UNIVERSITY: LILLE, Faculty of Sciences and Technologies

Scientific field : « Science de la Terre et de l'Univers, Terre – Enveloppes fluides »

Title of the thesis: Study of aerosol-cloud interactions using the synergy between advanced lidar and microwave/infrared radiometers

Supervisor: Goloub, Philippe, Professeur (LOA/IAR), philippe.goloub@univ-lille.fr

Co-supervisor: Olivier Pujol (LOA/IRN), Qiaoyun Hu (LOA/IAR), Igor Veselovskii (GPI, Russie)

Laboratory: Laboratoire d'Optique Atmosphérique

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ABSTRACT

The study of cloud formation and behavior is a crucial issue to improve the quality of climate predictions. Clouds that have a feedback effect on climate sensitivity, predicting their behavior and studying the different mechanisms of their formation are therefore crucial to best estimate the evolution of the Earth's radiative balance and temperature (IPCC 2013, Clouds and Aerosols Aerosol).

Among the effects that lead to cloud formation, one of the most important is the microphysical effect of aerosols, which play a role as CCN (Cloud Condensation Nuclei) to form water drops. In addition, the presence of aerosols in the atmosphere affects the lifespan of clouds, because by promoting the formation of small drops, they prevent them from reaching the size sufficient to precipitate and thus increase the life time of clouds.

The proposed research is the study of atmospheric aerosols in cloudy conditions. This new study will be based

(i) on an experimental approach based on original active remote sensing instrumentations (Lidar Mie-Raman-Fluorescence LILAS and LIFE for aerosols, clouds and water vapor) and passive (microwave and infrared radiometry for water vapor/clouds);

(ii) the use of simulation codes of the optical properties of aerosols and clouds and their mixture;

(iii) on the use of a cloud simulation model.

This project aims to develop a methodology for detecting, identifying and quantifying aerosols in clouds and their mixing state. It will contribute and complement the analysis of current and future space measurements to assess the impact of aerosols in cloudy atmospheres.

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Contact (e-mail address) : philippe.goloub@univ-lille.fr