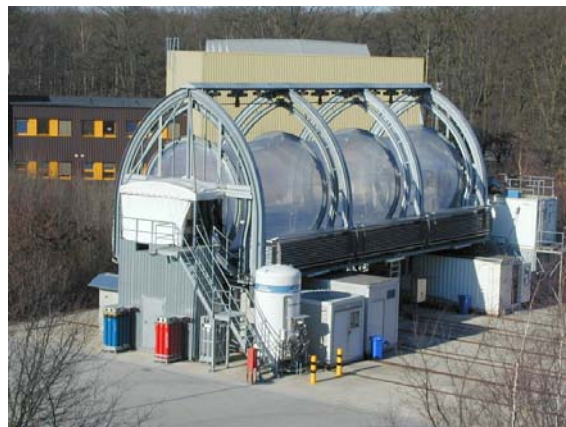


Intercomparison of NO₃ and N₂O₅ Instruments at SAPHIR

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The atmosphere simulation chamber SAPHIR on the campus of FZJ in Jülich is an unique platform for instrument intercomparisons under well defined conditions. This has been demonstrated in two international intercomparison campaigns investigating OH/HO₂ instruments and measurement techniques for oxygenated volatile organic compounds (OVOC) in 2005 (see <http://www.fz-juelich.de/icg/icg-ii/accent>).



We propose a new instrument intercomparison for NO₃ radicals and N₂O₅ molecules which both are of greatest importance for the nocturnal atmospheric chemistry and the loss of NO_x from the atmosphere.

In the atmosphere NO₃ is exclusively formed by the reaction of NO₂ with O₃. NO₃ is strongly photolyzed during the day, therefore significant concentrations are normally only detected at night. N₂O₅ is the product of the reversible reaction of NO₃ with NO₂. It is relatively unstable at elevated temperatures. Therefore NO₂, NO₃, and N₂O₅ establish a strongly temperature dependent equilibrium. NO₃ can react with a variety of hydrocarbons and aldehydes. N₂O₅ was found to react quickly on wet surfaces to form HNO₃ in the condensed phase constituting an important atmospheric loss reaction of oxidized nitrogen compounds.

In the past the only technique feasible for field detection of NO₃ radicals was Differential Optical Absorption Spectroscopy (DOAS). Some measurements are known using matrix isolation combined with electron spin resonance. Since some years other techniques like Cavity Ring Down Spectroscopy (CRDS) and Laser Induced Fluorescence (LIF) emerged which can measure NO₃ and N₂O₅ (after being converted into NO₃ by thermolysis). However, LIF and CRDS need in-field calibration of the instruments since NO₃ is drawn into the detection instrument, in contrast to DOAS where NO₃ is detected in situ. The calibration, however, has proven to be difficult and a possible source of error. DOAS is inherently calibrated by the use of well documented absorption cross sections.

The setup of this study will bring all techniques for simultaneous measurements to the SAPHIR chamber which is large enough to host all instruments. Simulation chamber experiments will be conducted under well controlled chemical atmospheric conditions in SAPHIR. Critical parameters like the dependence of NO₃ on water vapor and on NO₂ will be investigated in a series of first chamber studies. These will be followed by measurements of NO₃/N₂O₅ in realistic chemical systems as they have been observed in field experiments.

We also invite other groups within or outside of EUROCHAMP or ACCENT to participate in this activity. We are especially interested in a support of the field of gas phase HNO₃

and PAN measurements which would help to interpret the chemical systems by closing the NO_x budgets.

A workshop is planned for fall 2006 where all groups will get together discussing the experimental requirements, the necessary modifications of the SAPHIR chamber and the experiments to be conducted. In the further course the chamber will be modified in order to adapt the instruments. This will last up to 3 months. The intercomparison campaign is planned for April/May 2007 (to be confirmed during the first workshop). A data workshop is foreseen for late summer 2007.