1.047 Investigation of Secondary Organic Aerosol (SOA) formation pathways in Beijing using an observation-based SOA model.

Early Career Scientist

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Abstract:

SOA has been underestimated over China by current modeling studies to a larger degree than over Europe and the USA. In this study, we investigated SOA formation pathways in urban Beijing using a box model constrained by observations. Our model considers the multi-generation oxidation process of volatile organic compounds (VOCs) and intermediate VOC (IVOCs), and the chemical aging of semi-volatile primary organic aerosol (POA). Our results showed that the SOA formation rate reached 30.3 $\mu g\ m^{-3}\ day^{-1}$ in Beijing over the investigated two-day period. SOA produced from VOCs, IVOCs and POA contributed 14%, 82% and 4%, respectively. Contribution from IVOCs was similar to the magnitude of previous model underestimation which has been conducted. Considering the uncertainties in the emission rates and the POA volatile distribution factors, SOA yield in Beijing was 80.0 $\mu g\ m^{-3}$ with a range of 60.0–102.6 $\mu g\ m^{-3}$. We found that the oxidation of IVOCs contributed to the majority of SOA production in Beijing during the study period, which was not considered in previous simulations in China, and which likely improves the three-dimensional model SOA predictions in China. The SOA formed by IVOCs remains a large source of uncertainty, and the lack of observations in China make it difficult to choose the correct modeling parameters. The emission sources and reaction rates of IVOCs are needed for further identification and quantification purposes.