The microphysical structures of asymmetric hurricane eyewalls

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Microphysical processes within hurricanes play a critical role in determining the structure, track and intensity through their interaction with the storm dynamics. In this study, the microphysical and kinematic structures of asymmetric hurricane eyewalls are analyzed from ground-based polarimetric and airborne Doppler radars. In the major Hurricane Harvey (2017), polarimetric observations of reflectivity (Z_H), differential reflectivity (Z_{DR}), and specific differential phase (K_{DP}) all show wavenumber-1asymmetric pattern associated with the environmental vertical wind shear. However, a Z_{DR} column was found upwind of the Z_H maximum in a region with strong updrafts, but the high K_{DP} found cyclonically downwind. The azimuthal shift of the polarimetric variables indicates the size sorting process and an evolving raindrop size distribution within the eyewall. Similar dual-polarimetric signatures are also found in recent Hurricanes Irma (2017), Maria (2017) and Michael (2018). Furthermore, this newly learnt microphysical characteristics of eyewall are applied to evaluate different microphysical parameterization schemes used in hurricane simulations. The preliminary results show that simulations using double-moment microphysical parameterizations cannot well represent the observed microphysical structures.

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