TEN-YEAR EVOLUTION OF THE (NEW) WESTERN MEDITERRANEAN DEEP WATER

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Abstract
The evolution of the Western Mediterranean Deep Water (WMDW) thermohaline anomaly originated after winter 2005, has been recorded by two deep hydrographic stations seasonally sampled during the RADMED monitoring program at the NE of the Menorca Island and at Cape Palos (Spanish Mediterranean). The data reveal an increasing trend in salinity and temperature in the WMDW one order of magnitude higher that previous reported values. A deep mooring recently installed at the NE of Menorca and RADMED data will be used to characterize the relative contribution of new WMDW and diffusion on the evolution of the salinity and temperature profiles.

Keywords: Deep waters, Temperature, Salinity, North-Western Mediterranean, South-Western Mediterranean

In the Western Mediterranean after the winter 2005 an abrupt change in the Western Mediterranean Deep Water (WMDW) was observed, involving a complex termohaline structure (López-Jurado et al. 2005). This new situation, named Western Mediterranean Transition (WMT) (CIESM, 2009), which implied the contribution of different water masses and the appearance of a new WMDW, has been tracked up to now.

Along the Spanish Mediterranean coast, areas where differences in the large-scale hydrographic conditions are expected have been seasonally monitored through the RADMED programme (López-Jurado et al. 2015). RADMED deep stations provide a description of the water column, including intermediate and deep water masses and their anomalies along the time. They also allow for the study of some seasonal phenomena such as intermediate and deep waters formation and transport.

Two RADMED deep stations, one near Cape Palos lower continental slope (00º 45.45 W, 37º 22.37 N, 2400 m depth, sampled since 2007) and one NE of the Menorca Island (04º 34.96 E, 40º 10.00 N, 2540 m depth, sampled since 2003) are used to characterize the new WMDW temporal evolution. The interface between new and old WMDW has been defined as the salinity minimum below 700 m, well beneath the Levantine Intermediate Water (LIW) core. Mean salinity, $\langle S \rangle$, potential temperature, $\langle \theta \rangle$, and potential density anomaly, $\langle \sigma_0 \rangle$, below the interface to the bottom have been calculated to compare their temporal evolution with the mean values below 700 m to the bottom.

Figure 1 shows the interface depth at Menorca station and the mean values of the three analysed variables. Similar trends have been observed at the Cape Palos site (not shown) with a seasonal oscillation of the interface depth from 2007 to 2011, probably a dynamic feature due to a combined effect of seasonal forcing with the proximity of the continental slope. Both stations thus show an increasing trend in S and θ of the order of 10^{-3} year^{-1} and 5 10^{-3} ºC year^{-1} respectively along the analysed period, an order of magnitude higher than values previously reported for the 1900-2008 period (Vargas-Yáñez et al. 2010). Same temperature trend is found in the Strait of Gibraltar for the Deep Mediterranean Waters flowing out the Mediterranean through the Espartel sill (C. Naranjo, personal communication)

To clarify the relative contribution of new WMDW formation and the diffusive evolution of the S and θ profiles a deep mooring equipped with five current meters, eight CTDs, eight thermistors and two sediment traps has been installed at the Menorca station, in the frame of the RADMED programme and the ATHAPOC project. ATHAPOC main objective is the study of the new WMDW. The information provided by this mooring together with the historical RADMED data is going to be used to quantify the contribution of the different terms.

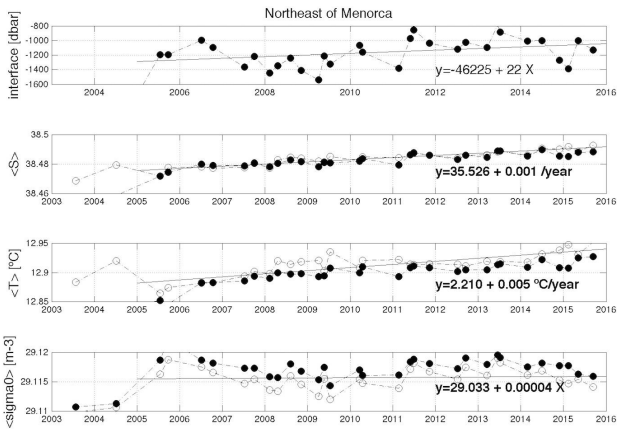

Fig. 1. Temporal evolution of interface depth, mean S, potential temperature and potential density anomaly from new WMDW to bottom (closed dots) and from 700 dbar to bottom (open dots). Lines indicate linear trends of mean values from 700 dbar to bottom, calculated from 2005 to 2015.

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