Geophysical Research Abstracts
Vol. 18, EGU2016-4827, 2016
EGU General Assembly 2016

Quantitative retrieval of aerosol optical properties by means of ceilometers

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In the last few years extended networks of ceilometers have been established by several national weather services. Based on improvements of the hardware performance of these single-wavelength backscatter lidars and their 24/7 availability they are increasingly used to monitor mixing layer heights and to derive profiles of the particle backscatter profile. As a consequence they are used for a wide range of applications including the dispersion of volcanic ash plumes, validation of chemistry transport models and air quality studies.

In this context the development of automated schemes to detect aerosol layers and to identify the mixing layer are essential, in particular as the latter is often used as a proxy for air quality. Of equal importance is the calibration of ceilometer signals as a pre-requisite to derive quantitative optical properties. Recently, it has been emphasized that the majority of ceilometers are influenced by water vapor absorption as they operate in the spectral range of 905 – 910 nm. If this effect is ignored, errors of the aerosol backscatter coefficient can be as large as 50%, depending on the atmospheric water vapor content and the emitted wavelength spectrum. As a consequence, any other derived quantity, e.g. the extinction coefficient or mass concentration, would suffer from a significant uncertainty in addition to the inherent errors of the inversion of the lidar equation itself. This can be crucial when ceilometer derived profiles shall be used to validate transport models. In this presentation, the methodology proposed by Wiegner and Gasteiger (2015) to correct for water vapor absorption is introduced and discussed.