## INTERDISCIPLINARY STUDIES ON THE BLACK SEA WATER INFLUENCE IN THE NORTH AEGEAN SEA

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Substantial extention of our knowledge on the Black Sea Water influence in the Aegean sea has been achieved through the succesfully approach of multible objectives : a) the hydrology of the BSW origin, b) the diagnostic analysis of the frontal zones, c) the simulation of the BSW mixing processes, d) the barotropic response of the circulation and e) the reconstruction of the current vectors on the base of NOAA-AVHRR thermal data.

The *in-situ* data shows a significant seasonal fluctuation of the position of the BSW lens, northern or southern from the Limnos island. The use of diagnostic criteria such as the Kibel-Rossby number documented the existence of several types of frontal zones and intensity. Moreover, a double system frontogenesis was found to reverse seasonally (ZODIATIS, BALOPOULOS, 1993).

The circulation is prevailed by the BSW current with various scale cyclonic and anticyclonic flow regions. Numerical experiments on the circulation give evidence that a fairly strong modification of the barotropic flow response exist, due to the BSW flux through the Hellespont strait (ZODIATIS *et al.*, 1994).

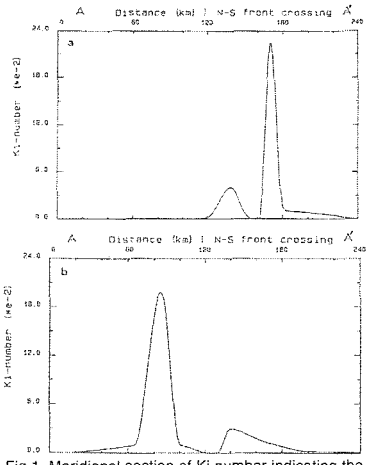


Fig.1. Meridional section of Ki number indicating the intensity of the N Aegean frontogenesis due to BSW. a) winter, b) summer seasons.

The low salinity of the BSW provides the necessary high stability buoyancy condition that restrict the homogenisation of the surface layer, despite the intense cooling and evaporation. This assumption is demonstrated through the application of 1D mixed layer model. Finally, the employment of the Maximum Cross Correlation method on satellite thermal data made possible to extract the currents in the prestrait region of Hellespont (ALEXANDRI *et al.*, 1994). These currents are comparable with the results obtained from the wind forcing flow pattern in the same period with NOAA images.

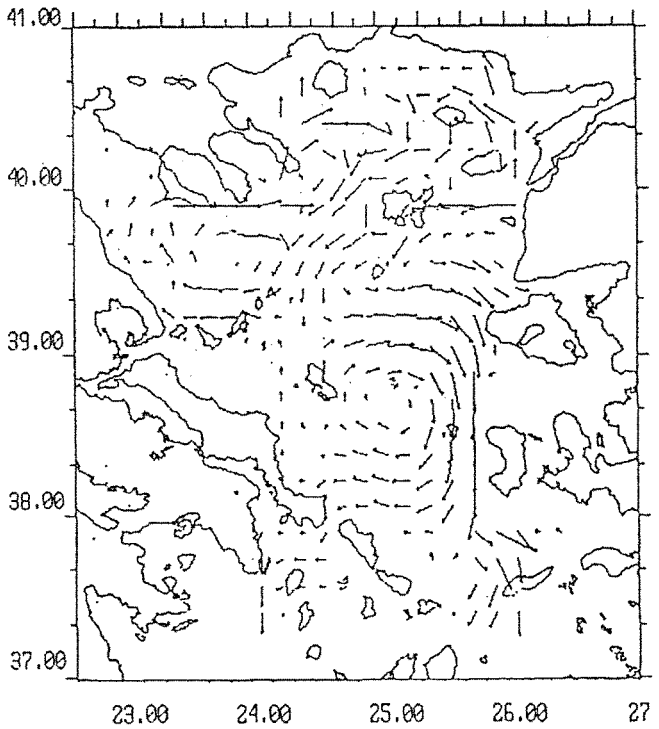


Fig.2. A case of barotropic flow response of the N Aegean with the Hellespont Strait open.

**REFERENCES**
ALEXANDRI S., E. BALOBOULOS, G. ZODIATIS, L. JONSSON, 1994. Currents estimation in the North Aegean sea using satellite data. *Ann Geophysicae*, Suppl. ii, 12 : 256.
ZODIATIS G., S. ALEXANDRI, E. BALOPOULOS, 1994. Modelling the Synoptic Scale Variability of the North Aegean Sea Dynamics. *Ann. Geophysicae*, Suppl. II, 12 : 247.
ZODIATIS G. and E. BALOPOULOS, 1993. Structure and Characteristics of the Fronts in the North Aegean Sea. *Boll. Oceanol. Teor. Appl.*, XI, 2.

