Discrimination between winter precipitation types based on explicit microphysical modeling of melting and refreezing in the polarimetric hydrometeor classification algorithm

Alexander Ryzhkov
Cooperative Institute for Mesoscale Meteorological Studies / University of Oklahoma, Norman, USA
Reeves, Heather (Cooperative Institute for Mesoscale Meteorological Studies / University of Oklahoma, Norman, USA)
Krause, John (Cooperative Institute for Mesoscale Meteorological Studies / University of Oklahoma, Norman, USA)
Burcham, Hoyt (Cooperative Institute for Mesoscale Meteorological Studies / University of Oklahoma, Norman, USA)

E-mail: Alexander.Ryzhkov@noaa.gov

The winter weather Hydrometeor Classification Algorithm (HCA) recently developed at NSSL (Schuur et al. 2012) combines the polarimetric radar data with thermodynamic output from numerical weather prediction models to enhance classification capabilities. The “background classifier” which is based on vertical profiles of temperature and humidity is essential part of HCA. Several existing algorithms for discrimination between four winter precipitation types, snow, rain, freezing rain, and ice pellets / sleet have been tested using a 10-year dataset of soundings and ASOS observations. The results of testing have been summarized in the journal submission of Reeves et al. (2014).

The presentation will be focused on a principally new “background classifier” based on a 1D model of melting / refreezing with spectral microphysics which has been developed and validated on the same dataset. The new algorithm clearly outperforms the previous ones examined by Reeves et al. (2014). In addition to its classification capability, the method quantifies liquid and solid parts of precipitation rate at the surface.

The algorithm assumes a certain size distribution and degree of riming of snow particles above elevated warm layer, and the type of precipitation at the surface depends both on vertical profiles of temperature and humidity and microphysical properties of snow aloft although the impact of the former is more significant. Possible utilization of polarimetric radar data to quantify microphysical properties of snow above the temperature inversion will be discussed. In addition, vertical profiles of mass water content of water and ice will be complemented by vertical profiles of polarimetric radar variables simulated from the model output and the origin of the recently discovered radar “refreezing signature” (Kumjian et al. 2013) indicating the transition from freezing rain to ice pellets will be examined.