Aerosol Activation and Scavenging during the Cloudy Test Campaign at the CERN CLOUD chamber

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Keywords: cloud formation, aerosol growth, GCR, CLOUD.
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Besides aerosol nucleation, which has been observed almost everywhere in the atmosphere (Kulmala et al., 2004), the growth of these newly formed aerosol particles and the formation of cloud droplets and ice crystals play a major role in atmospheric research. In previous studies at the CERN CLOUD chamber mainly nucleation events have been studied (Kirkby et al., 2011). However, the CLOUD 6 campaign mainly focused on the formation of cloud hydrometeors. The CLOUD chamber with a very low contaminant background, stable temperature conditions and a fast adiabatic expansion system allowed obtaining new scientific findings by determining which particles or particle fractions act as **c**loud **c**ondensation **n**uclei (CCN) and **i**ce **n**uclei (IN). Due to adiabatic expansion the relative humidity increases until the chamber is supersaturated and cloud droplets and ice crystals are formed. Cloud formation was investigated applying different pressure drops, expansion times and temperatures. In addition CERN's **P**roton **S**ynchrotron (PS) was used to simulate ion conditions of the atmosphere from ground level to the upper troposphere (Kirkby et al., 2011).

The purpose of this study was to investigate the activated fraction and the scavenging of aerosols during cloud events with a new CLOUD chamber setup. One SMPS and one TSI CPC 3010 were installed at the CERN CLOUD chamber to measure the aerosol particle size distribution and aerosol concentration. In addition, two cyclones were attached in order to remove all particles and hydrometeors larger than 1 µm from the sampling flow. Hence, the number concentration and the dry size distribution of interstitial aerosols (i.e. the non-activated particles) could be measured during the presence of clouds. During all other times the total dry size distribution was measured. By comparing the pre (total), inter (interstitial) and post (total) particle size distribution, aerosol activation and scavenging were investigated. In addition, charged and neutral conditions were tested.

Figure 1 shows an example of aerosol activation during a cloud event at T=-34°C. The concentration is plotted against the particle diameter where the green line denotes the concentration (dN/dlogD) before the cloud was formed and the red line the concentration while the cloud was present.

First tests of the new expansion system were successful, showing aerosol activation and scavenging. The cyclones removed droplets and ice crystals successfully to measure the interstitial aerosol concentration during cloud events.

For the upcoming campaign (CLOUD 8) further improvements of the system are planned to ensure that a longer cloud presence is possible. In addition, the possible influence of **g**alactic **c**osmic **r**ays (GCR) will be investigated.

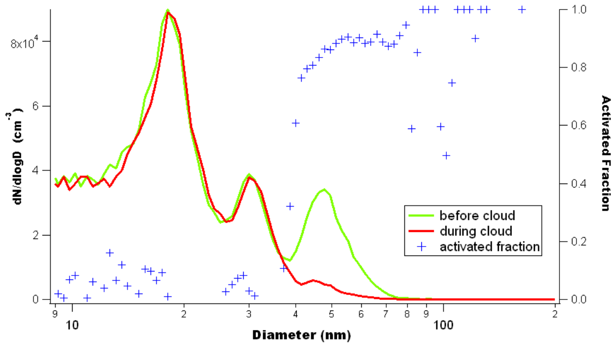

Figure 1. Number site distributions before and during the presence of a cloud. Particles larger than ~ 40 nm were activated to cloud droplets.

Acknowledgements: We would like to thank CERN for supporting CLOUD with important technical and financial resources, and for providing a particle beam from the CERN Proton Synchrotron. This research has received funding from the EC Seventh Framework Programme (Marie Curie Initial Training Network "CLOUD-ITN" no. 215072, MC-ITN "CLOUD-TRAIN" no. 316662, and ERC-Advanced "ATMNUCLE" grant no. 227463), the German Federal Ministry of Education and Research (project nos. 01LK0902A and 01LK1222A), the Swiss National Science Foundation (project nos. 200020_135307 and 206620_130527), the Academy of Finland (Center of Excellence project no. 1118615), the Academy of Finland (135054, 133872, 251427, 139656, 139995, 137749, 141217, 141451), the Finnish Funding Agency for Technology and Innovation, the Nessling Foundation, the Austrian Science Fund (FWF; project no. P19546 and L593), the Portuguese Foundation for Science and Technology (project no. CERN/FP/116387/2010), the Swedish Research Council, Vetenskapsrådet (grant 2011-5120), the Presidium of the Russian Academy of Sciences and Russian Foundation for Basic Research (grants 08-02-91006-CERN and 12-02-91522-CERN), and the U.S. National Science Foundation (grants AGS1136479 and CHE1012293).

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Kirkby, J. et al. (2011) *Nature.* **476**, 429-433.