

Chapter 6 THE OBSERVED FIELDS (Θ , S , s_q , DH)

6.1 Water Masses

As mentioned previously, according to several authors the vertical distribution of the NW Mediterranean can be understood as composed of three layers (Millot., 1999; Salat, et al., 2002):

- a) a surface layer down to 150-300 m,
- b) an intermediate layer down to 600 - 800 m and
- c) a deep layer down to the bottom.

Due to ocean-atmosphere interactions, the possibility of continental influence, as well as the possible interactions between the recent and old Modified Atlantic Waters, most of the variability is found at the surface layer. The different water masses found in it are, according to Salat, et al., (2002):

i) Continental Influence Water (CIW). This is characterized by its low salinity values ($S < 37.8$) as a direct result of the Ebro River runoff.

ii) Continental Shelf Water (CSHW). Less saline than the slope water ($S < 38$) because both of the continental influence and the fact that its Atlantic origin might be more recent, if there is advection from the south through the Islands Channels.

iii) Continental Slope Water (CSLW). The saltiest ($S > 38$) and the ones that might reach the highest temperatures.

iv) Winter Intermediate Waters (WIW): This is the deepest water mass of the surface layer and, as mentioned previously, is formed by convection mostly in the Gulf of Lyon. It has been characterized in the current bibliography on the region (Salat et al., 2002; Millot, 1999; Pinot et al., 1999; Salat & Font, 1987) by values of temperature and salinity in the ranges $[12.5^{\circ}\text{C}-12.8^{\circ}\text{C}]$ and $[38.1-38.35]$ respectively. In the present study, both for the set of FANS campaigns and for MEGO 94, this water mass seems to be characterized by values within slightly different ranges in both variables.

The intermediate layer is occupied by the Levantine Intermediate Water (LIW): This water mass is characterized by relative maxima, both of

temperature and salinity with values within the following ranges: [13°C -13.4°C] and [38.48-38.54] respectively. This water mass is clearly identifiable in all the campaigns.

The deep layer is occupied by the Western Mediterranean Deep Water (WMDW), with the following temperature and salinity ranges respectively:[12.7°C -12.9°C] and [38.42-38.46].

In the following sub-sections, corresponding to the oceanographic campaign, we present four $\Theta - S$ diagrams in the following manner:

Complete $\Theta - S$ Diagram, including all the data points from 5 m onwards.

On Shelf Diagram, from 5 to 200 m (bottom depth to 200 m)

Off Shelf Diagram, from 5 to 200 m (bottom depth larger than 200 m)

Deeper water Diagram, from 200 to 1200 m.

The 200 m isobath was chosen as a clear limit for the shelf/slope transition from a bathymetric criterion.

6.1.1 FANS I

By the time of this campaign the Ebro river runoff was low, with an average outflow 10 days before the cruise started of 124 m³/s (Salat et al., 2002), therefore the CIW ($S < 37.8$) was limited to a region near the river outflow, representing just few points both in the overall diagram (Figure 6-1) and in the “on shelf” one (Figure 6-2). The CSHW ($S < 38.0$) is then the water mass found all over the sampled area from the surface down to around 100 m depth.

Comparing the on shelf and off shelf diagrams (Figure 6-2 and Figure 6-3) we conclude that the potential temperature and salinity distributions are similar all over the study area within the upper 200 m, with CSLW occupying a layer between 50 and 150 m and WIW a layer in a range that runs from around 100 to 300 m.

The LIW occupies a layer ranging from around 350 and 450 m (considering the relative maxima criteria both in Θ and S) and below it is the WMDW. Both deeper water masses, together with a contribution of WIW, are clearly seen in Figure 6-4.

