OPERATIONAL OBSERVATORY OF THE CATALAN SEA (OOCS)

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ABSTRACT

The Operational Observatory of the Catalan Sea (OOCS) recently created by the Operational Oceanography Group at CEAB-CSIC is the main component of a Spanish research project (OAMMS) running from Jan 2009 to Dec 2011. The OOCS aims at performing observations of the marine environment in the Catalan Sea and beyond, assessing, modelling and forecasting the hydrodynamic and biogeochemical processes of the region. Observations and assessment are conducted on the base of in-situ observations by an oceanographic buoy and regular sampling at an OOCS station in the Blanes Canyon head. A 1DV model simulates variations of the marine conditions in the station. A 3D coupled hydrodynamic-biogeochemical model simulates the conditions in the Western Mediterranean. 7-days forecast and reanalysis is about to be performed with the 3D model, the atmospheric conditions provided by ECMWF and in-situ observations. Some of the services provided by OOCS are already available to the public through a dedicated website http://www.ceab.csic.es/~oceans/. The OOCS is expected to become a permanent service depending on resources available in the middle term.

1. INTRODUCTION

Observation and modelling of biological, physical and geochemical properties of the ocean are essential to assess present and past of the ecosystem functioning, and to predict upcoming changes in environmental patterns. At present, the observing systems at global, regional and local scales, such as environmental satellites and moored and drifting buoys, provide information for short and long term monitoring of the ocean. In the Catalan coast, a number of buoys, meteorological stations and tide gauges provide information to public and contribute, together with numerical models, to atmosphere and surface ocean forecasts. Existing services provide little information on the sea conditions below the surface. Furthermore, no instruments measuring biological and geochemical properties of water are available and therefore no assimilation in models and forecasts of those environmental variables are provided.

The OOCS, a component of project OAMMS funded by the Spanish Ministry of Science and Innovation, started operations in January 2009. The OOCS is maintained by the Group on Operational Oceanography at CEAB-CSIC, taking advantage of the facilities available at the CEAB. The observatory (Fig.1) aims at performing observations of the marine environment in the Catalan Sea and beyond also assessing, modelling and forecasting the hydrodynamic and biogeochemical processes of the area.

The observatory began by setting a time-series offshore station in the upper slope of the Blanes Canyon head at about 5 miles from the coast. The site generally shows open ocean water properties [1] and cloud-free characteristics. The proximity from the coast and the environmental characteristics has allowed carrying out regular monitoring cruises coincident with satellite overpasses (i.e. ENVISAT) contributing to calibration and validation of satellite observations [1], [2]. At the station, a moored oceanographic buoy is taking continuous measurements of meteorological conditions, sea surface and underwater physical and biogeochemical conditions. The buoy is presently moored in a temporal location for overall testing and data are published on a dedicated site (http://www.ceab.csic.es/~oceans/) on a daily basis. Two numerical models implemented by team members are used to represent the conditions in the Catalan Sea.

A 1DV physical and biogeochemical model [3] is expected to represent the conditions in the OOCS Station from surface up to 250 m depth. Biogeochemical variables available in the model are phytoplankton, zooplankton, detritus, nitrate and ortophosphate. A 3D coupled hydrodynamic-biogeochemical model [4], [5] represents the conditions of the Western Mediterranean. Historical meteorological conditions provided by the European Centre for Medium-Range Weather Forecasts (ECMWF) have allowed the model to perform marine hindcast [5]. At present, 7-day forecast and reanalysis of meteorological forcings (wind stress, heat and water balance), kindly supplied by the ECMWF and the Spanish AEMet, are performed for the Mediterranean Sea and published on the website. Forecast and reanalysis of marine conditions (temperature, salinity, nitrate, phosphate, and phytoplankton) will be performed in short by the 3D model (POM) of the western Mediterranean Sea and published on the website.

