DETERMINATION OF TURBULENT MIXING COEFFICIENTS ALONG THE ROMANIAN WEST COAST OF THE BLACK SEA

by

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ABSTRACT

The espace scale dependence of the turbulent mixing coefficient values determined from turbulent diffusion of dissolved substances, dispersion of finite particles, and current velocity fluctuations during 1976-1980 is presented, and the deviations from the "4/3 power law" in the shallow waters are pointed out.

RESUME

Les caractéristiques des processus turbulents à moyenne échelle ont été déterminés pendant 1976-1980 par des expériences sur la diffusion des substances dissoutes, la dispersion des particules discrètes et les fluctuations de la vitesse du courant.

On présente la dépendance des valeurs des coefficients de mélange turbulent en fonction de l'échelle spatiale des phénomènes, mettant en évidence les déviations par rapport à la "loi 4/3" dans les zones peu profondes.

In the semiempirical theories on the turbulent movement the momentus, mass and heat fluxes are parametrized by specific turbulent mixing coefficients. Their values and dependance on the space scale is to be determined by the experiment.

Turbulent exchange coefficient determinations were made by using the Ertel algorithm (2) applied to several current series recorded in the nearshore and shelf waters (10 to 50 m depth). The obtained values (ranging from 0.3 to 62.0 m^2/s) increase with the averaging period, up to 12 ou 18 hours (tidal and inertial periods) then a "saturation effect" occurs (4,5). The power law dependence -as computed for the 1-12 hours interval- have exponent values within the range of 0 to 1.6, thus proving deviations from the "2/3 power law" (2) (which corresponds to the "4/3 power law" in the space domain).

Turbulent diffusion coefficient determinations were made from the concentration measurements made either in the plume of the existing fresh or waste water sources, or in the patch resulted from an instantaneous dye release (Rhodamine B). From the first type of experiments, using a model with constant diffusion coefficient K (Fickian diffusion (4)), the obtained values (0.1-5.6 m^2/s) are in good agreement with those for other areas of the Black Sea (5,6). Using a "4/3 power law" dependence on the space scale (Ozmidov model (4)) the obtained values are somewhat larger as compared to the data for the other zones (5,6).

For the instantaneous sources, concentration time series measured in a fixed point were used in conjunction with the same two models, and the obtained values compared well with the results for the continuous sources. At the same time, the diffusion coefficients were also determined from the time derivative of the concentration variance across the patch, which requires no assumption concerning the space scale dependence (3). The results showed an increase of K with the diffusion time.

In order to assess the variation of K with the space scale of the phenomenon, free floats were used and the values of K were computed from the time derivative of the variance of the individual distances relative to the center of gravity of the float cluster (1). For dispersion times of the order of 1-2 hours, the power exponent varied from 0 to 0.87.

Further experiments over each area are needed in order to allow statistical determination of the coefficient dependence on external factors, such as density stratification, velocity shear and specific circulation patterns.

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