Geophysical Research Abstracts
Vol. 18, EGU2016-16306, 2016
EGU General Assembly 2016

Unstructured-grid coastal ocean modelling in Southern Adriatic and Northern Ionian Seas

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The Southern Adriatic Northern Ionian coastal Forecasting System (SANIFS) is a short-term forecasting system based on unstructured grid approach. The model component is built on SHYFEM finite element three-dimensional hydrodynamic model. The operational chain exploits a downscaling approach starting from the Mediterranean oceanographic-scale model MFS (Mediterranean Forecasting System, operated by INGV).
The implementation set-up has been designed to provide accurate hydrodynamics and active tracer processes in the coastal waters of Southern Eastern Italy (Apulia, Basilicata and Calabria regions), where the model is characterized by a variable resolution in range of 50-500 m. The horizontal resolution is also high in open-sea areas, where the elements size is approximately 3 km. The model is forced: (i) at the lateral open boundaries through a full nesting strategy directly with the MFS (temperature, salinity, non-tidal sea surface height and currents) and OTPS (tidal forcing) fields; (ii) at surface through two alternative atmospheric forcing datasets (ECMWF and COSMOME) via MFS-bulk-formulae.
Given that the coastal fields are driven by a combination of both local/coastal and deep ocean forcings propagating along the shelf, the performance of SANIFS was verified first (i) at the large and shelf-coastal scales by comparing with a large scale CTD survey and then (ii) at the coastal-harbour scale by comparison with CTD, ADCP and tide gauge data.
Sensitivity tests were performed on initialization conditions (mainly focused on spin-up procedures) and on surface boundary conditions by assessing the reliability of two alternative datasets at different horizontal resolution (12.5 and 7 km).
The present work highlights how downscaling could improve the simulation of the flow field going from typical open-ocean scales of the order of several km to the coastal (and harbour) scales of tens to hundreds of meters.