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Radiative budget in the presence of multi-layered aerosol structures in the frame of AMMA SOP-0

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This study is dedicated to shortwave calculations in the presence of multi-layered aerosol structures in the frame of AMMA SOP-0 in January-February 2006. Three datasets have been used to determine aerosol optical properties that are required as input parameters in a radiative transfer model. In situ measurements from the UK FAAM aircraft, remote sensing observations from an airborne lidar on an ultra-light aircraft (ULA) and AERONET datasets show the presence of an elevated biomass-burning layer between 1.5 to 5 km located over a dust layer around Niamey region (Niger). Vertical profiles of complex refractive indices, extinction coefficient, single-scattering albedo and asymmetry parameter have been retrieved. Airborne measurements have been compared to microphysical data obtained on the surface from ARM site (http://www.arm.gov/sites/amf/niamey/) at the Niamey international airport. The radiative fluxes calculated using TUV model have been compared to JNO2 actinometer-derived fluxes. Hence, downwelling and upwelling NO2 actinic flux measurements realized under clear-sky conditions at the surface level enabled to validate radiative computations. The best agreement is obtained with the observations of the lidar embarked on the ULA within 2%. Radiative calculations reveal the respective roles of the biomass burning and dust layers. Dust layer behaves similarly as an increase of the surface albedo, although it also slightly absorbs solar radiation (single scattering albedo ω_0 $\sim$0.91-0.97 at 355 nm), and that reflects a part of the radiative flux towards the elevated biomass burning layer, which is much more absorbing (ω_0 $\sim$0.80-0.85 at 355 nm). The sensibility of the results on the aerosol optical depth and on the complex refractive index of each layer has been also studied and will be discussed. This work

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