THE RELATION OF NEAR-SURFACE SHEAR FLOWS TO LOCAL WINDS IN THE CENTRAL EQUATORIAL PACIFIC

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ABSTRACT

A coupling between the local winds (U) and the current shears in the upper 20 m of the central equatorial Pacific is indicated by observations during PEQUOD (Pacific Equatorial Dynamics Project).

Correlations between wind stresses (assumed proportional to U^2) and shears at the ocean surface indicate that the wind stress determines the direction of the shear, but not its magnitude. The same analysis leads to the estimation of the vertical eddy viscosity coefficient (Av), which is observed to vary nearly as the square of the wind speed, with a constant of proportionality of about 1×10^{-4} sec.

The analysis of the shears at deeper levels (10, 30 and 50 m) indicates a consistent anticyclonic rotation of the shear vector with respect to depth on both sides of the equator, resembling an Ekman spiral.

A model from Stommel (1960) that applies Ekman dynamics at the equator is used to simulate the shears near the surface. Significant correlations of about 0.7 and 0.5 are obtained from the comparisons between modeled and observed shears at 10 and 30 m. Shipboard wind observations, mixed

layer depths estimated from temperature measurements and Av values depending on wind speed are used in the modeling. The applicability of the model is limited to the Ekman depth: $(2Av/|f|)^{1/2}$ (f: Coriolis parameter), which varies linearly with the wind speed when Av is proportional to the square of the wind speed.

Discrepancies between modeled and observed shears, particularly at levels below 30 m, indicate the importance of stratification in the current structure. Time dependence, non-linearities and horizontal mixing are also important factors to be considered.