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Retieving antenna miss-pointing for vertical pointing cloud radar and correcting the introduced Doppler velocity errors in the measurements

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In the last decades, Doppler velocity measurements from zenith pointing radars have evolved to a standard radar variable. Measuring Doppler velocities allow estimating particle sedimentation or fall velocity of hydrometeors and thus offer key information to evaluate micro-physical parametrizations in numerical weather prediction models. In the future, the joint ESA-JAXA satellite mission EarthCARE features the first Doppler capable 94-GHz Cloud Profiling Radar (CPR), with enhanced sensitivity and improved resolution compared to the CloudSat CPR. These features, especially the Doppler velocity measurements, are expected to improve the CPR-based microphysical retrievals in clouds and precipitation and for the first time provide information about convective motion in clouds.

To evaluate EarthCare CPR Doppler velocity from the ground, the Doppler velocity from five ground-based zenith pointing 94 GHz radar spread over Europa should be used in future. To increase the quality of the measured Doppler velocity the antenna miss-pointing has to be estimated. Unknown antenna miss-pointing is the main source of error in Doppler velocity measurements and can reach values on the same order as the fall velocity of pristine ice crystals. Knowing the angle of miss-pointing, the error in the measured Doppler velocity measurements can be corrected and the precision and quality improved. This is especially important for cases where Doppler velocity values are direct input for retrievals, which, e.g., employ multiple radar sensors with matching sampling(?) volumes.

Within this work we will present a retrieval technique to identify the angle of antenna miss-pointing for ground-based radar profilers and correct the measured Doppler velocity values. The retrieval technique is a statistical method requiring the uncorrected Doppler velocity measurements and additional wind information from reanalysis or in parallel measuring sensors. Evaluation of the retrieval was done using different wind input data sets, e.g., ECMWF IFS wind fields or retrieved wind information from Radar scans. Also, the retrieval was used to correct the miss-pointing angles of two in parallel measuring zenith pointing radars and, therefore, correct the velocity errors in dual Doppler velocity field.