THE PROPAGATION OF THE EASTERN MEDITERRANEAN TRANSIENT FROM THE EASTERN TO THE WESTERN MEDITERRANEAN BASIN

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Abstract

Recent studies have evidenced the highly sensitivity of the Mediterranean to the effects produced by the large-scale atmospheric systems. During the 1985-2003 period the hydrographic monitoring in the Strait of Sicily and Tyrrhenian sea evidenced significant changes of the hydrographic characteristics, related to the Eastern Mediterranean Transient. It was possible to follow the evolution of the water mass characteristics under the influence of the climatic transient occurred in the eastern Mediterranean before its beginning to the present phase of relaxation. The impact on the Tyrrhenian Sea has been evidenced, while possible effects on the western Mediterranean basin have been discussed.

Keywords: Eastern Mediterranean Transient; Strait of Sicily; hydrographic characteristics.

A hydrographic data set covering both the Strait of Sicily and the Tyrrhenian Sea and ranging from the second half of 80's until 2003 was able to describe the Eastern Mediterranean Transient (EMT) influence on the Strait and also to evidence changes induced in the Tyrrhenian water column. At their beginning the available data showed the hydrographic characteristics before the EMT influence. It was only after 1988 that a clear change was observed in the central region of the Strait: the LIW salinity increased progressively until 1992, followed by a sudden drop which lasted until 1997. During that period the EMT had the maximum influence on the Strait. Successively, the restoring phase begun, and continued during the following years. The available observations permitted also to establish that the EMT reached the Tyrrhenian entrance between April and May 1992 by an impulsive huge amount of salt and cold water mass. A significant agreement with the different phases observed in the EMT and with changes observed in Eastern Basin is found (1). More specifically, results confirm that the EMT begun well before the winter 1991-92 and that 1989 appears to be a more suitable period.

Comparing the Strait evolution with the evolution observed in the Levantine basin we can infer a very fast propagation of the EMT from the region of origin. The hydrographic situation in the Eastern Basin during October 1991 (2) can supply backing on this aspect. The distribution of salinity gives evidence that a significant volume of saltier water of Aegean origin is now present over most of the sea and explain the progressive salinity increase in the strait (Fig. 1). Conversely what seems to be related to the severe winters 1991-92 and 1992-93 (3) is the sudden inversion both in temperature and salinity, which can be associated to the sinking phase of the EMT. Due to its abnormally density increase, the new Sicily outflow sunk at very high depth, probably reaching the deepest layers of the Tyrrhenian basin. The consequence was that a remarkable amount of heat and salt spread along the deep water column. This behaviour suggests that the deep trends (θ and S) found in the southern Tyrrhenian (4; 5), can be explained in terms of EMT. The salinity increase in a layer comprehensive of intermediate and deep water (approximately from 250m to the bottom) suggests a greater salt export through the Strait during the EMT period, which is equivalent to net evaporation of 0.04 m/yr in the eastern basin.

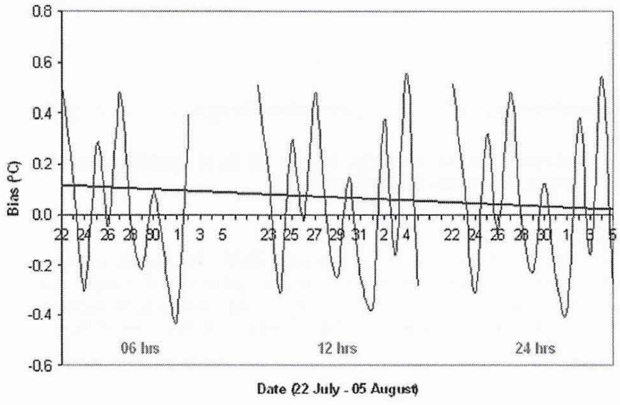

Fig. 1: Time evolution of S_{max} characteristics in the central part of the Strait of Sicily. (a) Potential temperature of S_{max}; (b) S_{max}; (c) Potential density of S_{max}.

Consequences related to the EMT can also be observed in the surface layer evolution. The salt conservation observed in the Strait evidenced that a salt decrease in the Atlantic Water (AW) corresponds to the LIW salt increase. As consequence, during the higher EMT phase, the eastern basin was reached by surface fresher water, hindering the production of new deep water. The AW behaviour suggests that the EMT, especially during its major activity, induced an enhancement of the Atlantic water through the Gibraltar Strait.

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