# Reconstruction of 3D cloud geometry using a scanning cloud radar

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Clouds are a main cause of uncertainties in the forecasts of weather and climate models. In part, this is due to limitations of remote sensing of cloud microphysics. Present approaches often use passive spectral measurements for the remote sensing of cloud microphysical parameters. Large uncertainties are introduced by three dimensional (3D) effects. Such 3D effects can, for example, be caused by varying orientations of cloud sides or by shadowed areas on the cloud. Passive ground based remote sensing of cloud properties at high spatial resolution can be improved crucially with this kind of additional knowledge of cloud geometry. Therefore, a method for the accurate reconstruction of 3D cloud geometry from radar measurements is developed and presented here. In the context of the Munich Aerosol Cloud Scanner Project (MACS), the dataset provided by this reconstruction will aid passive spectral ground-based measurements of cloud sides to retrieve microphysical parameters.

The developed 3D reconstruction scheme is investigated and optimized by simulated measurements of a static model cloud. For this purpose, the effects of different scan resolutions and varying interpolation methods are evaluated on the basis of the corresponding radiance fields. In (dynamic) reality a trade-off between scan resolution and scan duration has to be found. A reasonable choice is a scan resolution of 1° to 2°. The most suitable interpolation procedure is the natural neighbor method. Measurements are collected with the Munich miraMACS, a 36 GHz METEK MIRA-S scanning cloud radar. The 3D reconstruction method is demonstrated using radar scans of convective cloud cases and the reproduction of camera imagery (collected at the radar location) via 3D volume reconstruction and 3D radiative transfer simulation.