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Summary of research paper submitted* to Atmospheric Chemistry and Physics titled:

Optical and microphysical characterization of aerosol layers over South Africa by means of multi-wavelength polarization Raman lidar measurements

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Optical and microphysical properties of different aerosol types over South Africa were measured with a multi-wavelength polarization Raman lidar at Elandsfontein in the Highveld region of South Africa for one year. The observations were performed within the framework of the EUCAARI (European Integrated project on Aerosol, Cloud, Climate, and Air Quality Interactions) campaign of which the aim was to characterize particles in terms of physical, optical and chemical aerosol properties in order to reduce the uncertainty associated with aerosol with 50%. Since limited long-term data of this nature exists for this region, this study could significantly assist in bridging existing gaps relating to aerosol properties over South Africa.

A multi-wavelength PollyXT Raman lidar system was used to determine vertical profiles of aerosol optical properties, i.e. extinction and backscatter coefficients, Ångström exponents, lidar ratio and depolarization ratio. In addition, the mean microphysical aerosol properties, i.e. effective radius and single scattering albedo were retrieved with an advanced inversion algorithm. Thirty eight urban/industrial, biomass burning, and mixed biomass burning and desert dust aerosols atmospheric aerosol layers were studied. Raman lidar observations were combined with backward trajectory analysis, satellite fire observations and in situ data to identify sources of the elevated aerosol layers.

The results indicated clear differences between the intensive optical properties of biomass burning and urban/industrial aerosols in atmospheric layers. The measurements revealed a wide range of optical and microphysical parameters for biomass burning aerosols. The results indicates probable mixing of biomass burning aerosols in the area with desert dust particles, as well as the possible continuous influence of urban/industrial aerosol load in the region. The Lidar ratio at 355 nm, the linear particle depolarization ratio at 355 nm and the extinction-related Ångström exponent from 355 to 532 nm were 52 ± 7 sr; 0.9 ± 0.4 % and 2.3 ± 0.5, respectively for urban/industrial aerosols, while these values were 92 ± 10 sr; 3.2 ± 1.3 %; 2.0 ± 0.4, respectively for biomass burning aerosols layers. The study also indicated that biomass burning particles are larger and slightly less absorbing compared to urban/industrial aerosols. The particle effective radiuses were found to be 0.10 ± 0.03 μm, 0.17 ± 0.04 μm and 0.13 ± 0.03 μm for urban/industrial, biomass burning, and mixed biomass burning and desert dust aerosols, respectively, while the single scattering albedo at 532 nm were 0.87 ± 0.06, 0.90 ± 0.06, and 0.88 ± 0.07 (at 532 nm), respectively for these tree types of aerosols. The results for the analysed aerosol types in this study agreed very well with similar studies reported in literature.