Optical and chemical characterization of biomass burning aerosols

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The aim of this study is to characterize biomass burning organic aerosols (BBOA) detected during the EMEP summer campaign (07 June - 18 July 2012) at Magurele site (44.35 N, 26.03 E) near Bucharest, Romania, using collocated instruments.

Chemical composition and size resolved distribution of submicronic non-refractory aerosols at ground level have been evaluated using a C-TOF aerosol mass spectrometer (AMS) model (Allan et al, 2003). The long range transported aerosols have been studied using a multiwavelength Raman lidar system, which perform vertical measurements in the frame of EARLINET (Pappalardo, G., 2010) since 2008. The lidar system provides backscatter coefficients (1064, 532, 355 nm), extinction coefficients (532, 355 nm) and linear particle depolarization ratio (532 nm) of aerosols between 0.8 and 10 km altitude (Radu et al, 2010).

The long range transported aerosols cases were confirmed by Hysplit- Hybrid Single Particle Lagrangian Integrated Trajectory Mode (Draxler et al, 2012) and MODIS (Moderate Resolution Imaging Spectroradiometer) global fire maps.

Even though the instruments usually measure different air samples, AMS at the ground level and Lidar the vertical profile, on particular meteorological conditions the lofted layers sensed by lidar could be also detected by AMS after downward mixing. We identified 16 cases of biomass burning aerosols at ground level during this campaign. On 11th of July 2012 both AMS and lidar systems sensed BBOA. The air masses traveled from the West of Europe, where high density of forest fires has been showed by MODIS fire map.

The time series of 355 nm wavelength range corrected signal from lidar measurements show a distinct smoke layer at 2.5 km (Figure 1), which is mixing within the planetary boundary layer during the night of 11 July 2012. The plume, descending from 2.5 to 1.5 km, is characterized by extinction related Angstrom exponents (355/532 nm) between 2.2 and 1.7 and lidar ratios between 35 and 55, typical for smoke (Muller D. et al, 2005).

According to AMS measurements on 11 July 2012, main species at ground level are organics, nitrate, sulfate, and ammonium as can be observed in Figure 2. The organics concentrations represent around 40% from the total mass of the submicronic aerosols (Figure 2). The wood combustion marker *f60* values (ratio of m/z 60 to total organics) indicate the presence of BBOA (Cubison et al., 2011) after 18:00 UT, approximately 36 hours old. The age of BBOA was estimated by both *f44* (ratio of m/z 44 to total organics) and *f60* values and by Hysplit back trajectories. The smoke marker decreases by a factor of 2 between 18:00 and 14:00 next day, while the f44 increases from 0.15 to values around 0.25.

Using the synergy of AMS, lidar data and model the presence and age of BBOA was confirmed.

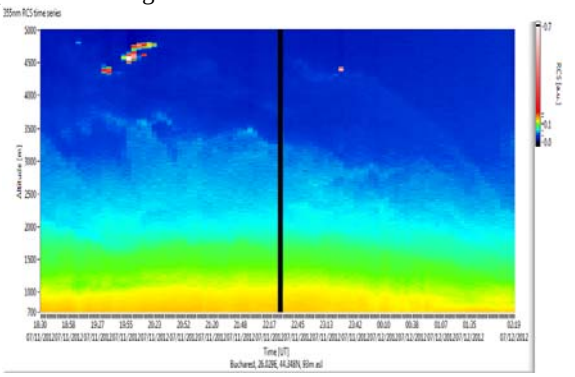

Figure 1. Vertical and temporal distribution of aerosol layers on 11th of July 2012 measured by the lidar

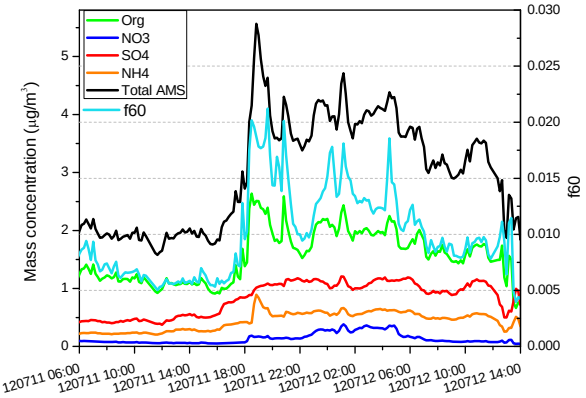

Figure 2. Time series of the mass concentrations of sulfate, nitrate, ammonium, organics and *f60* derived from AMS measurements on 11 of July 2012

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