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Comparison of ROx radicals measurements in the atmospheric simulation chamber SAPHIR

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Accurate measurements of organic peroxy radicals (RO□) are critical to understanding the formation of secondary pollutants, as the loss rate of RO_2 radicals determines the rate and fraction of ozone (O_3) and particulate matter formed. Due to their large structural variability and low concentrations in the troposphere, the measurement of RO_2 radicals in ambient air is challenging, with most techniques relying on conversion to other species before detection.

In the summer of 2022, a series of experiments covering a wide range of chemical conditions were carried out in the SAPHIR atmospheric simulation chamber at Forschungszentrum Jülich. The experiments focused on the oxidation of biogenic and anthropogenic precursors at current and future nitrogen oxides levels (from a few ppb to a few ppt of nitric oxide), using different oxidants such as hydroxyl radical (OH), O_3, and nitrate radicals (NO_3), covering daytime and nighttime conditions. One experiment was conducted by flushing the chamber with ambient air. Three different techniques were compared: PEroxy Radical Chemical Amplification (PERCA, three research groups), Laser Induced Fluorescence (LIF, three research groups) and Chemical Ionization Mass Spectrometry (CIMS, one research group).

Overall, good agreement (within the stated accuracy of each instrument) was found for most of the conditions investigated, with deviations observed for one PERCA instruments for high temperatures and acyl peroxyl nitrates (APNs) concentrations. The results highlight the strengths and limitations of each measurement method in terms of sensitivity, accuracy, temporal resolution

and potential interferences from other species.

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