



**Ecole Doctorale - 104**  
Sciences de la Matière, du Rayonnement  
et de l'Environnement

**UNIVERSITY:** Lille , Faculty of Sciences and Technologies

**Scientific field :** Optics and Lasers, Chemical Physics, Atmosphere.

**Title of the thesis:** Evolution of atmospheric air pollutions in the the Hauts-de-France region and their effects on solar irradiance: past, present and future situations.

**Supervisor(s):** Isabelle Chiapello - Co-advisor : Nicolas Ferlay

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

**Related research project (international/national/regional):**

**Expected/obtained funding:** Regional funding Hauts-de-France (June 2020) / ADEME (application before 03/31/2020, decision June 2020)

### **ABSTRACT**

Human activities have an effect on air pollution and the Hauts-de-France region is an area particularly impacted by multiple sources of air pollutants. The long-term evolution of air pollution in the region will depend on changes in transport and activities (industrial, agricultural), public policy choices and changes in practices, all in a context of climate change. This pollution significantly modifies solar radiation and can significantly affect the efficiency of solar farms. These processes are important in the Hauts-de-France region that has made the energy transition and the development of the solar sector priorities, and where the optimization of the exploitation of solar resources will be particularly sought after. The objective of this thesis is to evaluate the particulate air pollution in the Hauts-de-France region and its effects on solar irradiance, for past and future situations resulting from different climate scenarios. This evaluation will be based on the exploitation and study of the archive of particulate air pollution measurements (photometers of the AERONET network, and lidar) and radiation (direct, diffuse, spectral content) carried out continuously by our laboratory from its instrumented platform, and the use of detailed and proven modelling tools of solar illumination. These measurements and tools will enable us to analyse locally the co-variations between particulate atmospheric pollution and solar illumination and to extend it to the territory using atmospheric model outputs. A collaboration with the National Centre for Meteorological Research (CNRM) will also make it possible to produce this analysis over the entire territory for future situations resulting from the outputs of the ALADIN-Climat regional climate model for different scenarios, some already established (IPCC) and produced, and possibly some dedicated to the study.

**Planned recruitment date : from September 2020**

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