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Oil Spill forecasting tools integrated in an early detection and monitoring system for the Tuscany Archipelago

Joao Janeiro, Flavio Martins, and Anna Zacharioudaki

Centro de Investigação Marinha e Ambiental (CIMA), Universidade do Algarve, ISE, Estrada da Penha, 8000-139 Faro, Portugal

The increase of human occupation in the world coastlines, the growing industry activities directly related to the coast and the growing environmental awareness among the general public and media coverage, makes the response decision to oil spills a politically sensitive task. Regions like the Mediterranean Sea where the transport of oil is estimated to be 370 million tons/y, representing 25% of the world total, become particularly exposed to these accidents. The ARGOMARINE system which concept is the monitoring of the marine traffic and early detection of oil spill events, primarily due to carriers and commercial ships through environmental-sensitive sea areas, is a decision support tool for local authorities to early detect, forecast and respond to these types of events. This paper describes the forecasting system integrated in the ARGOMARINE. The system relies in a regional operational mathematical model based on the MOHID modelling system, that receives forcing information from a large scale operational model and downscale it to two increasingly higher resolution grids. The system core is compose by three models (3D hydrodynamics, wave and lagrangian transport) all linked in the same system and exchanging information in real time. This approach allows the exchange of turbulence information in real time between the modules, with practical results when simulating an oil spill. This type of approach also eliminates the need for data interpolation and increases the uniformity of the data analysis methods used by the model. Oil advection and weathering processes are coupled to the lagragian transport model. This is considered an important advance in the state of the art on oil spill forecasting. The oil model is mesh independent, being able to run over a system of nested meshes, using in each point the best hydrodynamic fields available. It simulates the main weathering processes that occur in an oil spill at sea surface and the water column, and its interaction with the coast. The system was implemented in the Tuscan Archipelago National Park area and the results obtained in hypothetical spills are coherent from the physical point of view and in good agreement with what is expected for the advection of the oil in the study area.