DENSE WATER SINKING IN THE BARI CANYON (SOUTHERN ADRIATIC SEA)

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Abstract

In order to study the role of the Bari canyon system as pathway for sediment and water coming from the Northern Adriatic, three moorings consisting of sediment traps and current meters, were deployed near the bottom, at 600 m depth, for one year. Two moorings were deployed within the canyon (B and C) and one on the adjacent open slope (A). Principal Component Analysis (PCA) on current data indicates that for moorings A and C the major variance occurs in the along- and the across-slope (along canyon axis) direction, respectively; while for mooring B the variance was almost equally between both components. A very good correlation between the major variance component and temperature was found showing 3-day and 10-day fluctuations mainly during the convection and spreading phase.

Keywords : Adriatic Sea, Continental Slope, Currents, Sediment Transport.

The Bari canyon is a morphological structure that incises the western Adriatic shelf in the southern basin, 600 km away from the main freshwater input to the Adriatic. It is generally assumed to play an important role in dense water sinking [1] and sediment transfer to the deep Southern Adriatic basin, although no direct observations are presently available to explain water dynamics and sediment transport associated with the canyon system. In order to study the water characteristics, dynamics, and vertical particle fluxes within the Bari canyon, three mooring lines equipped with sediment traps, current meters and temperature recorders were deployed near the bottom for one year (March 2004 - March 2005). One mooring (A) was deployed as reference on the open slope ∼10 km north of the canyon, the other two were deployed within the canyon (B in the northern branch and C in the southern branch), at a distance of 4.3 km from each other (Figure 1).

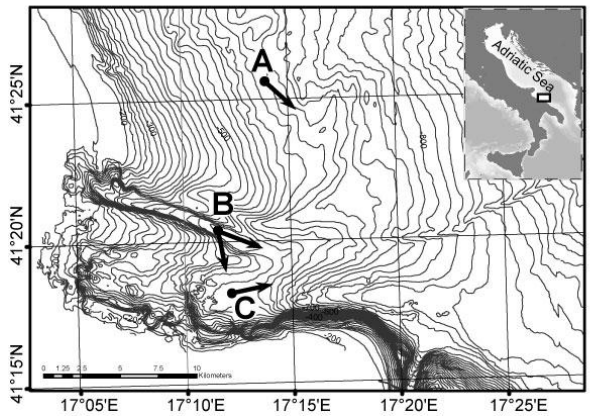

Fig. 1. Detailed multibeam (MB) bathymetry of the Bari canyon, mooring locations and main current directions

From the Principal Component Analysis (PCA) of the current components it resulted that at mooring A 89% of the variance is associated with the along-slope component with an average direction of ∼145°, and in mooring C to the across-slope component, with a prevalent direction of ∼80°, along the axis of the southern branch of the canyon. Differently, currents at mooring B showed two main directions: one southward, parallel to the isobaths (∼170°), and the other along the canyon axis (∼110°) with the variance divided in 60% and 40%, respectively. Velocity components (higher than 15 cm s^{-1}) indicate that those along the canyon axis occur only during the mixing and convection period associated with a temperature of 13.1°C, while those southward were measured during the whole year with a mean temperature of 13.5°C. Vertical particle fluxes collected inside the canyon were higher than those of the open slope, and peak values were recorded in correspondence to temperature minima. Time series of current and temperature were smoothed by applying a 25-hour low-pass filter and correlated with the temperature measured at each site (Figure 2).

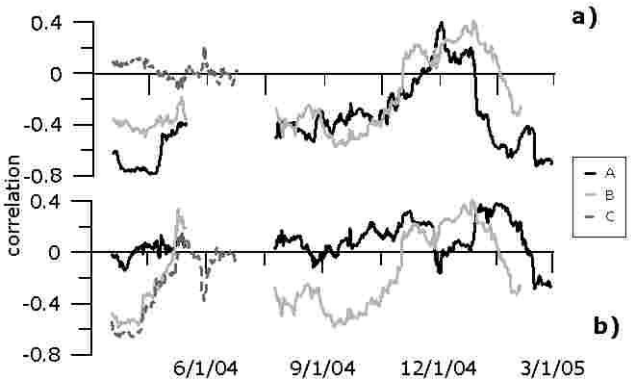

Fig. 2. Monthly moving correlation between a) along-slope current component and potential temperature, b) across-slope (down canyon axis) current and potential temperature in the three mooring sites

The highest correlation (r^2 =-0.60) was found during the late winter-early spring (post-convection) period for the along-slope component in mooring A, in contrast to what was found in mooring B and C, where the highest values were found for the across-slope component showing a 3-day fluctuation frequency. This fluctuation was confirmed by a spectral analysis of the raw data of the same period, which showed also high energy in the 10-day oscillation. All observations in the Bari canyon system are consistent with the presence of a vein of North Adriatic Dense Water (NAdDW) flowing southward, intermittently, along the Adriatic shelf and sinking in the southern Adriatic basin, both along the open slope and, in an enhanced way, through the Bari canyon.

Reference

Vilibić I. and Orlić M., 2002. Adriatic water masses, their rates of formation and transport through the Otranto Strait. *Deep-Sea Res. I* 49: 1321-1340.