

Interactive
Comment

Interactive comment on “Intercomparison of ammonia measurement techniques at an intensively managed grassland site (Oensingen, Switzerland)” by M. Norman et al.

Anonymous Referee #2

Received and published: 13 January 2009

General Comments The paper "Intercomparison of ammonia measurement techniques at an intensively managed grassland site (Oensingen, Switzerland)" compares ambient gas phase ammonia (NH₃) measurements over a managed grassland site from three different instruments. The paper is of interest to the scientific community because NH₃ is an important aerosol precursor and its main source, use as a fertilizer in agricultural activity is likely to increase with population growth.

This paper is well written, organized, and easy to read. The title and abstract adequately describe the content of the text. The scientific approach and applied methods are appropriate and valid. The scientific results and conclusions presented are clear

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and sufficiently supported.

The results show that the three instruments, a modified PTR-MS, a GRAEGOR, and an AiRRmonia, compare well except during precipitation events. Examination of the hourly averaged data show that the PTR-MS and AiRRmonia instruments agree within 3% of each other with a small offset and that the GRAEGOR instrument agrees with in 5% to 8% of the others with a larger offset. The time resolution or data acquisition rate of the PTR-MS (1 min) is much faster than the others allowing it to observe fast time scale changes in ambient NH₃ levels. The overall agreement between these instruments is very encouraging for future NH₃ flux measurements.

This paper is of very good quality and, as such, I have mainly minor comments and suggestions.

Introduction

The introduction is does a nice job of briefly summarizing previous NH₃ intercomparisons in the literature. However, two recent ones, Schwab et al., "A Laboratory Intercomparison of Real-Time Gaseous Ammonia Measurement Methods", *Environmental Science & Technology*, 41 (24), 8412-8419, 2007 and Whitehead et al., "Evaluation of Laser Absorption Spectroscopic Techniques for Eddy Covariance Flux Measurements of Ammonia", *Environmental Science & Technology*, 42 (6), 2041-2046, 2008, are not cited or summarized. A more recent and appropriate reference for the CIMS instrument listed on p. 19794 line 4 would be Nowak, J. B., J. A. Neuman, K. Kozai, L. G. Huey, D. J. Tanner, J. S. Holloway, T. B. Ryerson, G. J. Frost, S. A. McKeen, and F. C. Fehsenfeld (2007), A chemical ionization mass spectrometry technique for airborne measurements of ammonia, *J. Geophys. Res.*, 112, D10S02, doi:10.1029/2006JD007589.

Experimental

p. 19796 lines 9-10 Were the instruments places in the center of the field minimizing any wind direction dependence on observed NH₃ levels?

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p. 19799 lines 1-2 How is the ambient background determined for GRAEGOR? How is the mean response time then determined? I realize a submitted paper is referenced but from the text I do not fully understand what that 55 min means.

Results

p. 19083 lines 3-10 This paragraph discusses changes in the regression parameters resulting in application of the different calibration to the GRAEGOR instrument. The authors show this nicely in separate panels of figure 4. They should also consider showing two traces for GRAEGOR in figure 2, allowing the reader to see how this affects the time series.

Discussion

p. 19806 lines 1-19 This section discusses possible particle interference with the sampling methods used by each instrument. Since the GRAEGOR instrument measured aerosol NH₄⁺ during the intercomparison this data should be shown in figure 2 or separately. An earlier section mentioned that anion data, i.e., NO₃⁻ in particular, are not included in this study. Were the anion data recorded and not included in this paper? If so, I hope the authors are considering a follow up paper to more closely examine the partitioning between the gas and aerosol phases.

p. 19806 line 20 In the Inlets and humidity dependence section the following reference, Shah et al., "Ammonia adsorption in five types of flexible tubing materials", Applied Engineering in Agriculture, 22 (6), 919-923, 2006, might add to the discussion.

References

I cannot seem to find the following items in the reference list in the text: Gang, 2002 and Genfa et al., 2003. On the other hand, Williams et al., 1992 referred to in the text is not in the reference list.

Table 1

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For consistency the authors should consider using cm instead of inches in describing the tubing (here and elsewhere in the text). Do 1/8 and "#189; refer to inner or outer diameter of the tubing? The terms time resolution and time response are easily confused. Here I think the authors are using time resolution as referring to a data acquisition rate or sampling time, not instrument performance.

Figure 1

What happens to the wind speed data on July 30th?

Figure 2

I find this figure cluttered. It is difficult to distinguish between the PTR-MS and AiR-RMonia data. As mentioned earlier, I think the authors should consider showing two traces corresponding to the different calibrations used in Figure 4 for the GRAEGOR instrument.

Figure 4

The axis labels on each panel are very difficult to read and should be enlarged.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 19791, 2008.

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