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Outer Rainbands–Driven Secondary Eyewall Formation of Tropical Cyclones

Abstract

To investigate the influences of outer rainbands (ORBs) on secondary eyewall formation (SEF) in tropical cyclones (TC), a triplet experiment is conducted by idealized WRF Model. This experiment includes three simulations, which only vary in the size of the initial wind field of TC.

The authors propose two pathways to drive canonical SEF. First, the downwind end of ORBs release stratiform heating, which strengthen the radial boundary layer (BL) convergence locally. For wind-maximum formation pathway, BL convergence stretches the BL relative vorticity so that supergradient force within BL is strengthened and reinforce the tangential wind. For convective-ring pathway, BL convergence induces updraft, which makes supergradient force established atop BL via vertical advection of tangential momentum. This supergradient force could accelerate outflow above the BL and make vertical motion even stronger, eventually forming a secondary convective ring.

According to the results of the triplet experiment, inner rainbands (IRBs) is unable to form a canonical SEF since it is located at radially inward side where stronger frictional force exist. Because of that, secondary wind maximum couldn't form, which leads to a fake SEF since only secondary convective-ring is established and the two pathways is not well coupled. In comparison, ORBs are essential for SEF, which also indicates that TC with larger wind field could generate SEF easier. Any environmental conditions that favor stronger ORBs could have a similar result.

Keyword

Inner rainbands (IRBs), outer rainbands (ORBs)

References

Wang and Tan (2020). Outer Rainbands–Driven Secondary Eyewall Formation of Tropical Cyclones. *Journal of the Atmospheric Sciences*, **77(6)**, 2217-2236.