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Best Estimate Sedimentation Doppler Velocity from the EarthCARE Cloud Profiling Radar

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Abstract:
The joined ESA-JAXA Earth's Cloud Aerosol and Radiation Explorer (EarthCARE) mission features the first Dopplerized 94-GHz Cloud Profiling Radar (CPR), with enhanced sensitivity and improved resolution compared to NASA's CloudSat CPR. These features, especially the availability of Doppler velocity measurements, are expected to improve the CPR-based detection of clouds, microphysical retrievals in clouds and precipitation and for the first time provide information about particle sedimentation velocity and vertical motions in convective clouds.

The Doppler velocity estimates from the EarthCARE CPR are expected to be noisy due to several factors: motion of the platform, non-uniform beam filling, narrow Nyquist velocity boundaries, antenna mispointing etc. Some of these effects are expected to be addressed in the L2 data post-processing. After these corrections are implemented, the measured Doppler velocity is expected to have an uncertainty between 0.5 to 1.0 ms^{-1} that is too high for the Doppler velocities to be able to constraint particle size information especially in light precipitation and ice/snow sedimentation conditions.

Here, we will present additional improvements in the quality of the EarthCARE CPR Doppler velocities by using match filtering techniques and using spatially constructed Z-V power law relationships. The proposed technique is tested on the official test scenes of the EarthCARE L2 data products using a sophisticated EarthCARE CPR forward simulator. The proposed technique clearly improves the quality of the CPR Doppler velocities, thus, improves their applicability in constraining particle size information in L2 data products.