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Further Investigation of Ethylene (C₂H₄) as Amplification Agent with PerCA Method

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Abstract

Peroxy radicals (HO₂ and RO₂) are one of the most important key intermediates in most of the oxidation reactions taking place in the troposphere. They are produced by photolysis and oxidation of atmospheric volatile organic compounds (VOCs). Together with hydroxyl radicals (OH), they play a key role in most atmospheric oxidation mechanisms. The TROLAS group (Tropospheric Radical Observations and Laser Absorption Spectroscopy) at the Institute of Environmental Physics of the University Bremen (IUP-UB) has dedicated years for the measurement of peroxy radicals with peroxy radical chemical amplification (PerCA) technology. An indirect method called peroxy radical chemical amplification (PerCA) was used with CO as amplifying agent for the measurement of total peroxy radicals. In the OMO (Oxidation Mechanisms Observations) airborne measurement campaign in Europe, where the IUP instrument PerCEAS (Peroxy Radical Chemical Enhancement and Absorption Spectroscopy) was deployed, CO was unable to get on board certification on time and therefore C₂H₄ was used. Previous result at ambient pressure conditions showed an interference of C₂H₄ reaction with O₃ coming from the radical calibration source. Further investigation regarding to the C₂H₄ interference then proceed with higher NO mixing ratios and under the airborne measurement conditions added to the find out the systems performance with latest. The results showed as long as a trace of C₂H₄ exists at the source the competition of O₃ between NO and C₂H₄ is happened with NO maximum at 60ppmv. Further investigation with generation of higher, ozone concentrations, in the source will be needed to acquire more understanding and simulate the real conditions in the atmosphere using C₂H₄ as amplification agent.