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Obtaining properties of the planetary boundary layer aerosol in urban regions with an airborne multiangle radiometer

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The airborne sunphotometer system FUBISS-ASA2 for solar aureole- and direct- solar radiation measurements was extended by the zenith radiometer FUBISS-ZENITH, to enhance the possibilities of deriving aerosol properties from altitude resolved measurements.

FUBISS-ASA2 is an airborne sunphotometer with 256 spectral channels in the range from 300 to 1100 nm. It consists of a direct solar path and two paths for diffuse radiation measurements in the 4- and 6-degrees solar aureole regions. FUBISS-ZENITH is designed to measure the zenith radiance in the same spectral region.

An inversion technique to derive microphysical properties of the planetary boundary layer aerosol column was developed specifically for altitude profile flights in urban regions obtained with FUBISS-ASA2 and FUBISS-ZENITH.
The first data evaluation step are Mie-calculations with humidity dependant standard aerosol models. A comparison of the slope of the aerosol phasefunction in the forward scattering region derived from the aureole radiation measurements as well as the angström coefficient with the Mie-calculation results allows a first guess of the aerosoltype in the planetary boundary layer. In case of a typical continental or urban aerosol type which consists mainly of water soluble sulfates and nitrates as well as soot particles a further step of the inversion was performed. The optical thickness of the planetary boundary aerosol and the stratospheric background aerosol derived from the measurements with the direct solar path are then used as input data for zenith radiance simulations with the radiative transfer code MOMO. A lookup table for varying fractions of water soluble and soot particles in the planetary boundary layer is generated and can then be compared to the actual zenith radiance measurements.

As a first application, altitude profiles from the airborne campaign FUBEX-2008 in the Berlin region where processed and evaluated.