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Retrieving fall streaks signatures in radar data to study microphysical changes of particle populations within a mixed phase clouds

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Within mixed-phase clouds the interaction of ice crystals with super-cooled liquid water leads to an enhanced growth of the ice particles. The growth of ice particles from mixed-phase interactions is an important process for precipitation formation in the mid-latitudes. However, such a process is still not clearly understood, nowerdays.

To understand the ice particle growth within these clouds the microphysical changes of a single particle population falling through the cloud have to be analysed. Using the 3 beam configuration of the Transportable Atmospheric Radar (TARA) we retrieve the full 3-D Doppler velocity vector. This retrieved dynamical information is used to retrieve the path of a single particle population through the measured cloud system – the so called fall streak – so that microphysical changes along those path can be studied.

A way to study changes in ice particle microphysics is to analyse radar Doppler spectra. Microphysical changes along the path of a population of ice particles through a mixed-phase cloud can be correlated to changes in the retrieved radar spectrograms. The instrumental synergy setup during the ACCEPT campaign (Analysis of the Composition of Clouds with Extended Polarization Techniques campaign), fall 2014, Cabauw the Netherlands, allows to detect liquid water layers within mixed-phase clouds. Therefore, identified changes within the retrieved spectrograms can be linked to the presence of super-cooled liquid layers.

In this work we will explain the backtracking methodology and its use for the interpretation of velocity spectra. The application of this new methodology for ice particle growth process studies within mixed-phase clouds will be discussed.