Atmos. Meas. Tech. Discuss., 6, C137–C140, 2013
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Atmospheric
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Discussions

Interactive comment on "Intercomparison of NO_3 radical detection instruments in the atmosphere simulation chamber SAPHIR" *by* H.-P. Dorn et al.

Anonymous Referee #2

Received and published: 28 February 2013

General comments: This paper describes the comparison results of NO3 radical measurements made by seven absorption-based instruments at the SAPHIR chamber during the informal NO3comp campaign in 2007. A range of experiments from simple to complex reaction mixtures were performed, where NO3 was generated at mixing ratios roughly 1-10 times higher than the typical ambient level. Basically strong correlations were found for all instruments with a selected reference instrument. The linear regression analysis yielded negligible intercepts, and slopes close to unity, within accuracies of instruments. The presence of aerosol particles perturbed good agreement to some degree for several instruments, suggesting that NO3 loss on the walls or filters affected the results in a time-dependent manner. Standardization of the state-of-the-art instruments provides a firm basis of a synthesis across findings from individual field campaigns performed at different time and place using different instruments. The in-

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Interactive Discussion

Discussion Paper

tercomparison experiments are well-designed, and reliable methodologies are used to interpret the obtained results, demonstrating the high performance of the participating NO3 instruments. Important recommendations are made regarding the usage of filters to minimize the influence from ambient aerosols. Because of the large number of participating instruments, readers need to refer to section 2.1 frequently to pick up information of instrumental properties (e.g., with or without filters, transmission efficiency, inherent consideration of aerosols using broadband spectral features, and method to determine zero level and its frequency, etc). I would recommend adding several rows in Table 2 to summarize these features. Overall I recommend publication after minor revisions responding to the specific points listed below.

Specific comments:

1. Abstract, page 305, line 22. Does +/-5.3 pptv represent 1-sigma range?

2. Abstract, page 306, line 3. Important NO3 loss likely occurred on filters, in addition to cell walls.

3. page 309, line 16. The meaning of "calibration" is not very clear here. How many instruments are calibrated by generating known concentrations of NO3 during the campaign? Does the calibration mean determination of transmission efficiency through filters and inlets, on a relative basis, and/or path lengths in some cases?

4. page 309, line 21. Probably five of seven, not five of nine

5. page 314, lines 1-3. How constant was the decay rate of -0.4% h-1 for different experiments with different aerosol loadings? At which condition was it determined? Trends in Figures 11 and 12 for UAF-CRDS indicate that the decay rate changed with aerosol loadings for these experiments?

6. page 315, line 1. Delete "emitting"

7. page 315, lines 24 and 25. What is the meaning of the factors exceeding unity? Were they unchanged with time? In figure 12, there is almost no trend with aerosol

loadings for MPI-CRDS. Does this indicate that the transmittance was almost constant at least for this experiment?

8. page 316, line 21. What are the four tubes for?

9. page 319, line 20. is measured and spectrally resolved

10. page 327, line 28. What is the typical size distribution of the generated ammonium sulfate particles?

11. page 331-332. NO3 mixing ratios observed by UCC-IBBCEAS are always larger than others on 10, 11, 13, and 20 June. What is the possible explanation for this? Does the zero level always drift in the same direction?

12. page 332, line 1. Which kind of "drift" did the lamp have?

13. pages 333-336. For each experiment, which reaction controls loss of NO3 in the chamber? What is the typical NO concentration in the dark chamber? Does it influence NO3 loss? Can the NO3 lifetime be varied from experiment to experiment by factors of >10, for example, and thus affect the transmission efficiency through inlet lines?

14. page 334, lines 1-3. I would like to see another time series plot with increased time resolution to highlight fast variation in supplement.

15. page 334, line 5. What is the role of butanal in this experiment? Does it limit NO3 lifetime?

16. page 348, line 5. Does the water vapor absorption influence path length determination over the whole wavelength range studied with the UHD-CEDOAS instrument, or only at discrete H2O lines?

17. page 350 line 6. I would like to know pressure and residence time between sampling and detection in the UAF-CRDS instrument.

18. page 351. Does the co-presence of aerosol particles and high humidity affect the

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NO3 detection?

19. page 353, line 11. The maximum of the intercept values from Table 4 is 28 ppt (15 June, FZJ).

20. Figure 12. Can the x-axis be changed to filter-laden aerosol amount or time from the beginning of the experiment? The data points with the lowest dry SOA surface area frequently show different tendency. Is there any specific reason for this? What does the tendency for the ULEIC-BBCRDS mean, where a filter is not used? Wall loss?

21. One general question: In ambient air near surface, NO3 concentrations should be typically lower than those studied in the experiments. Is there any systematic difference in the regression line parameters for the whole range and for a low range (e.g., 0-20 ppt), for pairs of instruments having low-enough detection limits?

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 303, 2013.