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Characteristics of QLCS Downdrafts and Environments Observed during the VORTEX-Southeast Project

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Storm-generated downdrafts play a significant role in storm evolution, intensity, and duration. Importantly, descending rear inflow jets in quasi-linear convective systems (QLCS) have been linked to the occurrence of tornadoes. The VORTEX-Southeast project aimed to observe severe convection in northern Alabama to determine the topographic and environmental influences on tornadoes in the southeastern U.S. Because QLCSs often are associated with tornado production in this region of the country, a better understanding of how downdraft and outflow properties of these storms, including radar and environmental pre-cursors, can be used to predict tornadogenesis and other severe weather, is needed.

This work utilizes data collected by several mobile and fixed radars, radiosondes, vertical profiler observations, and surface in situ data collected in two QLCSs (27 March and 30 April 2017) during the VORTEX-Southeast project to characterize storm-scale downdraft processes. Although no tornadoes were observed in these events, each contained localized enhancement of low-level downdraft, vertical vorticity, and bowing line segments. We will examine synthesized multi-Doppler wind retrievals and dual-pol radar observations of the convective downdrafts to relate their four-dimensional kinematic and hydrometeor properties to observations of the surface outflow and free troposphere. Merger of a large quantity of single-Doppler-derived VAD wind profiles and radiosonde data sets will focus on mapping local variations of shear, moisture, and instability, illustrating their correlation with the local topography and downdraft characteristics. Comparisons of interacting environmental and storm-scale processes occurring in the southeast U.S. with those observed in other geographical regions (e.g., the U.S. central plains) will offer improved understanding of regional severe weather and tornado risks.