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Optical properties of the vertical aerosol column (OPAC)

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The energy distribution and photochemical reactivity in the planetary boundary layer (PBL) is controlled by scattering and absorption of aerosol particulates of different sizes. In highly polluted air masses a significant fraction of the shortwave radiation is absorbed already in the upper part of the PBL and the radiation reaching the ground is strongly attenuated depending on the wavelength. Vertical distributions of radiation parameters calculated by models are in a better agreement with experimental data collected in the upper half of the PBL than in the lower half. Discrepancies between measurement and model in the lower elevations of the PBL were observed above the ocean surfaces (Hofzumahaus et al, 2002) as well above continental surfaces (Früh et al, 2000). Very low number of measurements in the bottom part of PBL are due to the fact, that airborne platforms need to operate lower than 500 m above the surface, sometimes even down to less than 20 m. Due to safety and air traffic regulations these kind of experiments are not always allowed and there are very few airborne platforms which are able to obtain complex radiation and aerosol physical properties with low speeds and altitudes above ground. The aim of this project was to characterize in detail the physical and optical properties of aerosols in the atmospheric PBL column and compare the data with the radiation transfer model. Two locations were selected - Achern in the Rhine valley and Haselbach in the Black forest (southeastern Germany) in order to measure different aerosol loads and solar zenith angles. Both of these locations are remote sensing sites with air distance of 25 km from each other. The campaign timing

was set into a period when a large Convective and Orographically-induced Precipitation Study (COPS) was in progress also in Rhine valley. Microlight research aircraft was used as an airborne platform. This aircraft belongs to the Institute of Meteorology and Climate Research in Garmish-Partenkirchen. This aircraft operates a push type four blade propeller and it uses a hang glider wing. This configuration enables the aircraft to perform flights with low speeds (down to 20 m/s). The aircraft was equipped with two side pods attached to the main console and front sensing probe. First pod contained instruments to measure aerosol size distribution, total number concentration. Second pod carried instruments for measuring ozone concentration, UV and VIS radiation, cameras for documentation and data acquisition. Turbulence, temperature and pressure were measured with the front sensing probe. Aerosol scattering coefficients at wavelengths 430 and 550 nm were measured at the bottom of the aircraft. Sensors for the measurement of photolysis rates (J1D and JNO2), global radiation and spectral albedo were attached to gyro-stabilising mechanism on top of the wing. Same set of photolysis sensors for measurement of the surface reflected radiation was mounted to the bottom of the console. The position was recorded by GPS. Precise altitude above ground was measured by laser beam reflection. During two operation periods 15-30 June and 21-25 July 2007 5 flights were performed from Baden Airport within the OPAC campaign. 20.6. (2 hours), 24.6. (2 hours), 25.6. (1 hour), 23.7. (2 hours) and 25.7. (1 hour). All flights were performed under cloudless or low cloud condition (up to 4/8) and high pressure weather situation. The profiles were measured as flat spirals with diameter around 500 m very close to the ground at each site (the aircraft operator managed to obtain a special permit to fly below safe altitude) up to about 500 m above the upper rim of the PBL. The height of the PBL varied from 1.2 to 2 km depending on the time of the day. Libradtran modeling software was used to calculate the transfer of radiation through the PBL for all profiles. Comparison with measured radiation is just being processed. All result will be presented during the poster session.

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