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THE INFLUENCE OF THERMAL EFFECTS ON THE WIND SPEED PROFILE OF THE COASTAL MARINE BOUNDARY LAYER

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The wind speed profile in a coastal marine environment is investigated with data from the measurement program Rødsand, where meteorological data are collected with a 50 m high mast in the Danish Baltic Sea, about 11 km from the coast. When compared with the standard Monin-Obukhov theory the measured wind speed increase between 10 m and 50 m height is found to be systematically larger than predicted for stable and partly for near-neutral conditions. The data indicate that the deviation is smaller for short (10-20 km) distances to the coast than for larger (>30 km) distances.
The theory by Csanady (1974) offers a qualitative explanation for these findings: When warm air is advected over colder water, a capping inversion might develop. The air below is constantly cooled by the water and gradually develops into a well-mixed layer with near-neutral stratification. Typical examples as well as scatter plots of the data are consistent with this explanation. The deviation of measured and predicted wind speed profiles is shown to be correlated with the height and strength of the inversion layer as estimated with Csanady's theory.

Csanady, G. T.: 1974, 'Equilibrium theory of the planetary boundary layer with an inversion lid' *Boundary-Layer Meteorol.* 6, 63-79.