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## Solid ammonium nitrate aerosols: efficient ice nucleating particles in the upper troposphere during Asian monsoons investigated by aircraft, satellite and cloud-chamber

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Strong convection within the Asian monsoon system quickly transports polluted air masses from the boundary layer into the upper troposphere where secondary aerosol formation can take place. Here we present remote sensing observations by infrared limb sounding systems providing vertical and horizontal distributions of ammonia (NH<sub>3</sub>) and solid ammonium nitrate (AN) aerosol particles. Besides the identification of trace gases, characteristic signatures in the mid-infrared spectral region are used to infer information about composition and phase of the aerosol particles. We will show an analysis of AN and NH<sub>3</sub> in the Asian monsoon upper troposphere from a combination of two satellite limb sounders, CRISTA on SPAS in August 1997 and MIPAS on Envisat, from 2002-2011.

In addition, limb-imaging measurements obtained with the GLORIA instrument on board the Geophysica high-altitude aircraft provided the opportunity to obtain vertical cross sections along the flight path of AN aerosol mass and NH<sub>3</sub> volume mixing ratios during the Asian monsoon field campaign of the StratoClim project in summer 2017. We analysed the airborne dataset with the help of trajectory calculations combined with temporally and locally connected satellite data of nadir-pointing instruments, like IASI, to infer the distribution of NH<sub>3</sub> in the lower troposphere, as well as geostationary satellites to deduce the presence of convective influence.

Further, we performed experiments at the AIDA cloud and aerosol chamber laboratory (a) to support the analysis of the aerosol infrared spectral signature in remote sensing, (b) to investigate the conditions leading to the unexpected solid phase of AN particles as well as, (c) to study their potential to act as ice nucleating particles.

