ABYSSAL HYDROGRAPHIC CONDITIONS IN THE IONIAN SEA FROM 2006 TO 2009

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Abstract

During KM3NeT project, an intense observational activity was conducted in the Ionian Sea, mainly south-east of Capo Passero (Sicily) and off the south-western tip of Peloponissos (Greece). The several oceanographic cruises performed from 2006 to 2009 permitted to describe the current status of the deep layer, together with its recent evolution. While newly formed Adriatic dense water is the principal abyssal signature in the western Ionian, the Cretan water vein fills all the deep layer in the eastern Ionian. These observations confirm that the deep Ionian Sea is undergoing significant changes, especially after the Adriatic Sea has became an active source of dense water again.

Keywords: Deep Waters, Circulation, Ionian Sea

The Ionian Sea collects the dense waters formed in the Eastern Mediterranean in its abyssal plain. The Adriatic Sea was the main source of these waters up to the end of the 80's. After that date, an important climatic variation occurred (the Eastern Mediterranean Transient) which had an impact on the whole Eastern Mediterranean, and a new source started up in the Aegean Sea. The Aegean water was warmer, saltier and denser than the one formed previously in the Adriatic Sea, so it filled the deepest layers of the Ionian [1]. Around 1995 the Aegean source dropped and the Adriatic became an active source again, producing new water whose temperature and salinity were warmer and saltier when compared to the past [2, 3]. The several oceanographic cruises performed in the Ionian Sea from 2006 to 2009 permitted to follow the recent evolution in the abyssal hydrography, and provided some insight into their variability.

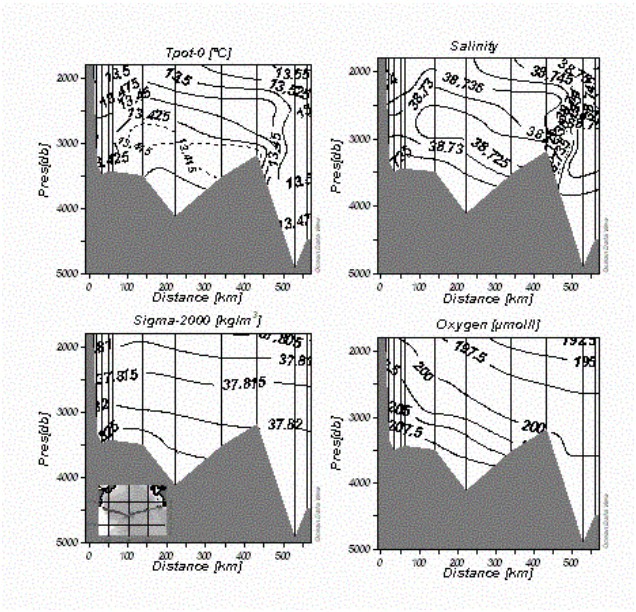

Fig. 1. Vertical section of potential temperature (°C), salinity, density (σ2 units), dissolved oxygen content (µmol/l) in July 2007 between 1500 m depth and the bottom.

In July 2007, a hydrographic section covered the central Ionian basin from Sicily to Greece almost synoptically (Fig. 1), giving a nearly complete zonal view of the abyssal layer. The physical-chemical properties from 1800 m to the bottom show distinct water masses, with significant differences both in temperature and salinity. A clear gradient can be observed in correspondence to the meridional ridge which separates the central and the eastern deeps. On the western side, below 2000 m, a marked stratification is found with warmer and saltier water superimposed on a fresher and colder layer. Both the layers extend their influence upto the central abyssal plain. The two water types are probably of Adriatic origin, but the higher oxygen content close to the bottom suggests that the most recent Adriatic water is warmer and saltier than before. On the eastern side, higher salt content and higher temperature evidence the presence of Cretan water in the deep column, mainly concentrated between 2000 and 3000 m of depth.

A comparison between observations off Sicily from different periods evidenced a certain water mass variability: an almost homogeneous stratification below 2500 m is sometimes replaced by a situation characterized by the presence of several water masses, identified by closed structures. Current measurements, acquired from May 2007 to May 2009 at 3000 m of depth near the Maltese shelf break and about 20 miles eastward, evidence the prevalence of a southward flow at the first site and a north-westward one at the second, while the oscillations of the two currents are inversely correlated. This suggests a circulation frequently organized along a cyclonic pattern, as indicated by the closed structures observed from the hydrography. More energetic currents are found close to the shelf break, and a pronounced variability is observed at both the sites, on the seasonal and the interannual time scales.

These results depict a variable cyclonic abyssal circulation that is more energetic when compared to previous measurements collected in the same area. The increased activity has probable links with the new Adriatic dense water flowing into the region.

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