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Organic nitrate and secondary organic aerosol yield from NO_3 oxidation of β-pinene evaluated using a gas-phase kinetics/aerosol partitioning model

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Abstract. The yields of organic nitrates and of secondary organic aerosol (SOA) particle formation were measured for the reaction NO_3+β-pinene under dry and humid conditions in the atmosphere simulation chamber SAPHIR at Research Center Jülich. These experiments were conducted at low concentrations of NO_3 (NO_3+N_2O_5<10 ppb) and β-pinene (peak~15 ppb), with no seed aerosol. SOA formation was observed to be prompt and substantial (~50% mass yield under both dry conditions and at 60% RH), and highly correlated with organic nitrate formation. The observed gas/aerosol partitioning of organic nitrates can be simulated using an absorptive partitioning model to derive an estimated vapor pressure of the condensing nitrate species of p_{vap}~5×10^{-6} Torr (6.67×10^{-4} Pa), which constrains speculation about the oxidation mechanism and chemical identity of the organic nitrate. Once formed the SOA in this system continues to evolve, resulting in measurable aerosol volume decrease with time. The observations of high aerosol yield from NO_x-dependent oxidation of monoterpenes provide an example of a significant *anthropogenic* source of SOA from *biogenic* hydrocarbon precursors. Estimates of the NO_3+β-pinene SOA source strength for California and the globe indicate that NO_3 reactions with monoterpenes are likely an important source (0.5–8% of the global total) of organic aerosol on regional and global scales.

Final Revised Paper (PDF, 2111 KB) Discussion Paper (ACPD)

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