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Long-term measurement of aerosol chemical composition in Athens, Greece.

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The collection of our samples was conducted for a period of five years (2008 – 2013) in Athens, Greece. The site is situated at the premises of the National Observatory of Athens on Penteli Hill, northeast Athens suburbs, and is considered an urban background station. The aim of our study was a first long-term estimation of the chemical mass closure of aerosol. For the purposes of the study, we applied three filter samplers during the sampling period: two Partisol FRM Model 2000 air samplers (one of them collecting PM_{10} and the other $PM_{2.5}$ fractions of aerosol) and one Dichotomous Partisol auto-sampler (with $PM_{2.5}$ and $PM_{2.5-10}$ inlet). Aerosols were collected on Whatman QM-A quartz fiber filters and the mass of the collected samples was estimated by weighing the pre-combusted filters before and after sampling, under controlled conditions, using a microbalance. All quartz filters were analysed for organic (OC) and elemental carbon (EC) by a thermal – optical transmission technique. The concentration of water soluble organic carbon (WSOC) was defined for each filter using a total organic carbon analyzer, while the content in main water soluble ions (Cl^-, Br^-, NO^{-3}, SO_4^{-2}, PO_4^{-3}, $C_2O_4^{-2}$, $NH4^+$, K^+, Na^+, Mg^{+2}, Ca^{+2}) was determined by ion chromatography. Additionally the filters were analyzed for trace metals by inductively coupled plasma optical emission spectrometry (ICP-OES). Aerosol chemical mass closure calculations were conducted for the $PM_{2.5}$ fraction. The area of Athens is characterized by aged aerosol that can originate from the marine boundary layer, the European mainland and occasionally from North African desert areas. The contribution of dust and particulate organic matter on PM levels was estimated taking into consideration the location of the sampling site, while identification and evaluation of sources was performed. Additionally, non-sea salt concentrations of the main ions were estimated to complete the chemical closure in the extended area. According to this first analysis of the aforementioned acquired data, the dominant components of fine particulate matter were carbonaceous aerosol, dust and sulfate anions. The average mass concentration of $PM_{2.5}$ was $20\mu g/m^3$ for the whole studied period while, about 23%, 20% and 15% of the total mass is due to POM, dust and $nssSO_4^{-2}$, respectively. As a result of the mass closure exercise the measured $PM_{2.5}$ fraction, collected in the studied site, was feasible to be reconstructed to a large extent.