Geophysical Research Abstracts
Vol. 18, EGU2016-15595, 2016
EGU General Assembly 2016

Long-term accounting for raindrop size distribution variations improves quantitative precipitation estimation by weather radar

Pieter Hazenberg (1), Hidde Leijnse (2), and Remko Uijlenhoet (3)

(1) University of Arizona, Department of Atmospheric Sciences (hazenberg@email.arizona.edu), (2) Royal Netherlands Meteorological Institute, Observations Research (hidde.leijnse@knmi.nl), (3) Wageningen University, Environmental Sciences, Hydrology and Quantitative Water Management, Wageningen, Netherlands (remko.uijlenhoet@wur.nl)

Weather radars provide information on the characteristics of precipitation at high spatial and temporal resolution. Unfortunately, rainfall measurements by radar are affected by multiple error sources. The current study is focused on the impact of variations of the raindrop size distribution on radar rainfall estimates. Such variations lead to errors in the estimated rainfall intensity (R) and specific attenuation (k) when using fixed relations for the conversion of the observed reflectivity (Z) into R and k. For non-polarimetric radar, this error source has received relatively little attention compared to other error sources.

We propose to link the parameters of the Z–R and Z–k relations directly to those of the normalized gamma DSD. The benefit of this procedure is that it reduces the number of unknown parameters. In this work, the DSD parameters are obtained using 1) surface observations from a Parsivel and Thies LPM disdrometer, and 2) a Monte Carlo optimization procedure using surface rain gauge observations. The impact of both approaches for a given precipitation type is assessed for 45 days of summertime precipitation observed in The Netherlands.

Accounting for DSD variations using disdrometer observations leads to an improved radar QPE product as compared to applying climatological Z–R and Z–k relations. This especially holds for situations where widespread stratiform precipitation is observed. The best results are obtained when the DSD parameters are optimized. However, the optimized Z–R and Z–k relations show an unrealistic variability that arises from uncorrected error sources. As such, the optimization approach does not result in a realistic DSD shape but instead also accounts for uncorrected error sources resulting in the best radar rainfall adjustment. Therefore, to further improve the quality of preciptitation estimates by weather radar, usage should either be made of polarimetric radar or by extending the network of disdrometers.