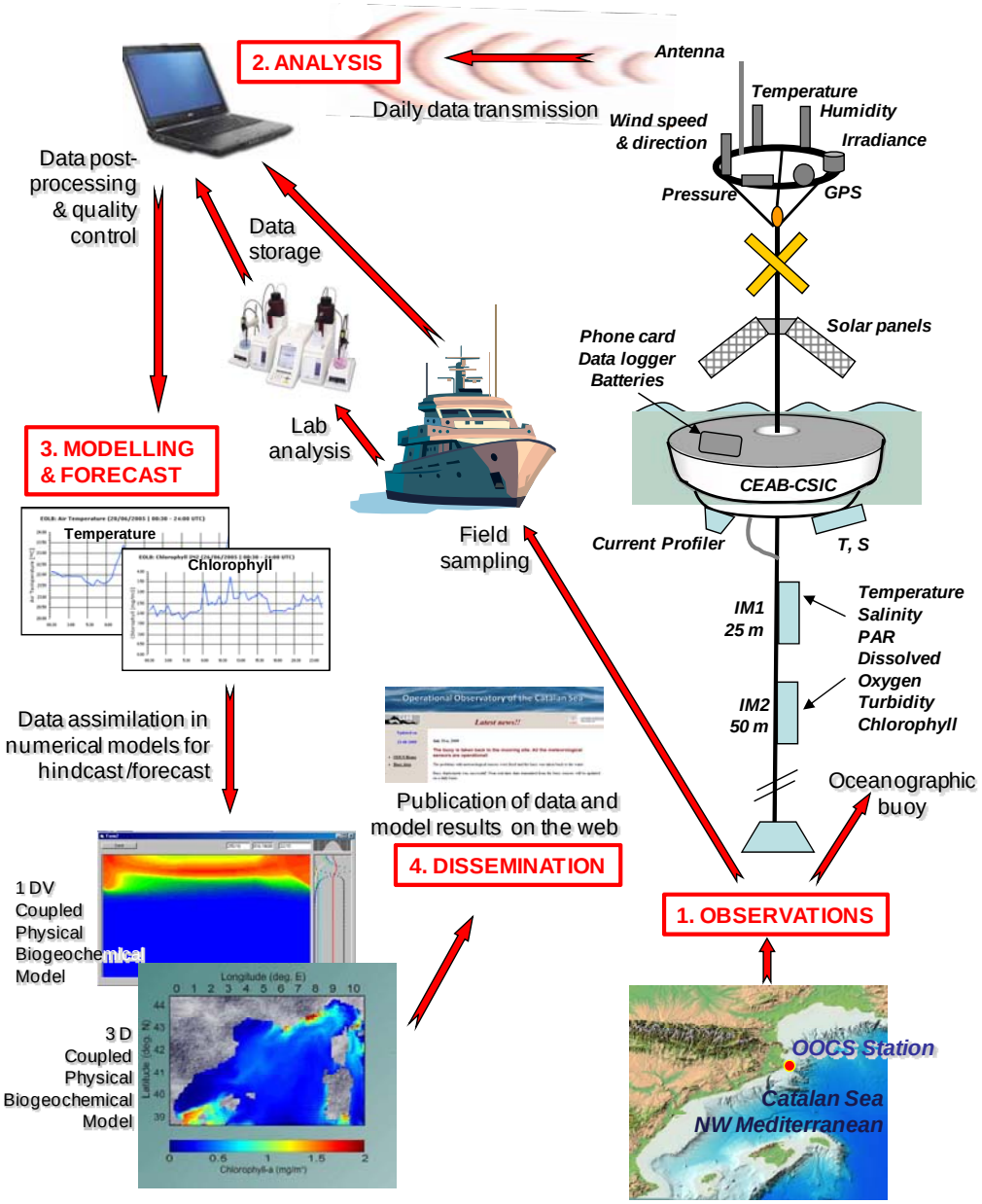

Fig. 1. The OOCS components from observations to dissemination of results.

The Roadmap for a European Marine Observation and Data Network from the Commission of the European Communities (Brussels, 7.4.2009, SEC 2009, 499 final) highlights the need for marine data collection and encourage all individual sources of marine data collection to become a part of a system identifying the available data sets and their quality in order to facilitate access to coherent data sets and to shape data collection and monitoring infrastructures. Within this framework, the OOCS is currently a part of the consortium MOON: Mediterranean Operational Oceanography Network. Data integration of marine observations by OOCS will be sent to the European data exchange system (EU-SEPRISE project) coordinated by Euro-GOOS (Association of Agencies from the Global Ocean Observing System for the development of Operational Oceanography in the European Sea areas and adjacent oceans).

