Abstract View

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An Oceanic Mixed Layer Model Capable of Simulating Cyclic States

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ABSTRACT

A new one-dimensional bulk model of the mixed layer of the upper ocean is presented. An entrainment hypothesis dependent upon the relative distribution of turbulent energy between horizontal and vertical components is offered as a plausible mechanism for governing both entrainment and layer retreat.

This model has two properties not previously demonstrated:

(i) The fraction of wind-generated turbulent kinetic energy partitioned to potential energy increase by means of mixed layer deepening is dependent upon layer stability, $H^*=h/L$, as measured by the ratio of mixed layer depth h to Obukhov length L. This results in a modulation of the mean entrainment rate by the diurnal heating and cooling cycle.

(ii) Viscous dissipation is enhanced for increased values of $\mathrm{Ro}^{-1}= hf/u_*$, where f is the Coriolis parameter and u_*. the friction velocity for the water. This enables a cyclical steady state to occur over an annual period by limiting maximum layer depth.

A nondimensional framework used to present the general solution also suggests a basis for model comparison and data analysis.