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High-resolution Forecasting for Harbour-Beach Interactions. A Mediterranean Application.

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Quality ocean information from observations and forecasting is crucial to support evidence-based decision making and providing a crucial framework for underpinning the scientific basis for policies that regulate the use of the oceans, coastal regions and port areas, maintaining their healthy ecosystems, protecting the development of the littoral zones, and monitoring the environmental mitigation efforts. However, there are fundamental gaps in our ocean observing and forecasting capabilities, limiting our capacity to manage the oceans, coastal regions, and port areas sustainably. Therefore, particularly for coastal areas, it is necessary to ensure high-level integration for coordinated observations that can be sustained in the long term and help to improve ocean forecasting to ensure safe and sustainable human-coastal interaction.

The EuroSea initiative [1] is an innovative action of the European Union that brings together key European actors in ocean observation and forecasting with key European end-users in ocean observation, thereby promoting a genuinely interdisciplinary ocean observing system and providing oceanographic products and services. Furthermore, it enables high-resolution coastal operations and forecasting systems in restricted domains such as local ports, beaches, and nearby coastal waters. The EuroSea Project aims to advance scientific knowledge about ocean climate, marine ecosystems, and their vulnerability to human impacts and demonstrate the ocean's importance for a healthy and economically viable society.

Within the EuroSea project framework, we present a 3D hydrodynamic tool to improve the sustainable management of Barcelona's local coastal waters. We use the Coupled Ocean-Atmosphere-Wave-Sediment Transport Modeling System [2] that utilises the Model Coupling Toolkit to exchange prognostic variables between the circulation model ROMS and the wave model SWAN. As part of the system, the wave and circulation models run with nested and refined grids to provide increased spatial resolution, scaling down to solve nearshore wave-driven flows, all within selected regions of a larger, coarser-scale coastal modelling system. Bathymetry was built using a combination of data from EMODnet [3] and specific high-resolution sources provided by local authorities. Copernicus products have driven these high-resolution simulations.

Field campaigns have been used to validate results, displaying agreements between modelled outputs and in-situ observations. Therefore, the model provides results that will be used to

develop new forecast capabilities, such as predicting erosion and flooding, simulating rip currents, tracking the floating debris, and knowing the flushing times.

Finally, we look ahead to the future of the development and maintenance of the operational prediction systems because their harmonisation and integration with the existing ocean knowledge will increase the availability of credible scientific evidence to inform industry, help to reduce the impact of human activities on the ocean and improve environmental management.

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[1] EuroSea Project (https://eurosea.eu/)

[2] Warner, J.C., Armstrong, B., He, R., and Zambon, J.B., 2010, Development of a Coupled Ocean-Atmosphere-Wave-Sediment Transport (COAWST) modelling system: Ocean Modeling, v. 35, no. 3, p. 230-244.

[3] EMODnet (https://www.emodnet-bathymetry.eu/)