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Estimation of black carbon content for biomass burning aerosols from multi-channel Raman lidar data

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Biomass burning due to natural processes (forest fires) or anthropical activities (agriculture, thermal power stations, domestic heating) is an important source of aerosols with a high content of carbon components (black carbon and organic carbon). Multi-channel Raman lidars provide information on the spectral dependence of the backscatter and extinction coefficients, embedding information on the black carbon content. Aerosols with a high content of black carbon have large extinction coefficients and small backscatter coefficients (strong absorption), while aerosols with high content of organic carbon have large backscatter coefficients (weak absorption).
This paper presents a method based on radiative calculations to estimate the black carbon content of biomass burning aerosols from 3b+2a+1d lidar signals. Data is collected at Magurele, Romania, at the cross-road of air masses coming from Ukraine, Russia and Greece, where burning events are frequent during both cold and hot seasons. Aerosols are transported in the free troposphere, generally in the 2-4 km altitude range, and reaches the lidar location after 2-3 days.
Optical data are collected between 2011-2012 by a multi-channel Raman lidar and follows the quality assurance program of EARLINET. Radiative calculations are made with libRadTran, an open source radiative model developed by ESA. Validation of the retrievals is made by comparison to a co-located C-ToF Aerosol Mass Spectrometer.

Keywords: Lidar, aerosols, biomass burning, radiative model, black carbon

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