Abstract View

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Dispersion of Marked Fluid Elements in a Turbulent Ekman Layer

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ABSTRACT

A stochastic model is derived for studying shear-dispersion in a horizontally homogeneous, turbulent Ekman layer that is evolving in time. It is based on a one-dimensional model including an advanced turbulence closure (k = ϵ) model, which yields the turbulent Ekman layer flow. A modified Langevin's equation is used to derive a Markov equation for the cross-flow velocity fluctuations in this inhomogeneous flow. Necessary statistical data for the Markov process are obtained from the k = ϵ model. Trajectories of marked fluid elements are then determined. Statistical properties of the dispersion process are calculated from the evolution of the cluster of marked fluid elements. The model is first applied to a plane Poiseuille flow. The results of the dispersion process are in good agreement with other, independent, estimates of dispersion in such a flow. A wind-driven Ekman layer is then considered. The results obtained agree well with data from tracer experiments in the ocean.