Geophysical Research Abstracts
Vol. 13, EGU2011-3281, 2011
EGU General Assembly 2011

Using proper drag coefficients for extreme wind speeds leads to improved hurricane simulations

Niels Zweers, Vladimir Makin, Hans de Vries, and Gerrit Burgers
KNMI, Weather Research, De Bilt, Netherlands (Niels.Zweers@knmi.nl)

Although in time the prediction of hurricane tracks has improved considerably, the strength of hurricane winds is often underestimated in numerical weather prediction (NWP) model forecasts. This underestimation is strongly related to the uncertainty in the computation of the surface momentum flux in NWP models. In general, in these models the computation of the surface momentum flux involves a formulation for the drag coefficient that is based on Charnock's relation. According to this relation the magnitude of the drag coefficient increases with increasing wind speed. However, both theoretical and observational evidence indicate that the magnitude of the drag coefficient levels off from a wind speed of about 30 m/s and then starts to decrease for increasing wind speed. Hence, in NWP models the surface drag is overestimated for hurricane wind speeds and the intensity of hurricane winds is underestimated in forecasts.

In this study a drag parameterization that accounts for the observed reduction in the drag coefficient is tested in the numerical weather prediction model HIRLAM (High Resolution Limited Area Model). The parameterization is based on the relation proposed by Makin (2005). The default drag formulation in HIRLAM is the Charnock relation. Both with this default and the changed drag relation, the tropical storms Ivan (2004) and Katrina (2005) in the Caribbean were simulated. The impact of the parameterization on both the hurricane track and hurricane intensity was examined. Our results indicate that, while the hurricane track is nearly unchanged, hurricane intensity is much improved with the new drag parameterization.