Geophysical Research Abstracts
Vol. 21, EGU2019-1980, 2019
EGU General Assembly 2019

Is Gamma Distribution Suitable for Raindrop Size Distribution Retrieval from Polarimetric Radar Measurements?

Hao Huang (1), Guifu Zhang (1,2), and Kun Zhao (1)

(1) School of Atmospheric Sciences, Nanjing University, Nanjing, China, (2) School of Meteorology, University of Oklahoma, Norman, Oklahoma, USA

Raindrop size distribution (DSD) is a fundamental parameter in rain microphysics. Retrieving DSDs from polarimetric radar measurements extends the capability of rain microphysics research and quantitative precipitation estimation. In this study, issues in DSD retrieval were studied with simulated and measured data. It was found that although a three-parameter gamma distribution model can capture the natural variabilities of DSDs, it was not suitable for directly retrieving DSD from polarimetric radar measurements. This was mainly because the DSD retrieval from polarimetric radar measurements using a three-parameter gamma distribution model was underdetermined, which made the retrieval sensitive to errors. An additional constraint, such as the statistical shape (μ)-slope(Λ) relationship used in the constrained-gamma (C-G) distribution model, helped to reduce the uncertainties and errors in the retrieval. In addition, the inclusion of specific differential phase (K_{DP}) measurements resulted in more accurate DSD retrieval and rain physical parameter estimation if the measurement errors were properly characterized. These results were also verified using two heavy rain events in east China. The study demonstrated the potential of using full polarimetric radar measurements to improve rain DSD retrieval.