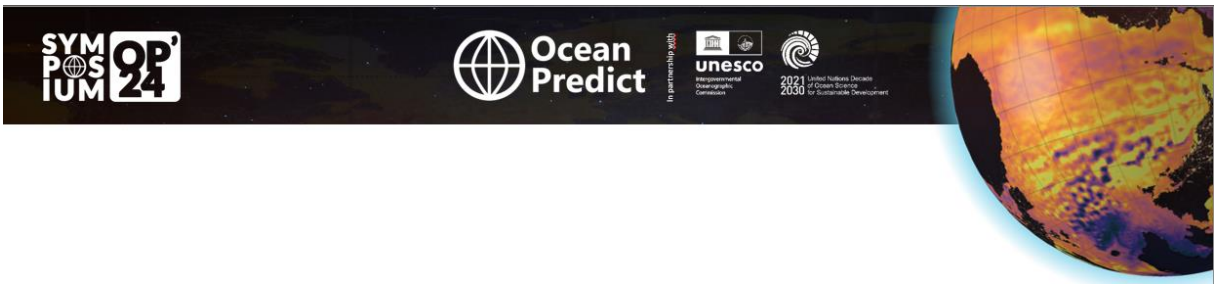

A coastal and estuarine operational oceanography system and derived downstream services for marine pollution prevention and water quality management

Marine pollution is a growing concern that affects the coasts around the world. In recent decades a significant effort has been made to obtain data on the physical environment and to develop tools for the prevention and management of marine pollution, whether from industrial discharges, accidental spills or plastic and marine litter. Despite the efforts made, the availability of data and tools at the coastal and local scale is limited, mainly due to the high spatial resolution required in these areas and the complexity of the processes to be modelled. In this context, the application of artificial intelligence (AI) and hybrid methods can facilitate the development of operational oceanography and decision support systems in coastal areas. To face these challenges, this work presents a coastal and estuarine operational oceanography system based on an innovative combination of dynamical and AI-based techniques to provide high-resolution ocean variables and the associated downstream services for marine pollution prevention and water quality management. The system is applied in the Cantabrian coast and in the Bay of Santander, one of the most important estuaries along the North coast of Spain (Gulf of Biscay). As main results, the following products are being developed: i) CANT-Coastal Modelling System (CANT-CMS): a coastal operational oceanography system based on ROMS model and nested to IBI-MFC to provide the short-term (2-5 days) forecast of ocean variables (~300 m spatial resolution) in the Cantabrian coast. ii) SDR- Local Modelling System (SDR-LMS): a local operational oceanography system based on machine learning techniques (RNN-LSTM) and nested to CANT-CMS to provide the forecast of ocean variables (~50 m spatial resolution) in Santander Bay. Currently, machine learning is applied for obtaining sea level and currents and is being explored for temperature and salinity. iii) IH-TESEO: an online modelling system nested to national and international providers, such as CMEMS at global and regional scale, as well as to CANT-CMS and SDR-LMS to provide the simulation and forecast of oil spills, chemical spills, drifting objects and Search and Rescue worldwide. iv) CICLOPE: a deep-learning based operational forecast system nested to IBI-MFC and CANT-CMS to provide water quality forecast at beaches and recreational areas in Santander Bay and Cantabrian coast. For the calibration and validation of the system, two hydrodynamic field campaings were carried out inside the estuary (1 month duration) and offshore (9-month duration). A detailed description of the system implementation and validation will be shown in the presentation.

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