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Contribution of wood combustion in winter submicron ambient aerosols over Athens

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Given that a smog pollution problem, mostly attributed to wood burning in fireplaces and stoves, is currently emerging in the Athens metropolitan area, several monitoring instruments were deployed at the National Observatory of Athens facilities in the region of Thissio, downtown Athens . These included an Aerodyne Aerosol Chemical Speciation Monitor with 30 minute time resolution and a Particle Into Liquid Sampler coupled with Ion Chromatography with 15 minute time resolution. The campaign duration was from December 2013 to February 2014 and the aim was to investigate the chemical composition of ultrafine aerosols connected to biomass burning.. Many events of high particulate matter concentrations (exceeding the 50 μg/m3 daily limit) were observed during night-time, with maximum concentrations occurring when stagnant atmospheric conditions prevailed.
Potassium measured by the PILS – IC, and the m/z = 60 fragment measured by the ACSM, was initially used as a tracer of biomass burning events. A good correlation was determined for those two factors, allowing for safe conclusions concerning the identification of these aforementioned biomass burning events. For utmost certainty, Black Carbon measurements coming from three different instruments, was also used. As a second step, Positive Matrix Factorization analysis was performed, using the SoFi interface, which utilizes the generalized multilinear engine (ME-2) (Canonaco et Al., Atmos. Meas. Tech., 6, 3649–3661, 2013), for the source apportionment of the organic particulate matter, determined by the ACSM. This analysis revealed a very important Biomass Burning Organic Aerosol (BBOA) factor with a clear diurnal cycle, showing maxima in the time interval from 21:00 in the evening to 02:00 in the morning. A Hydrocarbon-like Organic Aerosol (HOA) factor is also present with a maximum during the same time interval, attributed to fossil fuel used in central heating systems, and a secondary maximum during the day, attributed to city traffic. Two more factors were determined, an Oxygenated Organic Aerosol (OOA) factor implying processing in the atmosphere and a minor Cooking Organic Aerosol (COA) factor.¬