Mesoscale activity in the Catalan Current (NW Mediterranean) from May 1987 to December 1989

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In the frame of a research project on shelf/slope frontal dynamics in the NW Mediterranean (Spanish CAICYT PB86-0628), a current-meter mooring was maintained from May 1987 to December 1989 near the shelf break off the Ebro delta (40°43'4"N, 1°21'34" E). This site has resulted to be representative of the general southwestward flow in the region (Font, 1990) and very close to an area where an energetic mesoscale filament has been described (Wang et al., 1988).

One of the aims of this current study was to identify the occurrence of mesoscale events as perturbations of the general circulation in periods from 3 to 20 days. Aanderaa RCM7 current-meters were deployed at -15, -50 and -100 m with a sampling interval of 30 min. and an instrument maintenance about every two months. In total 85% of good data were recovered.

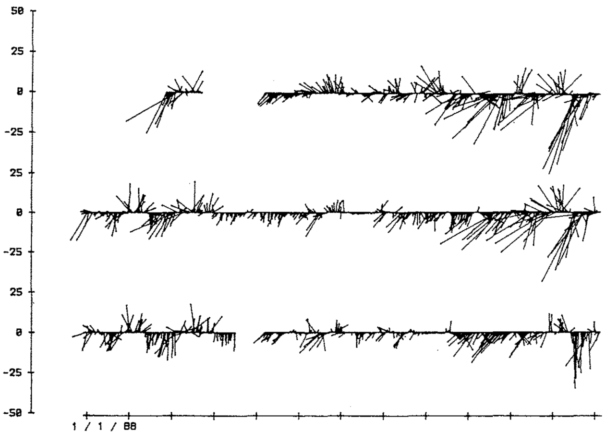

Fig. 1 Low-passed currents (33 h filter) at the three levels sub-sampled every 24 h, for the period 1 January - 31 December 1988

A first estimation of the mesoscale activity has been done with the same method used by Taupier-Letage & Millot (1986) in the Ligurian Sea: the variance of the two components of the velocity vector has been calculated by 20-day periods shifted 10 days, for the whole set of data. Low-passed and daily subsampled currents (fig. 1) were used for this calculation.

The three levels show a similar behaviour during the three years of observations, especially the intermediate and deep current-meters. After a quiet summer period, a sudden increase in mesoscale activity takes place by mid October (fig.2) and is maintained until the end of December. During winter the activity slowly decreases and a secondary and narrower maximum appears in June. The filament observed by Wang et al. (1988) in 1986 would correspond to one of these short active periods.

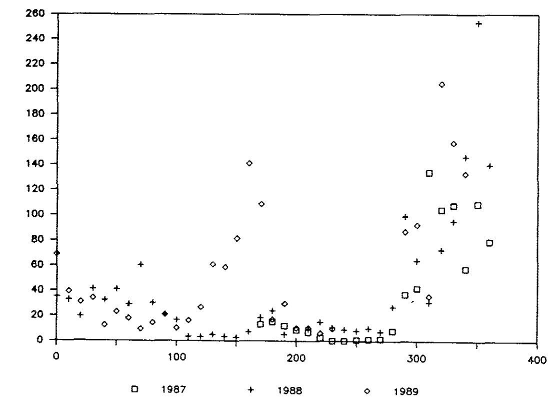

Fig.2 Mesoscale activity in cm^2/s^2 at -50 m for the three years

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Deep convection in the Levantine Sea

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Thermochaline analysis of the deep water in the Eastern Mediterranean shows (El-Gindy, El-Din,1986), that in their formation besides Adriatic and Cretan waters also participate the water of the Levantine Sea (5-15%).

Most of the favourable conditions, under which the winter convection in the Levantine Sea can be developed down to great depths, were occured in the Rhodos gyre area. The center of eddy activity appeared as a sourse of the LIW formation (Ovchinnikov,I.M., 1983,1984), under moderate winter conditions in 1977 and 1982,and with the convection mixing to be in the "pre-condition phase" (MEDOC Group 1969) reaching the depths of 150-200m. Modeling of this process showed that under more severe winter conditions, when in the center of Rhodos gyre the water cooling reach <=14deg.C, the convection can be spread down to the bottom participating in the formation of the Eastern Mediterranean deep water (Ovchinnikov,Plachin,1984). Field experiment on the board of R/V "Jacob Gakkel", during more severe winter conditions 1987, confirm the numerical computation results (Gertman, Popov, Trigoup, 1987).

Before the time of our field works, arctic air invasion occured from 2 to 5 March 1987 in the Rhodos gyre area. Then, during the first phase of the sampling period (7-23 March 1987), the north-western air (with speed up to 20m/sec) predominated with the Ta-Tw to be varied from 4 to 10 deg.C. At the same time the daily (13/3/1987) maximum heat loss in the area of Rhodos gyre reached the value of 76 Mjoule/m^2. Similarly at the MEDALPEX experiment (March 1982), during the deep water formation in the western basin, the maximum heat loss was 60 Mjoule/m^2 (Vakalyuk, Gudz, Popov, 1987). Therefore more greater heat loss from the sea surface, during the arctic air invasion in the Rhodos gyre area (2-5/3/1987), resulted the formation of the surface cool (14deg.C) and dense (29.25) water which excessed the density of the water layer below them (29.20). This caused an active convection mixing down to 700m (Fig.1), corresponding to the "energetically mixing phase". During this phase the dense water was sunk along of the formed water dome, while in the center of the water dome, water from the intermediate layer was raised to the surface. In the moment of the field sampling, less saline water (38.8-38.9) raised from the intermediate depths to the surface and restored the stratification in the surface layer. Therefore in the layer below it the convection mixing turned into the phase of "sinking and spreading".

Comparision of the observations, sampled one month after (during the second phase (16-23/4/1987) with the results sampled during the first phase, showed that the restoration of the thermochaline structure in the area of the water dome occured mainly from the horizontal turbulence and the gradually density stratification in deep layers. The changes which observed during the one month period, permit us to assume that the complete disapperance of the water dome may occured in the following 2-3 months, up to the middle of the summer.

We have to mention that the deep convection in the Rhodos gyre area (down to 800-1000m) observed also during winter 1989 and 1990.

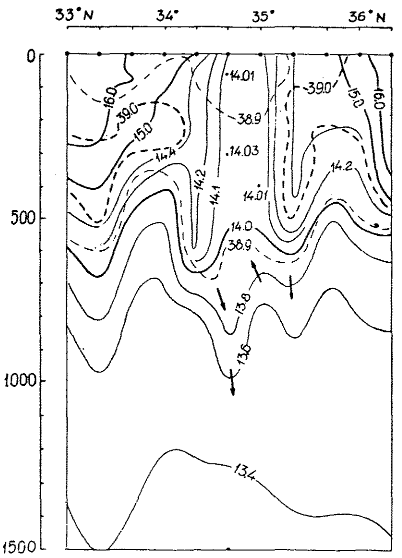

Fig.1. Temperature and salinity, south-north section along 28° 40 E 14-16.03.87 (R/V Jacob Gakkel)

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