

Does the Almeria-Oran Front disappear sometimes?

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One of the most important fronts in the Western Mediterranean is the well known Almeria-Oran front, in the eastern limit of the Alboran sea. It has been described by several authors (see Tintoré et al., 1988, for a synthesis on the subject) as the western limit of the Mediterranean waters at surface ($S > 37.5$). It can be traced not only by the important salinity gradients but also by temperature, fluorescence, nutrients, and, of course by the density. This properties contribute to the possibility to see this front markedly by satellite images (infrared or visible).

This front is a dynamical feature over all the surface layer up to 150-200 m depth but sometimes, due to the intense thermocline in summer, it can be hidden below, while in winter, the surface signature of the front appears clearly.

With this background, a cruise was planned for March 1990 to do an intense study of the front: CTD stations, XBTs, two current-meter moorings, TS, fluorescence and Doppler current-meter underway measurements, and AXBT flyghts. The cruise was done from 5 to 21 March 1990. Unfortunately, the area was only covered partially because the bad weather conditions did not allow us to work for many days and only one of the planned flyghts was successful. The current-meters are still there and they will be recovered next month. Nevertheless, the whole information still has some sense and we present here a summary of the "very hot" first results, three weeks after the end of the cruise.

The main result was that the front was not there. No important gradients of density were found and surface salinity was everywhere neatly lower than 37.5 (fig. 1). TS diagrams show always the signature of the Atlantic water over all the region. The continuous underway TS analysis in the way back to Barcelona showed high salinities only north of the Eivissa channel ($38^{\circ}30'N$) and only the stations in this channel did not show the signature of the Atlantic water. The field of doppler measured currents and the geostrophic calculations show the main path of the Atlantic water coming from Gibraltar (fig. 2) which is very similar to the classical picture obtained by Lanoix (1974) in summer.

It is still too early and the information obtained in the cruise needs a more detailed study to draw some conclusions on this results but some idea can be exposed now. The winter 1990 has been very warm and water remained stratified in temperature (in most places temperature was over $15^{\circ}C$ in the first 50 m, which indicates that this was not a recent warming of surface water but that winter processes were not strong enough to delete the last summer stratification). Under these circumstances, the Atlantic water had been spreading over all the region during all the winter while the Mediterranean water remained in depth. Bearing in mind this situation, we can see a conspicuous front near Cape Gata (fig. 1) which separates the most recent Atlantic water from the older one. This particularity is corroborated by the TS diagrams of the stations in its vicinity (fig. 3). This remainder of front can be the "seed" of the Almeria-Oran front. By mid April a French cruise will be done in the area and we will see if this new information can help to be more concludent.

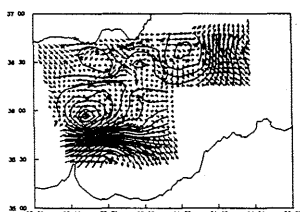
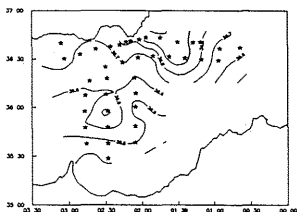


Figure 1. Salinity distribution at 10 m depth

Figure 2: Dynamic height and Doppler measured currents at 10 m depth

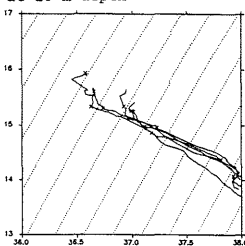


Figure 3. TS diagram of stations in the vicinity of the front.

References

- Lanoix F., 1974. Projet Alboran. Etude hydrologique et dynamique de la Mer d'Alboran. *Rapp. Techn. OTAN*, 66: 39 p.
- Tintoré J., P.E. La Violette, I. Bladé & A. Cruzado, 1988. A Study of an Intense Density Front in the Eastern Alboran Sea: The Almeria-Oran Front. *J. Phys. Oceanogr.*, 18(10): 1384-1397