The dedicated website (http://www.ceab.csic.es/~oceans/) provides additional information of the OOCS activities and available and upcoming services. The observatory is expected to be fully operational in 2011.

2. COMPONENTS

2.1. Multiparametric Oceanographic Buoy

The buoy system is composed by a doughnut-type float with an emerging structure containing a full set of meteorological sensors, the central data-logging facility and the real-time communications system. In addition, the buoy has underwater instruments measuring, at various depths, a number of oceanographic and ecological magnitudes.

The buoy outfit was completed at CEAB's facilities in July 2009 and was immediately located on a shallow (60 m depth), near shore mooring location off Blanes. In the present configuration, the buoy provides data from GPS, compass, two wind sensors, air temperature, atmospheric pressure, relative humidity and photosynthetically active radiation (PAR) in the atmospheric component and a down looking ADCP.

Final deployment was successfully performed in mid September 2009 with the indicated instrumentation plus a surface SBE37 Seacat (temperature and salinity) and two SBE16+ packages recently calibrated at factory with sensors of conductivity, temperature, dissolved oxygen, fluorescence, turbidity, and PAR located at 25 and 50-70 m depth.

Data are collected continuously and averaged over 30 minute periods. Transmission to the base in the CEAB is done daily. The data are available in near real time (within 24 hour of gathering) with rough quality control and will be displayed in our web http://www.ceab.csic.es/~oceans/.

2.2 Complementary Sampling and Infrastructure Maintenance

Fortnightly CTD/Niskin casts started in March 2009 on board the CEAB's vessel DOLORES. An autonomous rosette water sampler with ten 5 L Niskin bottles and a SeaBird 19+ CTD with fluorescence, PAR and turbidity sensors will be used to perform the casts. Bottle samples are used in lab to measure spectrophotometric chlorophyll-a concentration, dissolved oxygen using the Winkler method, and nitrate, nitrite, phosphate and silicate concentrations.

Six-monthly visits from the R/V GARCIA DEL CID will be performed at the mooring site. On-deck inspection and maintenance of the instrumentation on the buoy will be carried out. A CTD grid covering the continental shelf and the slope around the mooring site is planned for each cruise.

2.3 Real-time Modelling and Forecast

Real-time modelling and forecast is expected to be performed using the models developed by Group members: 1DV model [3] for the mooring site, a 3D hydrodynamic model for the Catalan Sea [4] and 3D coupled hydrodynamic-biogeochemical [5] for Western Mediterranean Sea. The models are being adjusted to assimilate data obtained from the OOCS observing system as well as from remote sensing. Forcings from the European Centre for Medium-Range Weather Forecasts have been used to perform marine hincasts and will be used to produce real time operational forecasts. 7-days forecast of the biogeochemical and oceanographic conditions are expected to be available shortly and made available to public (see http://www.oceans.cat/en/op_oceanography.html).

2.4 Historical Data

Oceanographic cruises carried out by the team in the last four decades in the study area providing historical information of hydrographic and biogeochemical conditions will soon be accessible on-line. Relevant features on these conditions can be found in several doctoral theses [i.e. 6, 7]. Data are under quality control processing at US NOAA Ocean Climate Laboratory.

Development and implementation of a Quality Control Program for all the components of the Observatory is in progress.

3. OUTREACH

The Observatory, through its web page, disseminates results and data sets and also advertises the willingness of the scientists in the CEAB to lecture in colleges, high schools and other communities which might be interested in knowing firsthand the experiences of the day-to-day work.

Integration of marine observations provided by OOCS to the European data exchange system (EU-SEPRISE project) coordinated by Euro-GOOS is in progress.

The future of the OOCS, after the end of the project OAMMS in 2011, will depend upon available support provided by the CSIC, the Ministry and/or any other potential national or international sources of funding. The Observatory aims at becoming a service for the scientific community and general public for local, regional and international meteorological and marine climate change projections.

4. REFERENCES

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