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Polycyclic aromatic hydrocarbons – fate and long-range atmospheric transport studied using a global model, EMAC-SVOC

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Polycyclic aromatic hydrocarbons (PAHs) are emitted by incomplete combustion from fossil fuel, vehicles, and biomass burning. They may persist in environmental compartments, pose a health hazard and may bio accumulate along food chains. The ECHAM/MESSy Atmospheric Chemistry (EMAC) model had been used to simulate global tropospheric, stratospheric chemistry and climate. In this study, we improve the model to include simulations of the transport and fate of semi-volatile organic compounds (SVOC). The EMAC-SVOC model takes into account essential environmental processes including gas-particle partitioning, dry and wet deposition, chemical and bio-degradation, and volatilization from sea surface, soils, vegetation, and snow. The model was evaluated against observational data in the Arctic, mid-latitudes, and tropics, and further applied to study total environmental lifetime and long-range transport potential (LRTP) of PAHs. We selected four compounds for study, spanning a wide range of volatility, i.e. phenanthrene, fluoranthene, pyrene, and benzo[a]pyrene. Several LRTP indicators were investigated, including the Arctic contamination potential, meridional spreading, and zonal and meridional fluxes to remote regions.