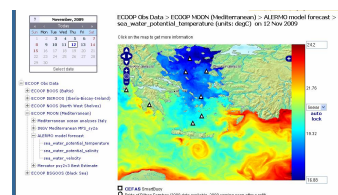
We have expanded the portal to encompass the whole of Europe with more available model output and observed data.

Majority of the observed data come from the SEPRISE project, whose data feeds are still maintained following the project end in 2007.

To the left we see DMI sea surface temperature model output including for the Baltic.

As well as larger regional models (above) there are a number of smaller coastal models - to the right we see BSH salinity output

One of the SEPRISE observations has been clicked and the salinity timeseries is displayed. In this case model (blue) and obs (red) agree at first and then diverge.



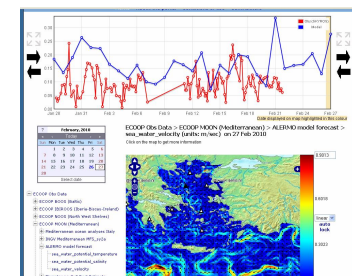
Left: The Alermo model of the University of Athens showing forecast of sea surface temperature for the Eastern Mediterranean

The White triangles show the location of overlapping SEPRISE observing platforms whose data can be compared with Alermo.

On the right we see the display of current vector data (using map functionality developed under the University of Reading Godiva2 project)

The Alermo current magnitudes (blue) are compared to those from one of the SEPRISE observing platforms.

Note that upon a click from the user the data are streamed to the portal in real time from the HR Wallingford WFS (obs) and the model data providers (U. Athens)



## Key benefits of the this task and the system developed are:

- It has provided a forum for engagement between data providers, users and expert scientists, which resulted in a set of user-driven requirements covering what inputs are useful, and how they should be combined and presented.
- It has developed a real-world demonstration of the potential to use standards based data services to combine and therefore add value to existing geospatial datasets.
- It can be easily extended for other parameters or regions provided input data services are available. Uni. Reading's Model-Obs portal, also developed for ECOOP, demonstrates the use of common systems for different regions (see right hand central panel).
- A working system has been developed which we intend will form the basis of future developments.

## Discussion

## Some lessons learned include:

- A limited number of ecosystem parameter in-situ observations are available in near-real-time – due to the limited number of observations made, the technical difficulty of producing good results from automated measurements, and the lack of procedures or perceived need for near-real-time transmission. In addition measurements tend to be held by the originators and only made more widely available when there is a compelling requirement.
- Performance remains a critical issue for web-based live services of this kind. Care must be taken to keep the system performing well as seemingly simple user requests can generate a lot of behind-the-scenes processing by the supporting systems.
- 'Operationality' is more difficult when aggregating services from multiple providers, because there are more possible sources of failure outside the system owner's control. This has not been a critical issue here, but could be for some applications.