

Closure between ice-nucleating particle and ice crystal number concentrations in ice clouds embedded in Saharan dust: Lidar observation during the BACCHUS Cyprus 2015 campaign

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For the first time, we compare ice-nucleating particle number concentration (INPC) derived from polarization lidar (Mamouri and Ansmann, 2015) with ice crystal number concentrations (ICNC) in ice cloud layers embedded in the observed Saharan dust layers (at heights above 6 km and corresponding temperatures from -20 to -40°C). ICNC is estimated from the respective cirrus extinction profiles obtained with the same polarization lidar in combination with Doppler lidar measurements of the ice crystal sedimentation speed from which the mean size of the crystals can be estimated. Good agreement between INPC and ICNC was obtained for two case studies of the BACCHUS Cyprus 2015 field campaign with focus on INPC profiling. The campaign was organized by the Cyprus Institute, Nicosia, where a lidar was deployed. Additionally, observations of AERONET and EALINET Lidar stations during the BACCHUS Cyprus 2015 field campaign, performed by Cyprus University of Technology in Limassol. Both, INPC and ICNC were found in the range from 10-50 1/L. Lidar-derived INPC values were also compared with in-situ INPC measurements (Horizontal Ice Nucleation Chamber, HINC, ETH Zurich, deployed at Agia Marina, at 500 m a.s.l., 30 km west of the lidar site). Reasonable and partly good agreement (during dust events) was found between the two retrievals. The findings of these closure studies corroborate the applicability of available INPC parameterization schemes (DeMott et al., 2010, 2015) implemented in the lidar retrieval scheme, and more generally INPC profiling by using active remote sensing (at ground and in space with CALIPSO and EarthCARE lidars).