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Multi-instrumental approach for aerosol profiling in the lower troposphere, use of UAV-based instrumentation.

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This study presents a multi-instrumental approach to studying aerosol properties in the lower troposphere. It focuses on a combination of in-situ techniques with remote sensing measurements utilizing model-based study. Measurements taken at the suburban site of Raciborz in the highly industrialized region of Silesia will be used. We will apply ground-based in-situ measurements, retrieval of aerosol optical properties profile utilizing the synergy of collocated CIMEL Sun-photometer and Lufht's CHM-15k Nimbus ceilometer, and UAV (Unmanned Aerial Vehicle) based measurements in the lowermost part of the troposphere.

Aerosol size distribution will be measured by tandem Aerodynamic Particle Sizer and Scanning Mobility Particle Sizer spectrometers that will serve as the starting point of GRASP retrieval of aerosol microphysical and optical properties based on Aurora 4000 polar nephelometer measurements. These retrievals will be used to normalize UAV-based instruments that include OPC (Optical Particle Counter) and LED-based COBOLT instruments for aerosol backscatter measurements during the night. OPC instrument will provide a profile of Particulate Matter concentration (PM) at certain altitudes while COBOLT instrument will provide a profile that is proportional to the aerosol backscattering coefficient. Whilst typical COBOLT operation requires normalization in the upper troposphere or lower stratosphere where aerosol effects are neglected we will normalize it close to the ground by GRASP retrieval. Supplementary measurements of atmospheric pressure and temperature profiles will be used to determine Rayleigh scattering.

Obtained UAV-based profiles of aerosol properties will be calibrated to the in-situ ground measurements while also being compared and adjusted to the lowermost part of the aerosol profile obtained by the synergy of remote measurements (GRASP) thus providing means for estimating continuous profile of aerosol properties from the ground to the mid-troposphere.

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