# The Levantine water in the Tyrrhenian Sea : double diffusion and basin scale mixing

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Double diffusive processes have now been encountered in many oceanic regions. They occur sporadically in space and in time and can increase the vertical diffusion coefficient by several order of magnitude. In this paper, an attempt is made to parameterise this micro-scale phenomena. The salt and heat fluxes, calculated from salt-finger theory, can be compare to the salt and heat balance in the Levantine Intermediate Water (LIW) tongue during its incursion in the Tyrrhenian basin, which offers a natural model to undertake such a study. Similar objectives have been pursued in the mediterranean out flow off Gibraltar (Lambert & Sturges, 1977. Hebert, 1988).

The Tyrrhenian sea is a semi-enclosed basin with a large opening of 180nm in the south between Sicily and Sardinia. The average depth is 1000m with a deep channel of 2000m in the eastern part, communicating between Sicily and Tunisia with the western basin. In the northern part it is opened to the Ligurian sea, between Corsica and the italian mainland. The deepest passage, on the corsican side, only reaches 410m.

Most of the LIW which enters the basin following the sicilian cost, between 300 and 600m, is believed to return to the western basin with a southward flow along the sardinian cost (Garzoli & Maillard,1979). All the hydrological sections (from the presently available data base) achieved between Sicily and Sardinia indeed show two distinct cores of warmer and saltier water having respectively in and out geostrophic flow. Estimates of these flows are however strongly dependent on the chosen reference levels: Climatological data of the section have been inversed using Singular Value Decomposition method (Mémery & Wunsch, 1989) in order to deduce more realistic values of the water, salt and heat fluxes through this section.

It has also been shown (Molcard & Tait, 1977) that double diffusive processes of salt finger type (Williams, 1975) are present in the deep basin of the Tyrrhenian sea and are responsible for the large homogeneous layers separated by sharp interfaces observed in the region. Laboratory and theoretical investigations directed at estimating the associated diapycnal salt fluxes (Stern, 1976. Turner, 1967. Schmitt, 1988) lead to an estimate of the average vertical salt flux out of the LIW.

The loss of salt and heat in the LIW during its incursion in the Tyrrhenian basin can therefore be compared to the expected loss due to double diffusion. Required time for the necessary amount of salt and heat to be drawn out of the levantine water, according to the vertical salt flux deduced from double diffusion theory, is discussed in view of the expected renewal time of the LIW deduced from the in and out fluxes, and the present knowledge of the general circulation in the basin.

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