UNIVERSITY: Lille , Faculty of Sciences and Technologies

Scientific domain: Optics and Lasers, Chemical Physics, Atmosphere.
Title of the thesis: Study of particulate pollution in the Lille area by combining chemical and optical observations
Supervisor(s): Isabelle Chiapello (CR CNRS HDR, LOA - Université de Lille) and Véronique Riffault (Professeure HDR, SAGE - IMT Lille-Douai)

Laboratory: Laboratoire d'Optique Atmosphérique (LOA), CNRS UMR 8518

Research project (international/national/regional): Labex CaPPA

Expected/obtained funding: Expecting ADEME fundings

ABSTRACT

This thesis aims at improving the validation and interpretation of physical and optical properties of the fine aerosol fraction, routinely measured by remote sensing at many ground-based stations, and derived from satellite observations at the global scale, based on in situ measurements at high temporal resolution of chemical, physical and optical properties. This topic is positioned in the context of current climate change and air quality issues, based on a comprehensive set of aerosol measurements performed on the instrumental platform of LOA/University of Lille by LOA and SAGE in the context of Labex CaPPA project (Chemical and Physical Properties of the Atmosphere). In particular, we will analyze the temporal variability of the chemical composition and optical properties of fine aerosols at various time scales (from diurnal to seasonal), and how it changes with specific particle pollution events. Sources and geographical origins of aerosol polluted air masses will be determined by combining multi-variate analysis and back-trajectory modeling. The link between aerosol chemical composition and optical properties (absorption, scattering, extinction) of the fine fraction at the surface will be parameterized. The relationship between remote sensing measurements of aerosol properties and surface PM1 chemical and optical properties will be also investigated.
This strategy will provide a new methodology to make the link between the fine particle composition and their optical properties. Consequently, it will make possible the reanalysis of long-term (about 10 years) remote sensing dataset acquired at LOA-Lille site (and at other AERONET2 sites). An extension of this work will be to reanalyze and interpret equivalent measurements provided by satellite observations at the regional and global scales.