



## Drag coefficient reduction at very high wind speeds

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The correct representation of the 10 m drag coefficient for momentum ( $K_{10}$ ) at extreme wind speeds is very important for modelling the development of tropical depressions and may also be relevant to the understanding of other intense marine meteorological phenomena. We present a unified model for  $K_{10}$ , which takes account of both the wave field and spray production, and asymptotes to the growing wind wave state in the absence of spray. A feature of the results, is the prediction of a broad maximum in  $K_{10}$ . For a spray velocity of  $9 \text{ m s}^{-1}$ , a maximum of  $K_{10} \sim 2.0 \times 10^{-3}$  occurs for a 10 m wind speed,  $u_{10} \sim 40 \text{ m s}^{-1}$ , in agreement with recent GPS sonde data in tropical cyclones. Thus,  $K_{10}$  is 'capped' at its maximum value for all higher wind speeds expected. The effect of spray is also shown to flatten the sea surface by transferring energy to longer wavelengths.