EXPERIMENTAL INVESTIGATION OF AN X-BAND POLARIMETRIC ALGORITHM FOR ATTENUATION CORRECTION AND MICROPHYSICAL RETRIEVAL

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This paper investigates attenuation correction for X-band dual-polarization radar (XPOL) observations. In addition, an algorithm is developed for estimating raindrop size distribution (DSD) model parameters on the basis of attenuation corrected XPOL reflectivity and differential reflectivity data. The DSD model is assumed to be a three-parameter normalized gamma distribution. Relationships are derived for determining specific and differential attenuation from horizontal/vertical polarization reflectivity and propagation phase shift data along a ray, while simultaneously retrieving variations of the normalized intercept DSD parameter (Nw) and mean drop diameter (D0). Using a constrained relation between the shape and slope parameters of Gamma DSD model along with the retrieved normalized intercept parameter value and mean raindrop diameter we estimate all three parameters of Gamma DSD for discrete space intervals along a radar ray. Closely matched XPOL radar rays with longer wavelength (S-band) dual-polarization radar measurements (SPOL), taken during the International H2O Experiment (IHOP), are used to assess the proposed XPOL algorithms. The study explores the dependence of attenuation correction on the selection of oblateness-size relation (or axial ratio) and the maximum diameter limit and evaluates its error characteristics for different total path-integration attenuation cases. Variations in the assumed form of the raindrop axial ratio may result in significant biases in attenuation and rain estimation. In addition, at this wavelength, resonance occurs for sizes larger than about 4 mm, and therefore several polarimetric variables exhibit non-monotone dependence on the drop diameter. This poorly documented region of raindrop sizes can consequently have a significant effect on some polarimetric variables. The XPOL estimated DSD parameters are evaluated against DSD retrievals derived from two existing SPOL algorithms.

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