Abstract View

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The Relationship between Downward Irradiance and Upper Ocean Structure

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ABSTRACT

The relationship between downward irradiance and upper ocean structure has been studied using a numerical model. Two general classes of irradiance parameterizations were utilized. The first (case I) employed a single attenuation length while the second (cast II) involved two attenuation lengths. The latter formulation provided for enhanced absorbance in the upper few meters. Wind speeds of 0, 1, 2, 3, 4, 5, 10 and 20 m.s^{-1} were used for the simulations in order to characterize heat versus wind dominated regimes. A one-dimensional second moment turbulent closure model was selected for the study so that heat could be treated differentially with depth. The case II results indicated warmer surface temperatures, shallower mixed layers, and more intense thermoclines than case I for wind speeds <10 m s^{-1}. Results converged for higher wind speeds. There was considerably greater sensitivity to wind speed for case II when compared with case I. Mean horizontal velocity as well as thermal structure was sensitive to the empirical formulation of downward irradiance. For low wind speeds the turbulent energy budget is dominated by shear production, dissipation and the diffusion of turbulent kinetic energy, regardless of parameterization. For high wind speeds, shear production is balanced by dissipation. The results of this study provide strong indications that downward irradiance and its proper parameterization are important in determining upper ocean structure and may have implications for large-scale climate studies.

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