WATER MASS STRUCTURE AND ASSOCIATED PROCESSES IN THE TYRRHENIAN SEA (SOUTHERN SECTOR) BY MEANS OF IN SITU DATA COLLECTED DURING VECTOR-TM CRUISES

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Abstract

In this work we will present the results obtained from the analysis of hydrological data collected during 5 oceanographic cruises carried out in the southern sector of the Tyrrhenian Sea. Details regarding the vertical structure and associated processes of the water column are presented, together with information regarding deep current and temperature data obtained from a mooring located approximately in the centre of the southern Tyrrhenian basin

Keywords: Tyrrhenian Se, Hydrology, Deep Waters, Deep Sea Processes

In the framework of VECTOR (**V**uln**E**rability of the Italian coastal area and marine Ecosystems to **C**limatic changes and **T**heir r**O**le in the Mediterranean ca**R**bon cycles) project, starting at the end of November 2006, six oceanographic cruises were carried out in the area, centered on the so-called VTM station (see Fig.1, which also shows the CTD stations regularly sampled during the cruises as well as the position of the mooring), selected as a test site to study the seasonal and interannual variability of the intermediate and deep hydrology and dynamics of the Tyrrhenian Sea. The VTM point depth is approximately 3450 m, its coordinates are 39°30' N, 13°30' E, approximately 90 nautical miles off the Italian coasts. The oceanographic cruises were carried out in different seasons even if three of the six were conducted in a winter month. Thus, in terms of interannual variability, information could be derived only for the winter season. The remaining three campaigns were in Fall (late November 2006), early and late Spring (April 2007 and first third of June 2008 respectively).

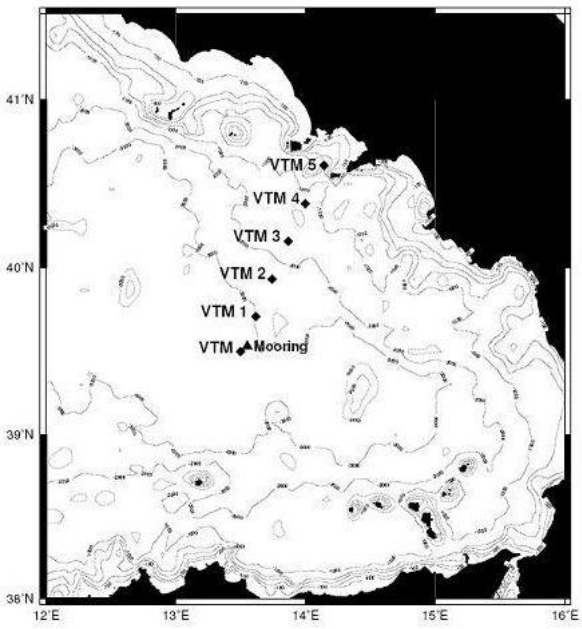

Fig. 1. Map of the stations sampled during VECTOR-TM cruises. Diamonds indicate CTD stations positions, whereas the triangle is the mooring

Moreover, on April 2007, a mooring was deployed very close (less than 1 nautical mile) to the point VECTOR-TM and worked up to January 2009. Current measurements at the depths of 1000, 1600 and 2200 meters, collected by means of Aanderaa RCM-9 currentmeters, are available for the period June 2007 –December 2007, whereas a yearly temperature time series (February 2008 – January 2009) at a depth of about 3430 meters is available too.

Information derived from this composite data set addressed three main issues: vertical structure of the investigated transect; thermoaline processes along the vertical, especially in the farthest offshore stations of the transect; intermediate and deep current patterns obtained from mooring time series.

The analysis of the collected CTD data allows identifying the three major water masses present in the basin: Atlantic Water (AW), Levantine Intermediate Water (LIW) and Tyrrhenian Deep Water (TDW). In particular, the vertical distribution of temperature and salinity of the upper layer, together with the relative geostrophic velocity field, pointed out that the overall circulation is broadly anticyclonic, as expected. If looked at from the perspective of long term change the data reveal several points of interest: for instance, bottom temperature and salinity values result slightly higher than in the past [1]; at the same time, the observed salinity maximum relative to the LIW is higher than in historical data (Fig. 2).

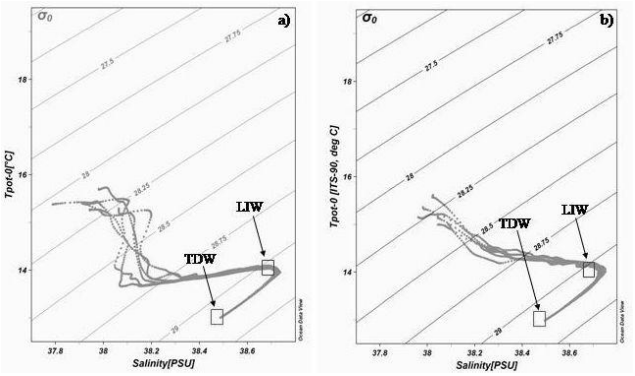

Fig. 2. Theta-S diagrams for the cruises VECTOR-TM 2 (a) and 6 (b). The two squares indicate the range of LIW and TDW as defined in [2].

The central Tyrrhenian is notoriously an area where double diffusive processes can be observed [2]. Thermohaline staircase structures have been found in all cruises, and characterized in terms of a number of parameters classically utilized for this purpose [3]. The stability of double diffusive structures in space and time (e.g., in terms of depth, width, gradient) is remarkable. Their associated temperature and salinity fluxes result stronger than in the past, and would deserve further investigations, prolonged in time.

Current data obtained from the mooring shows a relative strong W-NW flow with velocity values up to 10 cm/s at 1000 m whereas, as expected, the velocity slows down to few cm/s at deeper depths where the remaing two currentmeter were located. The direction is less stable with respect to the 1000 m currentmeter data but the net displacement is northwestward as well. Also, a diurnal tide signal can be observed from the spectral analysis of the deepest currentmeters whereas it does not appear in the 1000 m depth current measurement.

References

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