



## **Strong-wind and heavy-rainfall extents induced by tropical cyclones over South Korea**

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Strong-wind and heavy-rainfall accompanied with tropical cyclone (TC) landfall can make enormous socio-economic losses. This study investigated the areal extents of strong-wind and heavy-rainfall induced by TC for its landfall period over South Korea. Utilizing a high-resolution reanalysis data, the strong-wind and heavy-rainfall extents are defined as the number of grids in which wind speed and rainfall exceed their threshold values (11.2 m s<sup>-1</sup> and 1.38 mm hr<sup>-1</sup>, respectively). Note that the threshold values of wind and rainfall are derived from the top 99th percentiles of weather-station record. In this study, 126 TCs are examined for the period of 1979–2014. Both the strong-wind and heavy-rainfall extents increase with TC intensity, which means intense TC has large size. However, areal fractions of strong-wind and heavy-rainfall extent to total-influence extent, which is union of strong-wind and heavy-rainfall extents, present significant negative-correlation ( $r=-0.87$ ) between them. Based on this negative relation, rainfall-dominant TCs which possess large heavy-rainfall fraction but small high-wind fraction are defined, and vice versa for wind-dominant TCs. Thus, the rainfall-dominant TCs generally present heavier rainfall but weaker winds than wind-dominant TCs since the rainfall-dominant TC has much stronger divergence in upper-level and asymmetric convection than wind-dominant TC. An anomalous upper tropospheric trough located over the west of South Korea is found to be a possible reason for the different structure of the both TC types by causing following three effects: (1) rising motion associated with enhanced upper-level divergence ahead of TC propagation, (2) enhancement of secondary circulation induced by strong vertical wind shear, and (3) asymmetric convection related with faster TC movements. All of these factors are favorable to the rainfall-dominant TCs, but unfavorable to the wind-dominant TCs. The present study highlights importance of environmental conditions in determining the spatial distributions of strong-wind and heavy-rainfall by TC.