

Title: Global scale aerosol measurements in the upper troposphere/lower stratosphere obtained by the civil aircraft based project CARIBIC

Authors: Markus Hermann, Jost Heintzenberg, Bengt G. Martinsson, Hung N. Nguyen, Manuela Reichelt, Claudia Timmreck, Andreas Zahn, Helmut Ziereis, and Carl A. M. Brenninkmeijer

Abstract: Intercontinental flights onboard two commercial aircraft have been carried out since 1997 with an increasingly advanced aerosol payload within the CARIBIC project (<http://www.caribic.de>). Initially, particle numbers were counted with three fast Condensation Particle Counters with the lower threshold diameters of 4, 12, and 18 nm. Automated impactor samplers collected particles larger than 65 nm for post-flight elemental analyses utilizing Particle Induced X-ray Emission. With the switch from the initial Boeing B767 operated by LTU to an Airbus A340-600 operated by Lufthansa, an Optical Particle Counter was added to the payload. This instrument classifies particles larger than 150 nm in 256 size bins. The aerosol is aspirated through a calibrated inlet system. On the Airbus a video camera monitors continuously the flight path during sunlit hours. More than one hundred flights covering mainly the northern hemisphere on routes from Germany to East Asia, the Indian subcontinent, Africa, South America, and the Caribbean yielded a wealth of aerosol data in the upper troposphere (UT) and lower stratosphere (LS). Size-dependent aerosol climatologies of particle number and chemical composition have been accumulated as a function of latitude and longitude. With additional trace gas information from the CARIBIC payload systematic differences in aerosol size distribution and composition could be established between UT and LS. Gaseous tracers combined with trajectory analyses also allowed source interpretations of CARIBIC aerosol data. Repeated flights over the Intertropical Convergence Zone yielded new insights into vertical transport and aerosol formation over continental tropical regions. With the video-information aerosol process studies are possible in relation to deep convective activity. In a first comparison between measured CARIBIC aerosol data and the results from a global atmospheric model (MAECHAM4) the model captures the global features of the UT/LS aerosol quite well. Consistencies and disagreements will be discussed.