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RAL SEMINAR SERIES

The Mean Kinematic Structure of the Tropical Cyclone Boundary Layer and its Relationship to Intensity Change

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This study presents the relationship between the mean kinematic structure of the tropical cyclone boundary layer (TCBL) and storm intensity, intensity change rate, and vortex-scale structure. These relationships are examined using airborne Doppler radar and dropsonde data. Results show that the BL is generally deeper in weak storms than in strong storms. The BL layer outside the radius of maximum tangential wind speed (RMW) in intensifying storms is deeper than in nonintensifying storms. Updrafts originating from the BL are concentrated near the RMW for intensifying TCs, while updrafts span a large radial range outside the RMW for nonintensifying TCs. The maximum BL convergence inside the RMW is larger in intensifying storms than in nonintensifying storms. In terms of vortex-scale structure above the BL, storms with a quickly decaying radial profile of tangential wind outside the RMW tend to have stronger inflow near the RMW, deeper and more concentrated strong updrafts close to the RMW, and weaker inflow in the outer core region than those with a slowly decaying tangential wind profile. Interestingly, the narrow TCs also tend to intensify faster than broad TCs, suggesting that a key relationship may exist among TC intensity change, vortex shape, and the BL structure. This relationship is discussed in the context of spin-up dynamics and ventilation pathways.