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Characterization of aerosol properties based on fluorescence lidar measurements

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Atmospheric aerosol is one of the key factors influencing the Earth's radiation budget and multiwavelength lidar systems provide unique opportunity to derive height-resolved particle intensive properties. Amount of available information is increased, when Mie-Raman lidar is combined with fluorescence ones. The multi-wavelength Mie-Raman lidar system at Laboratoire d'Optique Atmosphérique, University of Lille, includes a wideband fluorescence channel allowing the derivation of the fluorescence backscattering coefficient β_F. The fluorescence capacity G_F, which is the ratio of β_F to the aerosol backscattering coefficient, is an intensive particle property, strongly changing with aerosol type, thus providing a relevant basis for aerosol classification. Our presentation will be focused at the following topics:

- *Particle classification based on fluorescence measurements*. Joint use of fluorescence and depolarization lidar measurements allows to identify main aerosol types, such as dust, smoke, pollen and urban particles.
- *Analysis of aerosol mixture composition.* Mie-Raman and fluorescence measurements allow to estimate the volume concentration of different components in particle mixture.
- *Aerosol fluorescence inside ice clouds*. The fluorescence backscattering is spectrally shifted in respect to elastic one, thus contributions of ice crystals and aerosol particles to the total backscattering can be separated. Based on these observations the aerosol concentration inside the cloud can be estimated and used for the study of ice formation.
- *Fluorescence technique in application to the study of the particle hygroscopic growth*. The water uptake increases the elastic backscattering but normally does not alter the chemical components, so total amount of fluorescent molecules within a particle does not change. The synergy of multiwavelength and fluorescence lidar measurements allows to estimate the volume of dry matter and the water uptake by the particle.