

Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

E-epsilon turbulence closure for sea spray-laden marine atmospheric boundary layer in high wind conditions¹ YEVGENII RASTIGEJEV, North Carolina A&T State University, SERGEY SUSLOV, Swinburne University of Technology — In-depth understanding and accurate modeling of the interaction between sea spray and a turbulent airflow under high-wind conditions is essential for improving intensity forecasts of hurricanes and severe storms. Here we consider the E-epsilon turbulence closure for the spray-stratified atmospheric marine boundary layer. Our mathematical model accounts for turbulent kinetic energy transport in the vertical direction, the dependence of the turbulent mixing length on the spray stratification and the spray inertia. It is shown that accounting for all these physical factors is important since none of them dominate for all possible hurricane conditions. The obtained analytical and numerical solutions show significant differences between the current E-epsilon model and the lower order Turbulent Kinetic Energy (TKE) and Monin-Obukhov (MO) similarity models considered previously. It is demonstrated that the air turbulence suppression by the spray causes an acceleration of the airflow and a reduction of air-sea drag coefficient that is qualitatively consistent with recent experimental observations.

¹The work of YR was supported by NSF, HRD-1036563 grant.

Yevgenii Rastigejev
North Carolina A&T State University

Date submitted: 07 Aug 2012

Electronic form version 1.4