Abstract View

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On the Mellor–Yamada Turbulence Closure Scheme: The Surface Boundary Condition for q^2

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ABSTRACT

A numerical model that uses a level-2½ turbulence closure scheme is used to compare two boundary conditions for the turbulent energy at the air–sea interface. One boundary condition, the most commonly used, sets the turbulent kinetic energy proportional to the friction velocity squared, while the other sets the vertical diffusive flux of turbulent kinetic energy proportional to the friction velocity cubed. The first boundary condition arises from consideration (simplification) of the turbulence closure scheme near boundaries, and the second arises from consideration of the influence of surface gravity waves on the transfer of turbulent kinetic energy from the wind to the water. Simulations using these two boundary conditions are compared to month-long observations of velocity, temperature, and salinity (as shallow as 2 m from the surface) from Knight Inlet, British Columbia, Canada. The circulation in the inlet is strongly influenced by the wind, tides, and freshwater runoff. The two boundary conditions produce simulations that are different down to a depth of at least 5 m. Somewhat more accurate simulations are produced by the second boundary condition. Also, simulations using the second boundary condition are more sensitive to variations in the roughness length. Based on the simulations, roughness lengths as large as 1 m (or greater) are possible.

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