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Assessment of vertical variability of radar backscatter moments

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Networks of weather radars are frequently used to improve quantitative rainfall estimations. Recent network developments combine radars with very different characteristics. Merging of large area covering C-band radar data with local area covering X-band radar data, for example, allows to profit both from high accuracy due to negligible attenuation and high spatial resolution. However, the scanning geometry of these systems differ significantly in terms of: elevation angle resulting in measuring height and different beam width. Precipitation varies strongly with height, especially under convective conditions. Therefore, beam width and elevation angle have an impact on the received signal. The quantification of this effect is important for inter-comparison and combinations of radar measurements taken at different heights as well as for data selection for a comparison of vertical and horizontal radar measurements.

We address the vertical variability using profiles of drop size distributions (DSD) estimated on measurements of micro rain radar (MRR). Several MRRs are installed in the north of Hamburg and the longtime time series are taken during the summer season 2013. In the analysis oblate drop shapes are used to derive polarimetric moments. To simulate different geometric radar properties like measuring height and beam expansion different heights weighting functions are taken into account. Comparisons and statistical analysis of these weighting functions will be presented. These functions are applied to vertical profiles of radar backscatter moments and centered at different heights. We can show that the vertical variability has a small bias because there is no general vertical tendency in DSD, but we can determine significant random deviations. There is a clear relation between the geometrical overlap of vertical sensitivity and differences within vertical weighted reflectivity.