



Home

Online Library ACP

- Recent Final Revised Papers
- Volumes and Issues**
- Special Issues
- Library Search
- Title and Author Search

Online Library ACPD

Alerts & RSS Feeds

General Information

Submission

Review

Production

Subscription

Comment on a Paper

Impact  
Factor  
4.927

ISI  
indexed



[Volumes and Issues](#) [Contents of Issue 24](#) [Special Issue](#)

Atmos. Chem. Phys., 9, 9401-9416, 2009

www.atmos-chem-phys.net/9/9401/2009/

© Author(s) 2009. This work is distributed under the Creative Commons Attribution 3.0 License.

## Evidence of ice crystals at cloud top of Arctic boundary-layer mixed-phase clouds derived from airborne remote sensing

A. Ehrlich<sup>1,\*</sup>, M. Wendisch<sup>1,\*</sup>, E. Bierwirth<sup>2,\*</sup>, J.-F. Gayet<sup>3</sup>, G. Mioche<sup>3</sup>, A. Lampert<sup>4</sup>, and B. Mayer<sup>5</sup>

<sup>1</sup>Johannes Gutenberg-University Mainz, Institute for Atmospheric Physics, Mainz, Germany

<sup>2</sup>Laboratory for Atmospheric and Space Physics (LASP), University of Colorado, Boulder, USA

<sup>3</sup>Laboratoire de Météorologie Physique (LAMP), Université Blaise Pascal, Aubière Cedex, France

<sup>4</sup>Alfred Wegener Institute for Polar and Marine Research (AWI), Potsdam, Germany

<sup>5</sup>Institute of Atmospheric Physics, German Aerospace Center (DLR), Oberpfaffenhofen, Germany

\* now at: Leipzig Institute for Meteorology (LIM), University of Leipzig, Germany

**Abstract.** The vertical distribution of ice crystals in Arctic boundary-layer mixed-phase (ABM) clouds was investigated by airborne remote-sensing and in situ measurements during the Arctic Study of Tropospheric Aerosol, Clouds and Radiation (ASTAR) campaign in March and April 2007. Information on the spectral absorption of solar radiation by ice and liquid water cloud particles is derived from airborne measurements of solar spectral radiation reflected by these clouds. It is shown by calculation of the vertical weighting function of the measurements that the observed absorption of solar radiation is dominated by the upper cloud layers (50% within 200 m from cloud top). This vertical weighting function is shifted even closer to cloud top for wavelengths where absorption by ice dominates. On this basis an indicator of the vertical distribution of ice crystals in ABM clouds is designed.

Applying in situ measured microphysical properties, the cloud-top reflectivity was calculated by radiative transfer simulations and compared to the measurements. It is found that ice crystals near cloud top (mixed-phase cloud top layer) are necessary to reproduce the measurements at wavelengths where absorption by ice dominates. The observation of backscatter glories on the cloud top generally indicating liquid water droplets does not contradict the postulated presence of ice crystals. Radiative transfer simulations reproduce the observed glories even if the cloud top layer is of mixed-phase character.

[Final Revised Paper](#) (PDF, 3332 KB) [Discussion Paper](#) (ACPD)

Citation: Ehrlich, A., Wendisch, M., Bierwirth, E., Gayet, J.-F., Mioche, G., Lampert, A., and Mayer, B.: Evidence of ice crystals at cloud top of Arctic boundary-layer mixed-phase clouds derived from airborne remote sensing, Atmos. Chem. Phys., 9, 9401-9416,



Search ACP

Library Search

Author Search

News

- Sister Journals AMT & GMD
- Public Relations & Background Information

Recent Papers

01 | ACPD, 23 Dec 2009: Airborne measurements of aerosol optical properties related to early spring transport of mid-latitude sources into the Arctic

02 | ACPD, 23 Dec 2009: Organic aerosol components observed in worldwide datasets from aerosol mass spectrometry

03 | ACPD, 23 Dec 2009: Optimal estimation of the surface fluxes of methyl chloride using a 3-D global chemical transport model

