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Microphysics-Based Bulk Parameterizations of Enthalpy and Momentum Fluxes for Tropical Cyclones

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Despite the powerful influence that sea spray has on air-sea enthalpy and momentum fluxes, most state-of-the-art tropical cyclone forecast models do not incorporate the microphysics of sea spray evaporation into their boundary layer flux schemes. Since the air-sea enthalpy and momentum fluxes control a tropical cyclone's intensification rate, increasing the accuracy of the associated bulk parameterizations is crucially important for improving forecast skill. New microphysics-based bulk parameterizations for enthalpy and momentum flux through the tropical cyclone boundary layer are developed from a set of prognostic evaporation equations and numerical simulations of evaporating, multiphase flow subject to extreme wind speeds. The microphysics-based parameterizations are computationally inexpensive and are functions of the local environmental conditions; these features allow forecast models to efficiently vary the air-sea enthalpy and momentum fluxes in space and time. By developing microphysics-based bulk parameterizations, the influence that sea spray exerts on tropical cyclone intensification can be more accurately simulated and intensity forecasts could be improved.