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**OCEANOGRAPHY OF THE EASTERN MEDITERRANEAN AND BLACK SEA**

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**ATMOSPHERE-OCEAN FLUXES, CLIMATIC VARIABILITY AND EXCHANGES  
BETWEEN THE EASTERN MEDITERRANEAN AND THE BLACK SEA**

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**ABSTRACT**

The Eastern Mediterranean Basin and the Black Sea constitute two largely isolated water bodies of the world ocean, surrounded by land and constrained by exchanges through straits. Both regions appear highly sensitive to anthropogenic or climatic change, as a result of their isolation, enclosed geometry, being subject to large gradients in properties, transport from land, and their relatively small inertia in comparison to the ocean. Comparable effects of anthropogenic and natural variability in the ocean-atmosphere-land system makes diagnosis of environmental issues difficult. The marine environmental changes are most readily felt near the coast, adjacent to the continental shelf and abyssal regions.

Typical circulations, coherent features, convective mixing and upwelling events in the two interconnected Seas, their short and long-term variability, as well as synchronisms, differences and similarities in terms of intrinsic scales and forcing functions, are displayed, based on intensive oceanographic and satellite observations in the last decades. Local forcing and remote atmospheric connections to systems such as the North Atlantic Oscillation are exemplified. Decadal and longer term climatic atmospheric variability, with intensified effects on air-sea fluxes in the region, their coincidence with convective events are studied, based on the analyses of atmospheric, oceanographic and satellite data. Coincidence of recent changes with the massive formation of Eastern Mediterranean deep waters during the Great Aegean Anomaly, and with pycnocline mixing in the Black Sea are investigated.

Atmospheric fluxes of momentum and heat obtained from ECMWF re-analysis data sets of 1979-1993, simultaneous satellite based and in-situ air and sea-surface temperatures, as well as marine heat storage and mixing characteristics based on time series of oceanographic measurements in the two seas are used to analyse their variability and interrelations. The results indicate a great degree of synchronism on interannual and decadal scales, and suggests strong atmospheric events and climatic variables linked to water mass formation.

The Turkish Straits, connecting the two Seas through the Bosphorus and Dardanelles Straits and the Sea of Marmara serves as a transition between them and reflects the changes taking place in the adjacent seas. However, the variability of both the forcing and the response affecting this relatively small, dynamic system is much greater. Various types of forcing and mass budgets, including river discharges into the Black Sea, atmospheric pressure and wind stress in the adjacent seas, and internal dynamics of the Straits determine the response. In addition, the mixing taking place along the Straits and the exit regions have strong consequences for the circulation and mixing in the adjacent Seas. These aspects are studied, based on available measurements and information.