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Integration of numerical modeling and observations for the Gulf of Naples monitoring network

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Lethal effects of mineral oils on fragile marine and coastal ecosystems are now well known. Risks and damages caused by a maritime accident can be reduced with the help of better forecasts and efficient monitoring systems. The MED project TOSCA (Tracking Oil Spills and Coastal Awareness Network), which gathers 13 partners from 4 Mediterranean countries, has been designed to help create a better response system to maritime accidents.
Through the construction of an observational network, based on state of the art technology (HF radars and drifters), TOSCA provides real-time observations and forecasts of the Mediterranean coastal marine environmental conditions. The system is installed and assessed in five test sites on the coastal areas of oil spill outlets (Eastern Mediterranean) and on high traffic areas (Western Mediterranean).
The Gulf of Naples, a small semi-closed basin opening to the Tyrrhenian Sea is one of the five test-sites. It is of particular interest from both the environmental point of view, due to peculiar ecosystem properties in the area, and because it sustains important touristic and commercial activities.
Currently the Gulf of Naples monitoring network is represented by five automatic weather stations distributed along the coasts of the Gulf, one weather radar, two tide gauges, one waverider buoy, and moored physical, chemical and bio-optical instrumentation. In addition, a CODAR-SeaSonde HF coastal radar system composed of three antennas is located in Portici, Massa Lubrense and Castellammare. The system provides hourly data of surface currents over the entire Gulf with a 1km spatial resolution.
A numerical modeling implementation based on Regional Ocean Modeling System (ROMS) is actually integrated in the Gulf of Naples monitoring network.
ROMS is a 3-D, free-surface, hydrostatic, primitive equation, finite difference ocean model. In our configuration, the model has high horizontal resolution (250m), and 30 sigma levels in the vertical.
Thanks to the cooperation of the Ocean Physics and Modeling Group and of the Atmospheric Modeling and Weather Forecasting Group of the University of Athens (partner of TOSCA project), the model surface air-sea fluxes are computed from the SKIRON Forecasting System.
ROMS model is initialized with the High Resolution Atlantic and Mediterranean Product of Mercator Ocean data set and the same data are used as boundary conditions for the western and southern open boundaries of the domain.
Realistic model simulations have been performed in the study area for the summer of 2009, in order to make comparisons with specific episodes and structures identified by HF radar data.
Typical circulation regimes have been selected from the mentioned year simulation and different flow structures are recognized, that are expected to have a significant effect on the renewal of the coastal waters. The model allows us to further investigate the spatial characteristics of dynamical structures, their generation process and their role in the flushing of the basin improving the understanding of the dynamics governing the circulation of the basin.
Model results show a good agreement with HF radar data collected during the analyzed periods in the Gulf of Naples.