Asymmetric aspects of secondary eyewalls and their formation in tropical cyclones

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This study examines kinematic and microphysical observations of asymmetric convection associated with the formation and evolution of secondary eyewalls in mature tropical cyclones. We use a combination of airborne Doppler radar and land-based dual-polarization radar observations from Hurricanes Harvey and Irma (2017) to address this issue. The 3D wind field is retrieved from airborne Doppler observations using the NOAA Hurricane Research Division variational retrieval scheme. Bulk dual-polarization variables (ZH, ZDR, KDP) are averaged over time and space to isolate persistent rainband and eyewall features of interest. Convection asymmetries within TC inner cores are often organized by a larger-scale factor, such as deep-layer environmental wind shear or track motion. Here, we analyze the datasets by the shear and track motion vectors. Most hypotheses for secondary eyewall formation and evolution invoke axisymmetric dynamical reasoning without fully identifying the role of asymmetric features. By focusing on convection asymmetries, these results provide a better understanding of the kinematic and microphysical processes that are involved in secondary eyewall evolution.

Keywords: Tropical cyclones, Dual-Doppler radar, Dual-polarization radar