THE STATUS OF THE DEEP HYDROGRAPHY AND EDDY FIELD DURING 2006-2009 AT THE SOUTHEAST IONIAN TENTATIVE NEUTRINO-TELESCOPE SITE

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Abstract

The deep neutrino-telescope site (NESTOR) in the southeast Ionian Sea is located offshore from the southwest end of the mainland of Greece in the deepest area of the Mediterranean with depths reaching 5.2 km. Among various multidisciplinary observational tasks in the period 2006-2009, long current-meter moorings were deployed and several west-east, normal-to-local-bathymetry hydrographic sections were conducted with main goal to monitor the physical water characteristics and flow conditions. The sections cut through a deep vein at ~3200 m of Cretan water in the southeast Ionian. A weakening in the presence of Cretan water and a tendency for offshore migration of the vein core is observed from 2006 to 2009, while the flow field at depths greater than ~3.5 km is dominated by a cyclonic eddy locked on the local bathymetry.

Keywords: Deep Sea Basins, Ionian Sea, Circulation

Introduction

The role of Physical Oceanography in the development of the appropriate infrastructure for the operation of underwater deep-facilities of neutrino telescopes in the Mediterranean has been to provide the description of the physical water characteristics and flow conditions along with their variability at the selected sites. One tentative site is located in the southeast Ionian Sea offshore from the south-west tip of Peloponissos/ Greece with depths of 4-5 km. This area is not far from the Cretan Straits, where the Cretan water masses outflow into the deep Eastern Mediterranean (Ionian and Levantine Seas). Thus, the involvement of Physical Oceanography in the effort of developing the Mediterranean neutrino telescopes is directly related to the deep thermohaline circulation, spreading and transformation of water mass properties originally generated at their formation regions.

Field Work

Intense observational work has been carried out in the period 2006-2009. A basic effort has been put to monitor the hydrographic conditions along a west-east section on a yearly basis, while additional CTD stations in the near vicinity have allowed to construct maps of dynamic topography showing the localized sub-mesoscale circulation structures. In parallel, long current meter moorings at two sites with bottom depths 4.5 km and 5.2 km have been maintained providing direct current measurements at four levels of the water column (Fig. 1). Unfortunately, in the period 2006-2009 there was no larger-scale hydrographic survey to map the particular meso-scale or sub-basin scale structure(s) in which the transect observations were/are embedded.

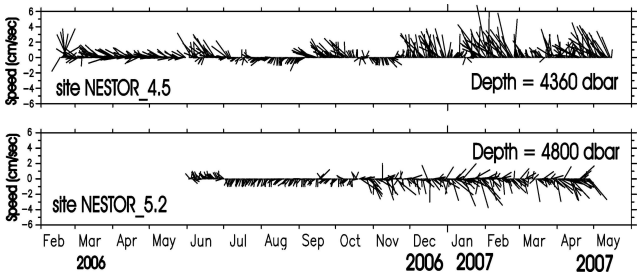

Fig. 1. Time series of deep currents at positions NESTOR_5.2 (36º 32,709' N - 21º 07.231' E) and NESTOR_4.5 (36º 32.822'N - 21º 29.064'E)

Results

A deep vein-like structure with a core at ~3200 m is identified in the transect to the west of Peloponissos. The local salinity maxima at its core indicate a Cretan origin. Below ~3200 m, there exist water masses of recent Adriatic origin, whereas at ~5.2 km there is a low-oxygen, isolated, old Adriatic water mass. Apart from the typical properties of temperature, salinity and dissolved oxygen used to identify and describe these structures, water transparency is also measured in the transects due to its importance in detecting neutrinos. The Adriatic and Cretan water masses do carry a transparency signal, characterizing their origin, with decreasing/increasing transparencies in the Adriatic/Cretan water mass. The core of the Cretan water at ~3200 m is shifting towards the west by ~30 km. In 2009 it loses the vein-like structure in salinity but it consistently preserves its higher transparency core signal in the entire observational period. The overall salinity is decreasing from 2006 to 2009. The deep flow field at depths of 4.5 km and 5 km is characterized by extremely weak velocities with mean speeds near ~2 cm/sec. A cyclonic eddy locked on the local bathymetry appears to exist at depths from ~3.5 km to the bottom in 2006 and 2008. In May 2009, however, its vertical extent is decreased to depths greater than ~4 km.

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