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Interactive comment on “Ammonia fluxes in relation to cutting and fertilization of an intensively managed grassland derived from an inter-comparison of gradient measurements” by C. Milford et al.

Anonymous Referee #1

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General comments:

The paper represents an interesting and straightforward study about the variability in ammonia flux measurements over a fertilized grassland. The study reveals how problematic and uncertain ammonia flux measurements could be, even in optimal conditions (low vegetation).

The study indicated that there were substantial differences in ammonia flux measurements and concentrations. Besides the influence of temperature (corrections), there

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might be other unaccounted instrumental factors contributing to the uncertainty. It would be interesting if authors could indicate what further measures (besides regular calibration and zero-flux test) could be undertaken to correct for any possible anomalous behavior of the AMANDA analyzer.

Specific questions:

Questions about the AMANDA analyser

- how robust is the temperature correction? Was the same (exponential) temperature correction used for all analysers? Why is there no proper ventilation inside the monitor to keep the temperatures below 30 °C?
- Concentrations were measured for 150 seconds at each height: Was the full sample period being used for the calculation of the concentration or were the first 30 sec discarded in order to normalize/adapt the readings to the measuring height?
- Using time steps of 15 minutes and 150 seconds for each height, only 2 replicates per height per time step are available. Why didn't the authors choose for 100 seconds intervals?
- The air-flow rate of the AMANDA was approximately 25 l min⁻¹: how large were the fluctuations in air-flow during the measuring period and what were the implications for the calculations? Were there large differences in air-flow among the AMANDA analysers. How and how frequent were air-flows measured? Are there significant differences in air-flows among the different institutes?
- Calibration of AMANDA analyser: weekly or daily? Are three standards enough to ensure a stable (linear) calibration curve?
- Inaccuracies in the measurement could be exacerbated in the large concentration range: is this > 50 or > 500 µg m⁻³. Do the authors have any idea about the departure between measured and real concentrations in the high concentration range? How frequent did the measured concentrations fell outside the calibration range?

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- How specific is the AMANDA? Are authors convinced that there were no aerosols captured by the wet denuders (although theoretically not possible)?
- The study was conducted over a period of 6 weeks. The data coverage is very high, although it was not clear whether gap-filling was included. Do authors think that the same coverage could be obtained when measuring over a full year?
- What was the reason that no higher liquid flow rate (1.5 ml min^{-1}) was used?

Questions about the applied statistics

How robust are the applied estimators from the linear regressions? Given the fact that both concentrations and fluxes are lognormally distributed, concentrations in the higher range will give more weight to the estimate of the slope c listed in Table 4 and 5? For example: In Figure 4A concentration measurements from the FAL-D analyzer in the higher range are situated on the 1:1 line but more departure is noticed at the lower concentration interval. The higher concentrations will determine the slope but it certainly does not reflect the departure observed in the lower range.

Authors choose regression estimates or R^2 to judge the intercomparisons, although they are not very suited given the lognormal distribution of concentrations and fluxes. Are there no other tools to assess the quality in terms of its variation on unbiasedness (RRMSE, index of agreement; statistics based on median values)? For example: on page 16: flux measurements are within 11 % of the mean estimate and the other within 32% (Table 5): This is taken from the slope which estimate is biased to some extent.

Why was the dataset not used for a real error propagation study? Different variables like u^* and meteorological variables were calculated by several institutes. This could have been used to conduct a more solid uncertainty analysis.

Table 8: It is not clear to me how the averages and the standard errors were calculated? Are they calculated from the mean concentrations and fluxes or were they calculated from the 15 min values for each different period (as in fig. 7a)?

Minor comments and technical corrections:

Page 4710, line 18: u is mean horizontal wind speed: it is never mentioned in a formula.

Page 4705, line 16: the friction velocity is measured by several institutes: all derived from similar sonic anemometers (same brands, open-path or close-path)?

Page 4713, line 1: Why was FAL-CH used as reference given the fact that data were not available during the pre-cutting period?

Page 4712, line 6: what is the average gap length?

Page 4714:, line 13: a reference to table 5 is lacking. It is also not mentioned that CEH underestimates the flux by 32 %.

Figure 4. Data from 3, 8, 9 and 10 June 2000 were not included. There was also substantial departure at 2 June 2000. Why data from 2 June were not discarded?

Page 4719, line 12: nocturnal ammonia emissions. Is there a possibility of nighttime stomatal emission of ammonia due to stomatal aperture at night?

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