Université de Lille 1 SCIENCES ET TECHNOLOGIES — UFR de Physique

Master Physique du fondamental au professionnel
http://master-physique.univ-lille1.fr

International Master 2 Atmospheric Environment: Research Training 2018-2019

Laboratory: LOA

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CaPPA Work Package: WP 2,3 (Aerosol microphysical, chemical and optical properties from fundamental heterogeneous processes to remote sensing) / WP 3 (Aerosol observations: Instrumentation and intensive field campaigns Monitoring from networks and satellite)

Characterization of aerosol properties in the vicinity of clouds to study of aerosol – cloud interaction

Abstract

One of the main issues in modeling the Earth radiation budget is the gap in the knowledge of modification of the cloud radiative properties induced by the atmospheric aerosol. This modification is strongly dependent on both the aerosol concentration and chemical composition, so for the analysis of aerosol – cloud interaction process, the characterization of aerosol properties in the vicinity of the cloud is needed. Significant amount of information about aerosol properties can be obtained from multi-wavelength Raman lidar observations. LILAS high performance LIDAR operated by LOA, based on the tripled Nd:YAG laser, allows to evaluate three backscattering, two extinction coefficients and three particle depolarization ratios ($3\beta+2\alpha+3\delta$). These observations can be inverted to provide day and night profiles of particle microphysical properties. The main aerosol types can be identified as well. Water vapor profiles are also measured. LILAS allows the measurement of the extinction Angstrom exponent with a vertical resolution about 10 m, so the hygroscopic growth of the aerosol in vicinity of the cloud should be observable.

During the internship, the student will analyze the existing LILAS observations over West Africa (SHADOW-2 campaign) and over Lille. He will take part in measurement sessions as well. In his/her study the student will focus mainly on:

- Retrieval of the particle size distribution and estimation of concentration of cloud condensation nucleus;
- Classification of aerosols, identifying the main aerosol types such as dust, maritime, sulfates, black and organic carbon.
- Study of the aerosol hygroscopic growth in the vicinity of the cloud.

The underlying question is to find out whether existing multi-wavelength lidar can provide the information about aerosol properties with a sufficient accuracy for modeling of the cloud modification processes.

Keywords: Aerosol classification, aerosol hygroscopic growth, cloud condensation nuclei, cloud properties, multiwavelength Raman lidar