An Improved Technique for Estimating ZDR Bias from Light Rain on Radars that Cannot Vertically Point

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Lightning protection, hardware constraints, and operational volume time requirements prohibit the Weather Surveillance Radar - 1988 Dual-Polarimetric-Doppler (WSR-88D) from vertically pointing for Differential Reflectivity (ZDR) calibration. Instead, comparing three types of external targets to their intrinsic values to discover and track trends of ZDR Bias has been successfully used by the United States Next-Generation Radar (NEXRAD) Radar Operations Center. Targets of Light Rain, Dry Snow, and Bragg Scatter for ZDR Bias estimation give the benefit of obtaining estimates during clear air and precipitation as well as accounting for the wide variety of climate regimes and seasonal variation of weather across the United States. The three methods are expected to give similar overall resulting estimates of ZDR Bias. Unfortunately, the existing technique for estimating ZDR Bias from Light Rain has a high bias and more variance compared to the Dry Snow and Bragg Scatter results. A training set of non-derived WSR-88D data from 24 sites with stable ZDR Bias from August 2016 through July 2017 was analyzed to determine general statistical characteristics of Light Rain targets observed by the radar. Any events determined as rain via a simplistic algorithm (similar to the existing technique) were subject to visual verification for inclusion in the training set. Training statistics were then used to determine a new filtering scheme for estimating ZDR bias from Light Rain targets. A separate set of 15 sites were selected for verification testing. Results from the new method have decreased variance, a reduced chance of capturing outliers from convection and winter weather influences, and match closer to Dry Snow and Bragg Scatters estimates from the same site. Verification test cases were visually analyzed for confirmation of classification as rain with little to no impact from convection or frozen precipitation.

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