

Selected DSD properties for meteo radar applications and microwave link attenuation in rain

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The radar reflectivity factor as well as the specific rain attenuation (of the radar signal, or of the microwave and mm wave link or MWS signal) does depend on the rain rate only roughly. They both depend on the drop size distribution (DSD) primarily; this fact is frequently neglected. As we have an one year DSD measurement, we used the DSD data to derive the radar reflectivity factor as well as the rain rate from it on one hand and the rain attenuation in the cm and mm frequency bands on the other hand. Interesting properties were selected. The particular contribution of rain drops of certain diameters to the rain attenuation is varying considering varying frequency. More concretely, the role of small rain drops is increasing with the frequency. The prevailing contribution is caused by drops of the equivolumetric sphere diameter close to 0.7–1.5 mm.

A big dispersion of rain rate values R corresponding to the observed values of the radar reflectivity factor Z is known through scatterplots. It is due to the DSD variability. Similar scatterplots "attenuation versus rain rate" were done considering frequencies in the 10 - 100 GHz region. A big dispersion is observed, too, but the dispersion depends on the frequency. It was found that the rain attenuation at frequencies close to 40 GHz depends on rain rate quite uniquely. These phenomena are discussed in this contribution.

All results in this contribution were derived from the actual drop size distributions measurement by the videodistrometer of ESA, which was lent to the Institute of Atmospheric Physics Prague in the period July 1998–July 1999.