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Sensitivity analyses of OH missing sinks over Tokyo metropolitan area in the summer of 2007

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Abstract. OH reactivity is one of key indicators which reflect impacts of photochemical reactions in the atmosphere. An observation campaign has been conducted in the summer of 2007 at the heart of Tokyo metropolitan area to measure OH reactivity. The total OH reactivity measured directly by the laser-induced pump and probe technique was higher than the sum of the OH reactivity calculated from concentrations and reaction rate coefficients of individual species measured in this campaign. And then, three-dimensional air quality simulation has been conducted to evaluate the simulation performance on the total OH reactivity including "missing sinks", which correspond to the difference between the measured and calculated total OH reactivity. The simulated OH reactivity is significantly underestimated because the OH reactivity of volatile organic compounds (VOCs) and missing sinks are underestimated. When scaling factors are applied to input emissions and boundary concentrations, a good agreement is observed between the simulated and measured concentrations of VOCs. However, the simulated OH reactivity of missing sinks is still underestimated. Therefore, impacts of unidentified missing sinks are investigated through sensitivity analyses. In the cases that unknown secondary products are assumed to account for unidentified missing sinks, they tend to suppress formation of secondary aerosol components and enhance formation of ozone. In the cases that unidentified primary emitted species are assumed to account for unidentified missing sinks, a variety of impacts may be observed, which could serve as precursors of secondary organic aerosols (SOA) and significantly increase SOA formation. Missing sinks are considered to play an important role in the atmosphere over Tokyo metropolitan area.

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