2.027 Contributions of condensable particulate matter to atmospheric organic aerosol over Japan.

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Abstract:

In Japan, emission factors of particulate matters (PM) from stationary combustion sources have been measured without dilution or cooling, thus condensable PM were not included in the PM emission inventory. Recently, contributions of condensable PM were analyzed by comparing measured PM concentrations from stationary combustion sources before and after dilution. From these data, we modified emission inventory to include condensable PM from stationary combustion sources. Emission rates of organic aerosol (OA) increased by a factor of seven over Japan by considering condensable PM. Emissions of OA of this estimate became even higher than the total $PM_{2.5}$ emissions of the previous estimate. In addition, road transport and biomass burning were the dominant OA sources in the previous estimate (filterable PM), while stationary combustion sources in industrial or power generation sector became the largest contributors to OA emissions over Japan in the revised estimate (filterable plus condensable PM). These results indicate that condensable PM from large combustion sources had critical contributions to total $PM_{2.5}$ emissions. Contributions of condensable PM from combustion sources were also evaluated from simulations of a chemical transport model with a volatility basis set (VBS) module in winter, spring, and summer of 2012. Simulated OA concentrations drastically increased around urban and industrial areas, including the Kanto region, in all the seasons. On average, OA concentrations increased by a factor of 3.7, 2.5, and 6.1 in winter, spring, and summer, respectively, in the Kanto region. By considering condensable PM from stationary combustion sources, model performance of OA was improved in winter. However, in summer, OA concentrations were generally overestimated by considering condensable PM. Contributions of primary and secondary OA should be further evaluated from comparison with measurement data of organic tracers.