Geophysical Research Abstracts
Vol. 13, EGU2011-8439-1, 2011
EGU General Assembly 2011

The sensitivity of combined passive microwave and multi-frequency radar signatures to microphysical assumptions

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The upcoming Global Precipitation Measurement (GPM) mission's core satellite will feature a dual-frequency Ku/Ka-band radar and passive microwave radiometer that will provide important global observations of snowfall and columnar ice content above the freezing level at higher latitudes. Compared to single frequency radar data, dual-frequency radar observations should provide a key constraint to retrieve parameters related to ice particle size distributions, especially when combined with coincident passive microwave observations. However, much of our current knowledge about dual-frequency radar (e.g., the dual-frequency ratio, or DFR) and higher frequency passive microwave signatures of larger frozen particles is based on two key assumptions: (1) utilizing variable density spherical models as proxies for snow and ice particles, and (2) using exponential particle size distributions (PSD) based on previous ground-based radar observations of snowfall. Using recently published observationally-based PSD parameterizations appropriate for mid-latitude synoptic weather systems and non-spherical ice particle models, the sensitivity of simulated dual-frequency radar and passive microwave signatures to these key assumptions will be demonstrated. Special attention will also be devoted to snowfall events coincidentally observed by CloudSat's Cloud Profiling Radar and passive microwave observations from the Advanced Microwave Scanning Radiometer-EOS (AMSR-E) and the Microwave Humidity Sounder (MHS).