MODELLING OF POLYCYCLIC AROMATIC HYDROCARBONS FROM SELECTED POINT AND AIR SOURCES IN CENTRAL EUROPE

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Motivation
Mean annual concentrations of benzo[a]pyrene (B(a)P) frequently exceed the target value 1 ng m⁻³ at air quality measurement stations across Europe. Air quality modelling can bring additional information such as the spatial distribution and the main sources of B(a)P, regional transport and processes, which influence its atmospheric levels. This study focuses on the concentrations of B(a)P on the regional and local scales and their linkage with existing monitoring networks.

Introduction
Atmospheric levels of polycyclic aromatic hydrocarbons (PAH) were established in the local and regional scales with a combination of modelling approaches and tools. The spatial distribution of benzo[a]pyrene (B(a)P) was modelled for a domain covering Europe using a modified version of the Community Multi-scale Air Quality (CMAQ) modelling system linked with the Weather Research and Forecast (WRF) model. In addition, the Lagrangian model CALPUFF was used to study the impact of point and area sources for B(a)P levels on the local scale.

Measurement Networks
Figure 1 shows the measurement stations with the sources of benz[a]pyrene (ng m⁻³) at EMEP stations in 2006 and 2008. This figure illustrates the concentrations of B(a)P in Europe. Regional levels of B(a)P were measured at EMEP stations in Slovakia for the year 2006 and 2010. The emission data set was developed further by the US EPA. It is the official emission model of the Lagrangian puff model CALPUFF (Scire et al. 2000) was used for the local study, focused on the comparison of emission sources in Slovakia. The primary aim was the source apportionment of PM₁₀. The domain of the size 13.5 x 22 km, with metallurgy and coke production (large industrial point source) and several areas of domestic heating was selected for modelling of B(a)P. The spatial resolution of the domain was 500 m x 500 m. The simulation of PM₁₀ for the year 2008 was run for each source type separately. No sink of B(a)P was included (dry and wet deposition switched off, no chemical degradation). An estimate of the annual mean concentration of B(a)P for each source type was obtained from the annual mean concentration of PM₁₀ scaled by the ratio of the emission factors, f_B(a)P/PM₁₀. Emission factors used for the reporting to the Convention on Long-Range Transboundary Air Pollution (CLRTAP) were used (SRIIR 2010). In domestic heating, only wood combustion was taken into account, as the amount of coal used for residential heating is negligible.

Results and discussion
A regional-scale simulation was run for selected days of January 2006. B(a)P concentration was obtained in coherence with the method used for the local study - from the primary carbonaceous pollutants scaled by the ratio of the emission factors. An estimate of the annual mean concentrations of B(a)P, from large point source (metallurgy, on the left) and non-attainment areas (on the right).

Detailed information on the simulation setup, input data acquisition and processing is presented in a companion paper (→HARMO 2013 poster No. H15-S0; Krajcovičová et al. 2013)

References

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