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Optical properties of dry and humid aerosols at an elevated site in central Europe (Kleiner Feldberg 8.44 E, 50.22 N, 810 m asl)

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As part of the Feldberg Aerosol Characterization Experiment (FACE-2004), we performed optical, physical and chemical measurements of fine aerosols (<1 μm) at a mountaintop in central Europe. The campaign was conducted at Kleiner Feldberg in Germany from 17 July to 18 August 2004 with the intensive phase lasting from 19 July to 4 August. Measurements of light scattering (σ_{dry}) by aerosols at dry (545 nm), ambient (450, 550 and 700 nm) and humid (545 nm) conditions were conducted during the campaign. In addition, the light absorption coefficient (532 nm) was measured at ambient conditions. The chemical analysis of the aerosols was made using an Aerodyne Aerosol Mass Spectrometer (AMS). Measurements of aerosol mass concentration (PM 1.0), size distribution, number concentrations, and chemical composition are used to retrieve mass scattering and absorption efficiencies as well as to facilitate interpretation of the optical measurements.

The first case study indicates that most of the particles were below 400 nm in diameter with a number peak at about 80 nm. The mean mass scattering (550 nm) and absorption efficiency is 2.8 and 0.16 m^2 g^{-1}, respectively. The observed single scattering albedo, Ångström exponent (450-700 nm), back scatter ratio (550nm) and

$\Delta\sigma_{dry}/\Delta$CO (Mm^{-1} ppb^{-1}) of the ambient aerosol are 0.95, 2.26, 0.18 and 0.27, respectively. The relative increase in σ_{dry} with increase in RH (85 %) is about a factor of 1.8. Ammonium sulfate contributes almost half of the aerosol mass (PM1.0). Large hygroscopic growth in scattering coefficient is consistent with the presence of significant amount of water soluble inorganic (sulfate, nitrate, ammonium) mass. The factors controlling the optical properties of aerosols in different meteorological conditions and airmass sources will be presented.