Revisiting Asymmetric CAPE in Sheared Tropical Cyclones

*Qingqing Li[1]

1. NUIST Nanjing University of Information Science and Technology

This study numerically revisits the characteristics and physical processes of azimuthally asymmetric convective available potential energy (CAPE) in the outer cores of vertically sheared tropical cyclones (TCs), which has been observed previously. The results indicate that a downshear-upshear contrast in CAPE occurs in weakly sheared TCs as pointed out in prior studies, while an enhanced downshear left-downshear right contrast is found in strongly sheared storms. Specifically, less (larger) CAPE values arise downshear left (right) under large shear environments. Downward transport of low entropy by the convective and mesoscale downdrafts in principal rainbands reduces the equivalent potential temperature (θe) in the downshear-left boundary layer, whereas positive horizontal advection by the asymmetric outflow contributes to the presence of a mid-level maximum of θe in the same quadrant. Resultantly, lower outer-core CAPE is present downshear left. In the downshear-right quadrant, a lack of convective downdrafts together with surface fluxes leads to higher θe in the boundary layer. The intrusion of dry air by ventilation produces lower θe in the upper troposphere on the right of the shear. Larger CAPE values thus arise downshear right. The effects of such azimuthally asymmetric CAPE on TC structure and intensity are also discussed.

Keywords: tropical cyclone, CAPE, shear