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Secondary organic aerosol production from modern diesel engine emissions

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Abstract. Secondary organic aerosol (SOA) production was observed at significant levels in a series of modern diesel exhaust (DE) aging experiments conducted at the European Outdoor Photoreactor/Simulation Chamber (EUPHORE). The greatest production occurred in DE with toluene addition experiments (>40%), followed by DE with HCHO (for OH radical generation) experiments. A small amount of SOA (3%) was observed for DE in dark with N₂O₅ (for NO₃ radical production) experiments. The analysis for a limited number (54) of polar organic compounds (POC) was conducted to assess the composition of modern DE and the formation of photochemical transformation products. Distinct POC formation in light versus dark experiments suggests the role of OH initiated reactions in these chamber atmospheres. A trend of increasing concentrations of dicarboxylic acids in light versus dark experiments was observed when evaluated on a compound group basis. The four toluene addition experiments in this study were performed at different [tol]_o/[NO_x]_o ratios and displayed an average SOA %yield (in relation to toluene) of 5.3±1.6%, which is compared to past chamber studies that evaluated the impact of [tol]_o/[NO_x]_o on SOA production in more simplified mixtures.

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