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Urban emission hot-spots as sources for remote aerosol deposition

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Large point sources such as major population centers (MPCs) emit pollutants which can be deposited nearby or transported over long distances before deposition. We have used tracer simulations of aerosols emitted from MPCs worldwide to assess the fractions which are deposited at various distances away from their source location. Considering only source location, prevailing meteorology, and the aerosol size and solubility, we show that fine aerosol particles have a high potential to pollute remote regions. About half of the emitted mass of aerosol tracers with an ambient diameter $\leq$ $1.0\,\mu$m is typically deposited in regions more than 1000 km away from the source. Furthermore, using the Köppen-Geiger climate classification to categorize the sources into various climate classes we find substantial differences in the deposition potential between these classes. Tracers originating in arid regions show the largest remote deposition potentials, with values more than doubled compared to the smallest potentials from tracers in tropical regions. Seasonal changes in atmospheric conditions lead to variations in the remote deposition potentials. On average the remote deposition potentials in summer correspond to about $70 - 80\,\%$ of the values in winter, with a large spread among the climate classes. For tracers from tropical regions the summer remote deposition values are only about $31\,\%$ of the winter values, while they are about $95\,\%$ for tracers from arid regions.