

EGU2020-6759

<https://doi.org/10.5194/egusphere-egu2020-6759>

EGU General Assembly 2020

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



The ATAL and its aerosol microphysical properties in the Asian Monsoon Anticyclone

Christoph Mahnke^{1,2}, Stephan Borrmann^{1,2}, Ralf Weigel², Francesco Cairo³, Armin Afchine⁴, Martina Krämer⁴, Jean-Paul Vernier⁵, and Terry Deshler⁶

¹Max Planck Institute for Chemistry, Mainz, Germany

²Institute for Atmospheric Physics, Johannes Gutenberg University, Mainz, Germany

³Institute of Atmospheric Sciences and Climate, ISAC-CNR, Rome, Italy

⁴Institute of Energy and Climate Research - IEK7, Forschungszentrum Jülich, Jülich, Germany

⁵NASA Langley Research Center, Hampton (Virginia), USA

⁶Department of Atmospheric Science, University of Wyoming, Laramie (Wyoming), USA

During the StratoClim 2017 measurement campaign in Nepal, within the Asian Monsoon Anticyclone (AMA), measurements of the aerosols' microphysical properties up to UT/LS altitudes were successfully completed with a modified version of the commercially available (Droplet Measurement Technologies Inc.) aerosol spectrometer UHSAS-A. Technical rearrangements of parts of the UHSAS-A were developed and implemented, which improve the instrument's measuring performance and extend its airborne application range from around 12 km altitude to the extreme ambient conditions in the stratosphere at heights of 20 km. The measurement techniques used for this purpose were characterized by laboratory experiments.

Within the AMA region, extreme values of the particle mixing ratio (PMR) ranging between 6 mg⁻¹ and about 10000 mg⁻¹ were found with the UHSAS-A (particle diameter range: 65 nm to 1000 nm). The median of the PMR for all research flights was about 1300 mg⁻¹ close to the ground. Within tropospheric altitudes, the PMR was highly variable and median values between 70 mg⁻¹ and 400 mg⁻¹ were observed. At levels of 370 K potential temperature, the median PMR maximally reaches about 700 mg⁻¹ while the 1 Hz resolved measurements show values up to about 10000 mg⁻¹. Between 450 K and 475 K, median PMR between 40 mg⁻¹ and 50 mg⁻¹ were observed. The aerosol size distributions (measured by the UHSAS-A) were extended by an additional diameter size bin obtained from the 4-channel Condensation Particle counting System (COPAS), i.e. for aerosol diameter between 10 nm and 65 nm.

The UHSAS-A measured aerosol particle size distributions were compared with balloon-borne measurements (by T. Deshler et al., Dep. of Atmospheric Science, University of Wyoming, USA) at altitudes of up to 20 km. These show that the size distributions measured during the StratoClim 2017 campaign fit well within the range of the balloon-borne measurements during the Asian Monsoon season over India (Hyderabad) in 2015 and the USA (Laramie) in 2013. Further analyses of measured particle size distributions by means of backscatter ratio show remarkable consistency

with CALIOP satellite observations of the ATAL during the StratoClim mission period.