THERMOHALINE CHARACTERISTICS OF THE MEDITERRANEAN DEDUCED FROM ARGO DATA IN 2000-2009 (STATISTICAL ANALYSIS)

Giulio Notarstefano [1]* and Pierre-Marie Poulain [1]

[1] Istituto Nazionale di Oceanografia e di Geofisica Sperimentale- OGS- Trieste, Italy - gnotarstefano@ogs.trieste.it

Abstract

Since 2000, numerous Argo floats have been deployed in the Mediterranean Sea under various programs and by different institutions/countries. Different cycling and sampling characteristics have been chosen to monitor this marginal sea, including cycles of 5 to 10 days, parking depths at 350 m and maximum profiling depths between 700 and 2000 m. This work contains the description of the thermohaline variability obtained using all the historical Argo data in the Mediterranean. The intrinsic variability of the temperature and salinity is described for most of the Mediterranean sub-basins by means of monthly statistics. The temporal decorrelation scales of temperature and salinity following floats are also estimated.

Keywords: Temperature, Salinity

Data and methods

In total, 88 Argo floats have been operated in the Mediterranean Sea between December 2000 and June 2009 (more than 7700 CTD profiles), out of which 27 correspond to the MFSTEP project [1]. The maximum density of floats was obtained in May 2006 with 31 floats running simultaneously. The following sub-basins were relatively well sampled by the floats: Catalan, Algerian, Ligurian, Tyrrhenian, Ionian, Cretan and Levantine. The Alboran and Aegean seas and the Sicily Channel area have limited Argo data. No data are available in the Adriatic Sea.

Thermohaline characteristics in the Mediterranean sub-basins

The following statistics have been calculated using the above-mentioned Argo data in the Mediterranean sub-basins:

• number of observations, mean and standard deviation of potential temperature (θ) and salinity (S) near 0, 600 and 2000 m;

• number of observations, mean and standard deviation of θ and S near depth of salinity maximum;

• depth of salinity maximum.

The mean S at the depth of salinity maximum is displayed versus time in Figure 1.

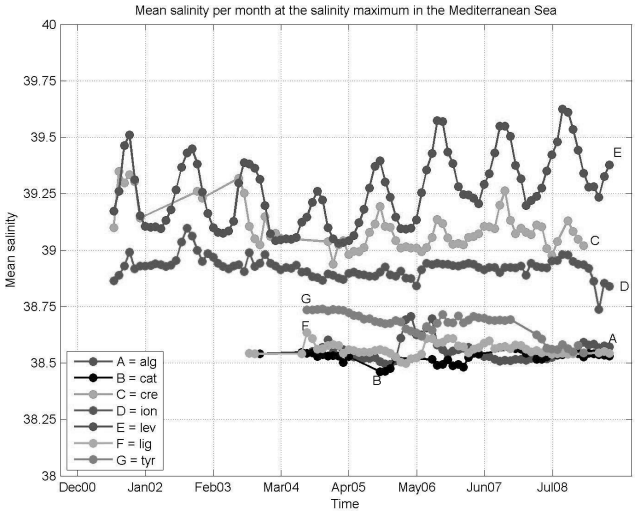

Fig. 1. Monthly mean of S at the salinity maximum in the Mediterranean sub-basins between December 2000 and June 2009.

Decorrelation scales of temperature and salinity

The time-lagged auto-correlations of θ and S at selected depths were calculated to estimate the decorrelation scales following the floats. For each float, a linear trend was removed from the data time series before computing the auto-correlation, in order to have a realistic measure of the data decorrelation. The auto-correlations of θ (Figure 2) and S are computed, by using a time step of 5 days. The Lagrangian integral time scale is computed by integrating to the first zero crossing of the autocorrelation function.

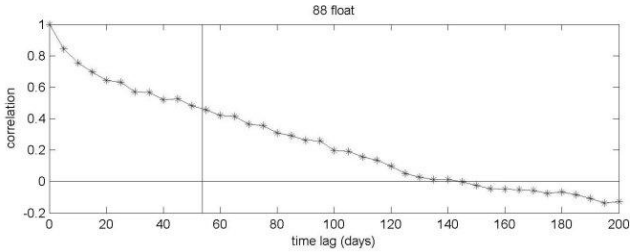

Fig. 2. Auto-correlation of temperature at 600 m versus time lag and integral time scale (vertical bar) for all the floats in the Mediterranean (trend is removed from the time series before computing the correlation).

Conclusions

Using the Argo data in the Mediterranean between December 2000 and June 2009, we have shown that:

• the Levantine sub-basin is in general the most populated with data spanning continuously between June 2001 and June 2009;

• the potential temperature exhibits a seasonal cycle near the surface in all the sub-basins, as well as the salinity in the Cretan and Levantine sub-basins;

• the characteristics of the temporal evolution of potential temperature and salinity at 600 and 2000 m show that the sub-basins can be mainly grouped in western and eastern sub-basins;

• trends are evident in the time series of monthly averaged temperature and salinity for some sub-basins, but their interpretation should be very cautious due to the non-uniform sampling of the floats, both in space and time;

• at 600 m the correlation coefficient for the potential temperature decreases to 0.84 after 5 days, and to 0.75 after 10 days. The zero-crossing occurs after about 140 days, whereas the Lagrangian integral time scale is about 60 days.

References

1 - Poulain P.-M., Barbanti R., Font J., Cruzado A. , Millot C., Gertman I., Griffa A., Molcard A., Rupolo V., Le Bras S. and Petit de la Villeon L., 2007. MedArgo: a drifting profiler program in the Mediterranean Sea. *Ocean Sci*., 3: 379-395.