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Global atmospheric emissions and transport of polycyclic aromatic hydrocarbons: Evaluation of modeling and transboundary pollution

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ABSTRACT Global atmospheric emissions of 16 polycyclic aromatic hydrocarbons (PAHs) from 69 major sources were estimated for a period from 1960 to 2030. Regression models and a technology split method were used to estimated country and time specific emission factors, resulting in a new estimate of PAH emission factor variation among different countries and over time. PAH emissions in 2007 were spatially resolved to $0.1^{\circ} \times 0.1^{\circ}$ grids based on a newly developed global high-resolution fuel combustion inventory (PKU-FUEL-2007). MOZART-4 (The Model for Ozone and Related Chemical Tracers, version 4) was applied to simulate the global tropospheric transport of Benzo(a)pyrene, one of the high molecular weight carcinogenic PAHs, at a horizontal resolution of 1.875° (longitude) $\times$ 1.8947° (latitude). The reaction with OH radical, gas/particle partitioning, wet deposition, dry deposition, and dynamic soil/ocean-air exchange of PAHs were considered. The simulation was validated by observations at both background and non-background sites, including Alert site in Canadian High Arctic, EMEP sites in Europe, and other 254 urban/rural sites reported from literatures. Key factors effecting long-range transport of BaP were addressed, and transboundary pollution was discussed.