Geophysical Research Abstracts
Vol. 17, EGU2015-5294, 2015
EGU General Assembly 2015

Retrieving Stratospheric Aerosol Extinction from SCIAMACHY Measurements in Limb Geometry

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Techniques for retrieving height resolved information on stratospheric aerosol improved significantly in the past decade with the availability of satellite measurements in limb geometry. Instruments like OMPS, OSIRIS and SCIAMACHY provide height resolved radiance spectra with global coverage. Long term data sets of stratospheric aerosol extinction profiles are important for a detailed investigation of spatial and temporal variation and formation processes (e.g. after volcanic eruptions or in polar stratospheric clouds). Resulting data sets contain vital information for climate models (radiative effect) or chemistry models (reaction surface for heterogeneous chemistry).
This study focuses on the SCIAMACHY instrument which measured scattered sunlight in the ultra-violet, visible and near infra-red spectral range since the launch on EnviSat in 2002 until an instrumental error occurred in April 2012. SCIAMACHY's unique method of alternating measurements in limb and nadir geometry provides co-located profile and column information respectively that can be used to characterize plumes with small horizontal extents. The covered wavelength range potentially provides information on effective micro-physical properties of the aerosol particles. However, scattering on background aerosol constitutes only a small fraction of detected radiance and assumptions on particle characteristics (e.g. size distribution) have to be made which results in large uncertainties especially for wavelengths below 700nm and for measurements in backscatter geometry. Methods to reduce these uncertainties are investigated and applied to our newly developed retrieval algorithm. In addition, so called spatial straylight contamination of the measured signal was identified as a significant error source and an empirical correction scheme was developed. A large scale comparison study with SAGE II for the temporal overlap of both instruments (2002 to 2005) shows promising results.