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Plain Language Summary: Tropical cyclone (TC) intensification is widely understood according to the wind-evaporation feedback. In the conventional framework, many authors have discussed the increase of sea surface evaporation as the surface wind increases near the eyewall. On the other hand, we discuss the surface evaporation decrease as the wind speed decreases in the outer region. Idealized numerical experiments showed that the increased surface evaporation in the outer region significantly weakens the TC and reduces its size. The radial contrast is suggested to have more importance for the TC organization than the water vapor mixing ratio itself. This is a very different interpretation of the wind-evaporation feedback on TC development from the conventional idea.

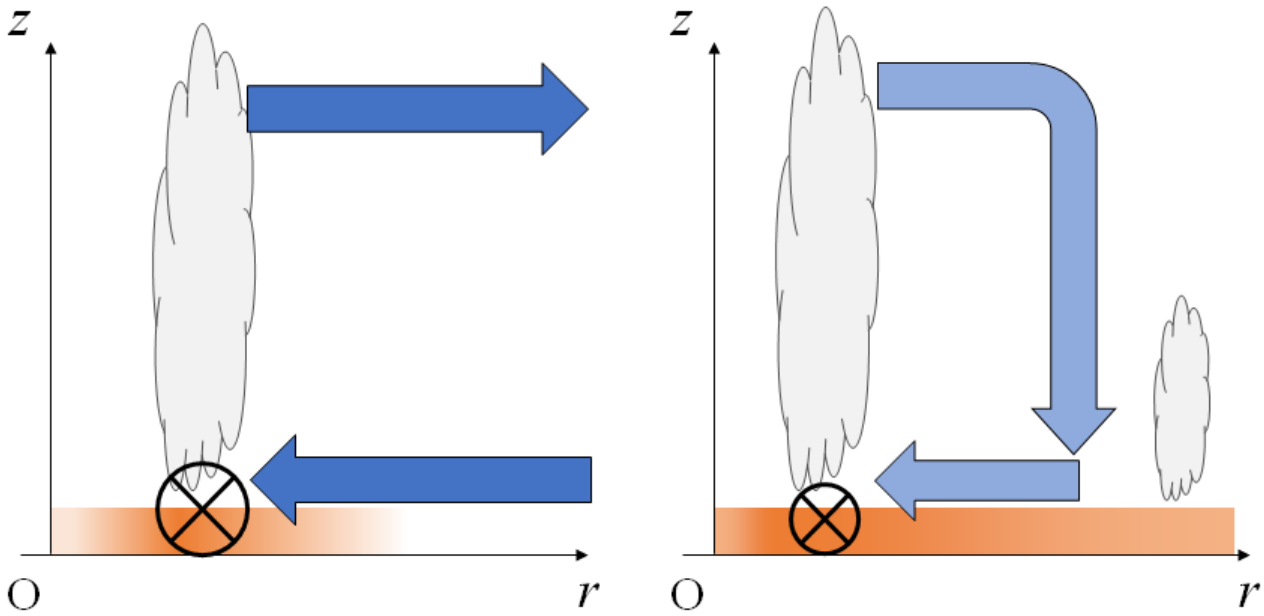

Figure 1. Schematic diagrams of the roles of the radial contrast of water vapor mixing ratio in TCs. These diagrams show secondary circulations of TCs with (left) and without (right) the wind-evaporation process in the outer region. The orange shadings represent the water vapor mixing ratio significantly controlled by the surface evaporation. The blue arrows represent the secondary circulation. The cross symbols indicate the maximum tangential wind speed (the large symbol size corresponds to the large value).

- The experiments set a lower limit of wind speed used in the parameterization of evaporation coefficient from the sea surface to suppress the wind-evaporation feedback in the outer region.
- Although the modified scheme significantly increases water vapor mixing ratio in the outer region of TCs, it weakens TCs, reduces their sizes, and delays the onset of rapid intensification.
- The findings suggest that the formation of radial contrast of water vapor concentration is vital for the wind-evaporation feedback in the TC organization.