Water masses dynamics through the Ibiza Channel

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Two oceanographic surveys were carried out at the Ibiza Channel (Balearic Island) during fall of 1990 and winter 1991. A grid of fifty four hydrographic stations placed five miles apart was established. In addition to these (surveys) a single mooring with six current meters was deployed in the center of the channel, during two consecutive periods covering from 15/11/90 to 24/7/91. Six different depths 100, 120, 170, 270, 470 and 720 meters were sampled.

Four water masses were found: Modificated North Atlantic Water (MNAW) at the surface layer (0-200 m), Levantine Intermediate Water (LIW) between 250 and 700 m depth, West Mediterranean Deep Water (WMDW) around 700 m depth to the bottom, and a stational West Mediterranean Winter Intermediate Water (WMWIW) between surface layer and LIW was observed on March.

Hydrographic measurements and dynamic topographies showed two different situations in the superficial waters (Fig. 1, 2): During November 1990 a cyclonic gyre was originated by the superficial movement of a NAW inflow (northward) near Ibiza island and the outflow of MNAW (southward) on the Mainland shore. In march 1991, cyclonic and anticyclonic gyres appeared in the NE-SW axes of the work area. These seemed as an intermediate situation, two bodies of water struggling to flow in opposite directions. Below, these superficial layer, water principally flows southward.

Both North Atlantic and Levantine Waters play an important role in the water exchanges through the Ibiza Channel and both help to cause an upwelling of deep waters on the Ibiza slope. Water masses flow and their stational variability were studied and calculated.

Moreover, time series of different parameters from half hour current meter records are been analysed. Geostrophic velocity distributions across different sections agree with the average velocities recorded by the more superficial current meters (Fig. 3, 4).

Low frequency analysis of this series show a baroclinic situation preferently at the beginning of 1991 and the pass to barotropic conditions on April 1991. From March to May a net southward flow was observed, an important result is the finding of a northward flow in all the column of water from May to July, when the data series recording ended.

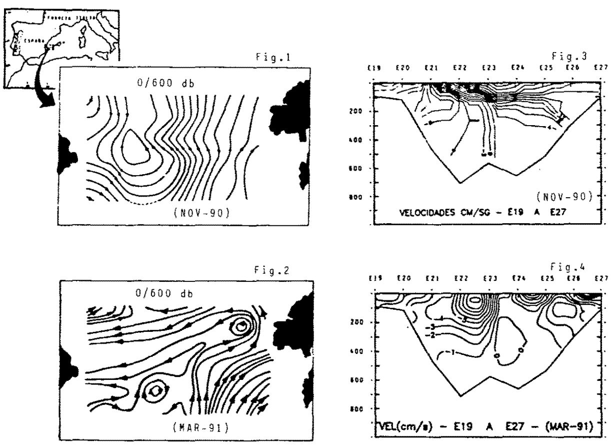

Fig. 1, 2.- Dynamic topographies (dyn cm) of the Odb surface relative to 600 db.
Fig. 3, 4.- Geostrophic velocities in a section on the channel sill.

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Heat storage in the Eastern Mediterranean

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The heat storage in the oceanic surface layers may be subjected to a considerable variability in space and time. In spite of the fact that the heat budget plays an essential role in the dynamics of the Ocean, only few works have regarded the heat storage in the Mediterranean (SAID, 1985 and PICCO, 1990).

The hydrographic data used retrieved from the WDC-A. It is made of about 1300 objectively tested TS profiles for the Eastern Mediterranean selected with a resolution of 0.5° square to obtain monthly mean profiles. Vertical resolution is that of standard depths. The heat storage were considered for the upper 100 and 300 m layers for the Eastern Mediterranean Sea east of Meridian, 20°E. Monthly heat storage (H) in J/m^2 has been estimated using the following relation :

$$H = 1/8 \sum (Cp_i + Cp_{i+1}) (\rho_i + \rho_{i+1}) (T_i + T_{i+1}) (Z_{i+1} - Z_i)$$

where:
Cpi: specific heat capacity in J/kg. °k (KorN, 1972),
ρ_i: water density,
T_i: water temperature,
Z_i: level depth,
Subscript (i) is refer to the ith level.

The first layer includes the Mediterranean surface and Atlantic subsurface water masses. The upper 300 m layer contain the upper part or the Intermediate layer as well.

The monthly mean values of heat storage in both considered layers are higher in the Levantine basin than that in the Ionian and Aegian Seas (Fig. 1), due to the fact that the Levantine basin lies in a considerable lower latitude than the other two basins. Moreover, the vertical mixing in the Levantine basin, especially in its northern part, is more effective and may reach to more than 300 m depth. In these regions, the heat gained at the surface reaches to a considerable depths and then horizontally advected westward.

The amplitude of annual signal is greater with about 6% in 0-100 m layer than in 0-300 m in Levantine Sea, and with about 12% and 25% in 0-300 m layer than in 0-100 m layer for Ionian and Aegian Seas respectively.

Heat storage in the upper 100 m layer ranges from about 6.6 E9 J/m^2 in January to 8.7 E9 J/m^2 in October in Levantine basin. In the Ionian Sea, it ranges between 6.3 and 8.1 E9 J/m^2 in January and September respectively. It changes between 6.2 and 7.9 E9 J/m^2 in April and September in the Aegian Sea.

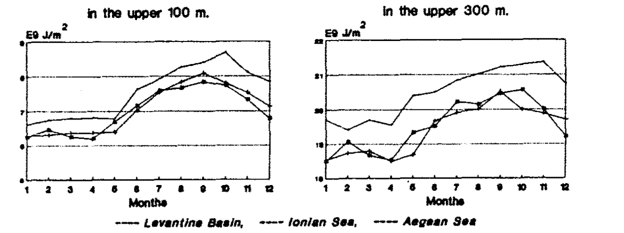

Fig. 1.- Monthly heat storage

In the upper 300 m layer, the heat storage ranges between 19.4 E9 J/m^2 in February and 21.4 E9 J/m^2 in November in the Levantine basin. In the Ionian sea it varies from 18.5 E9 J/m^2 in April to 20.5 E9 J/m^2 in September. In the Aegian Sea, it changes between 18.5 E9 J/m^2 in April to 20.6 E9 J/m^2 in October.

In general, the heat storage is higher and the period of heat storing is longer in the Levantine basin (Fig. 1).

According to the geographic distribution of the amplitude of annual signal, the minimum value, for both two layers under consideration, was observed in the northern Levantine basin while the higher values were found in the south SE of the same basin.

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