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The Dynamics of the Ionian Sea and its climatic implication: Interannual simulation for the period 1960-2000

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The Ionian Sea, located in the center of the Mediterranean basin, represents the crossroad between water masses originated in the Western and in the Eastern Mediterranean. The interannual variability of the circulation pattern of this basin and its role as a "water mass distributor" is studied by performing a hindcast simulation using the Princeton Ocean Model (POM) for the period 1960-2000. The model has a horizontal resolution of $1^o/20$ ($\sim$ 5 Km), incorporates a 6-hr atmospheric forcing, provided by the ARPERA atmospheric dataset, and it is one-way nested to the coarse OPAMED oceanographic model. In this study the dominant driving mechanisms of the Ionian general circulation are investigated. The relative importance of the atmospheric forcing (wind stress and thermohaline fluxes) and the lateral fluxes through the boundaries of the basin with the neighboring basins (Adriatic, Western Mediterranean, Aegean and Levantine basins) is estimated. Results show oscillations from anticyclonic to cyclonic mode in the general circulation pattern on a decadal scale, whose intensity and pattern depend on the combination of the vorticity input by the wind. The basin-wide surface circulation pattern is predominantly defined by the pathway of the Atlantic Ionian Stream in the western part of the basin, which is initially topography driven and later on highly correlated to the local wind stress curl. Periods of inverse circulation modes (cyclonic or anticyclonic) are associated with important differences in the thermohaline structure of the basin. During an intense cyclonic circulation period (e.g. years 1969-1975) high salinity anomaly is found in the western part of the basin, while the opposite (low salinity anomaly) occurs in the same area during a period of intense anticyclonic circulation (e.g. years 1987-1993). On the other hand, the surface and subsurface circulation pattern is also closely related to the lateral fluxes variability and the accumulation of water masses in the basin. These fluctuations have different (longer) time scales and are directly depended on the history of the thermohaline dynamics of the adjacent basins. More specifically, interannual variability in the LIW volume transport in the Ionian, which is presumably linked to the interannual variability of the formation rate of this water mass in the Levantine basin, can potentially influence the water mass formation processes in the Adriatic basin. The accumulation of this water mass in the intermediate layer of the Ionian basin in the anticyclonic circulation period related to the Eastern Mediterranean Transient (years 1987-1993) plays an important positive feedback mechanism in deep water formation processes in the Adriatic. In other periods characterized by anticyclonic circulation (e.g. years 1976-1982), the largest proportion of LIW directly exits the Western Mediterranean through the Sicily channel and low Adriatic deep water formation rates are detected.