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CCN characteristics of aerosol particles in the lowermost stratosphere during the CAFE-Africa campaign

Mira L. Pöhlker, Ovid O. Krüger, and the CAFE-Africa team
Max Planck Institute for Chemistry, Multiphase Chemistry Department, Mainz, Germany (o.krueger@mpic.de)

During the CAFE-Africa HALO aircraft campaign (August-September 2018) over the eastern Atlantic Ocean, we investigated the physical and cloud-nucleating properties of aerosol particles using a Cloud Condensation Nuclei Counter (CCNC, Droplet Measurement Technologies) and a Single Particle Soot Photometer (SP2, Droplet Measurement Technologies), which measured airborne particles on-line at high time resolution. Additionally, aerosol samples (100 nm lower cut-offs) were collected by impaction using a home-made single stage impactor for laboratory micro-spectroscopy analysis. This combination of online and offline measurement techniques offers the unique chance to study the particle hygroscopicity, black carbon (BC) fraction and size distribution, as well as its elemental composition in a more qualitative way. In addition online aerosol particle composition was measured using two aerosol mass spectrometers (AMS and single particle ablation instrument).

In three out of fourteen scientific flights of the campaign, the aircraft was reaching the lowermost stratosphere. In this layer, consistent and stable enhanced CCN number concentrations were observed, very often exceeding by orders of magnitude the CCN number concentration in the troposphere. The very low concentration of BC containing particles in combination with the presence of scattering particles rule out anthropogenic combustion emissions as only source of this particles, but rather give evidence for the existence of meteoric particles[1,2]. The particles found in the stratosphere showed very higher CCN efficiencies, this indicates a large inorganic fraction, probably caused by sulfuric acid[1,2] and can make the downward mixing of these aerosols highly relevant for cloud formation.

References
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[2] Cziczo et al., 2001. Science 291 (5509), 1772-1775. DOI: 10.1126/science.1057737