O-V10

SOME FEATURES OF THE CIRCULATION IN THE INTERMEDIATE AND DEEP LAYERS OF THE EASTERN MEDITERRANEAN SEA

A.M. KARAM° and S.H. SHARAF EL DIN°°

° Institute of Oceanography and Fisheries, Med. Sea Branch, Kayet Bay, Alexandria (Egypt)

°° Oceanography Department, Faculty of Science, Alexandria University, Alexandria (Egypt)

The absolute geostrophic velocity field was estimated on twelve isopycnal surfaces in the intermediate and deep layers of the Eastern Mediterranean Sea. The estimation method was proposed by Coats (1981). The model equation used is-

$$\frac{u_0}{\cos\phi}\left[\left(\frac{\partial h}{\partial\lambda}\right)_1-\left(\frac{\partial h}{\partial\lambda}\right)_n\right]+v_0\left[\cot\phi\,(h_n-h_1)+\left(\frac{\partial h}{\partial\phi}\right)_1-\left(\frac{\partial h}{\partial\phi}\right)_n\right]$$
$$=\cot\phi\int_{z=h_n}^{z=h_1} v'\,dz+\frac{u'_n}{\cos\phi}\left(\frac{\partial h}{\partial\lambda}\right)_n+v'_n\left(\frac{\partial h}{\partial\phi}\right)_n ,$$

where u_0 & v_0 are the unknown zonal and meridional absolute velocity components at the reference isopycnal surface denoted by the subscript 1, u'_n & v'_n are the zonal and meridional relative velocity components at the isopycnal n, λ is the zonal coordinate, ϕ is the meridional coordinate, h_1 & h_n are the depths of the isopycnals number 1 & n, $(\frac{\partial h}{\partial x})$ is the zonal slope of an isopycnal, $(\frac{\partial h}{\partial\phi})$ is the meridional slope of an isopycnal and z is the vertical coordinate (positive upward). Estimates from twelve isopycnal surfaces were used in the model equation creating an overdetermined system of equations in the two unknown u_0 & v_0.

The results on the intermediate isopycnals showed two cyclonic gyres in the Levantine Sea with a suggestion of flow from the Levantine Sea to the Aegean Sea, while in the Ionian Sea the water was flowing mostly to the west and northwest along 35°N and 36°N. On the deep isopycnals three branches of flow appeared in the Leventine Sea: The first was coming from the south of the Ionian Sea parallel to the coast, the second was directed from the Aegean Sea to the south and the third one initiates south of Cyprus and was directed westward along 34°N. In the Ionian Sea the cyclonic gyre found in the south on intermediate isopycnals persisted on deeper ones. Comparison of the flow on one of the intermdiate isopycnals with the dynamic height pattern of Ovchinnikov (1966) at 500m showed a great accordance.

Beside the above dynamical study of the circulation, isopycnal analysis was used in the deeper water. Accordingly the salinity was looked along the isopycnal surfaces σ_2=37.820 and σ_2=37.830 which mostly reached depths deeper than 2000m. On the former surface a westward movement was indicated in the Levantine Sea while in the Ionian Sea a cyclonic movement was suggested and confirmed by the potential vorticity pattern. On the deeper surface which existed only in the Ionian Sea, a gyral motion of an anticyclonic sense was suggested west of Crete. According to our results it seems that the circulation in the deep water is quite different from the simple picture presented by Wüst (1961) via the "Core" method.

O-VI1

^{3}He/^{4}He IN EASTERN MEDITERRANEAN DEEP WATER : GEOCHEMICAL AND OCEANOGRAPHIC IMPLICATIONS

Wolfgang ROETHER and Peter SCHLOSSER

Institut für Umweltphysik, Universität Heidelberg, Heidelberg (F.R.G.)

He isotope observations in deep water (below 1500 m) in the Eastern Mediterranean obtained on samples from a cruise of the F/S "Meteor" in 1978 show δ^3He values decreasing from about zero in the Ionian Basin to -4.5% in the Levantine Basin, while ^{4}He increases from about Δ^4He = +8% to +15%. Tritium again decreases eastward from values near 1 TR to very low ones. The δ^3He and tritium isolines are essentially vertical. Having negative δ^3He values, the Eastern Mediterranean is one of the few exceptions of the general rule of a ^{3}He excess being present in subsurface ocean water. A correction for tritiugenic ^{3}He based on the observed tritium concentrations and about one tritium half life (12.43 years) deep-water residence of the tritium leads to nearly homogeneous pre-anthropogenic δ^3He in the deep water (∿ -4.5%). The ^{4}He and the so-corrected ^{3}He-values point to addition of He from the sea floor, the mean ^{3}He/^{4}He ratio of which is intermediate of those typical of crustal and of mantle He. The average deep water He excess to be ascribed to a bottom source amounts to about 7%. Using a deep-water turnover time of 150 years, this excess converts into a He release rate of about $1.5\cdot10^3$ m^3 (STP) He per year. The isolines of δ^3He and tritium being vertical implies that vertical mixing in the deep water must dominate over along-basin exchange. If the source strength, or the isotopic ratio, distribution of the bottom-released He can be determined, He-isotope data can also give information on along-basin transports. Helium isotope, tritium, and freon observations within the POEM program planned for 1987 should allow us to answer in more detail the question of vertical and lateral circulation and mixing in the Eastern Mediterranean deep water.

O