CIRCULATION VARIABILITY IN THE ADRIATIC SEA AND IN SMALL DOMAINS ALONG THE EASTERN ADRIATIC COAST DURING 2007 AND 2008

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Abstract
POM and ROMS ocean models were used to perform a year-long simulation of the Adriatic circulation. Both models had almost the same setup which allowed for a reliable comparison between their results. Although these models successfully reproduced the basic characteristics of the Adriatic circulation, some differences appeared and they could be related to the different numerical formulation of two models. Model results were evaluated with the CTD and HF radar measurements. Simulated fields from both Adriatic models were used for the open boundary conditions in several coastal domains along the eastern coast through a nesting procedure. The impact of the selected open boundary conditions on the circulation and thermohaline properties in the coastal domains was assessed with ADCP and CTD measurements.
Keywords: Adriatic Sea, Circulation, Circulation Models, Coastal Models, Air-Sea Interactions

Current variability in the Adriatic Sea from November 2007 to October 2008 has been simulated with two three-dimensional nonlinear sigma models: Princeton Ocean Model (POM) [1] and Regional Ocean Modeling System (ROMS) [2]. In a year-long simulation both numerical models were forced with atmospheric, river and tidal forcing. Atmospheric forcing for the ocean models was calculated from the output fields of the meteorological mesoscale model ALADIN [3] having 8 km horizontal resolution and 3 hour resolution in time. A tidal function was applied on the southern open boundaries of both models for denivelation and transport, while the radiation condition was applied for the three-dimensional current field. The ocean models had horizontal resolution of approximately 2 km while along the vertical 22 and 30 sigma layers were defined for POM and ROMS respectively.

Surface mean monthly current fields obtained by the POM model show significant resemblance with the corresponding fields from the ROMS. Although considerable variability can be observed in the modelled current fields, they also indicate some common features in accordance with well-known characteristics of the Adriatic scale circulation. The general circulation is cyclonic with several imbedded, mostly cyclonic, gyres. Two cyclonic gyres are around the main pits – South Adriatic and Jabuka Pit, and one can be observed in the northernmost part of the Adriatic. Current fields in the winter period resemble bora induced current fields [4], indicating the bora wind as an important driving mechanism for the Adriatic general circulation. Current intensities during summer decreased and numerous small-scale eddies appeared. A South Adriatic cyclonic gyre over the deepest Adriatic area is present in all monthly current fields but with variable intensities. A cyclonic gyre above the South Adriatic Pit is a well-known characteristic of the Adriatic circulation and it is supposed to be topographically controlled by the South Adriatic Pit and Palagruža Sill.

The main difference between POM and ROMS monthly averaged current fields is manifested through the current velocity intensities, mainly in jet currents that are attached to the outer boundary of the Croatian outer islands, as well as through the intensities of the cyclonic South Adriatic gyre. The evaluation of the modelled fields was based on the thermohaline measurements along the Split-Mt Gargano transect and HF radar measurements in the northern Adriatic.

The results obtained from both Adriatic-scale models were used to define open boundary conditions for the coastal shelf model embedded along the eastern coast using one-way offline nesting procedure. The horizontal resolution of the shelf model was approximately 1 km. Furthermore, two local models with resolution of 200 m were nested in the coastal shelf model by using the same methodology. The evaluation of the modelled fields in the coastal area, as well as the assessment of their sensitivity to the choice of the open boundary conditions was made through CTD and ADCP measurements via RMS errors and correlation coefficients.

References

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