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Quantification of the effect of the weather radar polarization on the performance of attenuation correction algorithms at C- and X-band

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Climatological, meteorological and hydrological studies require quantitative precipitation estimates. Because of its spatial and temporal resolution as well as the extended coverage, weather radar is very suitable for such purposes. To obtain robust and accurate rainfall estimates using weather radar, the conversion between the radar reflectivity factor Z and the rainfall intensity R is a crucial step. Moreover, in the case of C- or X-band wavelengths, the importance of attenuation affecting the radar signal in rain has been recognized for a long time.

Because of the non-sphericity of rain drops, backscaterring and propagation of electromagnetic waves depend on their polarization state. As most operational weather radars in Europe are single-polarization C-band systems, the quantification of the influence of the polarization state on the attenuation of the radar signal and the performance of different attenuation correction algorithms is highly relevant. In this contribution, we focus on two such algorithms: a forward (Hitschfeld-Bordan) and a backward (Marzoug-Amayenc) scheme.

In order to produce robust statistics, we use a stochastic simulator of range profiles of rain drop size distributions (DSD), which parameters are derived from DSD measurements. We generate 1000 DSD range profiles and use a T-matrix code to compute the corresponding radar variables (i.e. reflectivity Z, specific attenuation k) at horizontal and vertical polarization states, at C- and X-band. In this manner, we generalize our previous work on the error statistics of radar attenuation correction algorithms for spherical rain drops using the Mie theory.