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A sea drag relation for hurricane wind speeds

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Numerical weather prediction models generally use the traditional bulk relation for wind stress, which is characterized by a drag coefficient. Computation of the drag coefficient is usually based on the Charnock relation, which has been proven to be an accurate formulation for many meteorological as well as oceanographic applications. According to the Charnock relation the magnitude of the commonly used 10-meter drag coefficient increases monotonically for increasing 10-meter wind speed. However, recent observations have indicated that the magnitude of the drag coefficient levels off from a wind speed of about 30 m/s and then decreases for increasing wind speed. The reason for this is that for very high wind speeds the stress above the air-sea interface starts to saturate with increasing wind speed. It is argued that the effects of sea spray are responsible for this phenomenon.

In this study the drag formulation by Makin (2005) is tested, which incorporates the decrease in the drag coefficient from a wind speed of $\sim$30 m/s. This parameterization is based on the Charnock formulation, however, with a correction term that represents the reducing effects of sea spray. The parameterization is implemented in the atmospheric model HIRLAM. With HIRLAM the tropical storms Katrina and Ivan in the Caribbean are simulated, with both the standard and the changed drag relation. Results from both simulations are compared with observational data in order to verify whether the adjusted drag relation is an improvement for hurricane modeling. Criteria for comparison are the 10-meter wind speed, the sea level pressure and the hurricane track.