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Technical Note: Performance of Chemical Ionization Reaction Time-of-Flight Mass Spectrometry (CIR-TOF-MS) for the measurement of atmospherically significant oxygenated volatile organic compounds

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Abstract. The performance of a new chemical ionization reaction time-of-flight mass spectrometer (CIR-TOF-MS) utilising the environment chamber SAPHIR (Simulation of Atmospheric Photochemistry In a large Reaction Chamber- Forschungszentrum Jülich, Germany) is described. The work took place as part of the ACCENT (Atmospheric Composition and Change the European NeTwork for excellence) supported oxygenated volatile organic compound (OVOC) measurement intercomparison during January 2005. The experiment entailed the measurement of 14 different atmospherically significant OVOCs at various mixing ratios in the approximate range 10.0–0.6 ppbV. The CIR-TOF-MS operated throughout the exercise with the hydronium ion (H₃O⁺) as the primary chemical ionization (CI) reagent in order to facilitate proton transfer to the analyte OVOCs. The results presented show that the CIR time-of-flight mass spectrometer is capable of detecting a wide range of atmospheric OVOCs at mixing ratios of around 10 ppbV in "real-time" (i.e. detection on the one-minute time scale), with sub-ppbV measurement also achieved following an increase in averaging time to tens of minutes. It is shown that in general OVOC measurement is made with high accuracy and precision, with integration time, mixing ratio and compound dependent values as good as 4–13% and 3–15% respectively. It is demonstrated that CIR-TOF-MS has rapid multi-channel response at the required sensitivity, accuracy and precision for atmospheric OVOC measurement.

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