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Atmospheric chamber measurements of H2SO4: characterization of formation and loss rates during the ozonolysis and aerosol formation studies

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Sulphuric acid, H_2SO_4, has been identified to play major role in atmospheric new particle formation and in subsequent particle growth. The oxidation of sulfur dioxide (SO_2) to sulfur trioxide (SO_3) initiated by the reaction with the hydroxyl radicals (OH) is assumed to be the dominant formation pathway of sulfuric acid (H_2SO_4) in the troposphere. It has been suggested in the recent years that the reactions of Criegee Intermediates (CIs) with SO_2 may also contribute to the H_2SO_4 formation, although the significance of this pathway compared to the reaction of OH with SO_2 is still under discussion. As the ozonolysis of anthropogenic and biogenic terpenes emitted into the atmosphere may represent an important source of OH and CIs a better understanding of the ozonolysis mechanism in relation to the H_2SO_4 formation is required.

In this study, we present the results obtained during the investigation of the ozonolysis of several unsaturated volatile organic compounds, including tetramethylethylene, α-pinene and limonene, using a newly constructed large atmospheric simulation chamber, HELIOS (ICARE-CNRS, Orléans, France). The HELIOS facility consists of a large outdoor simulation chamber (volume of 90 m^3) equipped with a wide range of in-situ on-line and off-line analytical instrumentation (FTIR, PTR-TOF-MS, GC-MS, CIMS (OH and H_2SO_4), SMPS, Figaero-API-TOF-CIMS, HCHO monitor and others). The results of kinetic and mechanistic studies of the reactions of different CIs with SO_2 induced by the ozonolysis of the studied VOCs under different conditions will be presented. The H_2SO_4 loss on the Teflon chamber wall and by the aerosol uptake were characterized using direct H_2SO_4 and particle measurements.

Keywords: ozonolysis, Criegee Intermediate, sulfur dioxide, sulfuric acid, HELIOS