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Microphysical properties of mixed-phase clouds from the analysis of spectral dual-polarization radar measurements

Y.Dufournet, C. M. H. Unal and H. W. J. Russchenberg

International Research Center For Telecommunication and Radar (IRCTR), Delft University of technology, The Netherlands. (y.dufournet@irctr.tudelft.nl)

In a saturated atmosphere, the possible presence of a liquid phase in a wide range of negative temperature lead to regions inside clouds where small supercooled water droplets coexist with a large panel of different ice crystal habits and sizes (Hobbs et al, 1971). In remote sensing, the emitted signal backscattered or absorbed by most of those particles is extremely difficult to interpret, and validation of mixed-phase region with in-situ measurements are still seldom (Fleishauer et al., 2002). However ground-based and satellite measurements provide long lasting time profile needed to validate and feed the input of climate models. A new technique is under development at the University of Delft to remotely determine the ice water content inside mixed-phase clouds from spectral dual-polarization measurements taken by the transportable S band atmospheric radar TARA. This radar has the advantage to get a direct measurement of the ice phase of the clouds since supercooled water droplets are small enough to be not detectable. A microphysical model has been created to retrieve the Ice Water Content of the mixed-phase clouds by taking benefit of the full potential of Tara (Spek et al., 2006). This technique is based on an iterative comparison of expected scattering by ice clouds (from the model) and observations of the polarimetric parameter spectral differential reflectivity (sZDR). This new parameter provides, the axial ratio (from dual polarization) versus the size (from Doppler velocities) of the ice particles, assuming they can be modeled as spheroids. During the last year, measurements of mixed-phase clouds have been taken in the climate research site of Cabauw (The Netherlands). The presented work will focus on the measurement, processing and assessment of the sZDR used as an input for the model.