THERMOHALINE PROPERTIES OF THE MEDITERRANEAN SEA AS MEASURED BY PROFILING FLOATS BETWEEN 2000 AND 2006

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Abstract
The temperature and salinity data collected by profiling floats throughout the Mediterranean Sea from 2000 to 2006 are used to study the spatial distribution and temporal evolution of the Mediterranean thermohaline properties and compared them with climatological values and ancillary ship-based hydrographic measurements published in the literature. Results indicate that the Mediterranean Sea is warmer and saltier (most importantly in the western basin) with respect to climatology mainly based on observations of last century.
Keywords : Temperature, Salinity, Open Sea.

Introduction
Since 2000, more than 70 profiling floats equipped with CTD sensors were deployed in the Mediterranean to monitor its thermohaline structure for scientific and operational purposes. In particular, starting in mid-2004, float operations were coordinated at the international level in the framework of MedArgo, which is part of the EU-sponsored MFS project [1] and is integrated into the worldwide Argo program [2]. The Mediterranean float data, with profiles extending as deep as 2000 m and spreading most areas of the Mediterranean, are analyzed to study the spatio-temporal variations of the thermohaline properties and compared with climatological values and results of hydrographic surveys.

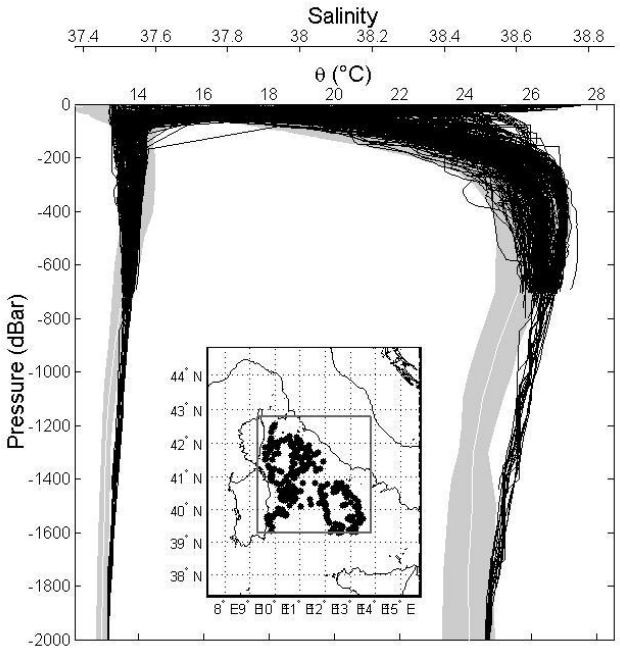

Fig. 1. Potential temperature (θ) and salinity (S) profiles in the northern and central Tyrrhenian Sea as measured by the profiling floats in 2004-2006 (black curves, 282 profiles). MEDAR MEDATLAS II annual mean (white curve) with ± 3 standard deviations (grey envelope). The locations of the CTD casts are shown in the insert.

Materials and methods
Both APEX and PROVOR battery-powered profiling floats equipped with Sea-Bird pumped CTD sensors were operated in the Mediterranean Sea. They were programmed to descent and drift at an intermediate parking depth (between 350 and 650 m), to descend further down to depths of 650 - 2000 m before ascending to the surface while measuring pressure, temperature and conductivity. Once at the surface, they transmitted the data via the Argos satellite system and repeated the above-described sampling cycle. The cycle length was 5 days for the majority of the floats and 10 days for some units. The float temperature (T) and salinity (S) profile data were processed, quality-controlled and distributed by the CORIOLIS Operational Oceanography Data Centre at IFREMER in Brest, France. The floats provided more than 5000 CTD profiles between March 2000 and mid-September 2006 . The T and D data were used to compute the potential temperature (θ). Diagrams of profiles versus depth, of the data at selected depths versus time, and θ-S diagrams were created to describe the spatio-temporal variability of the data.

Results
The θ and S values measured by the floats were studied in most sub-basins of the Mediterranean Sea. The area of the Tyrrhenian Sea locked between Sardinia, Corsica and Italia is particularly interesting. Indeed, in this area, the CTD profiles (271 to 700 m and 11 to 2000 m) show clearly that the intermediate waters between 500 and 1500 m are slightly warmer and significantly saltier when compared with values of the MEDAR MEDATLAS II climatology [Fig. 1]. The maximal salinity is 38.77 near 500 m. Between 1000 and 1200 m, the salinity is typically 0.1 larger than climatology, whereas potential temperature can be larger by about 0.5 C. Deeper in the water column (near 2000 m), the floats measured salinities spanning in 38.51-38.53 compared with the mean climatological value of 38.47, and potential temperatures in 13.07-13.11 C compared with 12.89 C. Since the MEDAR MEDATLAS II climatology is essentially based on hydrographic observations collected in the 20th century, the above-mentioned variations are thought to be related to long-term interdecadal variability of the whole Mediterranean Sea, including changes known as the Eastern Mediterranean Transient (ETM) [3] and the Mediterranean Sea Transient (MST) [4].

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References

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