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The Impact of Precipitation Types On Radar QPE Using Specific Attenuation for C-band Dual-Polarization Radar

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A novel Quantitative Precipitation Estimation (QPE) algorithm using the specific attenuation A has been developed recently. As opposed to the conventional R(Z) algorithm, the R(A) estimate is immune to attenuation, radar miscalibration, wet radome, and partial beam blockage. Although the R(A) algorithm is more robust to the variability of drop size distributions compared to other radar rainfall relations, the impacts of precipitation types on the performance of R(A) algorithm is not ignorable. Specifically, the rainfall rate could be estimated through the R=γA$\hat{}\Lambda$ relation, where the specific attenuation A is calculated from the ZPHI procedure using the net ratio α = A/KDP along the radar beam. For C-band dual-polarization radar, the coefficient α is quite stable even from different precipitation types, but the coefficients of γ and Λ are highly dependent on the precipitation types. In this work, the dependences of γ and Λ on precipitation types are first studied through simulation using the drop size distribution data, and a new version of R(A) approach is then proposed. According to the new algorithm, precipitation region is first segregated into three rain categories: stratiform, convective, and tropical. For these regions, the values of γ and Λ are calculated in each of the three regions through the Z – ZDR relation. The rainfall rate is then calculated using the obtained modified R(A) relation. The modified R(A) algorithm has been tested for light rain, flood, and typhoon precipitation events in Taiwan. Comparison with rain gauge measurements shows that the modified R(A) demonstrates better performance in terms of correlation coefficient, mean bias ratio, and the root mean square error than R(Z) and the original version of R(A) with fixed default value of the parameters .