## THERMOHALINE LENS IN THE WESTERN MEDITERRANEAN SEA

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Mesoscale and fine structure analysis of the water masses in the Ligurian sea revealed the presence of a cool less saline thermohaline lens. This lens with temperature .8 and salinity .4 differences, from the surrounding waters, extended vertically at about 100 m between 300 - 400 m depth and horizontally about 20 km. Similar cool less saline lenses were found at the sub-polar front in the North Atlantic (KARLIN *et al.*, 1988) and in the SE Ionian sea (ZODIATIS, 1992), in contrast to the salt Meddies and Reddies (ARMI & ZENK, 1984; FEDOROV & MESCHANOV, 1988).

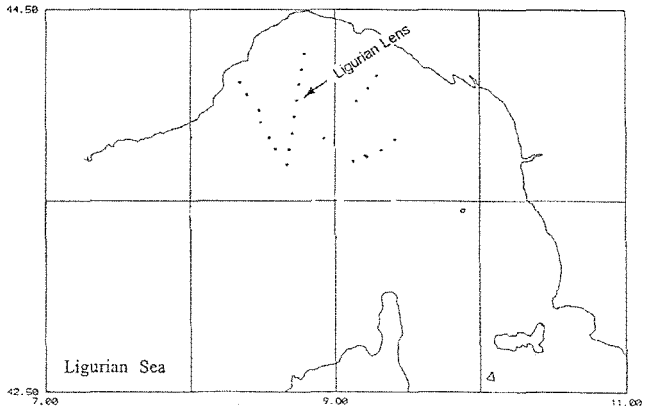


Figure 1. LIGUR 1991 (April)

Two possible mechanisms of such lens formation are proposed: a) frontal intrusive, due to isopycnic flow of denser surface water over a thermohaline frontal slope and b) convective one, due to the advection of residual winter intermediate layer. Various diagnostic fine structure and frontogenesis parameters, the density ratio, slope angles of T, S, density, isopycnic gradients were employed on the T(z), S(z).

The data processing indicates that the salt finger instabilities were favourable to be developed in the upper lens boundary, while diffusive convection instabilities were likely to appear in the lower lens interface. The contribution of the temper ature on the density gradient found to be greater than of the salinity, as the density ratio does not exceed the Rp = <.5 value. In addition, at the lens boundaries the like frontal interface is distinguished by the increase of the thermocline. The latter indirectly give evidence on the intrusive origin of the lens. Such intrusion may contribute to a substantial heat-salt fluxes, vertical mixing through the pycnocline.

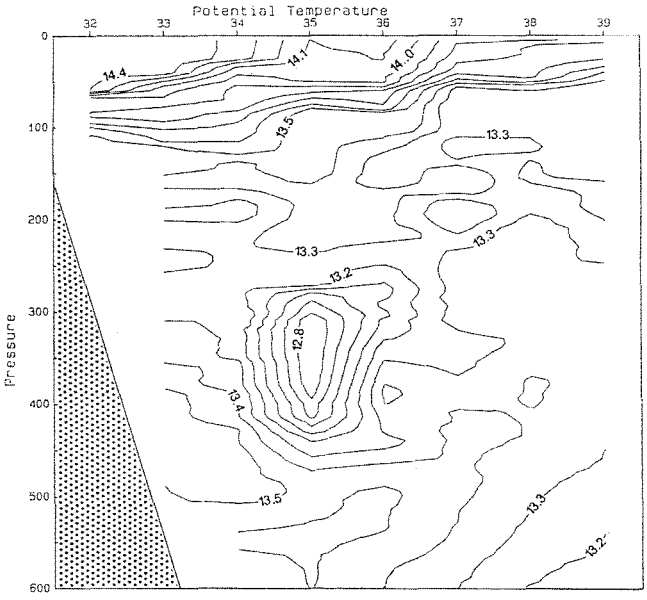


Figure 2. Ligurian lens - revealed by vertical temperature distribution

**REFERENCES**
ARMI L., W. ZENK, 1984. Large lenses of highly saline Mediterranean water. *J. Phys. Oceanogr.*, 14 : 1560-1576.
FEDOROV K., S.L. MESCHANOV, 1988. Structure and propagation of Red sea waters in the Gulf of Aden. *Oceanology*, 28 : 279-284.
KARLIN L., Y.Y. KLUIKOV, B.P. KUTKO, 1988. The Microscale structure of the hydrophysical fields at the upper layer of Ocean. Gidrometeoizdat. 162 p., Moscow.
ZODIATIS G., 1992. Lens formation in the SE Ionian Sea and Double Diffusion. *Ann. Geophysicae*, 10 : 935-942.