Abstract View

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Wind-Stress coefficients over Sea surface near Neutral Conditions—A Revisit

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ABSTRACT

A scaling law of wind-stress coefficients is presented to illustrate explicitly that the coefficient increases with wind velocity and decreases with fetch; physical reasonings of both trends are discussed. Besides being shown previously to be related to a criterion determining airflow separation from waves, the Charnock relation is further associated with the critical roughness Reynolds number identifying regimes of the atmospheric surface layer. Intrinsic errors and limitations of the Charnock relation, which provides an overall correlation between stress coefficient and wind velocity, are illustrated. A probable nondimensional expression, a refinement of the Charnock relation, is proposed between the roughness length and the wind-friction velocity involving not only gravity but also surface tension and viscosity. Previous compilation of wind-stress data obtained with eddy-correlation and wind-profile methods is found to be consistent with recent results obtained with similar techniques. A single, linear law empirical formula for estimating oceanic wind-stress coefficients at all wind velocities is suggested, and appears to provide a better representation than the power law formula-proposed earlier. Finally, recent results on relating roughness length to sea surface irregularities and on relating stress coefficient to roughness Reynolds number and to dominant wave characteristics are discussed.