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Evidence of ice crystal growth within mixed phase clouds along fall streaks – a radar observation case study

Lukas Pfitzenmaier (1), Yann Dufournet (2), Christine Unal (1), and Herman Russchenberg (1)

(1) Delft University of Technology, Geoscience & Remote Sensing, Delft, Netherlands (l.pfitzenmaier@tudelft.nl), (2) Sky-ECHO, HD weather nowcasing, Delft, Netherlands (y.doufournet@sky-echo.eu)

Mixed phase clouds contain both ice particles and super-cooled cloud water droplets in the same volume of air. Currently, one of the main challenges is to observe and understand how ice particles grow by interacting with liquid water within the mixed-phase clouds. In the mid latitudes this process is one of the most efficient processes for precipitation formation.

The case study presented here is based on observations obtained with the Transportable Atmospheric RAdar (TARA), S-band precipitation radar profiler, from Delft University of Technology during the Analysis of the Composition of mixed-phase Clouds with Extended Polarization Techniques campaign (ACCEPT) at Cabauw The Netherlands, autumn 2014. The high temporal (3 seconds) and spatial resolutions (21 m) as well as the Doppler and polarimetric capabilities of TARA are used to estimate size and shape information of the measured hydrometeors. In addition, the unique 3 beam configuration of TARA provides 3-D dynamical information within the cloud system.

Based on the dynamical information it is possible to retrieve the fall steak signatures of falling ice particles within radar measurements. Those signatures allow to follow particle population from their generation (at cloud top) to their disintegration. So this technique offers a new perspective for cloud microphysical evolution studies.

Using retrieved profiles of radar moments and spectral information along the fall streaks, microphysical information are estimated leading to a better understanding of the influence of super-cooled liquid layer on ice crystals growth under ambient conditions. A synergetic setup of instruments during the ACCEPT campaign was used to liquid layers within the cloud system. So several type of ice crystal growth processes could be detected and will be presented and discussed.