

Seminar “Physics and Chemistry of the Atmosphere”,
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SCIAMACHY and OMPS-LP aerosol characteristics: Advanced retrieval algorithms and sources of uncertainties

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Stratospheric aerosols play a key role in atmospheric chemistry and climate. They are considered a catalyst for ozone depletion, serve as condensation nuclei for polar stratospheric cloud formation, and, in large amounts, have a short-term impact on the Earth's radiative budget. The aerosol effects depend strongly on the aerosol particle size distribution (PSD). Despite its importance, available observations on PSD are rather limited, restricting the knowledge of chemical and climate aerosol feedback mechanisms.

We present a novel aerosol climatology including the PSD, the effective radius, and the extinction coefficient from limb observations of SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Cartography) operated aboard Envisat between 2002 and 2012. The aerosol climatology is successfully evaluated with in-situ balloon-borne measurements from Wyoming and global aerosol products from different satellite instruments (SAGE II, SAGE III, OSIRIS). The data set significantly expands the limited knowledge of stratospheric aerosol properties and serves to a better understanding of aerosol microphysical processes. We demonstrate its potential by comparing the simulated and observed aerosol plume evolution after the volcanic eruptions of Sarychev (Jun 2009).

The second part of the talk will focus on a new approach developed by the IUP, University of Bremen, which retrieves vertical profiles of aerosol extinction coefficients from OMPS-LP (Ozone Mapping and Profiler Suite Limb Profiler) limb-scattered radiances. These retrievals will be compared with data from OMPS-LP Saskatoon and NASA. Despite different retrieval strategies, the algorithms can retrieve Ext values with similar accuracy and are all reliably able to monitor the evolution of volcanic plumes. However, the specifications and assumptions within each retrieval introduce differences in the magnitude and spatio-temporal extent of the volcanic aerosol plume. The most significant factor contributing to these differences is the assumed aerosol particle size distribution. Understanding the causes of the differences between the Ext products support the improvement of the retrieval algorithms.