Retrieval of snowflake types from multi-frequency dual-polarization measurements

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Previously, hydrometeors have been classified according to their polarimetric radar parameters at lower radar frequencies. At higher radar frequencies, falling snow has been characterized by utilizing dual-frequency ratios. In this study, we combine these approaches by first modeling backscattering by various pristine ice crystals and their aggregates using hexagonal plates, hexagonal columns, needles, ordinary dendrites, fern-like dendrites, six-bullet rosettes, and lump graupel using the discrete-dipole approximation. Then we simulate a radar volume by averaging over exponential size-distributions and random shapes. To simulate falling, we assume almost horizontal orientation for the single ice crystals (2° average canting angle, 1° standard deviation). For the aggregates, we assume random orientation. Finally, we compare the modeling results to radar measurements obtained from the GPM Cold-season Precipitation Experiment (GCPEx) in order to retrieve snow types. The retrievals are validated by *in situ* microphysical data from airborne and ground-based probes.