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Biogeosciences Discussions

Interactive comment on "Estimation of NH_3 emissions from a naturally ventilated livestock farm using local-scale atmospheric dispersion modelling" *by* A. Hensen et al.

Anonymous Referee #3

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The paper addresses a high relevant and timely scientific question and fits perfectly the scope of Biogeosciences, and presents novel concepts, ideas, tools and data. The reached conclusions and substantial, although a slightly larger experimental setup would have made it possible to performed an even better analysis. The applied methods and assumptions are valid and clearly outlined. Measurements of background levels in different directions from the farm would, however, have improve the study. The descriptions of experiments and calculations are adequate, but there are some central references that should be added to the introduction and these are indicated in this review. The title and abstract of the paper is appropriate, and the paper is well structured in a fluent and precise language.

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In the introduction the authors discuss the difficulty of obtaining reliable emission data for naturally ventilated animal houses, which is rightly considered complex, expensive and labour intensive. Here it would be suitable also to mention process based ammonia emission models for farm houses as a potential tool, although these have their significant uncertainties. An example is the FASSET model for which descriptions together with journal references can be obtained at www.fasset.dk. The introduction should refer the recent review of local scale modelling of atmospheric nitrogen deposition (Hertel et al., 2006). For modelling ammonia from single farms, it would be local with reference also to a very recent paper where another Gaussian dispersion model OML-DEP has been evaluated against measurements from single farms (Sommer et al., 2009).

At the end of the introduction the authors explain the way measurements from the background station are used to subtract inferred emissions from upwind farms. However, they do not state explicitly whether only measurements are selected for the wind sector where the wind is blowing from the background station towards the farm. Assumingly this is the case, but it should be explicitly stated. Here it would have been highly beneficially with more than one background station, but the cost of additional stations is likely the explanation why this has not been used!? The selection of measurements from the appropriate sector is crucial for the results as the surrounding fields and farms must be a significant uncertainty in the analysis. It would be useful to present the difference between farm signal and background signal to have an indication of the potential error.

In section 2.2 it appear that 30 minutes averages are used. Usually dispersion models are evaluated for hourly mean values due to time scale of atmospheric processes. However, this is not a critical point. In the same section two references (Sutton et al and Milford et al.) are placed in foot notes at the bottom of the page, and there is no clear indication why these references are to be treated differently from other references in the article.

The authors could have compared the obtained diurnal cycle in emissions from the farm house with the parameterisations in the work of (Gyldenkærne et al., 2005; Skjøth et

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al., 2004).

Gyldenkærne, S., Skjøth, C. A., Hertel, O., and Ellermann, T., 2005, A dynamical ammonia emission parameterization for use in air pollution models: Journal of Geophysical Research-Atmospheres, 110.

Hertel, O., Skjøth, C. A., Løfstrøm, P., Geels, C., Frohn, L. M., Ellermann, T., and Madsen, P. V., 2006, Modelling Nitrogen Deposition on a Local Scale - A Review of the Current State of the Art: Environ. Chem., 3, 317-337.

Skjøth, C. A., Hertel, O., Gyldenkærne, S., and Ellermann, T., 2004, Implementing a dynamical ammonia emission parameterization in the large-scale air pollution model ACDEP: Journal of Geophysical Research-Atmospheres, 109.

Sommer, S. G., Østergård, H. S., Løfstrøm, P., Andersen, H. V., and Jensen, L. S., 2009, Validation of model calculation of ammonia deposition in the neighbourhood of a poultry farm using measured NH3 concentrations and N deposition: Atmospheric Environment, 43, 915-920.

Interactive comment on Biogeosciences Discuss., 6, 825, 2009.