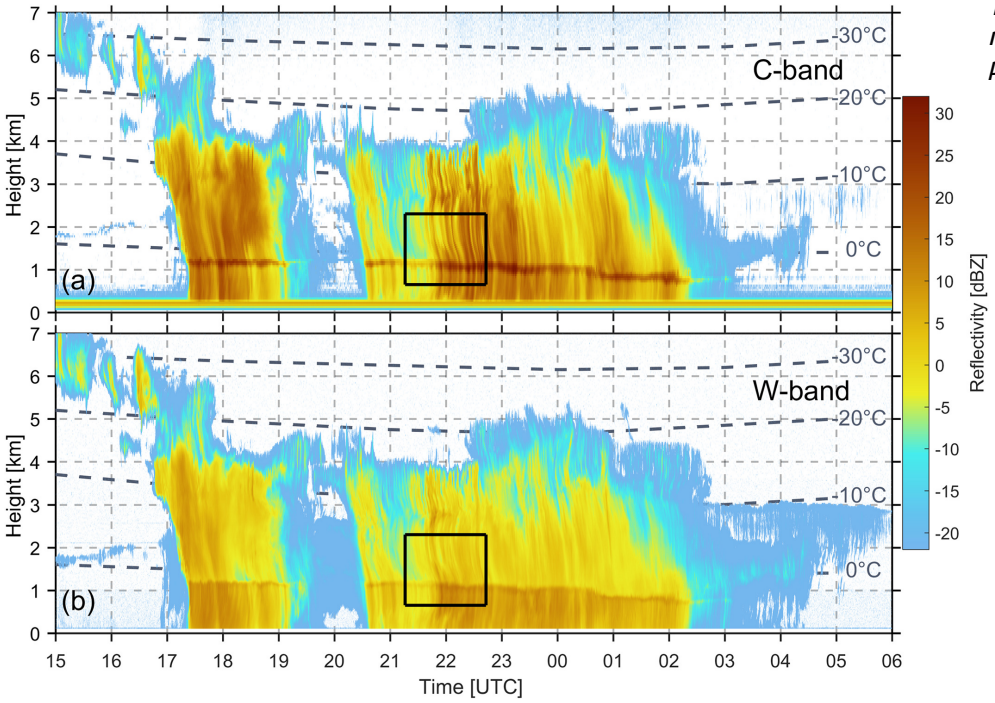
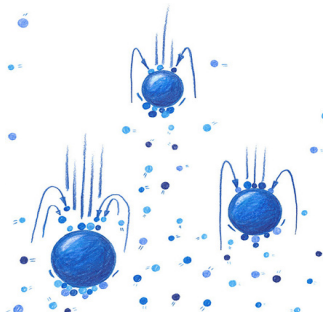
MSc topics 2023-2024

Drop size distribution retrievals from vertically pointing radars

Context: Raindrop size distributions (DSDs) are crucial for understanding the microphysics of rain. Between the moment raindrops are released from clouds and the moment they hit the ground, a lot can happen. Drops can grow in size by colliding with each other, or break up into hundreds of smaller pieces. Very small ones may never make it to the surface: they evaporate mid-air!



Time height profiles of radar reflectivity as seen by two vertically pointing C-band and W-band radars.



Raindrops grow in size by colliding with each other. When drops are too large, they break up into smaller parts. Radar can detect the signature of these processes.

Challenge: How do raindrop size distributions change with height? And what factors control these changes? To answer these questions, detailed measurements of the evolution of the DSD from the clouds down to the ground are necessary. This is difficult and can only be done using vertically pointing radars. However, before anything meaningful can be said, the DSDs need to be carefully retrieved from the Doppler spectra by correcting for attenuation, clutter, aliasing and vertical wind.

The goal of this thesis is to retrieve DSDs using simultaneous measurements by a vertically pointing micro-rain radar (MRR) and a cloud radar. The first task will be to process the radar data and implement DSD retrieval algorithms based on Doppler spectra. The second task will be to develop algorithms for quantifying vertical DSD evolution and detecting the signatures of collisional drop growth, breakup and evaporation. The last task will be to validate the retrievals using ground observations.

For more information about this topic, please contact:
Dr. Marc Schleiss, Assistant Professor
Dept. of Geoscience & Remote Sensing
m.a.schleiss@tudelft.nl

TU Delft