P315-WE

REGIONAL DISTRIBUTION AND SOURCE ALLOCATION OF ATMOSPHERIC PAH LOADS VIA PHENANTHRENES RATIOS

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Atmospheric PAH affect human health, due to respiratory uptake or uptake through the food chain. Therefore, airborne PAH loads and PAH deposition on crops surfaces have to be investigated in detail. The overwhelming part of atmospheric pollutants in the Cologne Conurbation (Germany) results from combustion processes related to traffic, lignite fueled power plants and industrial emissions. A passive biomonitoring approach chosen in the greater study involves analyses of PAH and other air pollutants (PM, trace metal loads and $\delta^{13}C$-/$\delta^{15}N$ isotopy) accumulated on vegetation, as these components due to low water solubility are excluded from root uptake (Lehndorff and Schwark, 2004, Urbat et al., 2004, Lehndorff et al., 2006). Passive sampling thus allows for the acquisition of a time-integrated and spatially well resolved dataset. The study is conducted in a densely populated and highly industrialised region of Germany based on airborne PAH accumulated in/on *Pinus nigra* needles. These needles are used as passive samplers due to the ubiquitous occurrence of *Pinus nigra* as ornamental tree in urbanized and rural areas. Needle ages of up to five years provide a time-integrated record of atmospheric pollution.

This presentation concentrates on loadings and ratios of phenanthrene (P) and its alkylated methyl- (MP), ethyl- and dimethyl-analogues (DMP) analysed on pine needles at 71 locations. The area covering 3000 km² is characterised by highly variable land use including forests, arable land, pastures, lignite open pit mining, industrial and residential areas. To adequately represent local air quality needles were taken from 3 trees at each location and first to third needle ages combined to a composite sample.

The regional distribution pattern of P shows a very pronounced maximum in the lignite mining region (Fig. 1), due to emissions of parent P from combustion in power plants. Intermediate phenanthrene concentrations are characteristic for the densely populated Rhine Valley with a bull´s eye pattern in P increase for Cologne City. The rural areas to the west and east of the study area show the lowest amounts of P in pine needles.

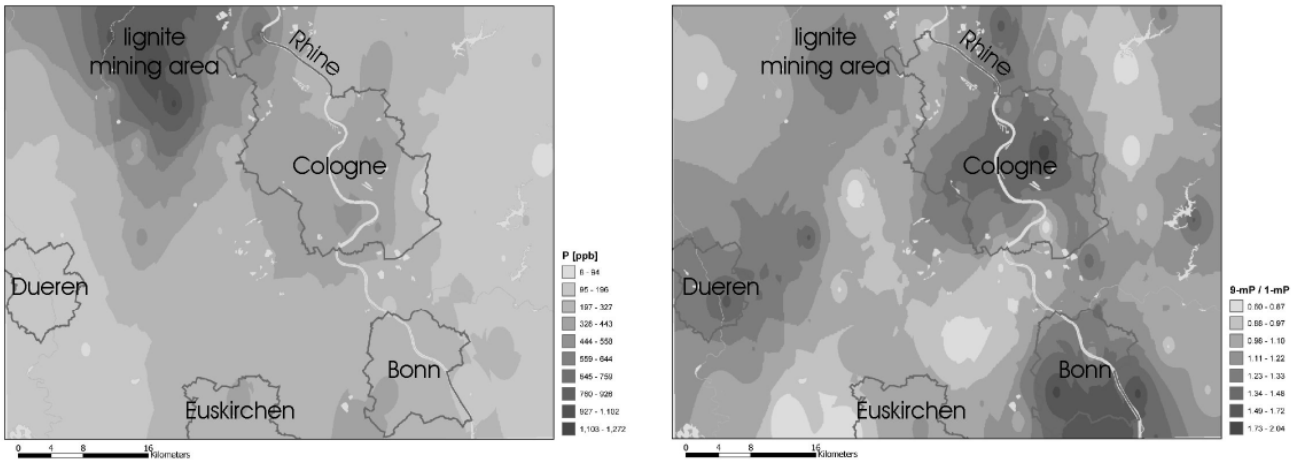

Figure 1. Distribution map of phenanthrene highlighting the lignite mining and combustion area and ratio of methylated phenanthrenes indicating incomplete combustion in high traffic regions.

The 9-/1-MP ratio depicts the Cities of Cologne, Bonn and Düren by elevated isomer ratios (Fig. 1). This is interpreted as a product of incomplete combustion of diesel fuel. The fact that the biological 9-MP isomer dominates in urban areas with highest traffic, industrial and household emissions is unexpected and demonstrates that behaviour of alkylated phenanthrenes in atmosphere and vegetation is far from being understood.

The study convincingly demonstrates that biomonitoring of PAH is a suitable and affordable means of investigating regional air quality.

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