

# Characteristics of the Outer Rainband Stratiform Sector in Numerically Simulated Tropical Cyclones: Lower-Layer Shear versus Upper-Layer Shear

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Idealized numerical simulations are conducted in this study to comparatively investigate the characteristics of the stratiform sector in the outer rainbands of tropical cyclones (TCs) in lower- and upper-layer vertical wind shear (VWS) with moderate magnitude. Consistent with the results in previous studies, the outer rainband stratiform sector of the TCs simulated in both experiments is generally located downshear left. Upper-layer VWS tends to produce stronger asymmetric outflow at upper levels in the downshear-left quadrant than lower-layer shear. This stronger asymmetric outflow transports more water vapor radially outward from the inner core to the outer core at upper levels in the downshear-left quadrant in the upper-layer shear experiment. More depositional growth of both graupel and cloud ice thus occurs downshear left in upper layers in the outer core, yielding more diabatic heating and stronger upward motions particularly in the stratiform-dominated part of the stratiform sector in the upper-layer shear experiment. Resultingly, a better-organized stratiform sector in the outer rainbands is found in the upper-layer VWS experiment than in the lower-layer VWS experiment. The diabatic heating associated with the stratiform sector produces strong midlevel outflow on the radially inward side of and weak midlevel inflow on the radially outward side of the heating core, with lower-level inflow beneath the midlevel outflow and upper-level inflow above. The upper-layer VWS tends to produce a deeper asymmetric inflow layer in the outer rainband stratiform sector, with more significant lower-level inflow and tangential jets in the upper-layer VWS experiment.

Keywords: tropical cyclone, outer rainband, stratiform, vertical wind shear