

### **Description for the general public**

Atmospheric aerosols constitute of solid and liquid particles suspended in air. They are an important factor shaping Earth's weather and climate while they also influence health and wellbeing of the human population. The presence of aerosols in the Planet's atmosphere results in a direct effect (absorption and scattering of electromagnetic radiation) and a number of indirect climate effects (impact on cloud evolution). While the former is relatively well understood, indirect effects are still a subject of ongoing studies in the light of anthropogenic global warming. A wide range of elements and chemical compounds can form aerosol particles characterized by different physical and chemical properties. A mixture of different aerosols is usually observed in the atmosphere and their properties often exhibits significant variability depending on aerosol composition and source of origin.

A number of techniques have been developed for measuring atmospheric aerosols. These may be divided into two main categories: *in situ* (direct) and remote. The former are usually performed at the ground level or near the surface (measurement masts) for sustainable measurements. Measurements in higher atmosphere, with the use of airborne instruments, usually constitute of individual passes (soundings) and cannot provide continuous data from different altitudes and are time limited. Remote techniques use electromagnetic radiation with wavelengths in the vicinity of aerosol sizes that means visible light to measure so called optical aerosol parameters. Depending on the light source these properties may be averaged over a column of air (sunphotometers, passive satellite detectors of solar light) or obtained with a laser light emitting LIDAR (Light Detection And Ranging) that provides vertical profiles of aerosol optical properties. LIDARs can vary significantly in their construction but most commonly used designs do not allow for measurements in the lowermost few hundred meters of the atmosphere. Consequently it is often impossible or impractical to obtain detailed information on aerosols in this important region.

In this project we propose a method for obtaining complete profiles of microphysical aerosol properties, especially in the lowermost layer of atmosphere that remains in direct interaction with the surface, where most of aerosol sources are located especially during winter smog events. The profiles will be calculated based on *in situ* measurements at ground level combined with retrievals based on optical measurements by means of LIDARs and sunphotometers. The missing near-surface parts of vertical profiles will be reconstructed analytically with the use of merging functions chosen based on the measured aerosol parameters as well as meteorological conditions. Our work will prove useful, among others, for atmospheric modeling especially in the scope of aerosol concentration and evolution near the surface. It can also allow for improvements in pollution forecasting that is strongly dependent on aerosol distribution in this region.