Abstract View

Volume 5, Issue 2 (April 1975)

Journal of Physical Oceanography
Article: pp. 288–299 | Abstract | PDF (915K)

A Numerical Study of Time-Dependent Turbulent Ekman Layers over Horizontal and Sloping Bottoms

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(Manuscript received June 28, 1974, in final form November 4, 1974)

DOI: 10.1175/1520-0485(1975)005<0288:ANSOTD>2.0.CO;2

ABSTRACT

A numerical study is made of a time-dependent turbulent Ekman bottom boundary layer. Parameters for the model were chosen to simulate conditions near the bottom of the Florida Current in the Straits of Florida. The model used is that of Lykosov and Gutman. It allows the coefficient of turbulent viscosity v to vary with time t and height z and permits the effects of an imposed stable stratification and sloping bottom to be included. The variation of v with t and z is not preset but is determined in the course of solving the problem subject to the turbulent energy equation, the similarity arguments of Komolgoroff, and a mixing length hypothesis of Zilitinkevich and Laykhtman. The results of this preliminary study are compared to the author's observations. The agreement is good for the friction velocity values as well as for the mean total Ekman veering. However, most of the computed Ekman veering occurred above the logarithmic layer while most of the measured veering occurred within the logarithmic layer. The results suggest, as do the observations, that turbulent Ekman bottom layers varying on time scales of order the local inertial period are not quasi-stationary. Allowing the bottom to be inclined at a small angle transverse to the flow is found to modify significantly the temperature profile near the bottom, leading at times either to the formation of a homogeneous layer of depth order 10 m or to conditions marginally suitable for the formation of convectively mixed layer of comparable depth.

top

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