Geophysical Research Abstracts
Vol. 21, EGU2019-16187, 2019
EGU General Assembly 2019

Ice crystal number concentration from satellite lidar-radar observations

Odran Sourdeval (1), Edward Gryspeerdt (2), Johannes Mülmenstädt (3), Martina Krämer (4), Tom Goren (3), Julien Delanoë (5), and Johannes Quaas (3)

(1) University of Lille, Laboratoire d'Optique Atmosphérique, Villeneuve D'Ascq, France (odran.sourdeval@univ-lille.fr), (2) Space and Atmospheric Physics Group, Imperial College London, London, UK, (3) Leipzig Institute for Meteorology, Universität Leipzig, Leipzig, Germany, (4) Forschungszentrum Jülich, Institut für Energie und Klimaforschung (IEK-7), Jülich, Germany, (5) LATMOS/UVSQ/IPSL/CNRS, Guyancourt, France

The number concentration of ice particle (Ni) is a quantity that is key for the study of ice cloud processes but that still remains very challenging to estimate based on remote sensing techniques. This leads to a lack of global observational constraints for Ni that becomes increasingly problematic in the context of further evaluating the microphysics schemes used in models or quantifying aerosol-cloud interactions. Efforts are therefore necessary to assess remote-sensing capabilities to infer Ni.

This work presents results based on a new satellite retrieval method, called DARDAR-Nice. This method uses synergic information from lidar and radar measurements in order to constrain parameters of a particule size distribution parameterization and subsequently infer the number of ice crystals from multiple minimal size thresholds. A major strength of merging lidar and radar measurements is that it allows providing vertical profiles of Ni for a large variety of ice cloud types. This new, publicly available, product now contains 10-years of global A-Train measurements.

The capability of DARDAR-Nice to retrieve Ni will first be investigated by comparisons to in situ measurements from multiple campaigns. Results of a case study will then be analyzed and global climatologies will be assessed. It will be shown that this new product is highly consistent with in situ data and theoretical expectations, despite some clear limitations in temperature ranges typical of mixed-phase clouds. Climatological analyses show notably a strong dependence of Ni with the vertical velocity and the temperature. This work will be put in the context of previous climatologies established from in situ observations and climate models.

Further work concerns the combined use of DARDAR-Nice and global reanalysis data to assess the importance of aerosol - ice cloud interactions. Despite numerous, and sometimes divergent, modeling results, very little has currently been done to understand these interactions on a global scale from satellite observations. Clear signals from such interactions are here noted and are exploited in view of presenting a first observational estimate of the aerosol - ice cloud radiative forcing.