PHY FOR OIL-SPILL EVENTS IN THE ANDALUSIAN COAST: A REAL CASE STUDY DURING THE FEDRA ACCIDENT (OCTOBER 2008)

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Abstract – The special hydrodynamic regime of the Andalusian Coast, the important meteorological influence, and the intense maritime traffic of oil tankers make the use of field measurements and appropriate hydrodynamic models to be an essential part of an operational system for the prevention and management of oil spills in these waters. An operational oceanography system has been developed, based on the use of different numerical models and field stations, whose results are implemented into an online GIS environment available to researches and Institutions at a website, providing oceanographic information and prediction fields with different levels of time-spatial covering and resolution. A practical example during the oil-spill accident of the tanker Fedra at Algeciras Bay in October 2008 is given.

Keywords – operational oceanography, hydrodynamic modelling, oil spills, Andalusian Coast.

1. INTRODUCTION

The Andalusian Coast constitutes a physical environment of special characteristics, due to the presence of environments with different hydrodynamic conditions: the Gulf of Cádiz at the West (Atlantic Ocean), the Alboran Sea at the East (Mediterranean Sea), and the Strait of Gibraltar connecting them. The intense maritime traffic of oil tankers sailing across the Strait of Gibraltar, together with the presence of oil refineries at Huelva and Algeciras, imply high risks of oil spilling within these waters, and unfortunately it has constituted a matter of usual occurrence through the last decades. The Research Group "Physical Oceanography: Dynamics" of the University of Cadiz have developed a system of operational oceanography for all this area, based on the use of different hydrodynamic, meteorological, wind-wave and transport-diffusion models, as well as in situ data acquisition stations. Results are real-time implemented into an interactive GIS (Geographic Information System) environment available online to the concerning researches and Institutions at a website, providing current hydrodynamic information and prediction fields. The system was applied to the real case of the oil-spill accident caused by the oil tanker Fedra inside Algeciras Bay in October 2008, which is presented as an example in this paper.

2. THE OPERATIONAL OCEANOGRAPHY SYSTEM FOR THE ANDALUSIAN COAST

The online GIS environment provides the time-spatial prediction fields of hydrodynamic properties based on the results of different numerical models: two-dimensional/depth-averaged (UCA 2D, [1]), two-dimensional/two-layer (UCA 2.5D, [2]) and three-dimensional (UCA 3D, [3]) hydrodynamic models, meteorological model (MM5, [4]), wind-wave model (modified SWAN, [5]), and transport-diffusion models [6], having different levels of spatial covering and resolution. In addition, an oceanographic buoy mooring is installed at Cadiz Bay, which is constantly measuring and transmitting via modem oceanographic data of surface elevation, currents, temperature, salinity, turbidity and chlorophyll concentration. These data are real-time implemented and recorded into the online GIS environment as a complement and validation of the model results. Similar field stations are planned to be installed in other points of interest throughout the Andalusian Coast. The resulting data of the precedent models and the field station are real-time implemented and recorded into an interactive online GIS environment, where the time-spatial fields of model results are graphically represented as well as the series from the buoy mooring. All these information are available at a website (http://sunotri01.uca.es/client) in a user-defined environment. The allowed researchers and Institutions are also able to download selected data series and time-spatial fields for scientific and social purposes. The 'default' contents of the GIS environment are the predictions and records from the hydrodynamic and meteorological models and the time series from the buoy mooring, whereas in case of a real oil-spill accident the requested results from the wind-wave and transport-diffusion models are also deployed.

3. A CASE STUDY: APPLICATION TO THE OIL-SPILL ACCIDENT OF THE TANKER FEDRA INSIDE ALGECIRAS BAY IN OCTOBER 2008

On 12th October 2008, the oil tanker Fedra wasted more than 150 tons of fuel into the Algeciras Bay waters, affecting the shoreline of these coasts. During the palliation and managing activities carried out for this oil-spill accident in the subsequent days, the described operational oceanography system provided the prediction of the time-spatial evolution of the spill for such period, considering the hydrodynamic and meteorological conditions present, as well as the nature, amount and location of the spill. In addition, the accident was used to validate the accuracy of the predictions given by the system, by comparing the calculated time-spatial fields with in situ photographs of the oil spill (Fig. 1). Results confirmed the ability of the operational oceanography system to predict the general evolution of the oil spill and the most affected coastal areas.

4. CONCLUDING REMARKS

An online GIS environment has been developed to integrate, host and represent the resulting oceanographic data from different models and field stations, available at a website and mainly focused on the establishment of an operational oceanography system for the Andalusian Coast. The scientific and social application of this system becomes a very useful tool for the monitoring, prediction and management of eventual oil-spill accidents in these waters, as demonstrated in the real case of the Fedra oil-spill accident. One remarkable advantage of the system is its ability to consider and assimilate data from other models, domains and field stations which could be developed in the future. However, it is still necessary to deep in the development of the best modelling and data analysis strategies in order to optimize the practical management of these accidents.

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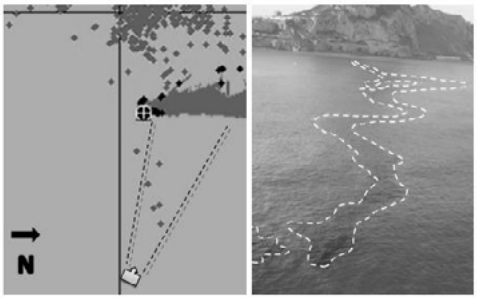

Figure 1. Example of comparison between the system prediction (left) and an in situ photo (right) for the Fedra accident.