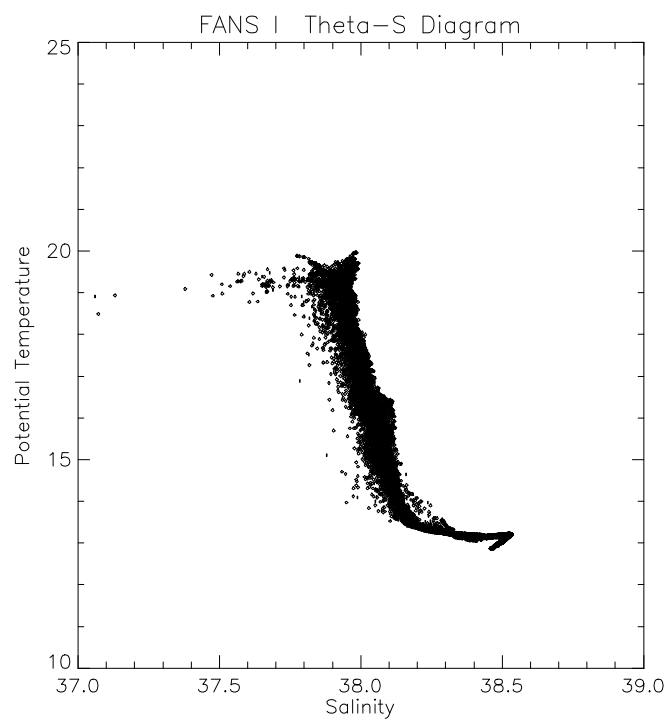


Figure 6-1. FANS I Complete Diagram

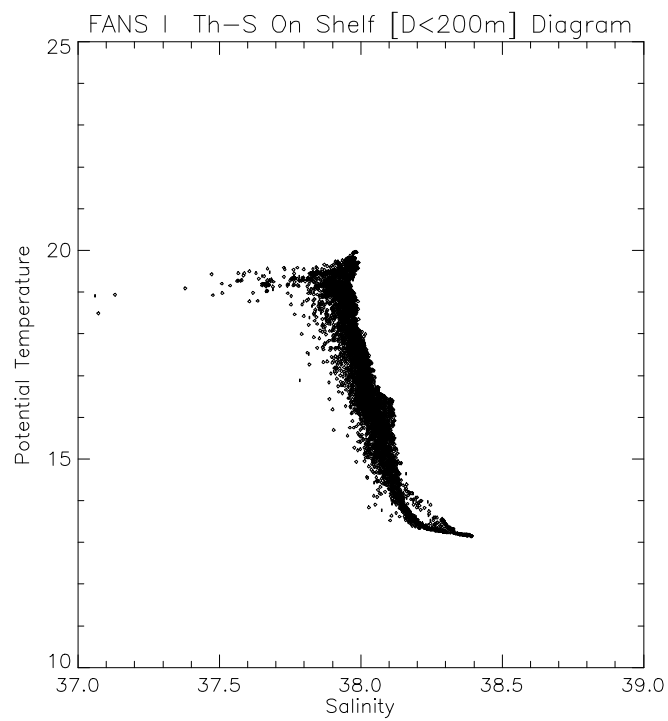


Figure 6-2. FANS I On Shelf Diagram

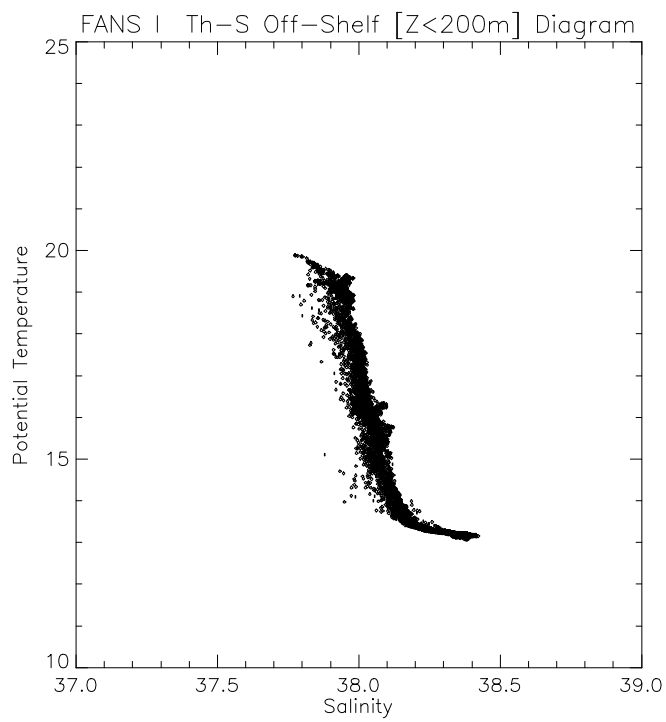


Figure 6-3. FANS I Off Shelf Diagram

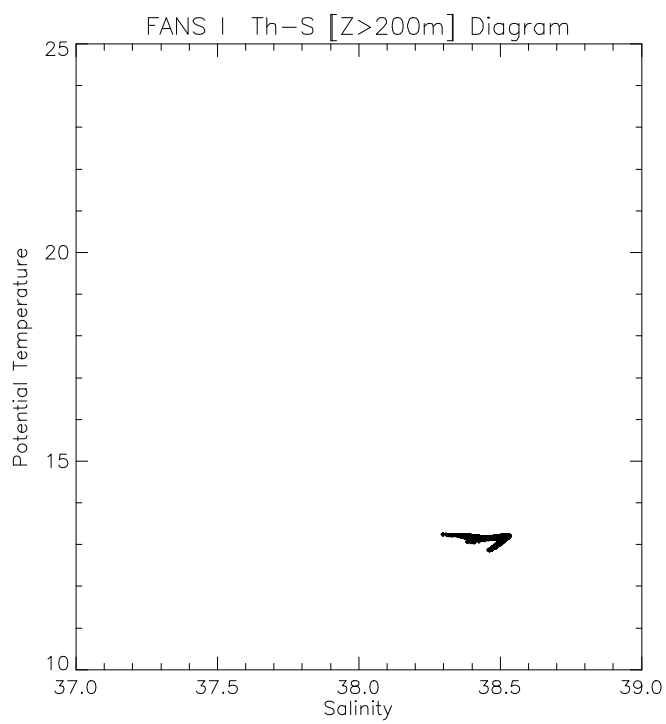


Figure 6-4. FANS I Deep Diagram.

6.1.2 FANS II

While the FANS I diagram seems to be in transition from summer to winter, the FANS II one (Figure 6-5) shows surface waters with temperatures as low or lower than the deeper water masses. This pattern of temperature inversion is a direct result of fresh water runoff from the Ebro River, which had an average flow ten days before the campaign of 1873 m³/s (Salat et al., 2002).

The surface layer is occupied mostly by CIW, which is widespread mostly all over the shelf, and to a lesser extent on the slope (Figure 6-6 and Figure 6-7) occupying a depth range from 5 to around 80 m, and by CSHW in a layer that ranges from 5 to 200 m depth. WIW is also found very near the surface down to depths slightly greater than 300 m. The large river runoff influences then most of the very surface layer on the whole study domain, and the vertical extent of its influence could very well be due to the lack of stratification.

Bellow 200 m (Figure 6-8) the deep water masses are very clearly shown in their typical pattern of a distorted “M”. The LIW is found around 400 m and the WMDW occupies the rest of the sampled area, down to 1200 m.

