Convective-Stratiform Rainfall Separation: A Three-Dimensional WRF Modeling Study

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In this study, convective-stratiform rainfall separation scheme is developed based on a three-dimensional surface precipitation budget equation using the WRF model simulation of Typhoon Fitow (2013). The results show that water vapor convergence moistens local atmosphere and support hydrometeor divergence, and maximum rainfall corresponds to water vapor and hydrometeor convergence and local atmospheric drying. The separation results are verified by analyzing vertical velocity and cloud microphysical budgets. Mean ascending motions are prevailing throughout the troposphere over convective rainfall regions, whereas mean descending motions occur below 5 km and mean ascending motion occur above over stratiform rainfall regions. The frequency distribution of vertical velocity shows that vertical velocity has a wide distribution with the maximum values up to 13 m s^{-1} over convective regions, whereas it has a narrow distribution with absolute values confined within 7 m s^{-1} over stratiform region. Liquid cloud microphysics is dominant over convective regions whereas ice cloud microphysics is dominant over stratiform regions. The physical characteristics of the convective-stratiform rainfall in the three-dimensional framework conform generally to those from the two-dimensional framework.

Keywords: Convective-stratiform rainfall, cloud budget, vertical velocity

