MERGING MEDATLAS DATA BASE AND NEW MONITORING PROGRAMS. WMED WARMING FROM 1900 TO 2008.

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Abstract

Data bases such as MEDATLAS [1] have proved to be an extremely valuable tool for assessing long term changes. Nevertheless, recent works have shown that the irregular time and spatial distribution of data can decrease the robustness of the analyses [2, 3]. Monitoring programs with systematic samplings are required in order improve the estimations of long term changes, but this arises the question of whether or not data from new monitoring programs and "old" data bases can be merged in order to construct long time series. In this work we check the homogeneity of time series constructed from MEDATLAS data base and the monitoring program RADMED in the Spanish Mediterranean. Time series extending from 1900 to 2008 show the warming and salting of the Western Mediterranean (WMED).

Keywords: Western Mediterranean, Monitoring, Time Series, Temperature, Salinity

The Spanish Mediterranean was divided in four different areas (squares in fig. 1) and all the temperature and salinity profiles from 1900 to 2000 in MEDATLAS data base were compiled. Because of biases recently reported in batithermographs [4], only bottle and CTD data were used. Time series within each square were vertically interpolated at 23 pressure levels from 0 to 2500 dbar. These series were merged with averaged profiles obtained from oceanographic stations from RADMED (IEO) and l'Estartit oceanographic station (ICM/CSIC) within the corresponding square. In this way we construct temperature and salinity time series extending from 1900 to 2008.

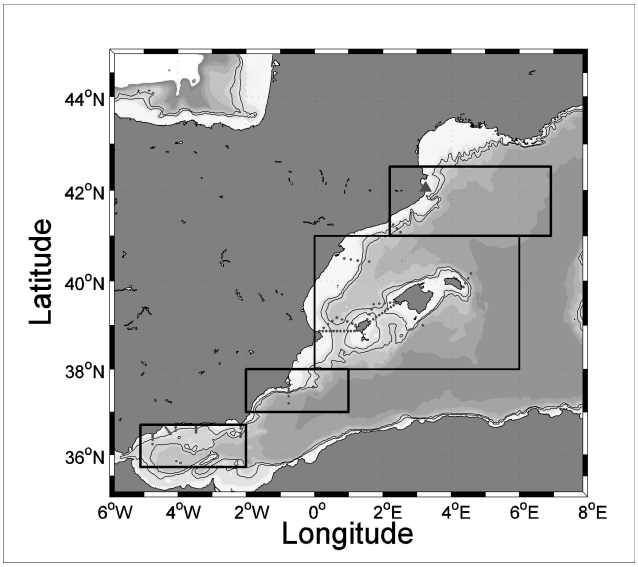

Fig. 1. Squares where MEDATLAS data were compiled and RADMED stations (dots). The triangle is l'Estartit oceanographic station.

First the homogeneity and normality of time series was checked by means of Alexanderson homogeneity tests and Kolmogorov-Smirnov tests. Both temperature and salinity time series were accepted as homogeneous after the corresponding tests. The length of these time series has shown that the WMED has increased its temperature at the three layers considered, that is, upper (0-200m), intermediate (200-600m) and deep (600m-bottom). The heat absorbed by the water column is equivalent to a heat gain of 0.23 Wm^{-2}. The salinity of the intermediate and deep layer also increased in a statistically significant way (fig. 2). These series show a strong decadal variability that makes it difficult to distinguish between those changes that are operating continuously in time, very likely as a result of climate change, and those that are the result of the inner variability of the climate system. The inclusion of data from the early twentieth century allow us to estimate long term changes, although decadal variability can not be resolved in this part of the time series. Our results highlight the non-linear character of the temperature and salinity time series and linear trends can only be considered as mean increments for the whole period of time. Furthermore, the homogeneity of the time series obtained and the continuity of the ongoing monitoring programs provides a tool for studying the effects of climate change in the Mediterranean. A correlation analysis with time series of heat absorbed by the upper 700m in the North Atlantic evidence that the WMED and the present time series can be considered as a proxy for larger scale climate change studies.

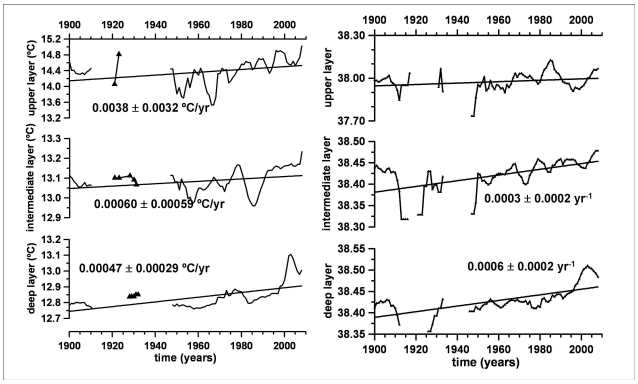

Fig. 2. Left column are mean temperatures for the upper, intermediate and deep layers averaged for the four areas selected. Right column is the same for salinity.

References

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