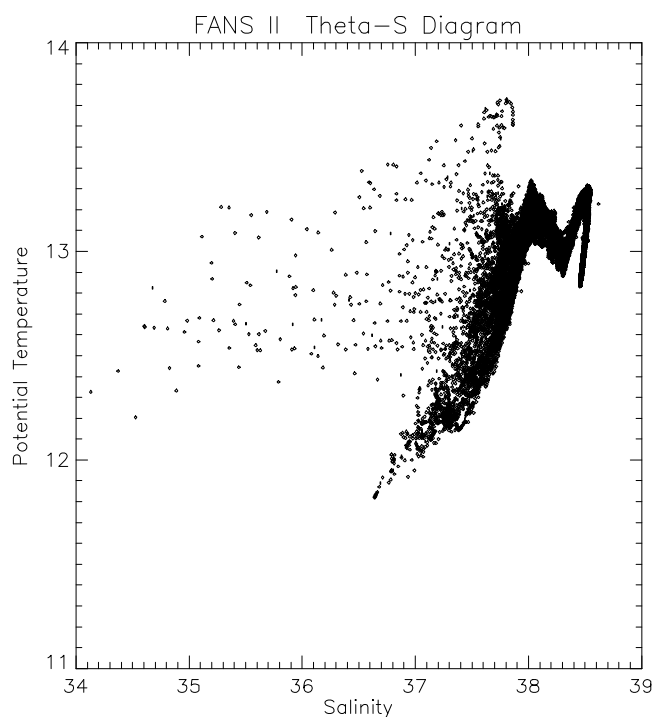


Figure 6-5. FANS II Complete Diagram

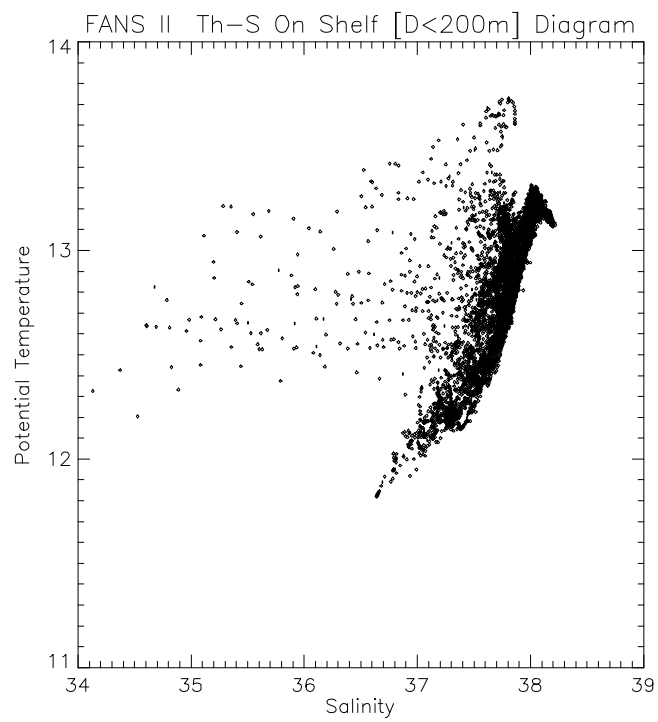


Figure 6-6. FANS II On Shelf Diagram

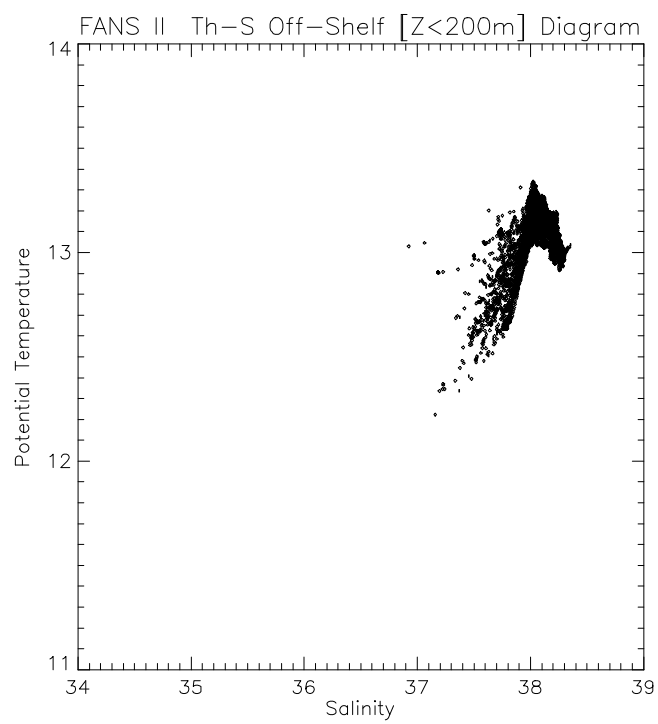


Figure 6-7. FANS II Off Shelf Diagram