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Biogeosciences Discussions

Interactive comment on "Advection of NH_3 over a pasture field, and its effect on gradient flux measurements" *by* B. Loubet et al.

Anonymous Referee #1

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This manuscript presents a novel method for estimated error in micrometeorological fluxes due to violation of the assumption of the non-divergence of the vertical flux. Micormeteorological flux techniques provide the most direct measurement of the air-surface exchange of trace gases however they are limited to areas that have stationary flow fields and horizontally homogeneous source strengths. Techniques that quantify the error in micrometeorological flux measurements that due not meet the desired fetch requirements are needed by the measurement communities to better understand the air-surface exchange of pollutants and quantify fluxes from areas with heterogeneous source strengths and non-ideal flow fields, i.e. urban settings, small scale agricultural operations, and mixed agricultural operations, etc.

General comments I find the term "measured" advection error a bit misleading and is

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referred as an inferred measurement in section 3.4. The "measured" advection error in the manuscript is a largely deterministic analytical model estimate of the advection error driven by measurements while the modeled advection error is a semi-stochastic model estimate also driven by measurements. The terms "inferred advection error" or "deterministic model advection error" would be more appropriate.

Much of the analysis between the "measured" and modeled flux advection error was for cases where the "measured" values relied on a constant vertical wind speed profile and a linear horizontal concentration gradient from nearby sources and sinks. Alternative wind speed profiles and horizontal concentration gradients were only briefly mentioned. The "measured" advection error with horizontal concentration profiles based on a logarithmic decay and a vertically variable wind speed profiles would be more consistent with previously measurements and would be more consistent with the profiles estimated by the FIDES-2-D model. An a comparison of the "measured" results with more realistic horizontal concentration and vertical wind speed profiles and and modeled results is merited.

The last paragraph of page 173 set up two hypotheses, one in which the surface flux from the field is constant and the other where the canopy compensation point is constant. Little is mentioned regarding these hypotheses after this point. The results of these hypotheses may be able to constrain the physical interpretation of the results. Where the tuned surface fluxes and compensation points in agreement with the vast array of field measurements? Did they exhibit a similar temporal trend as the measured surface fluxes?

Specific comments

Page 167 Line 21: "which is what is seek", This is a typo and should be corrected

Page 168 Equation 3: Why was u(z) assumed to be invariant with height? Clearly this is not the case under normal environmental conditions. The classic log linear profile or the power law function used in section 2.3 could have been easily incorporated into

BGD

6, S45–S47, 2009

Interactive Comment

equation 3.

Page 168 Lines 13 to 15: What micrometeorological technique did you use to estimate z0 and d? Did your estimate agree with those presented in the literature for agricultural corps? Before z0 is introduced in the text it should state that the measurements were taken over a grassland and give the crop height or a range of the crop heights.

Page 171 Lines 3 and 4: Please define "d". I assume that it is the zero plane displacement height. If so, how was it estimated? From micrometeorological measurements or as a function of canopy height, i.e. 2/3 h? Can you provide the references describing how these measured variables were estimated at 1 m above d?

Page 172 Lines 8-10: What kind of regression was used, linear, exponential, power, etc.?

Page 174 Lines 19-20: Why choose a linear regression to represent the concentration gradient from source to a some point downwind? Figure 4 and previous measurements show that ammonia concentrations decrease logarithmically downwind from sources. An logarithmic regression would be a much more appropriate choice and may rectify the overestimation of the local concentration gradients and improve the comparison of "measured" and modeled advection error estimates.

Interactive comment on Biogeosciences Discuss., 6, 163, 2009.