

Sea Observatory and operational modelling system for the south-eastern Brazilian shelf

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Our society depends on diverse activities related to the sea (e.g., fisheries and aquaculture, maritime transportation, exploration of natural resources), which demands an extensive knowledge of oceanic processes and related environmental impacts to achieve a sustainable development. A comprehensive understanding and the prediction of the ocean and coastal dynamics is a great challenge due to the high variability of environmental processes and large dimensions involved. Observation data (e.g., in-situ measurements and satellite data) are fundamental in this context; however, inherent constraints in the spatial and time scales are important limitations, which can be overcome by the application of numerical models. In order to provide useful answers to the demands, information from different types and sources need to be integrated and easily available to the stakeholders.

A web-based monitoring service for the Brazilian coast (Sea Observatory) has been developed in the frame of the User Uptake program from the Copernicus Marine Service, aiming to integrate in-situ measurements (e.g., tidal gauges and wave buoys), satellite data (e.g., sea surface temperature and phytoplankton), operational modelling forecast results (e.g., circulation, meteorology, waves), and vessel positions. All information available in the Brazilian Sea Observatory will be updated daily, considering the last forecast results. The main target users that can benefit from the Brazilian Sea Observatory are the oil and gas industry, aquaculture industry, renewable energy industry, public and research agencies, Brazilian navy and port administrations.

The users will have free access to visualize the different types of information in map or graph format. Registered users (e.g., oil and gas industry and public agencies) will be able to simulate on-demand marine pollution incidents (e.g., oil spills) based on the best available information (higher resolution models). During the project timeframe, the registration to this service will be free. In another perspective, the Brazilian Sea Observatory can be useful to obtain forecasts of the drifting of algal blooms, important for food safety. Plumes from sources of marine pollution and marine litter can also be tracked, providing essential information for an effective coastal management, supporting the decision-making process by environmental agencies, such as the closing of shellfish production zones. The metocean conditions available in the Brazilian Sea Observatory will be provided by partners of the grouping (e.g., UFPR) and external institutions (e.g., Copernicus Marine Service).

An operational modelling system based on a downscaling approach from the Copernicus Marine Service models will provide high-resolution forecast results (e.g., currents, water level, nutrients and phytoplankton) for local coastal systems, initially focusing on the south-eastern Brazilian shelf. Some of the most important ports and largest coastal cities in Brazil (e.g. Rio de Janeiro, Santos and Florianópolis) are located in this region. The littoral zone covers the coasts of the states of Santa Catarina, Paraná, São Paulo and Rio de Janeiro, where tourism is a significant part of local economic activities. The main production of shellfish of the country is also located in this area, particularly in the Santa Catarina state. Moreover, the pre-salt oil and gas exploration field is located on the continental shelf. Due to the wastewater discharges from large cities and industries, port activities, and oil and gas exploration, this region is subjected to great environmental pressures and high risk of accidents (e.g., oils spills), which may negatively affect other important activities, such as tourism, fisheries and aquaculture.

The operational modelling system will be composed of a first domain for the south-eastern Brazilian shelf (regional scale model), and multiple nested domains (local scale models) with higher grid resolutions. During the project timeframe, operational models will be implemented for the coasts of the Santa Catarina and Paraná states, and for local coastal systems (e.g., Paranaguá estuarine system, Babitonga bay) where are located some of the most important Brazilian ports in terms of financial turnover. In the future, the number of nested operational models can be enhanced to encompass other important coastal systems, in partnership with local institutions and companies. The Brazilian Sea Observatory and the operational modelling system can promote a cooperation network for the exchange of information and technology connected to oceanography research, based on Copernicus Marine Service products.