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Black Sea and Mediterranean Sea interaction: influence of the North Aegean dynamics

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The brackish Black Sea Waters outflow to the Aegean Sea, through the Dardanelles Straits, affects and determines significantly the hydrodynamic and physical characteristics of the Aegean Sea. At the same time, it affects several biological parameters, like chl-a concentrations, and, therefore, the general quality of the marine environment. The investigation and mathematical simulation of the North Aegean's physical oceanography contributes to the knowledge and understanding of the buoyant waters' circulation initial conditions in the wider East Mediterranean region. The implementation and adaptation of the 3-d hydrodynamic mathematical model HYCOM (Hybrid Coordinate Ocean Model) in the North Aegean Sea (1/50x1/50o), significantly contributes to the investigation of the area's hydrodynamic circulation. HYCOM, due to its hybrid coordinate operation, can describe at a satisfactory level, all the different topography and mixing cases of the complicated N. Aegean region. In addition, the high resolution atmospheric forcing and the nesting with a data assimilated broader Mediterranean HYCOM model along the southern open boundary of the North Aegean model, benefit the quality of the results and constitutes an important tool on the description and understanding of the Black Sea influence to the region's dynamics. A fundamental objective is the application and comparison of different Dardanelles outflow parameterizations based a) on the Black Sea water budget, b) on current measurements from a telemetric station in Limnos Island, and c) on historical time series. The Black Sea Waters plume evolution and the circulation patterns are dependant on the outflow rate magnitude, the flow distribution inside the straits and the prevailing winds. The long-term simulation covers the period of the last 20 years (1990-2010), investigating several physical characteristics of the North Aegean Sea, such as the deep water masses evolution, the major Black Sea waters circulation patterns and the upwelling processes over the eastern coastal region under specific etesian winds. Satellite and in situ data are also used to a) evaluate the model's performance, b) validate the proper Dardanelles parameterization and c) describe the physical characteristics spatial distribution and temporal evolution.