PAUL SCHERRER INSTITUT

LSM-Seminar

Thursday, October 15th, 2020 14:00-16:00 OSGA/EG06

Retrieval of atmospheric aerosol properties from multi-angle light scattering measurements (plus an introduction to various other computational activities within the Laboratory of Atmospheric Chemistry)

Rob. L. Modini

Aerosol Physics Group, Laboratory of Atmospheric Chemistry (LAC), Paul Scherrer Institute (PSI)

Atmospheric aerosols – nm to µm sized particles suspended ubiquitously in air – are the dominant source of uncertainty in quantifying the human contribution to climate change. In addition, certain types of atmospheric aerosols are associated with severe negative health effects, which result in millions of premature deaths each year worldwide. For these reasons, aerosols are the main overarching research topic of the PSI Laboratory of Atmospheric Chemistry (LAC).

The concentrations and climate-relevant properties (e.g. size, composition) of atmospheric aerosols vary drastically in both time and space. To capture this variability on the global scale, ground-based and satellite-borne remote sensing measurements of the intensity and angular distribution of light scattered through the atmosphere are routinely performed. These measurements contain information on aerosol sizes, shapes, and refractive indices (amongst other pieces of information). Various different computational approaches have been developed to solve the inverse problem of retrieving these aerosol properties from multi-angle light scattering measurements, ranging from iterative algorithms involving physically-based forward models, to look-up-tables and, most recently, to machine learning models. The machine learning approaches promise substantial speed-ups in computational time, which is an important feature for a number of different remote sensing applications.

In this talk I will introduce a new polar nephelometer instrument currently being constructed for the LAC. A polar nephelometer is a bench-top instrument that is used to perform multi-angle light scattering measurements on aerosols in situ, which creates the potential for highly-controlled laboratory validation studies. In particular, I will discuss our plans for investigating and validating different aerosol property retrieval algorithms using polar nephelometer measurements, including plans for a future collaborative project between the LAC and the LSM. The aim of this collaboration will be to tackle the aerosol-light-scattering inversion problem with an adapted version of the invertible neural network model that was developed by the LSM for optimizing the operation of a particle accelerator.

In addition to these specific topics, I will also present a general overview of computational activities within the LAC, with the goal of identifying other possible opportunities for collaboration between our two laboratories.

Contact: Dr. Andreas Adelmann Head a.i. LSM (andreas.adelmann.psi.ch, 42 33)