Geophysical Research Abstracts
Vol. 19, EGU2017-2727-1, 2017
EGU General Assembly 2017

Spatio-temporal aerosol particle distributions in the UT/LMS measured by the IAGOS-CARIBIC Observatory

Denise Assmann (1), Markus Hermann (1), Andreas Weigelt (2), Bengt Martinsson (3), Carl Brenninkmeijer (4), Armin Rauthe-Schöch (4), Peter van Velthoven (5), Harald Bönisch (6), and Andreas Zahn (6)

(1) Leibniz Institute for Tropospheric Research, Leipzig, Germany, (2) Federal Maritime and Hydrographic Agency, Hamburg, Germany, (3) Division of Nuclear Physics, Lund University, Lund, Sweden, (4) Air Chemistry Division, Max Planck Institute for Chemistry, Mainz, Germany, (5) Royal Netherlands Meteorological Division of Chemistry and Climate, Climate Research, The Netherlands, (6) Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology, Karlsruhe, Germany

Submicrometer aerosol particles in the upper troposphere and lowermost stratosphere (UT/LMS) influence the Earth‘s radiation budget directly and, more important, indirectly, by acting as cloud condensation nuclei and by changing trace gas concentrations through heterogeneous chemical processes. Since 1997, regular in situ UT/LMS aerosol particle measurements have been conducted by the Leibniz Institute for Tropospheric Research, Leipzig, Germany and the University of Lund, Sweden, using the the CARIBIC (now IAGOS-CARIBIC) observatory (www.caribic-atmospheric.com) onboard a passenger aircraft. Submicrometer aerosol particle number concentrations and the aerosol particle size distribution are measured using three condensation particle counters and one optical particle size spectrometer. Moreover, particle elemental composition is determined using an aerosol impactor sampler and post-flight ion beam analysis (PIXE, PESA) of the samples in the laboratory.

Based on this unique data set, including meteorological analysis, we present representative spatio-temporal distributions of particle number, surface, volume and elemental concentrations in an altitude of 8-12 km covering a large fraction of the northern hemisphere. We discuss the measured values in the different size regimes with respect to sources and sinks in different regions. Additionally, we calculated highly resolved latitudinal and longitudinal cross sections of the particle number size distribution, probability density functions and trends in particle number concentrations, but also in elemental composition, determined from our regular measurements over more than a decade.
Moreover, we generated seasonal contour plots for particle number concentrations, the potential temperature, and the equivalent latitude. The results are interpreted with respect to aerosol microphysics and transport using CARIBIC trace gas data like ozone and water vapour. The influence of clouds in the troposphere and the different stratosphere-troposphere-exchange processes is clearly visible. Besides providing information about UT/LMS aerosol particle sources, transport, and sinks, these distributions can be used to validate remote sensing instruments or global atmospheric aerosol models.