



Free troposphere aerosols-cirrus-contrails: optical properties and microphysics based on LIDAR measurements and Mie Inversion coupled approach

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Based on the inversion of the lidar elastic signals, the upper troposphere aerosols backscatter and extinction coefficients were regularly determined. A statistical analysis of data series taken regularly from Jungfraujoch Observatory (3500m ASL) from May 2000 to May 2002 shows good and realistic agreement, in terms of aerosol optical depth (AOD) when compared with observations made by the co-located sun-photometer instrument. A combined method based on elastic (Mie) – inelastic (Raman) signals is proposed, which allows the determination of extinction and the lidar ratio (i.e. extinction to backscatter ratio) of the cirrus clouds without any assumption. The retrieval of a typical contrail optical properties and preliminary calculations of its microphysics based on Mie theory (inversion) in the approximation of spherical particles is illustrated by an example. The typical profiles of upper troposphere aerosol and cirrus optical properties were obtained for 30 min integration time, and 75 m vertical resolution up to the lower stratosphere. The depolarization analysis at 532 nm was also operational and it was proven its worth in distinguishing between water and ice content cirrus clouds.

Keywords: LIDAR, Jungfraujoch, upper troposphere, aerosols, cirrus-contrails, Rayleigh, Raman, Mie inversion, backscattering, extinction, depolarization, Ångström coefficients