Geophysical Research Abstracts
Vol. 19, EGU2017-2298, 2017
EGU General Assembly 2017

Phase-partitioning in mixed-phase clouds – can we characterize the entire vertical column?

Heike Kalesse (1), Edward Luke (2), Patric Seifert (1), and Johannes Bühl (1)

(1) Leibniz Institute for Tropospheric Research, Remote sensing, Leipzig, Germany (kalesse@tropos.de), (2) Brookhaven National Laboratory, Upton, New York, USA

The characterization of the entire vertical profile of phase-partitioning in mixed-phase clouds is a challenge which can be addressed by synergistic profiling measurements with ground-based polarization lidars and cloud radars. While lidars are sensitive to small particles and can thus detect supercooled liquid (SCL) layers, cloud radar returns are dominated by larger particles (like ice crystals). The maximum lidar observation height is determined by complete signal attenuation at a penetrated optical depth of about three. In contrast, cloud radars are able to penetrate multiple liquid layers and can thus be used to expand the identification of cloud phase to the entire vertical column beyond the lidar extinction height, if morphological features in the radar Doppler spectrum can be related to the existence of SCL. Relevant spectral signatures such as bimodalities and spectral skewness can be related to cloud phase by training a neural network appropriately in a supervised learning scheme, with lidar measurements functioning as supervisor. The neural network output (prediction of SCL location) derived using cloud radar Doppler spectra can be evaluated with several parameters such as liquid water path (LWP) detected by microwave radiometer (MWR) and (liquid) cloud base detected by ceilometer. The technique has been previously tested on data from Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) instruments in Barrow, Alaska and is here utilized for observations from the Leipzig Aerosol and Cloud Remote Observations System (LACROS) during the Analysis of the Composition of Clouds with Extended Polarization Techniques (ACCEPT) field experiment in Cabauw, Netherlands in Fall 2014.