Quantitative Interpretation of Polarimetric Radar Observations of Hail

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Much work has been done with S-band polarimetric radar observations and observed hydrometeor types to develop hydrometeor identification schemes based on the observed polarimetric radar parameters Zh, Zdr, LDR, ρhv, and Kdp. These schemes identify the radar-dominant hydrometeor type in the regions of clouds scanned by the radar based on the values of the polarimetric parameters. In our present work, we are doing quantitative backscatter calculations based on the detailed aircraft-observed hail size distribution and comparing computed polarimetric parameters to those actually reported by the radar. These results will improve our ability to compute quantitative microphysical properties within storm volumes such as hail number and mass concentrations, liquid water fraction, and hail kinetic energy and kinetic energy flux, based on observed polarimetric radar signatures aloft. We will illustrate our research results by presenting an example analysis of airborne in situ hail observations along a pass through a large convective storm over the US High Plains region at about the -8 C level. Hydrometeor shadow images from airborne probes will be used as the input to compute hail size distributions. The polarimetric radar parameters will be calculated based on these size distributions using the T-matrix method. Values of effective density, canting angle and oblateness will be varied to find the values giving the best match between the computed and the actual polarimetric radar observations from the same storm region. Results from regions within updrafts, downdrafts, and with different hydrometeor population characteristics will be presented and compared.