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Polycyclic Aromatic Hydrocarbon and Polychlorinated Biphenyl Trends and Source Apportionment in Europe Using Back Trajectories

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Polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) are classes of organic substances with most of the individual substances being semivolatile and to some degree resisting degradation in the environment (persistent), hence, undergo long-range transport and reach pristine areas in high altitudes and latitudes. PCBs and even more so PAHs pose significant human health hazards in Europe (WHO, 2003).

PAHs are emitted especially in incomplete combustion processes in both the gaseous and particulate phases (sorbed to soot). PCBs have been banned from most uses, such that re-emission and volatilization from old urban and industrial materials are prevailing atmospheric sources. As a consequence of fuel, combustion technology and legislative changes sources are changing in strength, substance pattern, and geographic distribution.

Monitoring data in air at a central European continental background station, Košetice, Czech Republic, of 1997-2007 (Holoubek et al., 2007) were used in combination with back-trajectories to localize sources of selected PAHs and PCBs in central, western, eastern and southeastern Europe. The trajectory scheme uses the isentropic coordinate with some diabatic components and a special boundary layer modelling (Reimer & Scherer, 1992). Areal contact matrices over Europe are obtained by integration in time of the contacts of the backward trajectories with the ground (1x1 km^2 grid) and weighting by the observed concentrations (or fictive concentrations of factors). Positive matrix factorization (Paatero, 1997) was used to infer the substance patterns of the sources (so-called factors) which most significantly contributed to PAH levels at Košetice and a second site, Leipzig, Germany.

The interpretation of the results is based on matrices of transport to up to three receptor sites in central Europe. Potential source distributions are presented and discussed. The analysis of air pollution in Košetice in the periods 1997-99 and 2004-06 suggests that PCB sources have been decreasing quite uniformly across central and western Europe. There is no significant long-term trend of PAHs.

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