# Evolution of Vehicle Exhaust-Related Particulate Matter over a Multi-Decadal Time Period

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Emission control policies and techologies in the USA have been successful at reducing tailpipe emissions of gaseous pollutants from gasoline-powered motor vehicles. Similar policies for controlling diesel exhaust emissions have, until recently, focused on primary particulate matter emisions and have progressed more slowly. In this study, a new on-road motor vehicle emission inventory for carbon dioxide ($CO_2$) emissions, at 1-km spatial resolution, is used as the basis for mapping emissions of other pollutants such as black carbon (BC) and primary organic aerosol (OA). Emissions are mapped for U.S. urban areas, separately for gasoline and diesel-powered vehicles, in order to reflect differences in emission profiles and spatial and temporal distributions of emissions for these two engine types. High-resolution $CO_2$ emission maps are combined with gas and particle-phase emission factors derived from on-road measurement studies conducted in highway tunnels. To assess how emissions have evolved in space and time, emissions are mapped for the Los Angeles area in 1990, 2000, and 2010. Emission changes are compared with concentration trends measured in ambient air. We conclude that ambient reductions in BC are larger, and ambient OA reductions smaller, than can be explained by changes in emissions of BC from diesel and VOC from gasoline engines, respectively, over a twenty-year time period. At finer time scales, ambient BC concentrations in urban areas exhibit a clear midday peak, indicating a strong link to diesel engine emissions which peak at the same time of day. We also compared our maps of pollutant emissions to estimates of road transport emissions from the EDGAR model at 0.1 × 0.1 degree (~10 km) resolution. EDGAR tends to overestimate road transport emissions in cities, and understates emissions from highway vehicles in rural areas.