Estimation of the aerosols sources in a high polluted metropolitan area

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The aerosol plays an important role in the EARTH's radiative forcing and air quality studies. The most important aerosol sources are related with human activity, volcanic emissions and wild fires.

Gas emission and particulate air pollutants result from the combustion associated to human activity (biomass or fossil fuel). The combustion aerosol contains two major chemical components black carbon (BC) that primarily absorbs solar radiation and organic carbon (OC) that mainly scatters solar radiation (IPPC, 2013).
In this study we estimate the possible regional or local sources that can influence the level of aerosol concentration at the ground.

To evaluate the sources we collected data during a summer campaign, simultaneously with AROMAT (Airborne ROmanian Measurements of Aerosols and Trace gases), an ESA preparatory Cal/Val campaign. The measurements took place between 25 August and 13 September 2014. In order to fully characterize the aerosols, in-situ (e.g AMS, lidar, aethalometer, gas analizers) and Lidar measurements were performed at INOE (Magurele- near Bucharest). Lidar measurements provided aerosol extinction profiles and the dynamics of the atmosphere within the planetary boundary layer and above. In-situ measurements were performed to quantify ground level gases (e.g. NO_2, SO_2 and CO), aerosol chemical composition and black carbon concentrations (BC). The identification of the main sources of the aerosols was based on ME-2 algorithm implemented in SO-FI as described by Canocaco et al. (2013), Lanz et al. (2008), Paatero (2014).

The dataset collected at Bucharest showed the presence of fine particles, characteristics for local influence as well as important concentrations of oxidised organic and inorganic species. The source apportionment analyses made for Aerosol Mass Spectrometer (AMS) data indicate the presence of primary organic aerosols (biomass burning organic aerosol as well hydrocarbon organic aerosols) and secondary oxidized aerosols (Cubison et al, 2011). A deconvolution of BC data from Aethalometer measurements was done, based on particular sensitivity of BC resulted from wood burning, in the UV domain (Petit et al, 2015). The main source of BC was fossil fuel ("BC fossil"), biomass burning ("BC wood"), these contributions being significant and greatly enhanced during specific episodes (fig1). AMS markers for anhydrosugar (e.g. levoglucosan) fragmentation are correlated with the BC wood time series.

The optical parameters derived from the lidar data showed the presence of several layers during 1st and 11th of September 2014. Hysplit back trajectory revealed air masses arriving above Magurele from Europe areas where MODIS underlined the presence of fires.

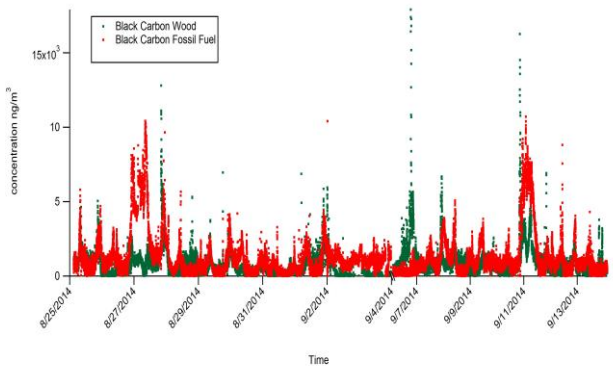

Figure 1. Black carbon time series deconvolved for wood and fossil fuel provenience

The study of chemical composition and aerosols in one of most important polluted area in Romania revealed different influences. Both the influence of local anthropogenic sources and long range transport aerosol was identified.

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