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Assessment of ice clouds - aerosol interactions in global satellite observations

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Interactions between aerosols and clouds, as well as their radiative consequences, have been a long-standing problem to understand cloud physics as well as anthropogenic impacts on climate. Satellite-based investigations of the direct and indirect impact of aerosols on liquid clouds have led to significant progress in the understanding during the last decade. This is partly due to the emergence of adapted cloud properties provided by satellites, such as the droplet number concentration. Ice clouds have suffered from such adapted quantity for much longer, but solutions have recently been appearing.

This study investigates aerosol - ice clouds interactions using ice crystal number concentration (Ni) profiles from a lidar-radar dataset (DARDAR-Nice), used cojointly with with collocated aerosol information from the Copernicus Atmospheric Monitoring Service (CAMS) reanalyses. A multitude of cloud regimes, subdivided into seasonal and regional bins, are considered in order to disentangle meteorological effects from the aci signature. First results of joint-histograms between Ni and the aerosol mass show an overall positive sensitivity of Ni to the aerosols load. This response is particularly strong towards to cloud-top and flattens towards cloud-base, consistently with expectations for homogeneous nucleation processes. The response of the ice water content, in terms of adjustment to the initial aerosol perturbation as also quantified.