DEEP OCEAN OBSERVING SYSTEM OVER MIDDLE AND LONG TIME SCALE: THE E2M3A SITE IN THE SOUTHERN ADRIATIC

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1. INTRODUCTION

The open-ocean convection has been considered the engine of the global conveyor belt. It is a mechanism forming new dense and oxygenated waters, and it triggers the solubility and the biological pump. Among the few zones in the world where the open-ocean convection takes place is the South Adriatic, a key area for the intermediate and deep thermohaline cell of the Eastern Mediterranean. There, the Adriatic Dense Water ADW formed prevalently by the open-ocean vertical convection, becomes the main component of the Eastern Mediterranean Deep Water (EMDW). This process takes place in the South Adriatic Pit (SAP) in the centre of the cyclonic gyre. The extension of the vertical mixing varies on the interannual and decadal time-scales in function of the air-sea heat fluxes and the pre-conditioning vertical density structure. The high spatio-temporal variability of the deep convection and its interaction with other processes makes difficult its study.

2. THE MOORING SYSTEM

Oceanographic cruises provide a good spatial coverage but lack in temporal resolution. The need of high temporal sampling to resolve events and rapid processes and the long sustained measurement of multiple interrelated variables from sea surface to seafloor can be solve by the use of moorings located in specific areas. Following the experience acquired during the European Project MFSPP (Mediterranean Forecasting System Pilot Project), and at the beginning of the 2000's within the second phase of the project Mediterranean Forecasting System Towards the Environmental Prediction (MFSTEP) the first deep water observatory **E2-M3A** containing CTD's and a multiparametric system together with surface measurements was deployed in the area (Nittis et al., 2003, Nittis et al., 2007).

In the framework of the Italian VECTOR project a revised deep-sea mooring ($41^0$29.7N, $17^0$42.1E) containing CT sensors at five depths, an upward looking 150 kHz ADCP and an Aanderaa current meter RCM11 was located in the vertical convection area. This mooring configuration permited to individuate water mass formation events, measuring simultaneously physical and chemical parameters.

A completely redesigned surface buoy system has been developed during 2008-2009 and it was deployed in late summer 2009 (Fig. 1). The system recently became part of an integrated network of deep European observatories developed in the framework of EuroSITES (http://www.eurosites.info/) project (EU-FP7) that will coordinate the European contribution to OceanSITES. The deployment of pCO2 sensor together with a pH sensor within the mixed layer will allow to estimate the carbon cycle at the site. Moreover, a surface buoy in a separated new mooring line will communicate with the instrument mooring through hydro-acoustic modems that will allow the real time data transmission from the platform to the land station. The new system is equipped with Iridium satellite link, ARGOS (1-way comm.) and acoustic modem link to collect data from instruments placed on the deep mooring.

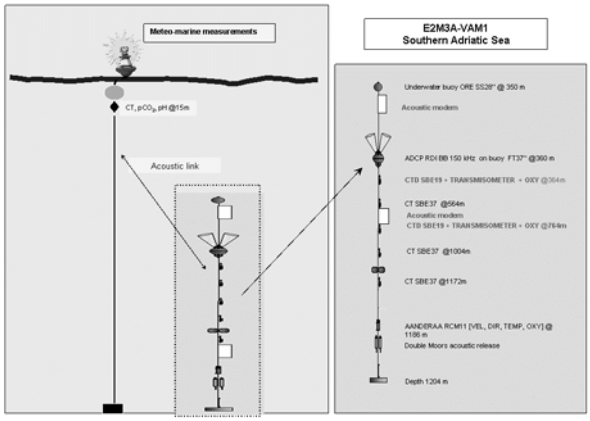

Figure 1.- E2M3A platform showing both moorings payload. Communication between moorings is done through acoustic modems. The platform is located in the centre of the Southern Adriatic Pit and the seabed is at a depth of 1205m.

In Table 1 and 2 a complete description of the scientific payload, parameters measured and position are presented.

Table 1 : Parameters measured at subsurface deep moring

Parameter	Depths measured (m)	Sensor(s) used
Temperature	265,564,764,1014,1170	SeaBird SBE 37 SeaBird SBE 16plus V2
Conductivity (Salinity)	265,564,764,1014,1170	SeaBird SBE 37 SeaBird SBE 16plus V2
Dissolved Oxygen	265,1170	SBE 16p-7a
Transmissometer	265,1170	WET Labs C-Star
Current	1182	AANDREAA combined instrument, also with temperature.
Current profile	265	ADCP upward looking

Table 2 : Parameters measured at surface buoy

Parameter	Depths measured (m)	Sensor(s) used
Wind speed/dir.	Surface	Young 05106
Air Pressure	Surface	Young 61202V
Air Temperature	Surface	Young 41372VC/VF
Air Humidity	Surface	Young 41372VC/VF
Compass	Surface	Young 32500
Pyranometer PSP	Surface	Eppley PSP
Sea Temperature	12	SeaBird SBE37
Salinity	12	SeaBird SBE37
Dissolved Carbon Dioxide	12	PSI CO2-*Pro* Pro-Oceanus

3. DATA ACCESS AND QUALITY CONTROL

Real time data is accessible via the EuroSITES DAC at NOC, Southampton, UK and GDAC Coriolis, Brest, France. The data is quality controlled according to the OceanSITES quality control procedures. The delayed mode data is typically quality controlled within 6-8 month after recovery of the instrumentation and provided OceanSITES NCF format.

4. SCIENTIFIC ACHIEVEMENT

Here, data recorded in the period between end-November 2006 and October 2008 covering the two consecutive year deep convection periods show an almost absence of mixing during winter 2006/2007 (Fig. 2), contrary with what occurred during the following winter when intermediate-deep convection occurred. The increase of temperature mainly so as for the salinity at the deep layers leads to a decrease of density at the bottom. The analysis of current data (RCM11 - Aanderaa) at the bottom and of the upper layer (ADCP) could will allow to track the development of internal mesoscale structures (eddies). Surface chlorophyll *a* obtained from the SeaWiFS data is a good indicator of the vertical mixing patch as demonstrated earlier Civitarese et al., 2005), and here it has been used in determining the patch position with respect to the mooring location and its geometry.

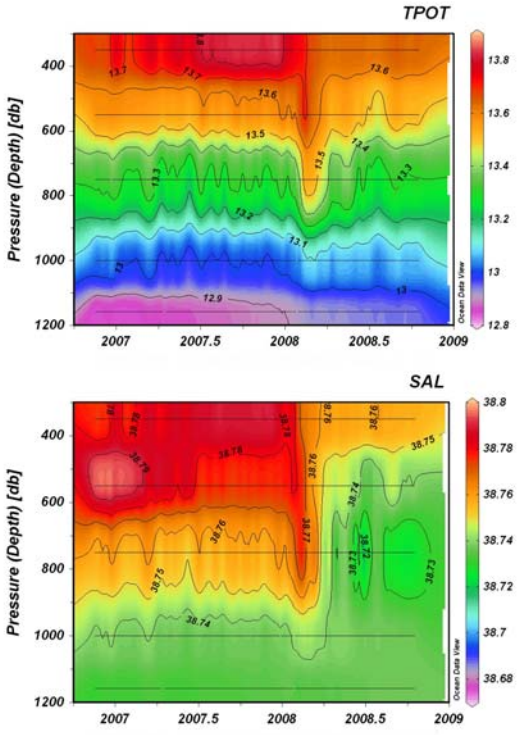

Figure 2.- Temporal evolution of Potential Temperature and Salinity time series from CT's in the Southern Adriatic Pit for the period between November 2006 and October 2008

5. REFERENCES

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