**Investigating the competition in cloud droplets activation by different aerosol systems using cloud chamber experiment datasets and modelling**

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The importance of aerosol particles in cloud formation via cloud condensation and ice nucleation processes cannot be downplayed in the Earth’s climate system. Various aerosol particles or systems have different potentials in activating to cloud droplets, hence acting as cloud condensation nuclei (CCN). The same goes for aerosol particles acting as ice-nucleating particles (INPs). However, the competition effects between two different aerosol particles or aerosol systems in activating cloud droplets are not well understood. On the other hand, the preferential behaviour of an aerosol type to act either as CCN or INPs is still a subject of discussion in the cloud study communities. In our recent and unique study, we explored this competitiveness amongst aerosol particles to act as CCN or/and INPs in our new state-of-the-art aerosol-cloud simulation chamber (AIDAd, KIT) as well as using advanced cloud process models to simulate these processes. Here, we used the University of Manchester, ACPIM model, the NCAR Lagrangian-particle-based DNS model, and the University of Illinois PartMC model to test whether these models are able to capture or reproduce the competition effects taking into consideration parameters such as number concentrations, aerosol composition/types, cooling rates, particle sizes, etc. In this report, we present firsthand the preliminary results from our new study on ‘**i**mproved **S**cientific **K**nowledge of Clouds, Ice Cr**Y**stals, and Aerosols through **LAB**oratory Access of a New Dynamic Cloud Chamber (iSKYLAB). The results from this study will improve the numerical simulation of these processes in climate models.

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