Explicit Simulation of Formation and Chemical Composition of the Secondary Organic Aerosol from Monoterpene Oxidation

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Abstract

Biogenic secondary organic aerosol, particularly contributed by monoterpene oxidation, have a significant impact on clouds and global climate. The impact depends on the concentration and the cloud condensation nuclei (CCN) activity of SOA. CCN activity of SOA is determined by its particle size and chemical composition. Despite a number of chamber studies on SOA formation and its CCN activity, few studies have simulated particle size and chemical composition of secondary organic aerosol (SOA) using explicit chemical mechanism. In this study, we used the box model PyCHAM to explicitly simulate the mass concentration, chemical composition (including organic nitrate (ON)), and particle size of SOA formed by oxidation in α-pinene and limonene under different conditions (high or low NO_x) in an atmospheric reaction chamber. We compared their mass concentration, chemical composition, and particle size with the measured values. We highlight the importance of highly oxygenated organic molecules and particle-phase reactions in SOA formation and shaping its chemical composition. This study elucidates the key processes in affect SOA concentration and chemical composition, which help improve the chemical mechanism of SOA formation and thus simulation of SOA concentration and its chemical composition, and its impact on climate.

Early Career Scientist

YES, I am an early career scientist.