Storm Surges Congress, Hamburg, Germany
13–17 September 2010
SSC2010-70

A consistent drag relation for atmospheric and storm surge models for hurricane wind speeds

N.C. Zweers (1), H. de Vries (1), V.K. Makin (1), and D. Vatvani (2)

(1) KNMI, Weather Research, De Bilt, Netherlands (Niels.Zweers@knmi.nl), (2) Deltares, Delft, Netherlands (Deepak.Vatvani@deltares.nl)

Numerical weather prediction and storm surge 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, according to which the magnitude of the drag coefficient increases monotonically with increasing surface wind speed. The Charnock relation has been proven to work well for many meteorological and storm surge model applications. However, the coefficients used in the atmospheric and storm surge models are usually set independently to simulate appropriate wind field and water levels.

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 with further increase of the wind speed. Above approximately 30 m/s the stress above the air-sea interface starts to saturate due to sea spray.

In this study a drag formulation developed by Makin (2005) is tested, which describes the above phenomenon. The parameterization is based on the Charnock formulation, however, with a correction term that represents the reducing drag caused by sea spray.

The parameterization has been implemented in the atmospheric model HIRLAM (High Resolution Limited Area Model) and the storm surge model Delft3D for the Gulf of Mexico using identical drag coefficients. Wave induced surge has been included in the simulations. Numerical experiments were carried out for the tropical storms Katrina and Ivan. Results from both simulations are compared with observational data in order to verify whether the adjusted drag relation is an improvement for hurricane and storm surge modeling.