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Year-long variability of polycyclic aromatic hydrocarbons (PAHs) and their contribution to winter intense pollution events in the urban environment of Athens, Greece

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Polycyclic aromatic hydrocarbons (PAHs) are organic pollutants with proven mutagenic and carcinogenic potential that originate from incomplete combustion, and partition to fine particulate matter. Nitro-PAHs & oxy-PAHs are oxidation products of PAHs with increased toxicity compared to their parent members and may reveal useful information about the aging and oxidation processes of PAHs.

In this study, we investigate the seasonal profiles of 31 PAHs and select oxidized forms such as nitro PAHs & quinones in Athens, Greece to understand their sources, levels, toxicity and impacts. PAHs levels were found to be significantly higher during winter, particularly during intense pollution episodes, compared to the other seasons. Chemical markers linked to biomass burning (BB) emissions are found to correlate well with the total amount of PAHs (ΣPAHs) during wintertime, strongly indicating that BB emissions are a significant source of PAHs. Positive Matrix Factorization (PMF) analysis showed that more than 50% of ΣPAHs originate from BB emissions and that a “factor” (composed of a specific mixture of PAHs) characterizes biomass burning emissions – and can potentially be used as a tracer. Analysis of the PMF series suggests that BB aerosol is much more carcinogenic than the effects of gasoline and diesel combustion combined. Finally, the exposure impact during winter is 9 times higher compared with the other seasons.

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