



Intercomparison of techniques to measure NH₃ concentrations and fluxes above a fertilized corn field



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Introduction

- During the summer of 2007, a consortium of government agencies and universities ran six unique NH₃ measurement techniques in a fertilized corn field (Lillington, North Carolina, USA).
- This allowed comparison of NH₃ concentrations and canopy-scale air-surface exchange fluxes using classic aerodynamic and modified Bowen ratio techniques.
- This work will allow an evaluation of the strengths and weaknesses of the different methods and provide much needed NH₃ flux and concentration data for fertilized cropping systems in the US.
- Initial concentration results for the Nitrolux, AMANDA and manual denuder systems are presented here.

Brief equipment summary (Fig. 1)

- An upgraded **AMANDA** system (Ammonia Measurement by ANnular Denuder sampling with on line Analyser) was run in a 3-height gradient mode above the vegetation and provided half hourly concentrations and fluxes.
- Two **Nitrolux-200** (Pranalytica, Inc.) photoacoustic spectrometers were run in a 2-height NH₃ flux gradient mode with automated switching between sampling heights, providing hourly concentrations and fluxes.
- A manual denuder (URG) system provided 12-hour integrated NH₃ concentrations at a single height for the duration of the experiment.
- A 2-height manual denuder (URG) gradient system was run during two 2-week intensives to provide 2-hour integrated NH₃ concentrations and fluxes.
- Manual denuders (URG) were periodically deployed near the end of the experiment in a 5-height vertical profile for 3-hour integrated in- and above-canopy NH₃ concentration profiles.

Fig. 1

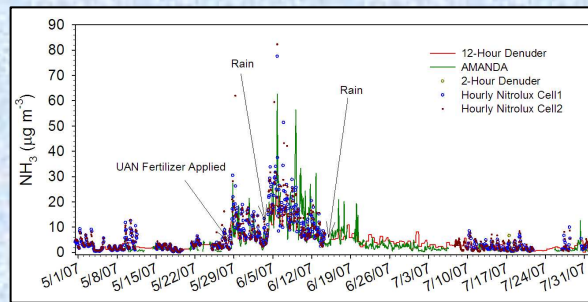


Fig. 2 General agreement in trends and concentrations between techniques.

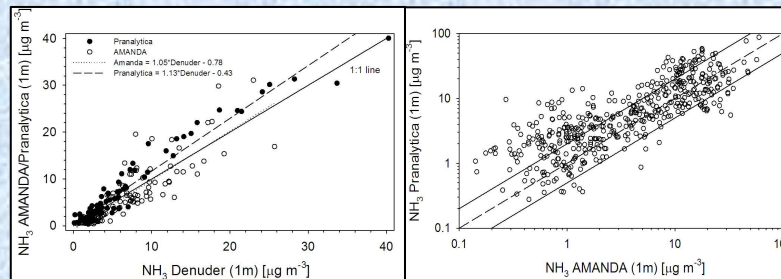


Fig. 3 Good agreement between AMANDA/Nitrolux and 12-hour manual denuders.

Fig. 4 Preliminary unfiltered 1 hourly data shows some periods of disagreements (dashed = 1:1, solid = 2:1)

Conclusions

- Good data coverage over the experiment period.
- General agreement in NH₃ concentration and temporal patterns between measurement techniques.
- Disagreement between Nitrolux and AMANDA at hourly scale a combination of intermittent sampling, spatial separation of towers and inlet effects (e.g., adsorption/desorption of NH₃ on Nitrolux inlet filters and tubing).
- Each measurement technique displayed strengths and weaknesses:-
 - AMANDA displayed good time resolution and data coverage, and compared well to the 12-hour integrated denuders. However, field operation and data analysis are time consuming.
 - Nitrolux displayed an adequate time resolution and compared well to the 12-hour integrated denuders. However, the instruments used in this study were not adequately robust for prolonged field use.

Next steps

- Further analysis of hourly concentrations and comparison of fluxes across techniques.

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